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PICTURE TRANSMISSION

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Fig. 1

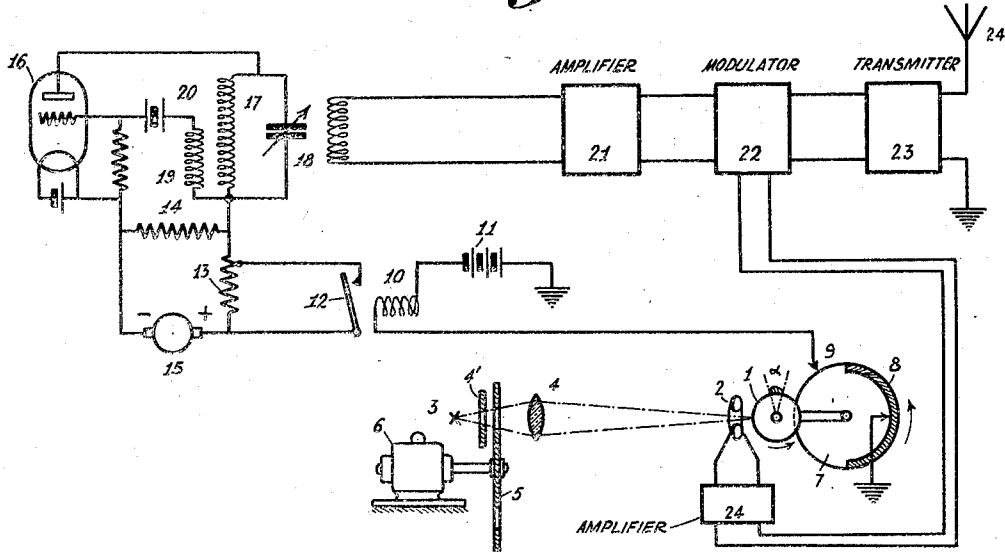
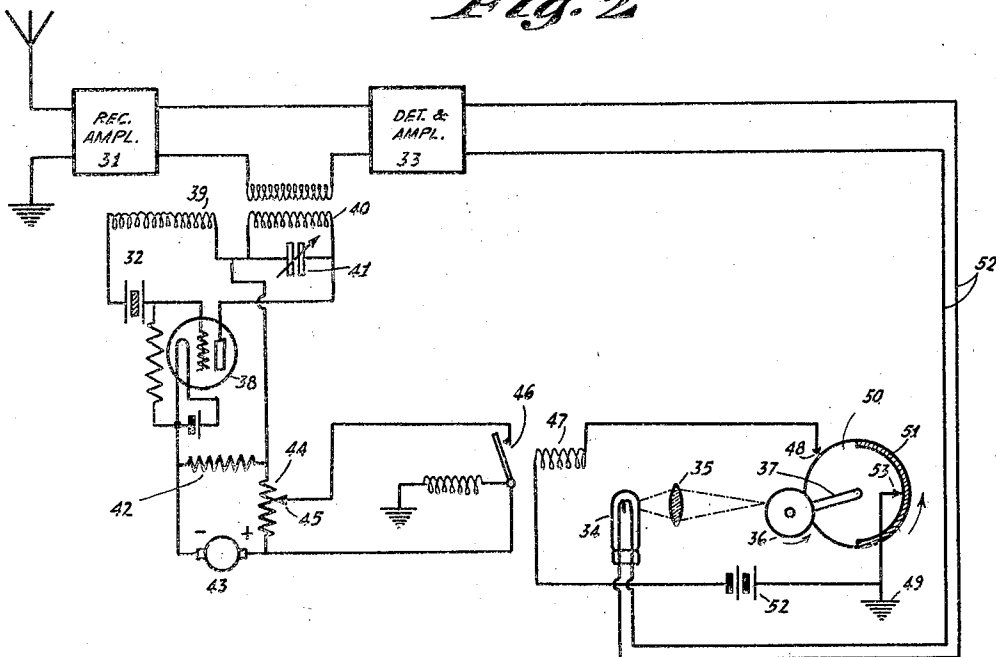


Fig. 2



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PICTURE TRANSMISSION

Original application filed February 23, 1929, Serial No. 342,059. Patent No. 1,784,850, dated December 16, 1930, and in Germany March 3, 1928. Divided and this application filed November 18, 1930. Serial No. 496,386.

This application forms a divisional part of my copending application Serial No. 342,059, filed February 23, 1929.

The present invention relates to picture transmission and is particularly directed to radio transmission of pictures, although, of course, it is possible to use the scheme for wire line or wired radio systems.

The object of the present invention is to produce a method and apparatus for transmitting pictures in which the detrimental effects of the fading phenomena during operation are substantially eliminated, and this result has been accomplished, in the present instance, by continually altering the transmitted wave.

According to the present invention, the transmitted wave is changed as to its frequency in the short time interval between the exploration and scanning of any two successive lines on a picture which is to be transmitted. It is, of course, possible, and also within the spirit and scope of the invention, to make this shift in frequency even during the transmission of any one line of the picture without waiting until the completion of any particular line of scanning, should conditions where this is necessary arise. However, the invention will be described only in connection with the former of the two above disclosed methods, since a system will readily suggest itself to anyone skilled in the art to which the invention relates by which the modified form of frequency shift may be accomplished.

Other objects of the invention will, of course, at once become apparent from a reading of the following specification and claims when considered together with the accompanying drawing, wherein Fig. 1 illustrates one form of transmitter for use with my invention, and Fig. 2 illustrates a suitable receiver to cooperate with the transmitter of Fig. 1, although it is to be understood that certain modifications and changes may be

made in the showing and arrangement set forth provided such changes fall within the spirit and scope of the hereinafter appended claims.

The means, as shown by the drawing, for accomplishing the objects of the invention may consist, for instance, in the use of a revolving contact which is coupled with the scanning device or associated with the picture carrying drum and whose positions actuate the element whereby the frequency of the transmitted wave is altered in the time interval between the exploration of any two successive picture lines. Of course, it is possible to change the frequency in many ways, for example, by causing the contact to change the connection and flow of a direct current, or, perhaps break the flow of a direct current which serves to magnetize an iron core choke coil with the result that the inductance thereof is influenced or changed. The said contact may also be used to connect or disconnect a driving mechanism for a condenser and, as has been shown in the present instance, a change in frequency by way of an increase or a decrease thereof may also be accomplished under certain conditions by the short circuiting of a resistance member.

By such automatically produced changes in frequency the picture lines scanned in sequence may be transmitted at different frequencies and since the fading phenomena manifests this but rarely on two different frequencies in the same manner it is possible to improve the quality and efficiency of transmission by making use of two distinct frequencies.

In so far as the use of the hereinafter described method, and the arrangement to be adopted at the receiving end, are concerned, automatic changes in the receiving apparatus must be effected broadly in accordance with changes in the transmission wave length. For instance, in the case of heterodyne reception the locally generated wave should suit-

ably be so changed that the same beat frequency will always be preserved. However, it is also possible to work without any alterations of the heterodyne frequency by adjusting the heterodyne to a frequency which is equal to the frequency of the longer wave minus half the difference between the two transmission waves or the frequency of the shorter wave plus half the difference between the two transmitted waves. In this case the same differential note will be obtained by both transmission waves while the heterodyne remains unvaried.

If the transmission takes place on two waves which are widely separated from each other then, under certain conditions, it may be necessary to change the tuning conditions at the receiving end in accordance with the changes in the wave length at the transmission end. In such cases, of course, the receiving arrangement must be so chosen and adapted that the changes in tuning are effected in synchronism with the changes in the wave length at the transmitting end. As has been above pointed out, however, if the changes in the transmitted wave length are small it is possible to leave the receiving apparatus unchanged, but whether or not the receiving apparatus is changed or unchanged will depend largely upon working conditions, which are different for each case.

Now referring more particularly to the drawing accompanying this description, a showing of one exemplification of the idea embodying this invention, it has been presupposed that the carrier frequency in relation to the receiver is little changed so that the special measures described for changing the receiver may be dispensed with in this case.

As shown by the accompanying drawing, the picture drum 1 carries the picture to be transmitted and for the purpose of concrete illustration of one embodiment of the invention a reflection type of transmitter using opaque or semi-opaque pictures has been shown. This picture carrying drum is driven from a synchronous motor of any desired type or characteristics, which is maintained by any well known scheme in synchronism with a like element at the transmitter. For convenience of illustration this synchronous motor has not been illustrated.

As shown by the drawing, the angle α designates the portion of the picture drum which is free from the picture elements. It is this portion of the picture drum which serves for securing the picture to the drum and by the present invention this is the portion of the picture carrying drum whose passage time before the scanning element is to be utilized in order to vary the wave length of the transmitter.

The photo cell 2, which is preferably of the annular type for a reflection type transmitter, is arranged adjacent the picture carrying

drum 1 for the purpose of scanning the picture. Light from a source 3 is projected through a small diaphragm 4' and lens 4 to produce a point image of the luminous source 3 upon the surface of the picture drum. For the purpose of producing the picture current carrier wave for amplification a perforated light chopper disk 5 has been provided. In accordance with the present illustration separate motor 6 has been shown for the purpose of driving this perforated light chopper disk.

Associated with the picture drum 1 is a commutating arrangement 7 which, through an appropriate speed reduction or driving gear mechanism, is so arranged as to run at one half the speed of the picture carrying drum 1. The commutator 7 has half of its circumference covered by a conducting segment 8, while the remaining part of the commutator is an insulating segment. A circuit through the battery 11 can be made through the electromagnet 10 by way of the sliding contact 9 only when the commutator is so turned that the contact 9 passes over the conducting segment 8 but while contact 9 rests on the insulating portion of the commutator there is an open circuit in this path.

The change from the current interruption period (as shown by the drawing) to the current flow period by way of the contact 9 takes place at the instant when the angle α passes through the scanning zone in front of the photo cell 2. This action is utilized for the purpose of influencing the transmitter as follows: when current flows from the battery 11 through the electromagnet 10, the contact 9, the conducting segment 8 and back to ground, a relay or switch 12 is closed and in this manner a portion of a resistance 13 connected in series with a direct current generator 15 is short circuited. This results in a change in the anode potential upon a vacuum tube 16 acting across the terminals of resistor 14.

The tube 16 is so arranged as to act as a crystal controlled generator. The tube arrangement 16 comprises an oscillatory circuit consisting of parallelly connected inductance 17 and capacity 18 and in addition a tickler or regeneration coil 19 and a control or master crystal 20 made from quartz.

It has been found, to be sure, that the wave length of the oscillation circuit is kept at a constant value inside relatively narrow bands by the aid of the crystal 20 but that inside the said interval it is liable to be acted upon by variations of the anode potential on the oscillator 16 with a result that according to whether the relay or switch 12 is closed or open a somewhat changed control frequency will be produced. This frequency will be altered from one line of the picture carried by the drum 1 to the next in accordance with the arrangement hereinbefore disclosed.

As shown by the drawing the energy from the oscillator 16 is amplified by means of an amplifier 21 and is then directed to a modulator 22 which is also supplied with current variations from the photo cell 2 which are first amplified in an amplifier 24 of well known characteristics or type. The output of the modulator 22 is then directed to a transmitter 23 of any desired type and is transmitted by means of the antenna system 24.

Instead of a change in the carrier wave at the sending end, an intermediate modulation wave, if used, could be altered, for also in this manner the alteration in the carrier frequency will be insured automatically. For instance, the scanning disk note could be varied, if such a disk is used at the sending end of the system.

To make reference now more particularly to Fig. 2 covering the receiver form of arrangement suitable for combination with the transmitting system of Fig. 1, signals as transmitted from the transmitting antenna 24, or the wire line equivalent, are received upon the antenna 30 and suitably amplified through the receiver amplifier 31. Connected with the output of the receiver amplifier 31 is a local oscillator, generally designated 32, adapted to produce with the incoming signal oscillations a beat frequency of suitable value, which signals are then detected and amplified in detector-amplifier system 33 and through the conductors 52 are directed to a glow lamp, or the equivalent, for the purpose of producing variable intensity glow to influence a suitable picture recording surface carried upon a record drum 36. Light from the glow lamp, or the equivalent, is directed through the optical system 35 so as to focus sharply upon the record drum. The record drum, as it is rotated in synchronism with the drum 1 of Fig. 1, drives through a shaft 37 a second commutating arrangement 50 to be more particularly described hereinafter.

Now making reference to the oscillator system 32, the arrangement comprises the vacuum tube 38 provided with the usual grid and plate coils 39 and 40 which are inductively associated, and across one is placed a variable capacity element 41 for the purpose of tuning the system. Current for the tube 38 is supplied from a direct current source 43 which is shunted by resistor element 42 and in series with the source 43 is a resistor 44 which may be tapped at a variable point 45.

Similarly to the manner shown in Fig. 1, when the record drum 36 is being rotated, the commutator 50, which is in the nature of a non-conducting ring provided with a semi-circular conducting strip 51, permits or prevents current to flow through the circuit including the battery 52, the relay winding 47,

the contact 48, the conducting portion of the commutator 50, the contact 53 and back to the battery 52. In the position shown, current cannot flow and the relay 46 is therefore open.

As the record drum 36 is rotated and arranged so as to carry with it the commutator 50, it will, upon a predetermined rotation, move the contact strip 51 from the position shown to a position so that it bears against the contact point 48, and under this condition current will then flow from the battery 52 through the relay winding 47 and close the relay 46. This closure of the relay 46 will then short-circuit the portion of the resistor 44 which is shunted by the relay, and thus produce a change in the anode potential of the vacuum tube which acts across the resistor 42 and then change the frequency generated thereby. To be sure, this change in frequency is relatively slight in view of the fact that the oscillator is crystal controlled, but nevertheless it is sufficient to produce a change in the resulting beat frequency sufficient to permit reception of the variable frequency picture modulated carrier sent out from the transmitting arrangement of Fig. 1, so that with suitable tuning the system for recording shown by Fig. 2 provides a means by which the detrimental effects of fading may be avoided through the continuously varying character of the transmitted wave.

Having now described my invention, what I claim and desire to secure by Letters Patent is the following:

1. In a picture receiving apparatus, a supporting drum for a recording surface, a source for producing recordings upon the recording surface carried by said record drum, means for receiving transmitted signals periodically varying in frequency by predetermined amounts, a local oscillator for generating a frequency suitable for producing a constant beat frequency from the varying frequency received signals, and means operable at predetermined time periods for varying the frequency of the local oscillator for maintaining a constant beat frequency irrespective of the change in the frequency of the received signals.

2. In a picture receiving system, a vacuum tube oscillator for generating constant frequency energy, means for receiving signals at periodically varying frequency, means for combining the received signal frequencies with the locally generated frequencies for producing a constant beat frequency, means for utilizing the resulting beat frequency energy for producing a record of the received signals, and means responsive at predetermined periods during the recording action for altering the frequency of the local oscillator for maintaining a constant beat frequency at periods of change in frequency of the incoming signal energy.

3. In a picture receiving apparatus, a record drum carrying a recording surface, optical means for influencing the record surface carried upon said record drum, means for causing said optical system to trace a predetermined path along a record surface carried upon said drum, means for receiving varying frequency transmitted signals, a local oscillator for generating frequencies to produce with said received signal frequencies a beat frequency of predetermined value for controlling said optical system, and means operable at predetermined periods in the recording upon said record surface corresponding to periods of changes in the frequency of the incoming signal energy for varying the frequency of the said local oscillator for maintaining constant beat frequency irrespective of the frequency of the incoming signal energy. 75
4. In a picture receiving apparatus, means for producing visible picture representations, means for receiving transmitted signals which vary periodically in carrier frequency by predetermined amounts, means for producing from the received carrier frequencies beat frequencies from which the visible representations are produced, and means operable at predetermined time periods corresponding to the exact periods of change in the received carrier frequency for maintaining constant beat frequencies in the receiver. 80
5. In a signalling system, means for receiving signalling oscillations transmitted with a periodically varying carrier frequency, means for generating locally constant frequency energy for producing with the received signals beat frequencies of predetermined value, means for producing from the resulting beat frequencies visible indications of the signals transmitted, and means for altering the frequency of the locally generated energy at predetermined time periods corresponding to the changes in carrier frequency at the transmitter so as to produce continually substantially constant beat frequency for all changes in the received carrier frequency. 85
6. In a signalling system, the method of producing visible picture records which comprises receiving signals transmitted from a remote point and periodically varying in frequency by predetermined amounts, generating locally a frequency for producing beat frequencies of predetermined value from the received signals, and varying at predetermined time periods the locally generated frequency for maintaining constant beat frequency in the receiver irrespective of the change in the frequency of the received signals. 90
7. In a receiving system, the method which comprises receiving signals varying in frequency at a substantially constant rate, locally generating energy of a frequency suitable for producing a desired beat frequencies from the received signals, producing from the resulting beat frequencies visible indications of the received signals, and varying at predetermined time intervals the locally generated frequency for maintaining a constant beat frequency at periods of change in the frequency of the incoming signalling energy. 95
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