Nov. 3, 1931. E. F. W. ALEXANDERSON 1,830,586

TRANSMISSION OF PICTURES

Filed Aug. 9, 1926

Fig. 1.

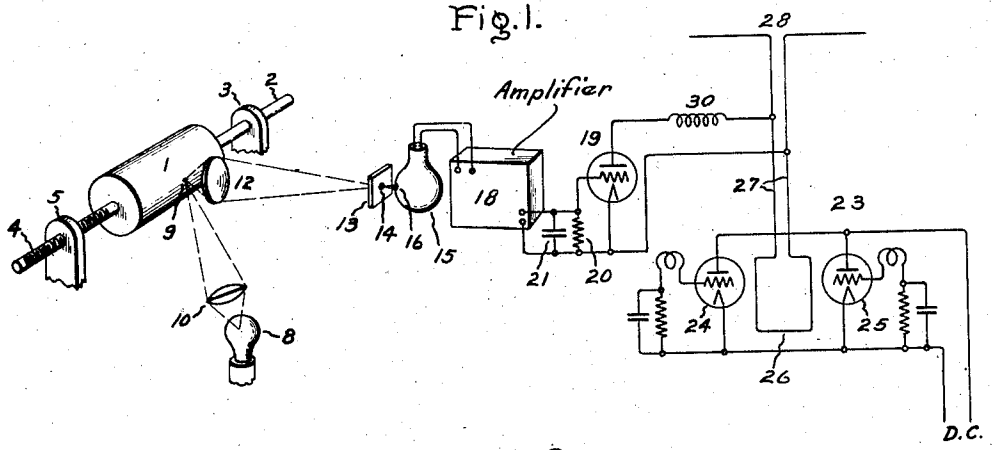


Fig. 2.

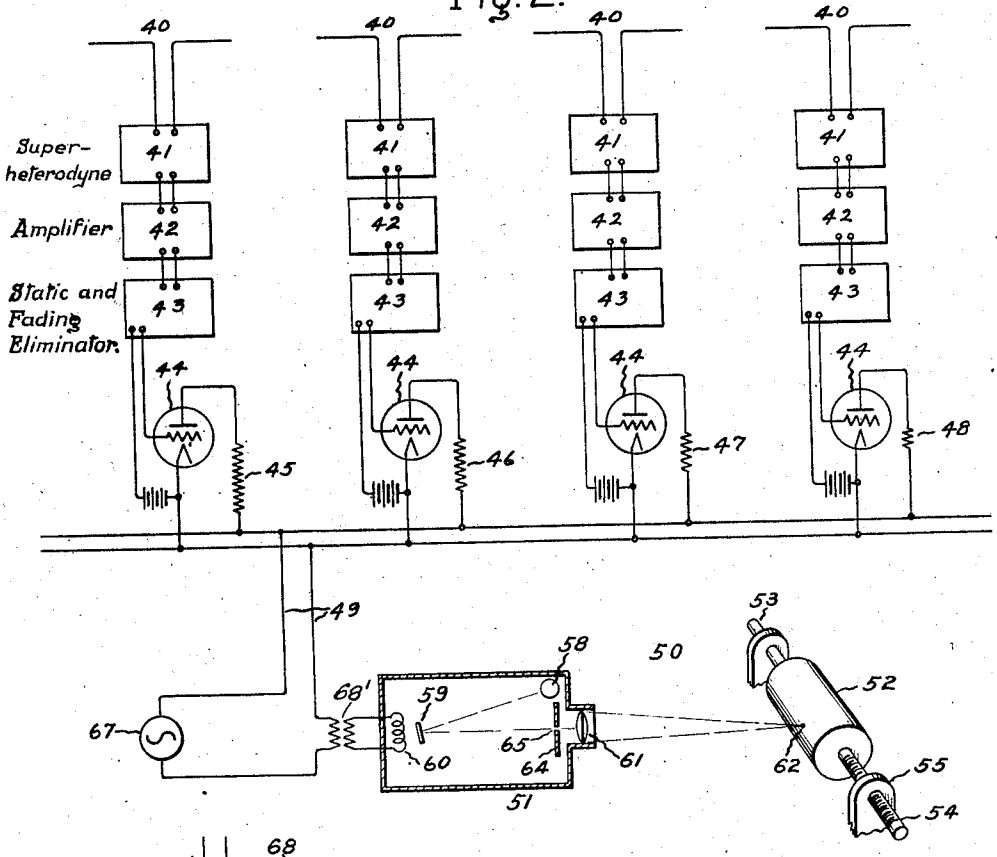
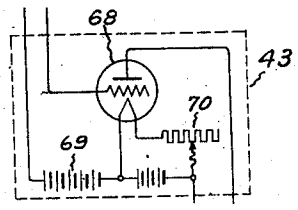


Fig. 3.



Inventor
Ernst F. W. Alexanderson,
by Alexander S. Lamb
His Attorney.

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UNITED STATES PATENT OFFICE

ERNST F. W. ALEXANDERSON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

TRANSMISSION OF PICTURES

Application filed August 9, 1926. Serial No. 128,267.

My invention relates to the electrical transmission of pictures from one place to another and particularly to the transmission of pictures by radio.

An object of my invention is the provision of an improved method and means by which pictures may be transmitted quickly and accurately and independently of the effects of signal fading. In accordance with my invention I overcome the effects of fading chiefly by causing the carrier current by which the signal is transmitted to have a variable wave length with a substantially constant amplitude, the variations in wave length corresponding to the light and dark portions of the picture being transmitted.

My invention will be better understood from the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

Referring to the drawings, Figs. 1 and 2 are diagrammatic representations respectively of a transmitter and a receiver illustrating my invention, and Fig. 3 is a detail diagram of a supplemental static and fading eliminator employed in the receiver.

In Fig. 1 of the drawings I have shown a drum 1 mounted on the shaft 2 shown journalled at one end in bearing 3 and screw-threaded at 4 into the support 5 at the other end. Upon this drum the picture to be transmitted is mounted, the drum and shaft being rotated by suitable means not shown. The picture to be transmitted may be a photograph, prints, drawing or a written or printed page, the term picture being employed in the description and claims in its broadest sense. At a suitable point is a source of light 8, the rays from which are collected and brought to a focus on the surface of the drum at the point 9 by the lens 10. Close to and in front of the illuminated spot 9 is the collecting lens 12, preferably a very short focus lens, and on the opposite side is the screen 13 having a small hole 14 therein. Behind the screen is the photo-electric cell 15 whose window 16 is in positon to receive the light passing through the opening in the screen. The spot 9 and the opening 14 in the screen are arranged at conjugate focii of the lens 12 and the screen opening is of such size that the light which passes through it comes from a very small area of the picture on the drum. This area will be termed a "unit area", its dimensions having the same relation with the dimensions of the opening 14 in the screen as the respective distances between those points and the lens have with each other. This arrangement, therefore, has a two fold advantage: arranging the lens 12 close to the drum permits a maximum amount of light reflected from the unit area of the picture being directed to the photo-electric cell, and the opening in the screen, while itself very small, determines a unit area of the picture of much smaller dimension. The screw thread 4 has a very fine pitch so that as the drum rotates it travels slowly longitudinally.

The photo-electric cell 15 is shown connected to an amplifier 18 which may be an electron discharge device and which in turn connects with an electron discharge device 19, a resistance 20 and a condenser 21 being shown shunted across the connecting leads. As a suitable means for producing a carrier wave I have shown a short wave oscillator 23 of well known construction comprising the electron discharge devices 24 and 25 and the generating coil 26 which connects by leads 27 with the antenna 28. It should be understood that the plate circuits of the devices 24 and 25 form a closed loop which is inductively related both to the grid circuits of these devices and to the circuit comprising the loop 26, the inductance 30 and the space discharge device 19. Under these conditions, the application of a direct current potential to plate circuits of the devices 24 and 25 causes current to be transmitted through the devices 24 and 25 one after the other, the rapidity with which current is changed from one to the other of the devices being dependent on the constants of the circuit which comprises the loop 26, the inductance 30 and the space discharge device 19. The change of current from one device to another of course involves a reversal in the direction in which current is transmitted through the circuit comprising the plates of the devices. The plate and fila-

ment of device 19 thus connect with the antenna leads 27 through an inductance 30 whereby the length of the carrier wave produced is varied in accordance with the impulses received from the photo-electric cell.

Referring now to the receiver illustrated in Fig. 2 it will be seen that I have shown by way of example four similar receiving sets each of which is tuned to respond to a different wave length. Each set is shown comprising a receiving antenna 40, a superheterodyne 41, and amplifier 42 and a supplementary static and fading eliminator 43. Connected with the latter are circuit closing and opening devices shown as electron discharge devices 44 whose plate and filament circuits connect through resistances 45, 46, 47 and 48 respectively with the control circuit 49 of the recorder 50 severally to control the operation thereof. The recorder is shown comprising the oscillograph 51 and the drum 52 rotatably mounted on the shaft 53 of which one portion 54 is screw-threaded into the support 55. The drum is in all respects similar to the drum 1 of the transmitter and in operation is rotated by suitable means not shown in synchronism with drum 1. On the surface of the drum a suitable light sensitive member may be wrapped as for example an unexposed film or paper. The oscillograph 51 is shown comprising the source of light 58, the vibratory mirror 59, the actuating coil 60 and the lens 61 by which the light rays from the source 58 and reflected by mirror 59 are brought to a focus at the point 62 on the drum. Between the mirror and the lens I have shown the light intercepting screen 64 having the opening 65 therein through which the light rays may pass. The actuating coil 60 of the oscillograph is shown connected through the control circuit 49 by means of a transformer 68′ to filter out the direct current component of the current flowing through the vacuum tubes to the source 67 of alternating current of a suitable frequency to cause the oscillograph mirror to vibrate rapidly. The several resistances 45, 46, 47 and 48 each have a different value and each is arranged to bridge the control circuit 49 of the oscillograph in response to the operation of the discharge device 44 associated therewith.

In the operation of transmitting a picture by the above described apparatus a carrier wave is radiated from the antenna of the transmitter where amplitude is substantially constant but whose wave length varies in accordance with amount of light reflected into the photo-electric cell by the successive unit areas of the picture being transmitted. At the receiving station one or another of the several tuned receivers will respond whenever the wave length corresponds with that for which the particular receiver is tuned. As each receiver serves to close the control circuit of the oscillograph through a resistance having a value different from that of the others it will be seen that the oscillograph may vibrate with four different amplitudes. In vibrating, the beam of light reflected by the mirror of the oscillograph passes at each vibration over the opening 65 in the screen 64 at which time the light passes through to the sensitive film or paper on the drum 52. Since the number of vibrations per second of the oscillograph are fixed by the frequency of the source 67 the amount of light which passes through the opening 65 in the screen depends upon the amplitude of vibration, the greater the amplitude the less the light. In the present case, therefore, four grades of light will affect the sensitive film or paper on the receiving drum depending upon the varying wave length of the carrier wave.

While an inherent advantage of the system itself is that the reception does not depend upon the amplitude of the received signal, it may nevertheless be found desirable in certain cases to employ means to further insure the elimination of the effects of signal fading and also the effects of static. Accordingly I have shown each of the four tuned receiving sets of Fig. 2 provided with a static and fading eliminator 43. In Fig. 3 I have shown diagrammatically one of these eliminators. Each comprises a three electrode electron discharge device 68 having a grid biasing battery 69 and a filament control rheostat 70 by which the device is operated at the point of saturation. The grid bias has such a value that normal static impulses are incapable of overcoming the bias and hence produce no effect on the recorder. The signal, however, has sufficient amplitude to overcome the bias. The device being operated at the point of saturation, the effect of static is reduced in the same proportion as the signal strength and variations in the received signal due to fading are substantially eliminated. The above described means for eliminating static and fading are described and claimed in my copending application Serial No. 128,266, filed Aug. 9, 1926 assigned to the same assignee as the present application.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In apparatus for the transmission of pictures, a receiver comprising a plurality of carrier wave receiving means each tuned to respond to a different wave length and a recorder including a coil arranged to respond to the several receiving means.

2. In apparatus for the transmission of pictures, a receiver comprising a plurality of carrier wave receiving means each tuned to respond to a different wave length, a recorder, and means including a source of alternating current for causing the recorder to produce a different record in accordance with

the operation of each of said receiving means.

3. In apparatus for the transmission of pictures, a receiver comprising a plurality of carrier wave receiving means each tuned to respond to a different wave length, a photographic recorder and a device associated with and responsive to each of the receiving means for controlling the recorder, each device causing the recorder to produce a record of different intensity.

4. In apparatus for the transmission of pictures, a receiver comprising a plurality of carrier wave receiving means each tuned to respond to a different wave length, a photographic recorder comprising an oscillograph and an actuating circuit therefor and control means for said circuit comprising a circuit closing device and a resistance for each of said receiving means, the several resistances having different values and being connected to said actuating circuit.

5. In apparatus for the transmission of pictures, a receiver comprising a light sensitive member, a vibratory member having means for directing a beam of light on the light sensitive member, a screen having an opening therein arranged in the path of the beam of light, a source of alternating current connected to said vibratory member, and means for varying the current actuating said vibratory member in accordance with the wave length of the received signal.

In witness whereof, I have hereunto set my hand this 6th day of August, 1926.

ERNST F. W. ALEXANDERSON.