March 1, 1949. L. ROSEN 2,462,904

TELAUTOGRAPH SYSTEM

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FIG. 1.

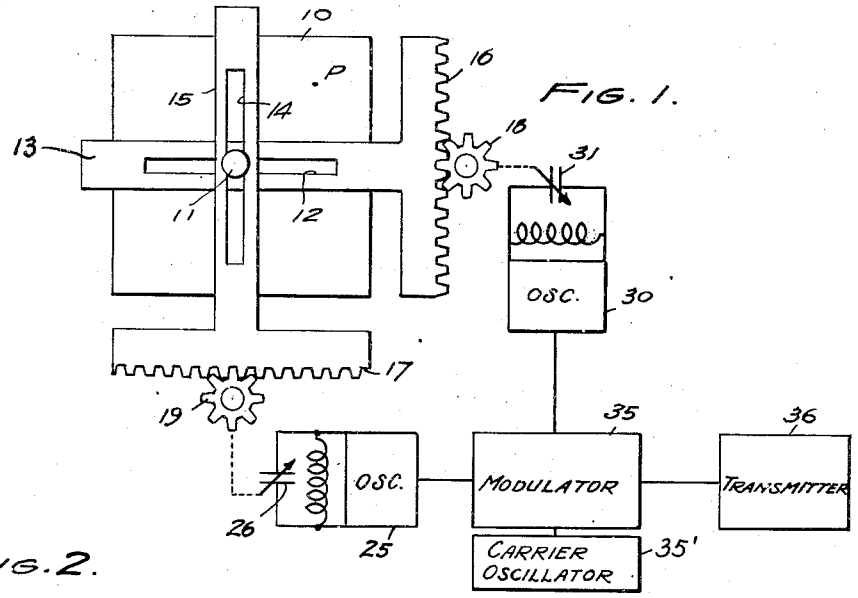
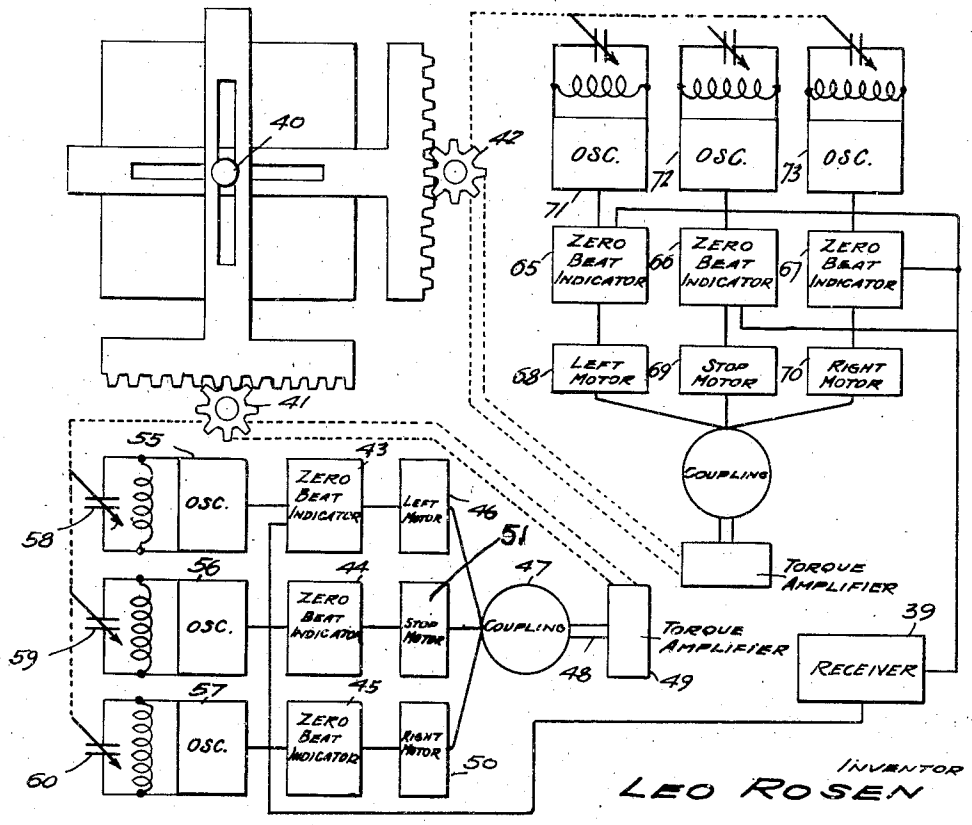


FIG. 2.



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TELAUTOGRAPH SYSTEM

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to improvements in electrical apparatus, telautograph systems and the like.

Heretofore, telautographs, considered generally, have been inadequate in that they did not provide a faithful reproduction, and they required special wiring between the sending instrument and the receiving and reproducing apparatus.

It is, therefore, an object of this invention to provide a telautograph which will furnish an accurate reproduction of the message or other material intended to be transmitted.

Another object is to provide a telautograph operable over ordinary communications lines, without special wiring.

A further object is to provide a telautograph operable by signals suitable for wireless communication.

It is also an object of the invention to utilize a frequency change in a signal furnished by the originating apparatus for directing and limiting the movement of the reproducing means.

These and other objects are attained by the novel combination and arrangement of elements hereinafter described and illustrated in the accompanying drawings, forming a part hereof, and in which:

Figure 1 is a block diagram of the apparatus for producing the pattern to be transmitted;

Figure 2 is a block diagram of the receiving and reproducing apparatus.

With reference to the drawings, and particularly to Figure 1, 10, represents a writing mechanism including a stylus 11 adapted to be moved vertically in a slot 12 in member 13 and simultaneously in a slot 14 in member 15, horizontally. A movement of the stylus is, in other words, accompanied by some characteristic displacement of one or both of the members 13 and 15. Such displacement is transferred to the racks 16 and 17, by members 13 and 15, respectively, and thence to the pinions 18 and 19.

An oscillator 25 is arranged to have its normal frequency varied by a capacity change in the variable condenser 26, and the latter element is linked in any desired manner with pinion 19, so that the frequency of oscillator 25 becomes a function of the horizontal displacement of member 15. The direction of movement of this member may hereafter be referred to as the X-axis.

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Another oscillator 30, similar to oscillator 25, and with means 31 for varying its frequency, is linked to pinion 18, so that the output of this oscillator is a function of the displacement of stylus 11 along the Y-axis. The frequency range of oscillator 30 should differ from the range of oscillator 25.

The outputs of the two oscillators are fed into modulator 35, together with the output of carrier oscillator 35', and from there to the transmitter 36. The exact type of transmitter is unimportant. The signals can be carried equally well over wired and wireless systems.

In Figure 2 are illustrated the receiving and reproducing elements of the invention. Receiver 39 is conventional, its exact nature depending upon whether wired or wireless signals are utilized, etc. A writing apparatus similar to the apparatus 10 of Figure 1, including a stylus 40 and pinions 41, 42, and cooperating racks, is provided. In this case, of course, the pinions are intended to drive the racks, rather than to be driven by them.

Three beat indicators, 43, 44, 45, handle the X-axis signal, the signal being fed to the beat indicators in parallel. These indicators may be of any convenient type. They function to provide an output or a failure of output when two signals having a predetermined frequency relation are received. In the present case, they generate an output when the two signals are of the same frequency, and thus may hereafter be referred to as zero beat indicators.

Zero beat indicator 43 is connected to left motor 46, this being a motor turning to the left or otherwise arranged to drive stylus 40 left-wardly, through coupling 47, shaft 48, torque amplifier 49 and pinion 41. Beat indicator 45 is connected to right motor 50 for driving stylus 40 rightwardly in similar fashion. Indicator 44 is connected to a stop or brake motor 51, the function of which is to stop one motor, shaft 48 and other related parts, before a newly actuated motor takes control. This operation will be more fully described later.

Three oscillators 55, 56, and 57, of convenient type, with means for varying their frequencies, as variable capacitors 58, 59, 60, respectively, also feed into the zero beat indicators, 55 into 43, 56 into 44, and 57 into 45. The frequency of oscillator 55 is less than that of 56, which, in turn, is less than the frequency of 57. And these oscillators, unlike oscillators 25 and 30, of Figure 1, are so arranged that their frequencies are variable simultaneously, rather than individually, while

the before-mentioned frequency difference between them is constantly maintained. The condensers 58, 59 and 60 may be geared or otherwise connected together for this purpose, and they are then motivated by shaft 48, pinion 41, or some other part associated with movement of the stylus 40 along the X-axis.

Zero beat indicators 65, 66, 67, motors 68, 69, 70 and oscillators 71, 72, 73, serve the Y-axis signal. The parts are essentially similar to those already described, and they function in the same manner, the principal difference being in adjustment. These parts, in other words, handle signals covering a different frequency range—that of the Y-axis—than do the parts previously explained.

The apparatus functions in the following manner:

Assume that stylus 11, Figure 1, is moved upwardly and to the right from its illustrated position toward point P. The movement will of course produce a displacement of the stylus in the slots 12 and 14 of members 13 and 15, respectively, and will also cause changes in the positions of the latter two members, 13 moving upwardly, and 15, to the right. Since member 13 is secured to rack 16, this rack will move upwardly, and in like manner rack 17 will move rightwardly, thereby causing clockwise rotation of the pinions 18 and 19.

As mentioned earlier, these pinions are linked with the variable condensers 31 and 26, and it will be assumed that this linkage is such that clockwise rotation of pinions 18 and 19 decreases the capacities of condensers 31 and 26, and thus increases the frequencies of oscillators 30 and 25.

After modulation, the combined X-axis and Y-axis signal is transmitted in whatever fashion the circumstances demand.

Upon reception, the X-axis signal is introduced to zero beat indicators 43, 44 and 45 in parallel, and the Y-axis signal, to zero beat indicators 65, 66 and 67. Considering the X-axis signal, it will be understood that oscillators 55, 56 and 57 are also feeding into the zero beat indicators 43, 44 and 45, respectively.

At some predetermined point, the incoming X-axis signal and the signal generated by oscillator 56 will have the same frequency, and zero beat indicator 44 will be activated. Then, as the stylus 11 is moved to the right, the X-axis signal will increase in frequency and reach the frequency of the output of oscillator 57, zero beat indicator 45 will be activated, and right motor 50 will be started. Motor 50, operating through coupling 47, shaft 48, and amplifier 49, drives pinion 41 clockwise, and the pinion in turn moves its cooperating rack rightwardly, thereby driving stylus 40 in the same direction.

While stylus 11 continues its rightward movement, the capacity of condenser 26 is progressively reduced, and thus the frequency of oscillator 25 continues to rise. This increasingly fast signal is nevertheless kept synchronized, after reception, with the output of oscillator 57 by means of the mechanical connection between pinion 41 and the ganged condensers 58, 59 and 60.

When stylus 11 stops, however, the frequency of the oscillator associated with it will become constant. Disregarding a very small fraction of a second of lag between the stylus 11 and stylus 40, the frequency of oscillator 56 will then be the same as that of the incoming X-axis signal, zero beat indicator 44 will be actuated, and stop motor 51 will take control. In a similar manner, a leftward movement of stylus 11 causes left motor 46 to take control from motor 51.

The operation of the Y-axis system is in all respects the same as that of the X-axis system, just described. Working in conjunction, the two systems provide for stylus 40 a resulting action substantially duplicative of the movement of stylus 11.

It will be understood, of course, that the invention is not limited to the transmission of intelligence according to a system of rectangular coordinates. Under certain conditions, the written or printed message may be one-dimensional in nature; on the other hand, spherical, cubical, and polar coordinates may be employed.

It should be understood further that many changes can be made in the forms and proportions of the various parts of the apparatus shown and described without departing from the spirt of the invention. For the true scope of the invention, therefore, reference should be had to the appended claims.

The invention having been described, what is claimed is:

1. An apparatus for producing a representation of a signal of varying frequency, said apparatus including a device for making the representation, means for actuating the device comprising a motor for moving the device in one direction, a second motor for moving the device in another direction, controlling means governing the actuation of said motors comprising a beat indicator for each motor means for applying the signal simultaneously to said beat indicators, an oscillator for each beat indicator, the normal frequencies of the oscillators varying each from the other, means dependent upon movement of the device for varying simultaneously the frequencies of the oscillators, and means dependent upon a predetermined beat condition in said indicators for selectively actuating said motors.

2. The combination of a movable device for producing a pattern to be transmitted, an oscillator, means for increasing the frequency of the oscillator upon movement of the device in one direction and for decreasing its frequency upon movement in another direction, means for transmitting the output of said oscillator, receiving and reproducing means including a stylus or the like, a second oscillator having a normal frequency adapted to be increased upon movement of the stylus in one direction and decreased upon movement of the stylus in another direction, a third oscillator having a normal frequency different from that of the second oscillator and adapted to have its frequency likewise increased and decreased upon movement of the writing device while maintaining between the two last mentioned oscillators the frequency difference mentioned, and means responsive to an increase in the frequency of the first mentioned oscillator for driving the stylus in one direction and responsive to a decrease in the said frequency for driving the stylus in another direction.

3. The combination of a stylus for producing a pattern to be transmitted, the stylus being adapted to move along at least two axes, an oscillator, means dependent upon movement of the stylus along one axis for varying the frequency of the oscillator, a second oscillator, means dependent upon movement of the stylus along another axis for varying the frequency of the second oscillator, a modulator for the outputs of the oscillators, and means for transmitting the output of

said modulator, receiving and reproducing means including a second stylus adapted to move along at least two axes, a first motor for driving the second stylus in one direction along one axis, a second motor for driving the second stylus in the opposite direction along said axis, a brake or the like for stopping one motor before the other motor takes control, controlling means governing the actuation of said motors and the brake, said controlling means comprising a beat indicator for each motor and for the brake adapted to have the output of the modulator applied in parallel thereto, an oscillator for each beat indicator, the normal frequencies of the last mentioned oscillators varying each from the others, means dependent upon movement of the second stylus along an axis for varying simultaneously the frequencies of said last mentioned oscillators, and means dependent upon a predetermined beat condition in said indicators for selectively actuating the motors.

4. The combination of claim 3, further characterized by a third motor for driving the second stylus in one direction along another axis, a fourth motor for driving the second stylus in the opposite direction along said other axis, a brake or the like for stopping one of said third and fourth motors before the other takes control, controlling means governing the actuation of said motors, the said controlling means comprising

a beat indicator for each motor and for the brake adapted to have the output of the modulator applied in parallel thereto, an oscillator for each beat indicator, the normal frequencies of the last mentioned oscillators varying each from the others, means dependent upon movement of the second stylus along the other axis for varying simultaneously the frequencies of said last mentioned oscillators, and means dependent upon a predetermined beat condition in said indicators for selectively actuating the third and fourth motors.

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