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METHOD OF AND APPARATUS FOR SYNCHRONIZATION IN PICTURE TRANSMISSION

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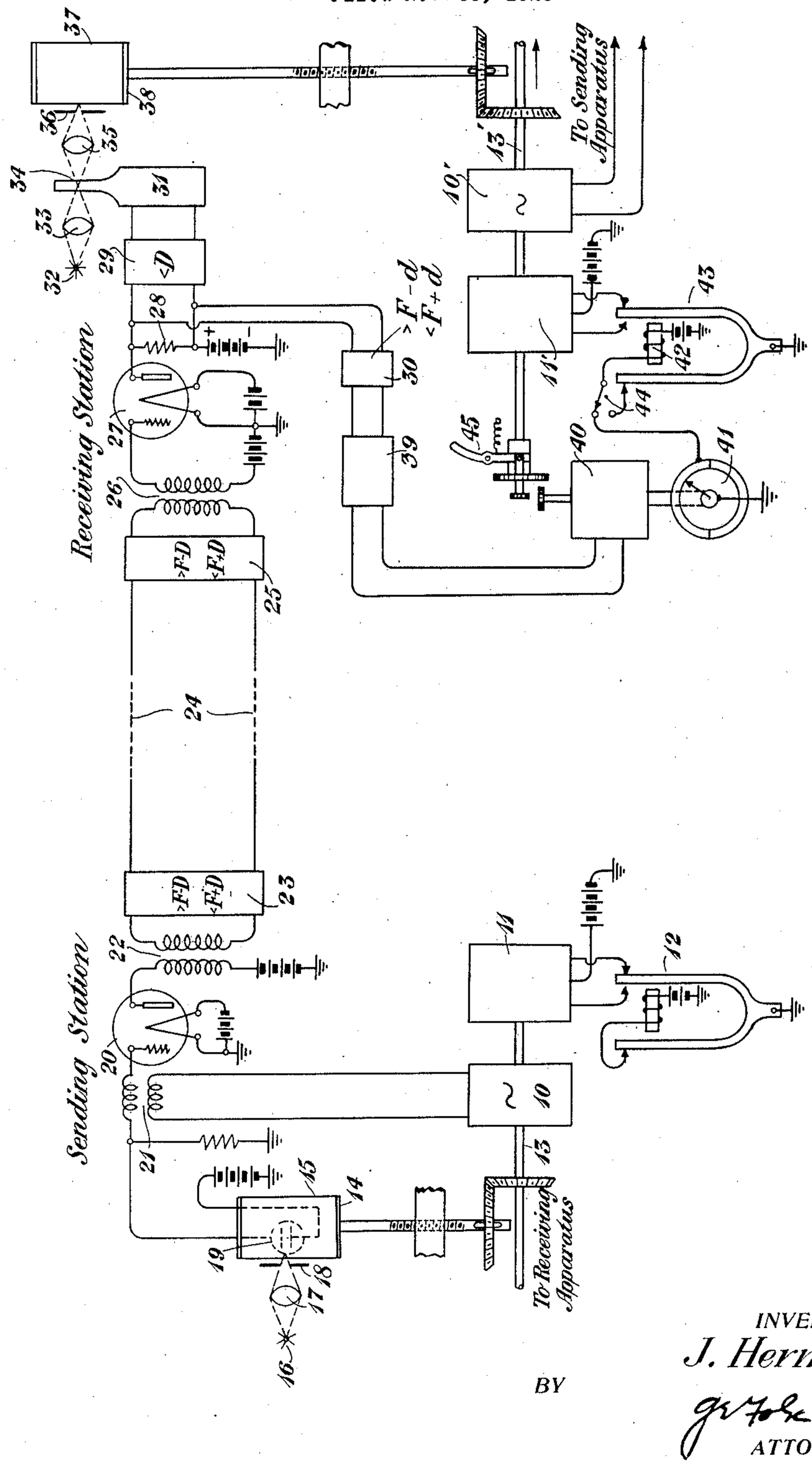

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METHOD OF AND APPARATUS FOR SYNCHRONIZATION IN PICTURE TRANSMISSION.

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The principal object of my invention is to provide for synchronous operation of apparatus at the transmitting and receiving stations of a carrier current communication system. Another object of my invention is to provide a carrier current picture transmitting system in which synchronization is effected by means of the carrier current. These and other objects of my invention will become apparent on consideration of a specific example which I have chosen for disclosure in this specification. It will be understood that the invention is defined in the appended claims and that the drawings and the following specification relate to the particular embodiment of the invention chosen by way of example.

The drawing is a diagram showing apparatus by which my invention may be practised.

At the sending station the alternating current generator 10 on the shaft 13 is driven by the phonic motor 11, whose rate is determined by the tuning fork 12. Thus, the generator 10 applies an alternating electromotive force of definite frequency through the transformer 21 on the grid of the three-electrode vacuum tube modulator 20.

The picture to be transmitted in the form of a semi-transparent film 15 is wrapped on the glass drum 14, which is rotated from the shaft 13. The drum 14 is also provided with screw means to traverse it slowly in an axial direction while it rotates so that the spot of the film 15 adjacent to the opening in the screen 18 travels over a helical path of the film 15.

Light from the source 16 is directed by the lens 17 through the opening in the screen 18 and through the adjacent portion of the film 15 to the photoelectric cell 19. Accordingly, the current through the photoelectric cell 19 varies in proportion to the transparency of the film 15 and a corresponding electromotive force is superposed on the grid of the three-electrode vacuum tube modulator 20.

The output from the modulator 20 goes through the transformer 22 and through the band-pass filter 23 to the line 24. This output will be a carrier current of frequency F determined by the generator 10 and modulated in accordance with the lights and shades of the picture film 15.

Let D be a member such that essential side bands of current frequency will be comprised between the frequency limits F—D and F+D; these are the cut-off frequencies of the band-pass filter 23.

At the receiving end the modulated carrier current from the line 24 goes through a similar filter 25 and through a transformer 26 to the grid of a three-electrode vacuum tube demodulator 27. The output from the tube 27 goes through the resistance 28 in shunt to which are two multiple branch circuits with respective filters 29 and 30.

The filter 29 is a low-pass filter which passes frequencies below D, where D is a number which represents the maximum essential frequency produced by the revolving drum and photoelectric cell at the transmitting station. In other words the band width of the low-pass filter 29 must be large enough to pass all frequencies which are essential to an accurate reproduction of the transmitted picture.

On the other hand, the filter 30 is a band-pass filter with a very small band width so that the filter 30 passes only the narrow band comprising the carrier frequency F. The band width of this filter may be represented by the limits F+d and F—d, where d is a small number.

The frequency band transmitted by the filter 29 goes to the electromagnetic light valve 31, which controls a shutter at 34. The light from the source 32 is directed by the lens 33 through the opening permitted by the shutter 34 and then through another lens 35, through an opening in the screen 36 to the sensitive film 37 on the rotating drum 38.

It will be seen that the variation of current through the photoelectric cell 19 at the transmitting station corresponds to the transparency of the film 15 at the spot under the opening in the screen 18. This same current is again obtained at the receiving station by demodulation of the carrier current from the line 24 in the vacuum tube 27. The current thus obtained passes through filter 29 to the light valve 31 where it determines the opening of the shutter 34 so that a corresponding intensity of light falls on the spot of the film 37 adjacent to the opening in the screen 36.

The drum 38 carrying the receiving film 37 is rotated and traversed in synchronism

with the transmitting drum 14 by apparatus now to be described.

The carrier current passed by the filter 30 and amplified by the amplifier 39 drives the synchronous motor 40, which drives an interrupter 41 in the circuit of the control magnet 42 for the tuning fork 43. The tuning fork 43 is tuned to very nearly the frequency of the tuning fork 12 at the sending station, that is it is very nearly a copy of the tuning fork 12. Accordingly, it is readily forced to vibrate at the frequency determined by the interrupter 41, that is, the fork 43 is forced to vibrate at the same rate as the fork 12. The fork 43 determines the speed of the phonic motor 11′ on the shaft 13′ geared to the receiving drum 38. Thus, the receiving drum is rotated and traversed in synchronism with the sending drum 14.

The shaft 13′ also carries an alternating current generator 10′ of the carrier frequency F. The current from the alternating current generator 10′ goes to a three-electrode vacuum tube modulator similar to 20 for sending from east to west. At the ending station shown at the west a receiving drum like 37 may be driven from the shaft 13.

It will be seen that for transmission both ways the carrier current frequency F is determined by the tuning fork 12 at the station on the west.

In order to bring the synchronous motor 40 to the proper speed for operation from the received carrier frequency current, a clutch 45 is provided to engage the shaft of the synchronous motor 40 with that of the phonic motor 11′. The phonic motor may then be operated from its own tuning fork by throwing the switch 44 to make the fork 43 self-operative. When the motor 40 has become synchronized the clutch 45 is disengaged and the switch 44 is thrown to the position shown in the drawing. The tuning fork 43 will then be operated from the interrupter 41 on the synchronous motor 40.

It will be seen that by my invention no auxiliary currents or impulses are necessary for synchronization but the fundamental carrier current itself is not only modulated to transmit the picture but is filtered out and employed to drive the receiving apparatus at the rate of the carrier current itself, which is determined at the sending station.

I claim:

1. The method of synchronizing apparatus at two places between which transmission is effected by modulated carrier current, which consists in determining the speed of the apparatus at both places in accordance with the carrier frequency.

2. The method of synchronizing the transmitting and receiving apparatus in a modulated carrier current communication system, which consists in determining the speed of both the transmitting and receiving apparatus in accordance with the frequency of the carrier current.

3. In a modulated carrier current transmitting system, the method of synchronizing the transmitting and receiving apparatus, which consists in generating the carrier current at the transmitting end with a frequency proportional to the speed of the transmitting apparatus and filtering out the carrier current at the receiving end and driving the receiving apparatus at a speed determined thereby.

4. In the transmission of pictures by means of a modulated carrier current, the method of synchronizing the transmitting and receiving apparatus which consists in driving the transmitting apparatus at a speed determined by the speed of the carrier current generator and at the receiving end controlling the speed of the receiving apparatus by the carrier component of the modulated received current.

5. Means for synchronizing apparatus at two places between which a carrier current transmission is effected comprising respective motors at the places, and means at each place to correlate the motor speed with the carrier frequency.

6. In a picture transmitting system, a carrier current generator at the transmitting end, means to modulate its output in accordance with the elements of the picture to be sent, a line to carry the modulated current, means to expose a spot of a sensitive receiving film in accordance with the modulated current received from the line and means to move the receiving film in synchronism with the transmitting film, said last mentioned means having its speed determined by the carrier component of the received current.

7. Means for receiving a picture represented by a modulated carrier current comprising a filter to separate out the carrier component, a motor with speed controlled by said carrier current and a picture receiving drum driven by said motor.

8. Means to receive a picture transmitted by a modulated carrier current comprising a movable picture receiving film, a source of light, means to direct a beam from said source on a spot of said film, a shutter across said beam of light, means to control said shutter by the demodulated received current and means to filter out the carrier component of the received current and thereby to determine the speed of the picture receiving drum.

9. In a signaling system means for generating a sustained alternating current, means for continuously modulating said alternating current according to message signals, means for receiving said modulated current,

and means for dividing said received current into message signal currents and into synchronizing signal currents.

10. The combination of signal recording means, means for driving said recording means, means for generating a sustained alternating current, means for modulating said alternating current by signal currents, and means for utilizing said modulated currents to control the operation of said driving means and to control the operation of said signal reproducing means.

11. Picture reproducing apparatus comprising a moving sensitized film, means for exposing said film, means for generating a carrier current, means for modulating said current according to the characteristics of the picture to be reproduced, means for demodulating said current, means for selecting a portion of the demodulated current to control the movement of said film, and means for selecting another portion of said demodulated current to control said film exposing means.

In testimony whereof, I have signed my name to this specification this 23rd day of November, 1923.

JOSEPH HERMAN.

DISCLAIMER

1,626,731.—*Joseph Herman*, NEW YORK, N. Y. METHOD OF AND APPARATUS FOR SYNCHRONIZATION IN PICTURE TRANSMISSION. Patent dated May 3, 1927. Disclaimer filed March 12, 1930, by the assignee, *American Telephone and Telegraph Company*.

Hereby enters this disclaimer to the said claim of said Letters Patent, which is in the following words, to wit:

"9. In a signaling system means for generating a sustained alternating current, means for continuously modulating said alternating current according to message signals, means for receiving said modulated current, and means for dividing said received current into message signal currents and into synchronizing signal currents."

[*Official Gazette April 1, 1930.*]

DISCLAIMER

1,626,731.—*Joseph Herman*, New York, N.Y. METHOD OF AND APPARATUS FOR SYNCHRONIZATION IN PICTURE TRANSMISSION. Patent dated May 3, 1927. Disclaimer filed November 2, 1933, by the assignee, *American Telephone and Telegraph Company*.

Hereby enters this disclaimer to the said claims of said Letters Patent which are in the following words, to wit:

"1. The method of synchronizing apparatus at two places between which transmission is effected by modulated carrier current, which consists in determining the speed of the apparatus at both places in accordance with the carrier frequency.

"2. The method of synchronizing the transmitting and receiving apparatus in a modulated carrier current communication system, which consists in determining the speed of both the transmitting and receiving apparatus in accordance with the frequency of the carrier current."

"4. In the transmission of pictures by means of a modulated carrier current, the method of synchronizing the transmitting and receiving apparatus which consists in driving the transmitting apparatus at a speed determined by the speed of the carrier current generator and at the receiving end controlling the speed of the receiving apparatus by the carrier component of the modulated received current.

"5. Means for synchronizing apparatus at two places between which a carrier current transmission is effected comprising respective motors at the places, and means at each place to correlate the motor speed with the carrier frequency.

"6. In a picture transmitting system, a carrier current generator at the transmitting end, means to modulate its output in accordance with the elements of the picture to be sent, a line to carry the modulated current, means to expose a spot of a sensitive receiving film in accordance with the modulated current received from the line and means to move the receiving film in synchronism with the transmitting film, said last mentioned means having its speed determined by the carrier component of the received current."

"10. The combination of signal recording means, means for driving said recording means, means for generating a sustained alternating current, means for modulating said alternating current by signal currents, and means for utilizing said modulated currents to control the operation of said driving means and to control the operation of said signal reproducing means."

[*Official Gazette November 28, 1933.*]