

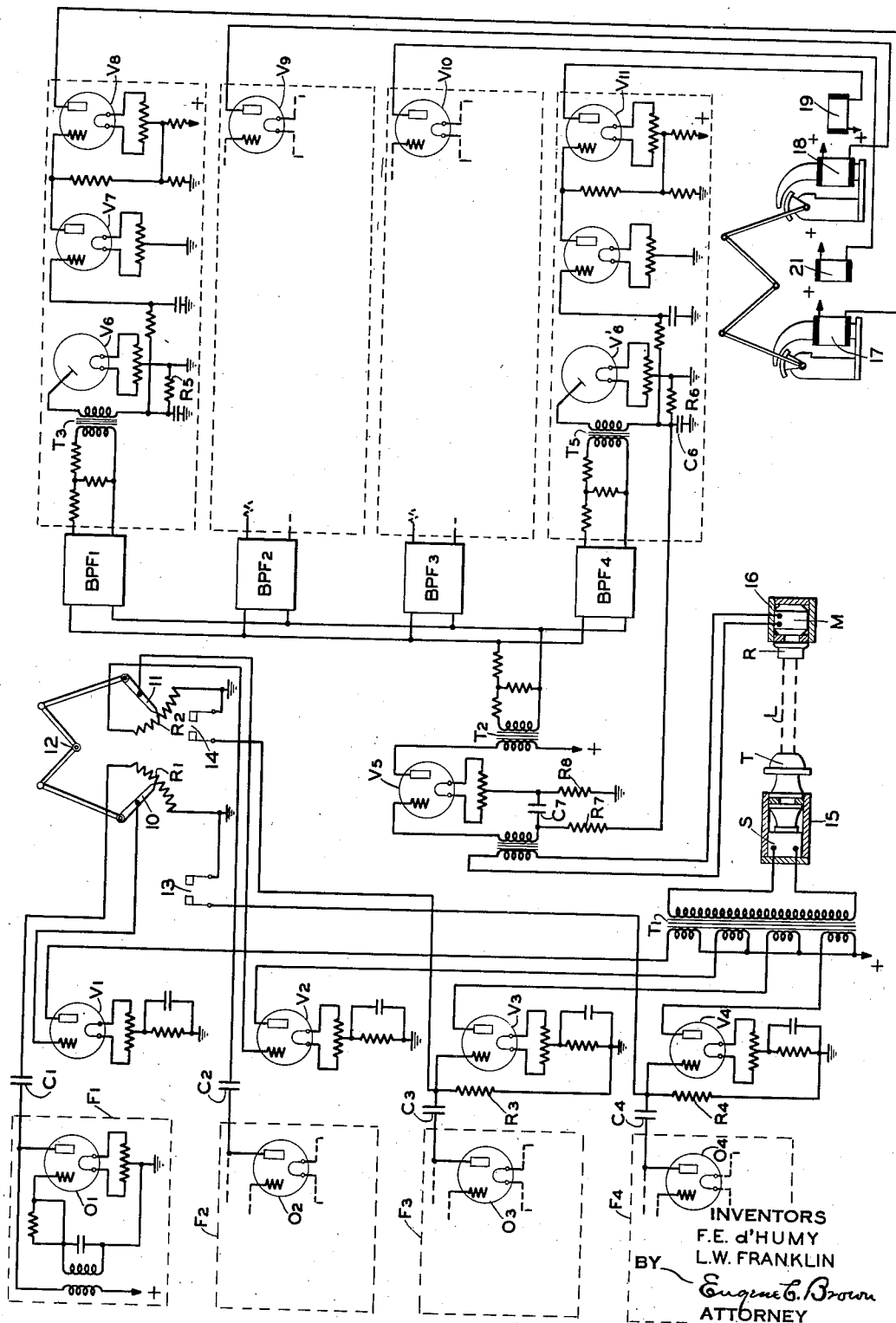
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TELAUTOGRAPH SYSTEM

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TELAUTOGRAPH SYSTEM

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This invention relates to a telautographic system and more particularly to the operation of telautograph apparatus over much greater distances than has heretofore been possible.

5 The telautograph method of transmitting intelligence over wires is quite efficient from the standpoint of terminal apparatus required but is limited to operation over very short circuits. In the usual telautograph method of communication the transmitting mechanism consists of a stylus or pencil tracer connected through links to two rheostats or potentiometers across the outside terminals of which battery is applied to form a coordinate potential controlling system. 10 As the stylus is moved in forming the characters of the message being written, the two potentiometer arms are moved simultaneously in response to the horizontal and vertical movements of the stylus. Thus the voltages on the two potentiometer arms will vary in accordance with the message being written. The two potentiometer arms are connected through two separate line wires to two solenoids at the receiving end of the circuit. The armatures of the solenoids are so disposed and connected to the receiving stylus or pen through links similar to those at the transmitting end of the circuit, that the movement of the transmitting stylus is electrically transmitted to the receiving stylus and hence the receiving stylus follows the motion of the transmitting stylus. A considerable amount of power is required to operate the receiving solenoids and since this power must be transmitted over the line wires, they are, of course, limited in length due to the electrical resistance thereof and the corresponding voltage drop therealong. 25 In addition to these two operating currents, a pulsating or alternating current is superimposed on the two line wires and serves through an alternating current relay to operate a pen lifting magnet. This current flows while the transmitting stylus is in contact with the paper and is interrupted whenever the transmitting stylus is raised from the paper. The pen raising current also serves to aid the stylus in passing over rough spots in the paper since while the alternating or pulsating current is flowing, there is a certain amount of vibration in the stylus which aids the operating solenoids in overcoming the static friction of the pen on the paper as it moves thereover. The shifting of the paper is accomplished by moving the pointer or transmitting stylus to one corner of the writing window at which position it opens one of the transmitting circuits thereby operating a relay at the receive-

ing station which in turn actuates the paper feed mechanism.

One of the objects of the present invention is to utilize terminal apparatus of this general nature and at the same time to enable telautograph communication to be carried on over great distances. 5

Another object is to enable the operation of telautograph apparatus over a single circuit.

A still further object is to provide a telautograph system which is operable over a standard telephone system. 10

Another object is to provide means in such a telautograph system for compensating for variations in line conditions and line characteristics.

Other objects and advantages of the invention will hereinafter appear. 15

In accordance with the present invention, currents of four separate frequencies are employed, two of which represent the vertical and horizontal tracing movements of the transmitting stylus, the third of which controls the pen lifting mechanism, and the fourth of which controls the paper feed and also provides a channel by means of which the variations in line signaling condition can be compensated for. The oscillating currents employed for controlling the writing movement of the recording stylus are separately controlled in amplitude in accordance with the lateral tracing movements of the transmitting stylus. The oscillating current employed for operating the pen lifting mechanism is permitted to flow whenever the transmitting stylus is in contact with the paper and is interrupted whenever the transmitting stylus is raised from the paper. The oscillating current employed for controlling the paper feed is normally continuous but is interrupted whenever a paper feeding movement is desired. These four oscillating currents are sufficiently separated in frequency so that they may be transmitted simultaneously over a single circuit without danger of interaction with each other. They may be applied directly to the line circuit through suitable coupling transformers. However, in accordance with the preferred embodiment of the invention, the signaling frequencies are all maintained within the audible range and are utilized to produce distinct tone signals which are transmitted over a standard telephone system by placing the telephone transmitter in sound transferring relation to the sound producer. At the distant terminal of the telephone system the received tones are converted into electrical oscillations which are filtered and after being amplified are rectified and applied to the 50

receiving elements of the recording telautograph apparatus.

The invention will be more fully understood by reference to the accompanying drawing in which the single figure illustrates schematically a preferred embodiment thereof.

At the transmitting station there are four separate sources of frequency F1, F2, F3 and F4, each comprising a vacuum tube oscillator O1, O2, O3 and O4, respectively, of the inductively coupled feed-back type. Each oscillator is tuned to a different frequency, preferably within the range between about 300 and 3000 cycles per second and spaced apart in frequency sufficiently to prevent interaction therebetween when all four frequencies are impressed upon a single conductor.

The output of each of the oscillators is connected through individual buffer tubes V1, V2, V3 and V4, respectively, to a transformer or other coupling device T1 and from the secondary winding of the coupling transformer to a sound producer S.

Between each of the oscillator tubes O1 and O2 and their associated buffer tubes V1 and V2, are two variable coupling devices controlled by the lateral movements of the telautograph transmitting stylus. The variable couplings comprise two resistance elements R1 and R2 having one terminal connected through coupling condensers C1 and C2 respectively, to the plate elements of the vacuum tube oscillators O1 and O2 and their opposite terminals grounded. The telautograph contact arms 10 and 11, which are controlled by link or other motions from the transmitting stylus 12, travel over the resistances R1 and R2 respectively. Each of the resistances R1 and R2 constitute potentiometers connected as stated in the output circuit of the oscillator tubes O1 and O2. The arms 10 and 11 are connected respectively to the grids of the buffer tubes V1 and V2. These potentiometers serve to vary the amplitude of the oscillations from the sources F1 and F2 in accordance with the horizontal and vertical tracing movements of the stylus 12. Thus the amplitude or volume of the tones produced by the sound producing device S will vary in accordance with the movement of the stylus 12.

A grounded switch point 13 is disposed so as to be closed whenever the stylus is moved to an extreme corner position, thereby interrupting the input circuit to the tube V4 and hence the output current from this tube. The interruption of the signals from the source of frequency F4 actuates the paper feed mechanism at the receiving station, as will hereinafter appear. The contact 13 is open during writing movements of the transmitting stylus so that a continuous flow of current of the frequency of the source F4 is supplied to the transformer T1, at such times. These oscillations are employed at the receiving station to control means for compensating for variation in line conditions, as will hereinafter appear.

The carrier frequency F3 is fixed in amplitude and is keyed off whenever the stylus is lifted from the paper. For this purpose a switch 14, opened by the stylus in the usual manner whenever the stylus is pressed against the paper and closed whenever the stylus is lifted from the paper, serves in the latter case to ground the grid of the buffer tube V3 and hence to interrupt the output of the tube V3 except when the stylus is in contact with the paper.

The sound producing device S is enclosed in

a sound insulating container 15, the open end of which may be placed in contact with the mouthpiece of a standard telephone transmitter T so that the signals will be impressed on the diaphragm of the telephone transmitter and hence corresponding signals will be transmitted over the telephone line L and reproduced as sound signals by the telephone receiver R at the distant end of the telephone circuit.

The tone signals produced by the telephone receiver R are picked up by a microphone M, preferably enclosed in a sound insulating container 16 having its open end in contact with the telephone receiver R. The electric signals produced by the microphone M are amplified by the amplifier tube V5 and are applied through an output transformer T2 to four band pass filters BPF1, BPF2, BPF3, and BPF4, designed to pass currents of a frequency corresponding to the sources F1, F2, F3, and F4, respectively.

The output side of the filter BPF1 is coupled through a transformer T3 to a diode rectifier tube V6. A T-shaped network of resistances Ra, Rb and Rc may be provided before and after the filter BPF1 to match the filter impedance through the coupling transformers T2 and T3, so as to increase the efficiency of the filter. The voltage generated across the resistance Rb of the rectifying tube V6 is applied to the grid of an amplifying tube V7. The rectified signals from the tube V7 are applied to the grid of an amplifying tube V8, thereby producing essentially direct current in the output circuit thereof, the amplitude of which varies in accordance with one component of movement of the transmitting stylus 12. The signals passed by the filter BPF2 are amplified and rectified in a similar manner, the output current from the tube V9 varying in amplitude with the other component of motion of the transmitting stylus 12. The oscillations passed by the filter BPF3 are rectified and amplified in the same manner, the output current from the tube V10 being of a constant amplitude but being keyed off whenever the controlling contacts 14 of the transmitter are closed by raising of the transmitting stylus 12. The oscillations passed by the filter BPF4 are likewise rectified and amplified and are keyed off whenever the controlling contacts 13 of the transmitter are closed to effect a paper feed operation.

The receiving telautograph equipment is of a common form comprising a pair of pen tracing solenoids 17 and 18, a paper feed magnet 19, and a pen lifting magnet 21. The solenoid 17 is in the output circuit of the tube V8 and is therefore controlled by variations in the oscillations from the source F1. The solenoid 18 is in circuit with the output of the tube V9 and hence is controlled by variations in the amplitude of the oscillations from the source F2. The pen lifting magnet 21 is in series with the output of the tube V10 and is thus controlled by the keying off and on of the oscillations from the source F3, and the paper feed magnet 19 is in series with the output of the tube V11 and is thus controlled by the keying off and on of the oscillations from the source F4.

As stated, the oscillations from the source F4 are normally being transmitted to the receiving station, being interrupted only when it is desired to advance the paper in the recorder. These oscillations are therefore available at all times during writing movement of the transmitting stylus to compensate for the variations in transmission efficiency of different telephone circuits, or the

same circuit at different times, which will be experienced in the practical operation of the system. This is accomplished in the following manner: The signal energy passed by the filter BPF4 and applied to the tube V6 through the transformer T5 is rectified and produces a pulsating direct current voltage across the resistance R5. This voltage is smoothed or filtered by the combined action of resistance R6, condenser C6 and resistance R7 and condenser C7, and produces an added negative voltage, in addition to that produced by the plate current drop through resistance R8. This added negative voltage is applied to the grid of tube V5, and thus acts to reduce the amplification of this tube. This added voltage is proportional, or nearly so, to the received signal, so that the action thereof is to level out the amplitude of the signals from sources F1, F2, F3 and F4, as applied, through their respective filters BPF1 to BPF4 to their individual amplifiers.

In the operation of the system, movement of the stylus 12 into contact with the paper opens contact 14 thereby causing oscillations from the source F3 to be applied through the tube V3 to the transformer T1 and hence to the sound producer S, the tone thus created passing over the telephone circuit to the receiver R, the received tone being converted by the microphone M into electrical oscillations which pass through the filter BPF3 but are blocked by the filters BPF1, BPF2 and BPF4. The current passing through the filter BPF3 after being amplified and rectified is passed through the pen lifting magnet 21 thereby operating the same to lower the receiving pen into contact with the recording sheet.

Movement of the transmitting stylus 12 over the paper causes arms 10 and 11 to move over the resistances R1 and R2 thereby varying the amplitude of the oscillations supplied from the sources F1 and F2 and hence producing tones which also pass over the telephone circuit and selectively through the filters BPF1 and BPF2, and thence after being rectified and filtered to the solenoids 17 and 18 respectively. The recording stylus is caused to move over the recording paper by variations in the amplitude of the current supplied to the solenoids 17 and 18. When the paper is to be advanced, the transmitting stylus is moved to one corner of the writing window so as to close the contacts 13, thus interrupting current from the source F4 and hence interrupting current flow through the paper feed magnet 19. Deenergization and reenergization of magnet 19 causes the paper to be advanced in the recorder 20.

It will be noted that a telautograph system has been provided in which four distinct frequencies are employed, one for the vertical movement of the stylus over the paper, one for the horizontal movement thereof, one for raising the stylus from contact with the paper and one for feeding the paper. These oscillating currents are of such a nature that they may be readily transmitted over a single circuit without interaction therebetween and may be converted into separate tone signals differing in frequency and varying in amplitude so as to be readily transmitted over a standard telephone circuit without any alteration whatsoever in the telephone system. It is merely necessary to call any telephone subscriber having a receiving telautograph equipment in the usual manner and upon the connection being made, to place the telephone transmitter in sound transferring relation to the sound

producer S at the transmitting station and the telephone receiver R in sound transferring relation to the microphone M at the receiving station, after which telautograph communication can be carried on without interruption so long as the connection is maintained. If desired, of course, similar communication can be conducted in both directions simultaneously by utilizing frequencies different from F1, F2, F3 and F4 for transmission in the opposite direction.

It is to be understood that the invention is not limited to telephonic transmission of the telautograph signals nor is the system restricted to the particular circuit arrangements shown and described since many variations thereof are possible within the scope of the invention and within the skill of those trained in the art.

What is claimed is:

1. The combination with a telephone system of a telautograph transmitter having a transmitting tracer, a plurality of sources of electrical oscillations of distinct frequencies, means for varying said oscillations in accordance with lateral movement of the transmitting tracer, means for converting said oscillations into distinct tone signals of frequencies between three hundred and three thousand cycles per second, means for impressing said tone signals on a telephone transmitter of said telephone system, receiving means associated with said telephone system for detecting said signals, a telautograph recorder and means for operating said telautograph recorder in accordance with said received signals.

2. The combination with a telephone system of a telautograph transmitter having a transmitting tracer, means for producing variable electrical signals in accordance with lateral movement of said transmitting tracer, means for converting said electrical signals into sound signals of frequencies between three hundred and three thousand cycles per second, and applying said sound signals to the telephone transmitter of said telephone system, a telautograph recorder and receiving means coupled to the telephone system for operating said telautograph recorder.

3. The method of transmitting telautograph signals which comprises providing oscillations of two separate frequencies, varying said oscillations in accordance with the lateral movement of the transmitting tracer, converting said oscillations into sound signals of two substantially different frequencies between three hundred and three thousand cycles per second, transmitting said sound signals over a telephone system, converting the received sound signals at the distant telephone receiver into electrical oscillations and controlling the operation of a telautograph recorder in accordance therewith.

4. The method of transmitting telautograph signals which comprises providing oscillations of two separate frequencies, varying said oscillations in accordance with the lateral movement of the transmitting tracer, providing substantially continuous oscillations of a third frequency and of constant amplitude, converting said oscillations into sound signals, transmitting said sound signals over a telephone system, converting the received sound signals at the distant telephone receiver into electrical oscillations, amplifying said oscillations, controlling the amplification of certain of said oscillations in accordance with the magnitude of the received signals corresponding to said substantially continuous oscillations of a third frequency and controlling the

operation of a telautograph recorder in accordance with said amplified oscillations.

5. The combination with a telephone system of a telautograph transmitter having a transmitting tracer, a plurality of sources of electrical oscillations of distinct frequencies, means for varying said oscillations in accordance with lateral movement of the transmitting tracer, means for converting said oscillations into tone signals, means for transmitting said tone signals over said telephone system, receiving means responsive to said signals, means for continuously regulating the amplitude of said signals during the transmission of tracer-movement signals in accordance with a characteristic of the telephone system, a telautograph recorder and means for operating said telautograph recorder in accordance with said received signals.

6. The combination with a telephone system of a telautograph transmitter having a writing surface and a transmitting tracer, a plurality of sources of electrical oscillations of distinct frequencies, means for modulating said oscillations in accordance with the lateral movement of the transmitting tracer, an additional source of oscillations, means for varying said additional oscillations in accordance with the movement of the transmitting tracer toward and away from the writing surface, means for converting said oscillations into tone signals, means for transmitting said tone signals over said telephone system, means for converting received tone signals into electrical signals, means for modifying continuously the amplitude of said signals in accordance with a characteristic of the telephone system, a telautograph recorder, and means for operating said telautograph recorder in accordance with said telephonically received signals.

7. The method of transmitting telautograph signals which comprises providing oscillations of two separate frequencies, varying said oscillations in accordance with the lateral movement of the transmitting tracer, converting said oscillations into sound signals, transmitting said sound signals over a telephone system, converting the received sound signals at the distant telephone receiver into electrical oscillations, regulating the amplitude of said oscillations continuously during variations of said tracer controlled oscillations in accordance with a characteristic of the telephone system and controlling the operation of a telautograph recorder in accordance therewith.

8. The method of transmitting telautograph signals which comprises providing oscillations of two separate frequencies, varying said oscillations in accordance with the lateral movement of the transmitting tracer, providing oscillations of a third frequency, varying said latter oscillations in accordance with a lifting movement of the transmitting tracer, providing oscillations of a fourth frequency, converting said oscillations into sound signals, transmitting said sound signals over a telephone system, converting the received sound signals at the distant telephone receiver into electrical oscillations, using the oscillations of the fourth frequency to modify the amplitude of the received oscillations, and controlling the operation of a telautograph recorder in accordance with said received oscillations.

9. The method of transmitting telautograph

signals over a telephone circuit which comprises generating oscillations of two separate frequencies, varying said oscillations in accordance with the lateral movement of the transmitting tracer, transmitting said varying oscillations over the telephone circuit concurrently with a substantially continuous control current of a frequency different from said two frequencies, amplifying said oscillations at the receiving end of the circuit, regulating the amplification in accordance with the magnitude of said control current and controlling the operation of a telautograph recorder in accordance with said amplified oscillations.

10. The method of operating a telautograph recorder which comprises controlling the respective stylus movements by alternating currents of different frequencies, and continuously regulating the amplitude of the recorder currents by and in accordance with variations in the received current during tracing movements of the stylus to compensate for transmission line attenuation.

11. In combination with a telautograph recorder having a stylus and paper-feed mechanism, means for generating currents of different frequencies to control the movement of the stylus and the operation of the paper-feed mechanism and means associated with said recorder for regulating the amplitude of the recorder currents in accordance with the magnitude of the current for operating the paper-feed mechanism.

12. In combination with a telautograph recorder having a stylus and paper-feed mechanism, means for generating currents of different frequencies to control the movement of the stylus and the operation of the paper-feed mechanism, means for operating the paper-feed mechanism upon the interruption of one of said currents and means responsive to the flow of said one of said currents for regulating the amplitude of the currents applied to said recorder.

13. In an alternating-current telautograph system, a telautograph transmitter having a stylus connected to potentiometer contact members, means for generating currents of different frequencies, amplifying means for said currents and connections from said contact members to points intermediate said generating means and said amplifying means to control the amplitude of the respective currents in accordance with the movements of said stylus.

14. In an alternating-current telautograph system, a telautograph transmitter having a stylus connected to coordinate potential controlling members, a plurality of alternating-current generators, a plurality of amplifiers each having the input circuit thereof connected to one of said generators and connections from said coordinate potential controlling members to the respective input circuits of said amplifiers.

15. In a telautograph system having a telautograph recorder and an amplifier for compensating for line attenuation, means jointly operative to effect the paper-feed function of said recorder and to control the gain of said amplifier, said means being normally operative to provide gain control and becoming operative to provide paper feed in the recorder when it is rendered inoperative to control the amplifier.

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