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1,660,886

K. C. RANDALL

SIGNALING SYSTEM

Filed July 11, 1924

3 Sheets-Sheet 1

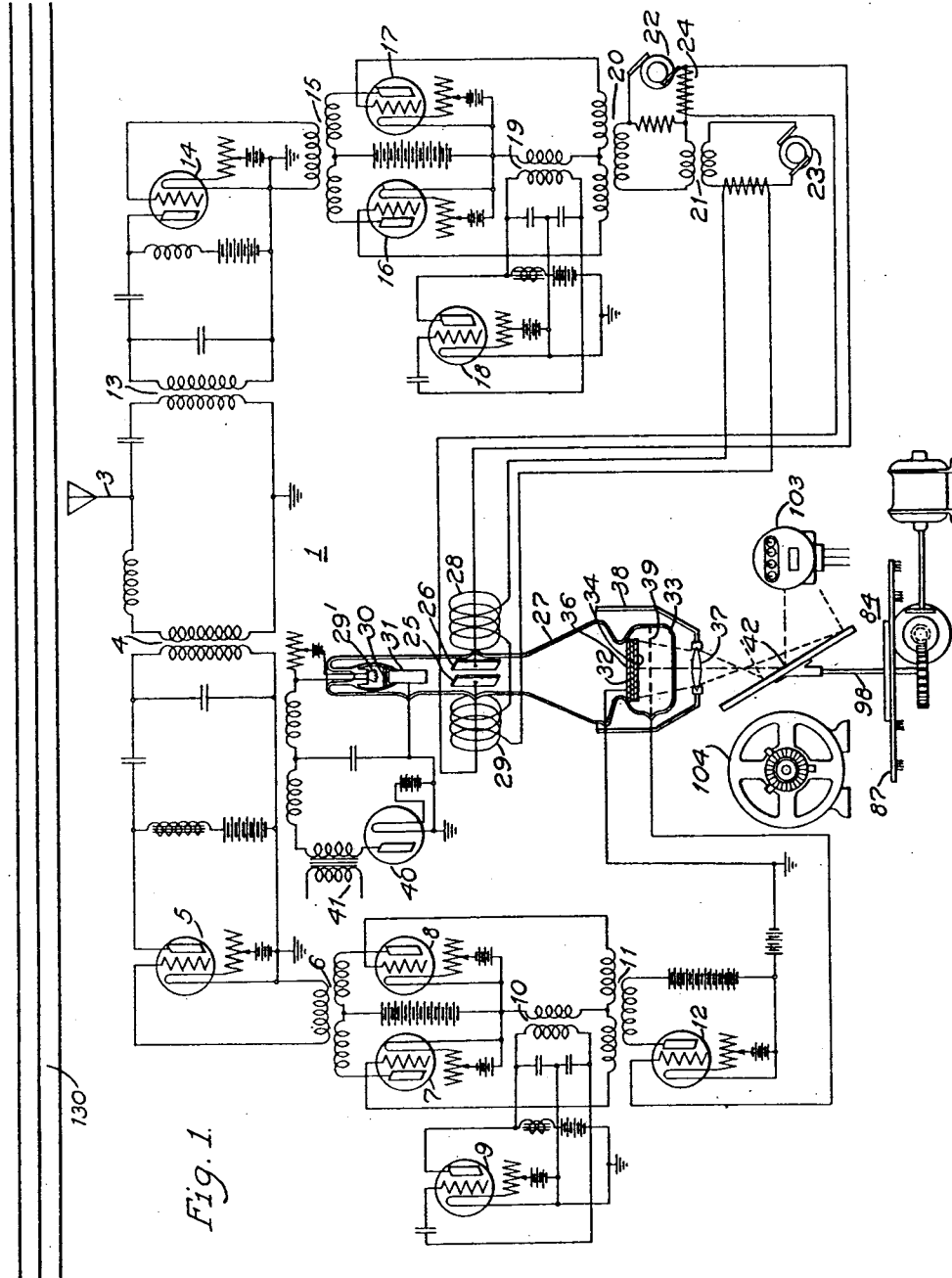


Fig. 1.

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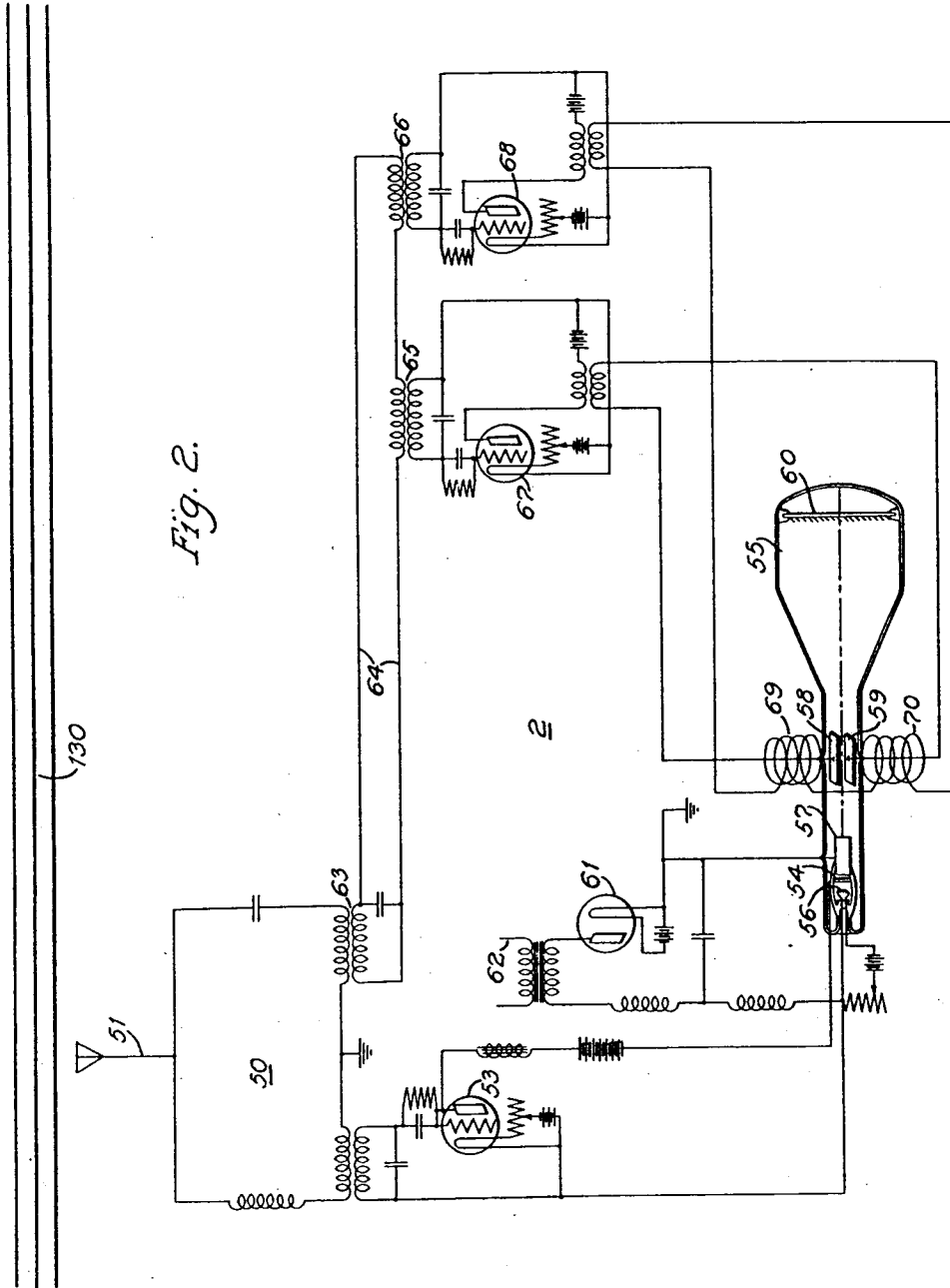
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SIGNALING SYSTEM

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1,660,886

3 Sheets-Sheet 2



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SIGNALING SYSTEM

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3 Sheets-Sheet 3

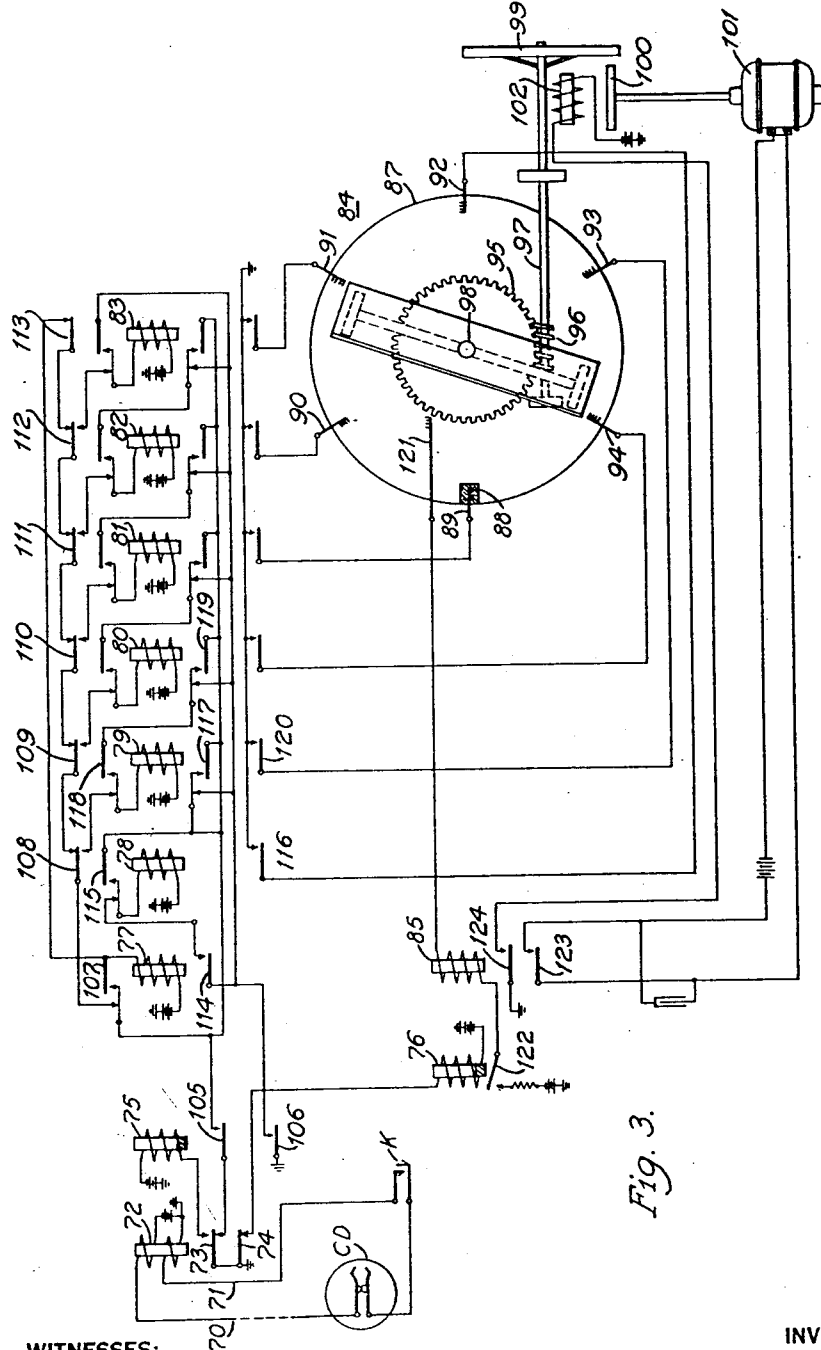


Fig. 3.

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SIGNALING SYSTEM.

Application filed July 11, 1924. Serial No. 725,354.

My invention relates, in general, to signaling systems and more particularly to means for supervising, from a central point, the operation of electrical equipment in a remotely-disposed station or substation.

One object of my invention is to provide means whereby a dispatcher at a central station is able to see a substantially simultaneous reproduction of the operation of the remotely-disposed electrical apparatus.

Another object of my invention is to provide an improved television system that shall be applicable for enabling the dispatcher to observe the function of electrical equipment in a remote station and ascertain the indication of meters, the operation of electric generating machines, etc.

Another object of my invention is to provide a device at the station that may be controlled from the dispatcher's office to cause the television apparatus to transmit an image of any desired portion of the station or apparatus unit therein.

A still further object of my invention is to provide improved circuits for a group of relays that are used in controlling the device mentioned in the preceding paragraph.

The above and other objects of my invention will be explained more fully hereinafter with reference to the accompanying drawings forming a part of this specification.

Referring now to the drawings, Figure 1 is a diagram of the transmitting television apparatus at the station.

Fig. 2 is a diagram of the receiving television apparatus at the dispatcher's office; and

Fig. 3 is a view of the apparatus and circuits for selecting the desired apparatus so that its image may be transmitted to the dispatcher's office.

Both the apparatus in the dispatcher's office and the apparatus in the station are shown by means of conventional circuit and apparatus diagrams in sufficient detail to enable my invention to be readily explained and understood.

The apparatus of the transmitting set 1 at the station comprises an antenna system 3 that is so tuned that it may oscillate at two separate and distinct frequencies. The antenna 3 is disposed below a power circuit 130 which extends to the dispatcher's office. The radiations emitted from the antenna 3

will be transmitted over the power circuit 130. By the use of this power circuit, considerable efficiency is gained in the operation of the transmitting apparatus, inasmuch as the radiations are confined to this circuit instead of being permitted to radiate through space.

The oscillating circuit, including the antenna 3, is connected on one side by means of a transformer 4 to the plate circuit of an amplifier triode 5. The grid of the amplifier 5 is connected through a transformer 6 to the plate circuits of modulator triodes 7 and 8. An oscillator triode 9 is connected through a transformer 10 to the grid circuit of the modulator triodes 7 and 8. The above arrangement comprises what is known as an ordinary "push and pull" transmitting arrangement.

By means of a transformer 11, the plate circuit of an amplifier 12 is also connected to the grid circuits of the modulator triodes 7 and 8.

The oscillating circuit comprising the antenna 3 is also connected, by means of a transformer 13, to the plate circuit of an amplifier triode 14. The grid circuit of the amplifier 14 is connected, by means of a transformer 15, to the plate circuits of modulator triodes 16 and 17. An oscillator triode 18 is connected, by means of a transformer 19, to the grid circuits of the modulator triodes 16 and 17. By means of transformers 20 and 21, alternating-current generators 22 and 23 are also connected to the grid circuits of the modulator triodes 16 and 17.

The generator 22 is so constructed as to generate high-frequency alternating current of a frequency of about 1000 cycles, while the alternating-current generator 23 is adapted to generate an alternating current of a frequency of about 16 cycles.

It is, of course, obvious that triodes connected in oscillating circuits may be used in place of the alternating-current generators 22 and 23.

The plates 25 and 26 in a cathode-ray tube 27 are connected in the circuit through a series transformer 24. Coils 28 and 29 are associated with the cathode-ray tube 27 in such position that the magnetic field which may be produced by said coils is parallel to the electrostatic field which may be gen-

erated by the plates 25 and 26, and these coils are connected in circuit with the alternating-current generator 23.

The cathode-ray tube 27 is similar in some respects to the ordinary cathode-ray oscillograph and has a hot cathode 29, a diaphragm 30 and a tubular anode 31. The diaphragm 30 has a small hole so cut therein as to form the cathode ray into a thin beam.

In place of the ordinary fluorescent screen is substituted a composite plate 32 having layers of different material. The plate 32 is placed in the glass container of the cathode-ray tube in such manner that there is a portion 33 at the end of the tube which is sealed from the remaining portion. The plate 32 is constructed of a thin sheet of aluminum foil 34 which may be about .0001 micrometers in thickness, upon which is placed a layer of aluminum oxide, the thickness of which may be about .0003 micrometers. Upon this is placed a layer of alkali metal 36 which may be potassium hydroxide, or other photoelectric material. The whole of the cathode-ray tube 27 is filled with argon vapor at low pressure.

A lens 37 or system of lenses is secured in place by means of a frame 38 disposed at the end of the cathode-ray tube. The lens 37 is arranged to focus the image or scene that is reflected from a mirror 42 upon the photoelectric metal of the composite plate 32. A gird 39 is placed at some distance in front of the composite plate 32 and is connected to the grid of the amplifier triode 12. A high potential is applied to the anode 31 by a rectifier 40 which is supplied with current from an alternating-current source 41.

In the receiving device 2, an oscillating circuit 50, including an antenna 51, is adapted to be resonant to current of two distinct frequencies, these frequencies being the frequencies generated by the oscillating circuits that include the triodes 9 and 18 of the transmitting set. The antenna 51 is also disposed below the power circuit 130 so that it may be affected by the carrier-current radiations in the circuit. An amplifier triode 53 is connected to the oscillating circuit 50. The plate circuit of the amplifier triode 53 is connected to a grid 54 in a cathode-ray tube 55.

The cathode-ray tube 55 is constructed in a manner similar to the ordinary cathode-ray oscillograph and comprises a hot cathode 56, the grid 54, a tubular anode 57, plates 58 and 59 that are used to set up an electrostatic field and a fluorescent screen 60. The anode 57 of the cathode-ray tube 55 is supplied with high voltage by the operation of a rectifier 61, that rectifies the alternating current supplied by a source of alternating current 62.

The oscillating circuit 50 is also connected

by means of a transformer 63 to a circuit 64. The circuit 64 is, in turn, connected by means of transformers 65 and 66 to the grid circuit of the amplifier triodes 67 and 68. The plate circuit of the amplifier triode 67 is connected to the plates 58 and 59 of the cathode-ray tube 55, while the circuit of the amplifier triode 68 is connected to the coils 69 and 70 that are associated with the cathode-ray tube 55 and so disposed with respect thereto that the magnetic fields generated by the coils are parallel to the electrostatic field generated by the plates 58 and 59.

The transformer 65 is so constructed that it acts as a wave trap for the particular high frequency that is generated by the generator 22 at the transmitting station so as to eliminate this frequency from the circuit 64. In a like manner, the transformer 66 acts as a wave trap for the particular frequency generated by the generator 23 by the transmitting station.

In Fig. 3, a calling device CD and a key K are located at the dispatcher's office. The calling device CD may be of any ordinary and well-known type and its function is to interrupt the circuit, including conductors 70 and 71, extending between the dispatcher's office and station. The key K may be of any ordinary and well-known type which functions, when operated, to complete the circuit including the conductors 70 and 71 and a line relay 72 at the station. The relay 72 at armatures 73 and 74 controls the circuits of the slow-acting relays 75 and 76. Relays 77 to 83, inclusive, are of the usual type and control the operation of a device 84. The relay 76 controls a circuit for a relay 85.

The device 84, referring to Figs. 1 and 3, comprises a flat metallic disc 87 that carries an insulating segment 88 near its circumference. The disc 87 is engaged by brushes 89 to 94, inclusive, which are equally spaced about the circumference of the disc. These brushes are adapted to rest upon the metallic disc and are so positioned that, as the disc 87 moves, the insulating segment 88 is adapted to bring any one of the brushes from contact with the metallic disc. The disc 87 is adapted to be driven by a gear 95 that is operated by a worm 96 on a shaft 97. There is a shaft 98 mounted upon the disc 87 to which is mounted the mirror 42. A disc 99 is attached to the shaft 97. The disc is adapted to be drawn into engagement with a disc 100 that is driven by a motor 101 by the operation of a magnet 102. When the magnet 102 is energized, the disc 87 is rotated, as is the mirror 42.

The whole device 84 is so positioned with respect to the transmitting cathode-ray tube 27 that the objective of the lens 37 falls upon the mirror 42, as has been indicated in the drawing. As the mirror 42 rotates,

it is adapted to reflect the desired views of the apparatus in the substation. For instance, in one position of the mirror 42, it is adapted to reflect the image of the meter 103 and, in another position, an image of the generating machine 104. Of course, other electrical apparatus, as well as a general view of various portions of the substation, may be reflected by the mirror 42.

Having briefly described the apparatus shown in the drawings, I will now explain its detailed operation. For this purpose, it will be assumed that the dispatcher desires to ascertain the reading of the meter 103. In order to accomplish this result, it is necessary for the mirror 42 in the substation to be in such position that it reflects an image of the face of the meter 103.

At the dispatcher's office, the disposition of the mirror will be assigned a certain definite number. It will be assumed that this number is 2 in the present instance.

In case the dispatcher desires to bring the mirror 42 into any other position, a digit other than 2 will be dialed. In accordance with this operation, some of the relays in the relay group comprising the relays 77 to 83, inclusive, will be operated in the same manner as before and with substantially similar results.

In order to observe the operation of the meter, the dispatcher will operate the key K and will then operate the calling device CD in accordance with the digit 2. When the key K is closed, a circuit is completed for the line relay 72 at the substation over the trunk conductors 70 and 71. The relay 72, upon being energized, completes a circuit for the slow-acting relay 75 at armature 73, and at armature 74 opens the circuit of the slow-acting relay 76. The relay 76 will now be deenergized before the dispatcher has operated his calling device.

The relay 75, upon being energized, prepares a circuit for the relay 77 at armature 105 and at armature 106 prepares locking circuits for the relays 78 to 83, inclusive. When the calling device CD is operated, two interruptions are produced in the circuit of the line relay 72 and this relay retracts its armature twice. By the operation of the armature 74, the slow-acting relay 76 is maintained energized.

Upon the first retraction of the armature 73, a circuit is completed extending from ground by way of said armature and its back contact, armature 105 and its front contact, normally closed springs controlled by armature 107, armature 108 and its back contact, armature 109 and its back contact, armature 110 and its back contact, armature 111 and its back contact, armature 112 and its back contact, armature 113 and its back contact and relay 77 to battery.

The relay 77 is energized to open its orig-

inal energizing circuit by the operation of armature 107 shortly after it has completed a locking circuit for itself at the front contact of this armature over a portion of the previously traced circuit. Another result of the operation of the relay 77 is that, at armature 114, a circuit is completed for the relay 78. The relay 78 is energized to complete a locking circuit for itself at armature 115, to open its original energizing circuit at this armature and to place ground upon brush 92 at armature 116.

When the relay 72 is energized after its first deenergization, the circuit of the relay 77 is opened and this relay is deenergized. The relay 78 remains operated by reason of its locking circuit which extends from ground by way of armature 106 and its front contact, normally closed springs controlled by armature 117, armature 115 and its front contact and relay 78 to battery.

Now, when the armature 73 is again retracted, there is a circuit completed which extends from ground by way of said armature and its back contact, armature 105 and its front contact, normally closed springs controlled by armature 107, armature 108 and its front contact, normally closed springs controlled by armature 118 and relay 79 to battery.

The relay 79 is energized to open its original energizing circuit at armature 118, and to establish another locking circuit for itself at the front contact of this armature which extends to the normally closed springs controlled by armature 119 to ground by way of front contact and armature 106. Other results of the operation of the relay 79 are that a circuit is prepared for the relay 80 at armature 109, and at armature 120 ground is placed upon the brush 93.

The relay 78 is not deenergized when its locking circuit is opened by reason of the fact that another circuit is completed for it which extends from ground by way of armature 73 and its back contact, armature 105 and its front contact, armature 115 and its front contact and relay 78 to battery. However, when the relay 72 is again energized, the circuit for the relay 78 is opened and this relay is deenergized to prepare a circuit for the relay 80. The relay 79 remains energized by reason of its locking circuit previously traced.

The slow-acting relay 76 is maintained energized during the intermittent operation of the line relay 72. However, after these two interruptions in the circuit of the relay 72 have been produced by the operation of the calling device CD, the relay 72 remains permanently energized and the circuit of the relay 77 is, consequently, opened for a sufficient interval of time to permit this relay to deenergize. As a result of this operation, a circuit is completed which extends from

battery by way of back contact and armature 122, relay 85, brush 121, metallic disc 87, brush 93 and armature 120 and its front contact to ground.

5 The relay 85 is energized over the above circuit with the result that the circuit of the motor 101 is closed in an obvious manner at armature 123, while, at armature 124, a circuit is completed which extends from ground
10 by way of said armature and its front contact and magnet 102 to battery. The motor 101 is immediately started to operate. The magnet 102 is energized to bring the disc 99 into engagement with the disc 100 with the
15 result that the worm 96 drives the gear 95.

The disc 87 is rotated until the insulated segment 88 is brought under the brush 93. By this operation, the circuit of the relay 85 is opened and this relay is immediately
20 deenergized to open the circuit of the motor 101 and also the circuit of the magnet 102. By the deenergization of the magnet 102, the movement of the shaft 97 ceases, as does the rotation of the disc 87. During the move-
25 ment of the disc 87, the mirror 42, which is attached to the shaft 98, is rotated into proper position so that it reflects the image of the meter 103.

A sufficient interval of time having elapsed
30 to bring about the operation of the device 84, the dispatcher will restore the key K to normal, thereby bringing about the deenergization of the line relay 72 and the slow-acting relay 75. By the deenergization of
35 the slow-acting relay 75, the locking circuit of the relay 79 is opened and this relay is restored to normal. The relay 76 is energized to open another point in the circuit of the relay 85.

40 All the control apparatus is now restored to normal and may be operated by the dispatcher to bring the mirror 42 into a position so that it reflects the image of another portion of the station.

45 It will be seen, as shown in the drawings, that the mirror 42 has but six positions, corresponding to the six brushes 89 to 94, inclusive, resting on the disc 87. The number of positions may, obviously, be increased
50 indefinitely by the addition of more brushes and more relays, such as 78 to 83, inclusive.

The dispatcher has now brought the mirror 42 into the proper position so that the lens 37 of the transmitting device focuses
55 the image of the metering device 103 upon the grid 39 and upon the composite plate 32. The operation of the television transmitting apparatus will now be described.

Ordinarily, the oscillations generated by
60 the oscillator 9 are not radiated by the antenna 3. This is because of the fact that these oscillations are neutralized by the action of the modulator triodes 7 and 8, and, consequently, there is no transfer of energy
65 into the secondary of transformer 6. The

only manner in which the antenna can be set in oscillation by the operation of the triode 9 is by a change in condition in the primary of the transformer 11 which is connected to the grid 39 and to the aluminum foil 34 of 70 the composite plate 32.

The light from the image placed before the lens 37 is so varied that, upon the focusing of this light upon the photoelectric material 36 of the composite plate 32, electron emission of varying intensity by this substance takes place in accordance with the light from the object placed before the lens 37. This electron emission may be considered a species of conduction between the photoelectric 80 material 36 and the grid 39. This phenomena is intensified by the argon vapor that fills the container 33 as a result of the ionization of the vapor.

In view of the fact that the aluminum 85 oxide plate 35 is an insulator, there is no electrical connection existing between the grid 39 and the aluminum plate 34, even though the photoelectric material emits electrons. When the cathode beam strikes a particular point upon the aluminum foil, it is of sufficient intensity to penetrate it, as well as the aluminum oxide. As a result of this operation, through the particular point that is covered by the cathode beam, there is 95 conduction between the aluminum plate 34 and the grid 39. The current flowing in the circuit is amplified by means of the amplifier triode 12. The output of the amplifier 12 now causes the modulator triodes 7 and 8 to transmit, through the transformer 6, the high-frequency oscillations, generated by the oscillator triode 9, modulated in accordance with the current in the amplifier triode 12 which, in turn, is governed by the intensity 105 of the light focused upon the particular spot at which the cathode ray is located. The intensity of this electron stream is, of course, governed by the intensity of the light reflected from the object. 110

As previously mentioned, the alternating-current generators 22 and 23 are producing alternating current of a high and low frequency, respectively. By the operation of the modulator triodes 16 and 17, the oscillations 115 produced by the oscillator triode 18 are modulated in accordance with both the frequency of the alternating current generated by the generator 22 and the alternating current generated by the generator 23. This modulated high frequency current is amplified by the amplifier triode 14 and radiated by the antenna 3. 120

As the output of the alternating-current generator 22 is also connected to the plates 125 25 and 26 in the cathode-ray tube 27, an electrostatic field is set up by these plates which varies in accordance with the frequency of the current generated by the generator 22. As this electrostatic field varies, the electro- 130

static action upon the electrode beam causes it to be swung from one side of the composite plate 32 to the other.

A portion of the alternating current generated by the generator 23 also traverses the coils 28 and 29 which, as before mentioned, are so positioned with respect to the cathode tube 27 that the magnetic field generated by these coils is parallel to the electrostatic field generated by plates 25 and 26. The varying magnetic field set up by these coils tends to cause the cathode-ray beam to traverse the plate 32 in a direction at right angles to that before described.

The resultant action between the magnetic fields and the electrostatic fields upon the cathode beam is such that the beam covers every point in the whole area of the composite plate 32 in $\frac{1}{32}$ of a second, that is, in $\frac{1}{2}$ cycle of the frequency generated by the alternating-current generator 23. Thus, in $\frac{1}{16}$ of a second, the cathode beam traverses the surface of the composite plate twice.

As the cathode beam traverses the surface of the composite plate 32 point by point in a definite sequence, there is a current flowing from the grid 39 and the aluminum foil 34 at each particular point, and this current is directly proportional to the intensity of light reflected from the object to be observed. Thus, the oscillating current generated by the oscillator triode 9 is modulated in accordance with the light from each portion of the image.

At the receiving station, the modulated oscillatory currents generated by the oscillator 9 of the transmitter are received by the antenna 51 and transferred to the detector triode 53 through the transformer 52. The detector triode 53 then operates to detect the modulations and then these are transferred through its plate circuit to the grid 54 of the cathode-ray tube 55.

By means of the transformer 63, associated with the oscillating circuit 50, the modulated radio-frequency current generated by oscillator 18 is received and transferred by transformers 65 and 66 in the detector triodes 67 and 68. By the operation of the transformer 65, only the radio frequency that is modulated by the generator 22 is detected. In a like manner, by the operation of the transformer 66, only the radio frequency modulated by the generator 23 is received by the detector triode 68.

As the plate circuit of the detector triode 67 is connected to the plates 58 and 59 in the cathode-ray oscillograph 55, an electrostatic field is set up by these plates which varies in identically the same manner as the electrostatic field generated by the plates 25 and 26 in the transmitting cathode-ray tube. Likewise, the plate circuit of the triode 68 is connected to the coils 69 and 70 which generate a magnetic field parallel to the elec-

trostatic field generated by the plates 58 and 59 and that varies in exactly the same manner as the magnetic field set up by the coils 28 and 29 at the transmitting station. Thus, when the cathode-ray beam passes through the grid 54 and the anode 57 to the fluorescent screen 60, it is caused to traverse a path in accordance with the resultant magnetic and electrostatic fields set up. Therefore, the cathode-ray beam traverses the whole area of the fluorescent screen once in $\frac{1}{32}$ of a second, or twice in $\frac{1}{16}$ of a second, in the same manner as the cathode beam in the cathode-ray tube 27 at the transmitting station.

When the cathode beam in the cathode-ray tube of the transmitter is in a certain particular position, the oscillating current generated by the oscillator 9 is modulated in accordance with the intensity of the light falling upon that particular point. This modulated current is radiated by the antenna 3 and received by the antenna 51 at the receiving station. At this particular point, the cathode beam in the cathode-ray tube 55 will be in the same relative position as the cathode beam at the sending station. By the action of the grid 54, the intensity of the cathode ray reaching the fluorescent screen at this particular point is varied in accordance with the light from the image at the transmitting station.

Thus, for every particular point on the image, the carrier current radiated by the antenna 3 is modulated whereby the potential on the grid 54 of the receiving cathode-ray tube 55 is varied, as is, also, the intensity of fluorescence of the particular point upon the fluorescent screen 50.

As the whole area of the composite plate 32 at the transmitting station and the fluorescent screen 60 at the receiving station is covered by the cathode beams in $\frac{1}{32}$ of a second, the image of the object will be displayed on the screen 60 during $\frac{1}{2}$ of a second. However, as the frequency of the oscillation of the generator 23 is 16 cycles per second, the picture will be transmitted twice and will remain on the screen 60 during $\frac{1}{16}$ of a second. Thus, due to the persistency of vision phenomena, any movement of the meter before the lens 37 will be properly transmitted and recorded upon the fluorescent screen 60 and will appear thereupon as a moving image.

It will be seen that the indication of the meter 103 will be produced upon the fluorescent screen 60 and, as a consequence thereof, the dispatcher is able to ascertain the indication of the meter.

In the same manner as above, the dispatcher may control the device 84 so that the mirror 42 is adapted to reflect an image of a generating machine 104. The image of this machine will be transmitted in

a manner similar to that above described. If this generating machine is sparking excessively at the commutator, the dispatcher will be apprised of such fact in the same manner as if he were present in the station.

In substantially the same manner as above, any operation of the substation may be observed by the dispatcher and he may thus ascertain the functioning of any electrical equipment therein.

In the case described, the beams in the cathode-ray tubes are operating all the time, as are the oscillating circuits and other associated apparatus. It will be apparent that this is unnecessary and that the apparatus may be so arranged that the apparatus will be functioning only so long as the key, K is operated at the dispatcher's office and the relay 75 is energized at the substation.

In the system just described, the television apparatus at the substation and dispatcher's office are operated by carrier current over the power circuit 130. It is obvious, of course, that the communication between stations may be obtained by ordinary space radio.

My invention is not limited to the particular arrangement of the apparatus illustrated and described, but may be variously modified without departing from the spirit and scope thereof, as set forth in the appended claims.

I claim as my invention:

1. In a signaling system, the combination with a first station, a plurality of images at said first station, a second station, picture-transmitting apparatus at said first station for transmitting images from said first to said second station and means for selecting said images to be transmitted from said second station.

2. In a signaling system, a first station, picture-transmitting apparatus thereat arranged to be focused on any one of a plurality of images, a second station remotely disposed from said first station, and means including circuit arrangements for controlling the focusing of said transmitting apparatus from said second station.

3. In a signaling system, a first station, a plurality of devices thereat, picture-transmitting apparatus for translating the images of any one of said devices into electric currents, means for transmitting said currents to remote points, a second station for translating said currents into an image, and means controlled from said second station for selecting one of said devices to have its image transmitted.

4. In a signaling system, a first station, a second station, a plurality of devices at said first station, picture-transmitting apparatus for transmitting the image of any one of said devices, and means controlled from said second station for selecting the devices whose image is to be transmitted.

ond station for selecting the devices whose image is to be transmitted.

5. In a signaling system, a first station, a remotely disposed station, a picture-transmitting apparatus for translating into electric currents views within its focal range, and means including circuit arrangements whereby any one of a plurality of views are brought within the focal range of said transmitting device.

6. In a signaling system, a first station, a remotely disposed station, a picture-transmitting apparatus for translating into electric currents views within its focal range, means for translating said currents into views at said second station, and means including circuit arrangements whereby any one of said views are brought within the focal range of said transmitting device.

7. In a picture-transmitting system, a first station, a plurality of views, a second station, picture-transmitting apparatus for transmitting views from said first to said second station, and means controlled from said second station for selecting the view to be transmitted.

8. In a picture-transmitting system, a first station, a cathode ray tube for translating views into electric currents at said first station, a reflector for reflecting views upon said tube, a remote station for receiving said views, and means controlled from said remote station for controlling said reflector.

9. In a signaling system, a first station, a second station, picture transmitting apparatus at said first station, and means for selectively controlling the operation of the picture transmitting apparatus from said second station.

10. In a signaling system, a first station, a second station, picture transmitting apparatus at said first station, picture receiving apparatus at said second station, means including said picture transmitting and receiving apparatus, for transmitting pictures from said first station to said second station, and means for selectively controlling the operation of said picture transmitting apparatus from said second station.

11. In a signaling system, a first station, a second station picture transmitting apparatus at said first station, picture receiving apparatus at said second station, a signaling line connecting said stations, means including said picture transmitting and receiving apparatus and said signaling line for transmitting pictures from said first station to said second station, and means for selectively controlling the operation of said picture transmitting apparatus from said second station.

12. In a signaling system, a first station, a second station, picture transmitting apparatus at said second station, picture receiving apparatus at said second station, a transmitting

ting medium connecting said stations, means including said picture transmitting and receiving apparatus and said transmitting medium for transmitting pictures from said first station to said second station, and means for selectively controlling the operation of said picture transmitting apparatus from said second station.

13. In a signaling system, a first station, a second station, a plurality of devices at said first station, means for transmitting images of said devices from said first station to said second station and means for controlling said first mentioned means from said first station.

14. In a signaling system, a first station, a second station, a plurality of devices at said first station, means for transmitting the images of said devices from said first station to said second station, and means for selectively controlling said first mentioned means to transmit images of predetermined ones of said devices, from said second station to said first station.

In testimony whereof, I have hereunto subscribed my name this 7th day of July 1924.

KARL C. RANDALL.