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CARRIER WAVE CALL SIGNALING SYSTEM

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Fig. 1.

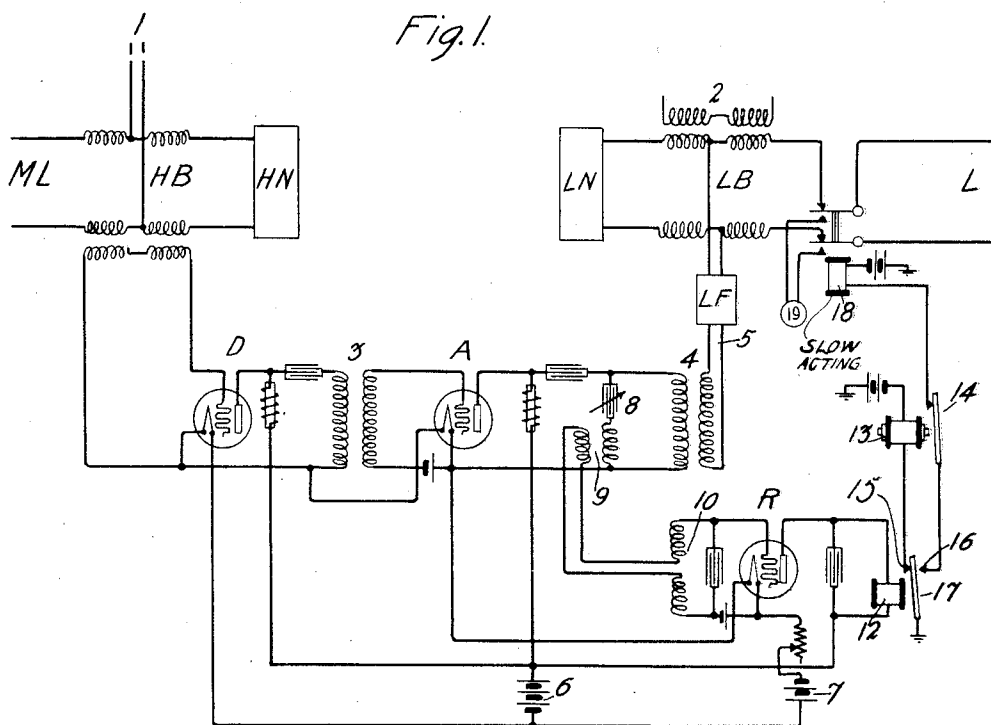
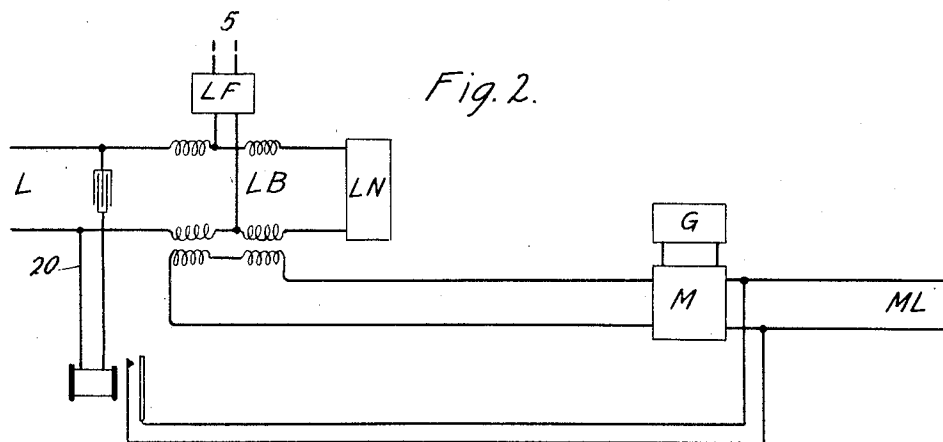


Fig. 2.



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UNITED STATES PATENT OFFICE.

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CARRIER-WAVE CALL-SIGNALING SYSTEM.

Application filed December 29, 1920. Serial No. 433,748.

To all whom it may concern:

Be it known that I, JACOB S. JAMMER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Carrier-Wave Call-Signaling Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to a carrier wave signaling system, and more particularly to a closed circuit signaling system which includes means for preventing the actuation of the signaling means when the power fails.

For the purpose of the present description a closed circuit signaling system may be characterized as one in which signaling means at a receiving station is actuated by reason of an interruption or change of condition of a normal energy flow between the sending and receiving signaling circuits. Probably, the simplest arrangement for the accomplishment of the signaling function by a closed circuit system is that in which a normally transmitted current holds up a relay except when the circuit is interrupted, when the deenergization of the receiver relay results in the closing of a local ringing circuit. A signaling system of this kind is adapted to be used with that common type of modulated carrier current transmitting system in which the desired low frequency currents, which may be telephonic currents, are transmitted as modulations of a carrier current which is continuously transmitted, the signal being actuated upon interruption of the carrier current. The system may equally well be used in voice frequency signaling systems or in other systems in which there is normally a continuous transmission of energy to the receiver. In signaling systems of the kind described, a single break or interruption of the normal flow of the current will result in a continuous actuation of the signal, as long as the interruption continues. While this is desirable in the case of a normal signaling operation, since it makes for a simplicity of the circuits and manipulation, it renders the system subject to undesirable disturbances whenever the normal transmission fails on account of a break in the transmission circuit or otherwise.

It is the principal object of this invention

to provide a closed circuit signaling system, in which the signal is not actuated upon failure of the power supply.

A further object of the invention is to provide a closed circuit signaling system in which the signal is actuated only in consequence of a change of condition, at a predetermined frequency, of the normal transmission.

The invention utilizes as an essential element a slow-acting relay, by which is meant a relay so designed as to require a relatively long time for energization or deenergization of its actuating winding. The expression "slow-acting" will be used to distinguish from a vibrating type of relay which can be energized or deenergized sufficiently during a single cycle of a low frequency interruption to either operate or release its armature. By proper proportion of the moving elements, as well as by proper design of the magnetic circuit, a relay embodying the same mechanical and electrical elements as in a vibrating type can be made sufficiently slow to actuate so that a definite period of time is required for it to pull up its armature. A periodic current of longer period will cause the relay to operate in unison therewith; a periodic current of shorter period will not affect the relay. If used with an associated vibrating relay which makes and breaks its circuit at a rate above this limiting frequency, it may be considered as slow-acting as compared with the vibrating relay. This vibrating relay controls the circuits of two slow-acting relays in such manner as to cause the call indicator at the receiver to operate if the interruptions occur at a certain rate to which the vibrating relay responds. A single actuation of the vibrating relay as in the case of failure of power controls the slow-acting relays so that the call indicator is not operated.

In the drawing Fig. 1 shows a detailed circuit arrangement at a receiving station, and Fig. 2 shows schematically one means for effecting the periodic interruption of a normal transmission. The principal subdivisions of the system will be designated by reference characters which are suggestive of the functions of the elements so identified. For example, the capitals D, A, ML,

LN are used to designate respectively, detector, amplifier, main line and low frequency net work.

Referring to Fig. 1, a main line or carrier current circuit ML and a local line or low frequency circuit L, balanced respectively by networks HN and LN, are connected for two-way call transmission. As shown there is included in line ML a hybrid coil HB of well known type, to the series winding of which is connected the input circuit of a thermionic detector D. Detector D functions in the usual manner as a demodulator to analyze the complex high frequency wave impressed on its input into separable components, the low frequency component of which corresponds in all respects to the modulating current. The output current of the detector, which includes the carrier and low frequency components, is transmitted by means of transformer 3 to amplifier A from which amplified energy is transmitted by transformer 4 to circuit 5. A low pass filter LF suppresses the carrier frequency component and passes the detected low frequency wave which enters the low frequency line L through the balanced circuit LB. A common space current source 6 and filament energizing source 7 are provided for the detector and amplifier elements. The system may be varied in many ways from that shown without violating any of the essential principles of the invention which requires merely the continuous presence of a current at the receiver. This element is here furnished by the carrier component which is continuously transmitted whether or not the system is being used to transmit modulated currents.

The circuits 1 and 2, associated with hybrid coils HB and LB respectively, are provided in order that a transmitting branch circuit may be connected in balanced relationship to the receiving circuit between the carrier current circuit ML and the low frequency circuit L.

Considering now the invention as applied to the above described system, the circuit 3, in shunt to the amplifier output, is resonant to the carrier frequency and accordingly a large part of the carrier current is transmitted through this circuit and through transformer 9 coupled thereto to thermionic relay R. The relay R has an input circuit 10 also tuned to the carrier frequency. This relay operates in a well known manner to receive trains of carrier frequency waves and to vary the amplitude of the unidirectional current traversing a relay 12 in its output circuit for the duration of each carrier wave train. Relay 12, accordingly, during the interval of carrier current flow, holds up its armature 17 and completes a circuit through the winding of relay 13. Relay 13 when

energized, maintains circuit closer 14 in a closed condition. Circuit closer 14 is in circuit with the winding of relay 18 which circuit also contains a circuit closer 16, 17 which is closed when the movable contact of relay 12 is released by interruption of the current through its winding. Relays 13 and 18 are slow-acting in the sense of being slow to release. They will accordingly be sometimes designated as slow-release relays. Relay 12 is quick-acting and is capable of vibrating at the usual ringing frequency.

When the carrier current is periodically interrupted at the transmitting station, as by means which will be hereinafter described, the armature 17 will vibrate at a corresponding frequency between fixed contacts 15 and 16. Relay 13 is sufficiently slow-acting to maintain circuit closer 14 in actuated position during the interval that contact 17 travels from contact 15 to contact 16 and back to 15. The vibrating relay accordingly alternately connects relay 13 and relay 18 to ground. Relay 18 is sufficiently energized by the intermittent energization of its winding to maintain the low frequency line L continuously across the local ringing source in circuit 19. Or the relay 18 may be considered as sufficiently slow to release to hold up its armature during the interval while the contact 17 is out of contact with 16.

In the event of a failure of power, the relay 12 will release its armature 17 which will fall back and thereafter maintain contacts 16, 17 closed. After a sufficiently long interval the relay 13 will release its armature and open the circuit through relay 18. Relay 18 is so designed as to be slow to respond, as well as slow to release and is made sufficiently slow to respond that its circuit is opened at 14 before it can connect the line L across the ringing source. Hence, a failure of power is not attended by even a momentary signal actuation.

Figure 2 shows schematically one means for producing a periodic interruption of carrier current. The circuits shown are adapted to cooperate with the receiving circuits which have been described. Obviously similar circuits may be applied at the station illustrated in Fig. 1 in the transmission channel connected to circuits 1 and 2 between the main line ML and low frequency line L. The parts L, LB, LF, LN and 5 accordingly are similar to the correspondingly indicating elements in Fig. 1, only the circuits associated with the low frequency balanced circuit being shown. Low frequency impulses from line L are, for normal transmission, transmitted through the balanced circuits LB and used to modulate the carrier frequency current supplied by generator G, the output current of modulator M being transmitted over

main line ML to the detector D of the receiving circuit. When it is desired to transmit call signal impulses over the line a low frequency current from a signaling source, not shown, is supplied to the line L and is picked up by a tuned circuit of a vibrating relay 20 which periodically short-circuits the output of the modulator M and in effect interrupts the carrier current.

Although the invention has been specifically described as applied to a particular form of modulated carrier current system, it should be understood that the efficient operation of the signaling system is dependent in no way on the particular carrier current system with which it may be used provided only that the current is continuously transmitted. The principle of the invention may equally well be applied to a signaling system in which the continuously transmitted current has no function other than to operate the relay apparatus. It is equally applicable to multiplex carrier transmission in which a plurality of different frequency carrier waves are transmitted over a common transmission line having individual relay apparatus controlled by each carrier wave.

What is claimed is:

1. A signal transmission system comprising a transmission medium, a signal element associated with said transmission medium, means for normally transmitting energy individual to said signal element continuously over said medium, means for actuating said signal element, and means dependent only upon the interruption of said normally transmitted energy for preventing the actuation of said signal element.

2. A closed circuit signaling system comprising a receiver including a signal element, means for causing continuous flow to said receiver of current individual to said signal element, means responsive to said current for normally preventing the actuation of said signal element, and an additional means dependent only upon failure of said current individual to said signal element for preventing the actuation of said element.

3. A system adapted for signaling by modulated current comprising means for continuous transmission of an unmodulated carrier wave component, a signal, means energized by said unmodulated component for normally preventing the actuation of the signal, and additional means associated therewith for preventing the actuation of the signal solely by the failure of said unmodulated component.

4. A closed circuit signaling system comprising a receiver, means for causing con-

tinuous flow of current to said receiver, means responsive to said current for normally preventing actuation of the signal and additional means for preventing the actuation of the signal except by an interruption of said current at a predetermined frequency.

5. A system adapted for signaling by modulated carrier current comprising means for continuous transmission of an unmodulated carrier wave component, a signal means energized by said unmodulated component for normally preventing the actuation of the signal, and additional means for preventing the actuation of the signal except upon interruption of said unmodulated component at a predetermined frequency.

6. In a closed circuit signaling system, in combination, a transmitting station, a receiver station including a low frequency line, means for causing a continuous flow of current to the receiving station, means at the transmitting station for periodically changing the condition of said current, a vibrating relay at the receiving station responsive to changes in condition of said current, a local ringing source, a slow-release relay for connecting the low frequency line to said source, a slow-acting relay, and means associating said relays whereby said slow-release relay is maintained in actuated condition only when the condition of said currents periodically changes according to a particular frequency.

7. The combination specified in claim 6 in which the said slow-release relay is also slow to respond.

8. In a closed circuit signaling system, in combination, a transmitting and a receiving station, the latter including a low frequency line, means for causing a continuous flow of current from the transmitting to the receiving station, means at the transmitting station for periodically interrupting said current, a vibrating relay at the receiving station responsive to the interruptions of said current, a local signaling source, a slow-release relay for connecting said low frequency line across said source, a slow-acting relay, and means associating said relays whereby said slow-release relay is maintained in actuated condition only when said current is periodically interrupted according to a predetermined frequency.

9. The combination specified in claim 8 in which the said slow-release relay is also slow to respond.

10. A closed circuit signaling system, comprising means for continuous transmission of power, a receiving circuit, including a low frequency line, a signal means for preventing the actuation of the signal on failure of the power, means for periodi-

cally interrupting the normal transmission of energy to the receiver, a vibrating relay at the receiver responsive to said interruptions, said relay including a grounded movable contact and two fixed contacts operatively arranged with respect to said movable contact, a slow-release relay in circuit with one of said fixed contacts and ground, a slow release relay in circuit with the other of said fixed contacts and ground and adapted to connect the low frequency line across a local ringing source, a circuit closer interposed in said last mentioned circuit between said vibrating relay and the last mentioned slow-release relay and adapted to be actuated to closed position when said first mentioned slow-release relay is energized, said slow-release relays being so designed as to hold up their armatures when the energizing currents therethrough are interrupted at substantially the frequency of said interrupting means, whereby the signal is actuated only when there is a periodic interruption of the normal transmission according to this frequency.

11. The combination specified in claim 10 having the second mentioned slow-release relay sufficiently slow to respond so that on failure of power the first mentioned slow-release relay breaks the circuit through said second mentioned relay before the latter is sufficiently energized to actuate the signal whereby failure of power does not affect the signal.

12. In a call signaling system, a common transmission medium, means to impress carrier waves on said medium, means to periodically withdraw said waves from said medium at a predetermined rate, a receiving station, a signal at said receiving station, and means responsive to said carrier waves at said receiving station for actuating said signal and responsive only to a predetermined rate of withdrawal of said waves.

13. A call signal system comprising a transmission circuit, a relay, a movable element controlled by said relay to occupy either of two positions according as said relay is energized or deenergized, a signal element, means for operating said signal element, means for applying a carrier wave to said circuit to actuate said relay and means for maintaining said signal element unresponsive when said movable element remains in either of its positions.

14. In a carrier wave system, a transmission medium, means to impress carrier waves on said medium, means to periodically withdraw said waves from said medium at a predetermined rate, a receiving station, a signal at said receiving station, a two-position relay maintained in one of its positions by the incoming carrier wave and in the other posi-

tion by means operated when the carrier wave is withdrawn, and another relay adapted to cooperate with said two-position relay to prevent an indication by said signal when said two-position relay remains in either of its positions longer than a predetermined period.

15. In a call signal carrier wave system, a transmission medium, means to impress carrier waves on said medium, means to periodically withdraw said waves from said medium at a predetermined rate, a receiving station, a signal at said receiving station, a two-position relay maintained in one of its positions by the incoming carrier wave and in the other position by means operated when the carrier wave is withdrawn, and a second relay adapted to cause an indication by said signal when said first mentioned relay is changing position at the predetermined rate of interruption of said carrier wave.

16. In a carrier wave signaling system, a transmission line, means to impress carrier waves upon said line, means to periodically withdraw said waves from said line at a predetermined rate, a receiving station, signaling means at said receiving station, a relay responsive to the withdrawal of said carrier waves having a front and back contact corresponding respectively to its actuated and unactuated position and means to prevent a signal indication when said relay is in either its actuated or unactuated position.

17. In a signaling system, an electroresponsive device, an actuating circuit therefor open at a plurality of points and a plurality of relays cooperating upon the energization of all and subsequent intermittent deenergization and energization of one at a predetermined periodicity, to close said circuit intermittently to actuate said electroresponsive device continuously.

18. In a signaling system, an electroresponsive device, an actuating circuit therefor open at a plurality of points, and a plurality of relays cooperating upon the energization of all and subsequent intermittent deenergization and energization of one at a predetermined periodicity, to maintain said actuating circuit continuously closed at one point and intermittently closed at another point to actuate said electroresponsive device continuously.

19. A multiplex transmission system comprising a common transmission circuit, means for simultaneously supplying thereto a plurality of different frequency waves, an indicating device, means to operate said device upon interruption of a given wave and means, dependent solely upon the failure of the means for supplying said given wave, for preventing false operation of said device.

20. A multiplex signaling system comprising a common transmission circuit, means for simultaneously supplying thereto a plurality of different frequency carrier waves each modified in accordance with an individual message, a calling device, means to operate said device upon interruption of a given carrier wave, and means for preventing false operation of said device in consequence of the failure solely of the means for supplying said given carrier wave. 10

In witness whereof, I hereunto subscribe my name this 22nd day of December A. D. 1920.

JACOB S. JAMMER.