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PILOT CHANNEL INDICATING SYSTEM

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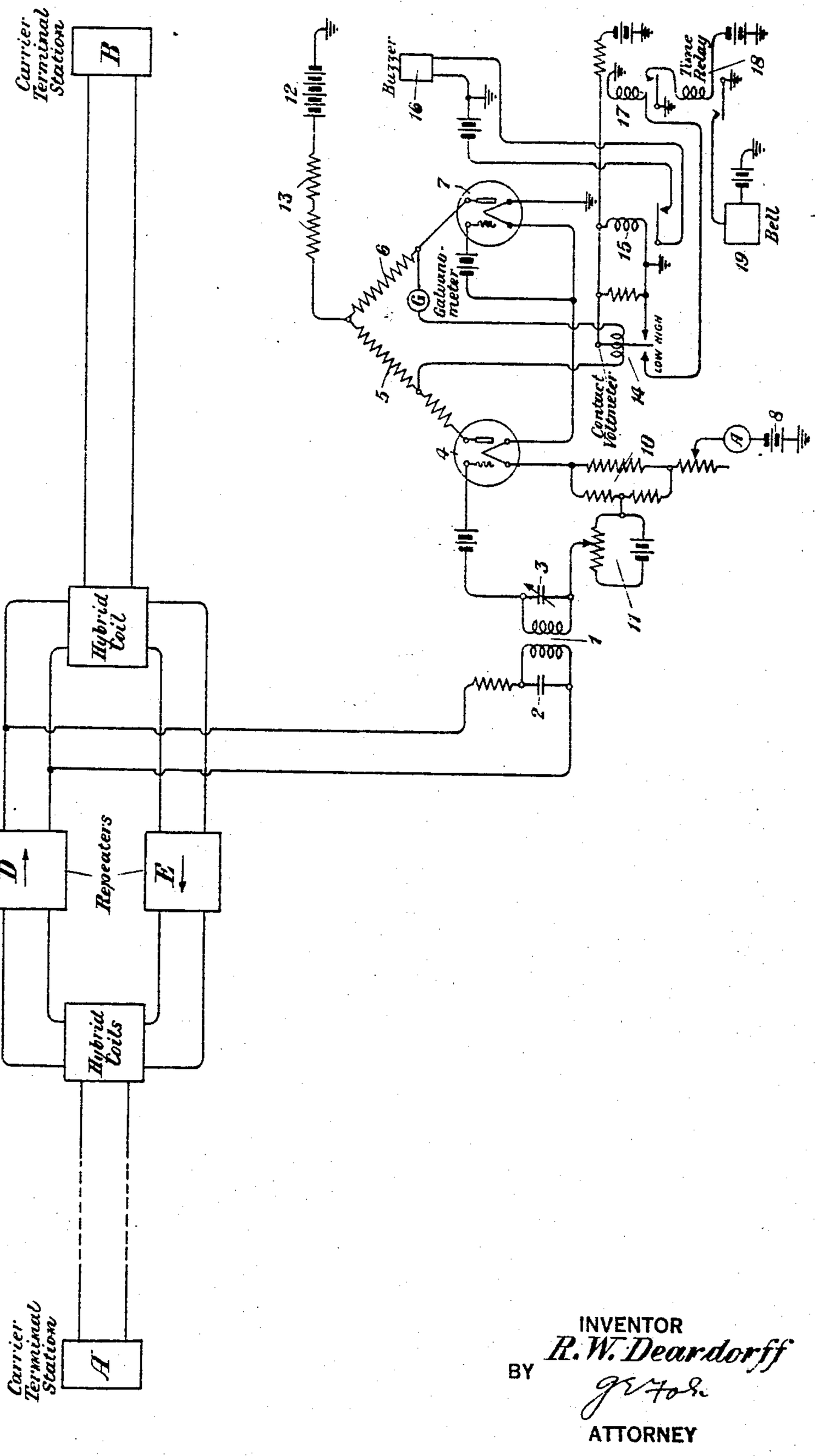

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PILOT CHANNEL INDICATING SYSTEM

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This invention relates to alternating current signaling systems, and particularly to means for indicating variations from normal of the current of a pilot channel transmitted over such systems.

In the operation of carrier or radio signaling systems employing one or more repeaters between the terminals thereof, it is customary to transmit a single frequency wave together with the signaling waves, the single frequency wave being known as a pilot channel. The pilot channel serves as an index of line conditions that affect the transmission of signals. The frequency of the pilot channel is so chosen with respect to the frequency of the signaling waves that any variation of line conditions that affect it will, in like manner, affect the signaling channels that operate simultaneously with the pilot channel over the same line. As is well known, the signaling waves in a carrier system are side bands produced by the modulation of a carrier frequency by the low frequency signal that it is desired to transmit. The pilot channel may be either of a frequency that is outside of the range of the frequencies being transmitted, or one of the carrier frequencies may be chosen and used as a pilot channel. For the purpose of describing this invention, I will assume that one of the carrier frequencies is employed as the pilot channel.

This invention resides in part in a method and means for indicating variations from normal of the current representing the pilot channel.

Another object of the invention is to prevent the operation of the indicating apparatus, or at least a part of it, when the departure from normal of the said current is not of a sustained character.

Other objects of the invention will be apparent from the following description when read in connection with the attached drawing showing schematically a form of embodiment of the invention.

In the drawing, A and B represent two carrier terminal stations adapted for the transmission and reception of signals by means of carrier currents over the line extending between the stations. This line has inserted in it a repeater station C, which, in the form shown, comprises hybrid coils and repeaters D and E, the purpose of which is to amplify the currents being transmitted from A to B, and vice versa. The direction in which the currents pass through each repeater is indicated by the arrow. Bridged across the output side of repeater D is an indicating circuit, the purpose of which is to show variations from normal of the transmission level of the pilot channel established upon the line extending between A and B. This indicating circuit includes a selecting circuit which is made up of the windings of the transformer 1 and the condensers 2 and 3 which may be either fixed or variable. The selecting circuit is connected with the input side of the vacuum tube rectifier 4. The plate of this rectifier is connected with the ratio arm 5 of a Wheatstone bridge network. The other ratio arm 6 of this network is connected with the plate of the tube 7 which should have substantially the same characteristics as tube 4, inasmuch as the sole purpose of tube 7 is to balance tube 4. The filaments of both tubes are energized by the source 8 which is connected with the said filaments through the resistance 9 and the resistance network 10. A potentiometer 11, consisting of a resistance and a battery, serves to keep the grid of the tube 4 at such a potential that when an alternating current representing the normal pilot current is applied to the grid of tube 4, the Wheatstone bridge network will be balanced, and the alarm apparatus connected across the outer ends of the ratio arms will not operate. A source of plate voltage 12 is connected through the resistance 13 with the junction point of the ratio arms. A marginal relay 14 is connected in series with the galvanometer G in the branch of the Wheatstone bridge circuit that extends across the outer ends of the ratio arms 5—6. This marginal relay, when it closes its right-hand contact, shunts the winding of relay 15 which, by the releasing of its armature, operates the buzzer 16, thereby giving an indication that the pilot current is abnormally high. When the armature of relay 14 touches its left-hand contact, it closes a circuit through relay 17 which at-

tracts its armature, and if the departure of the pilot current from normal continues a predetermined length of time, will cause the operation of the time relay 18. This will produce the operation of an indicating device 19, thereby showing that the pilot channel has fallen to a predetermined lower level. These indications of an abnormal rise or fall in the magnitude of the pilot channel will lead the repeater attendant to make suitable adjustment of the repeaters D and E at his station, so that the signals being transmitted over the line will be given the required amount of amplification.

The manner in which this system operates will require only a brief amplification of the foregoing description. Let it be assumed that carrier signals representing the modulation of carrier frequencies by signal frequencies are being transmitted over the line between A and B. Let it further be assumed that the carrier frequencies are also being transmitted together with the side bands, and that those carrier frequencies are employed for the actuation of the ringing apparatus at the carrier terminal stations. That is to say, if station A desires to ring station B, it will do so by the interruption of a carrier frequency in accordance with a definite code whereby the apparatus at station B will respond. It is desirable to bring out that feature, because when a carrier frequency upon such a system is also employed as a pilot channel, it is not only desirable but necessary that the alarm apparatus at a repeater station or a terminal station will not respond to the falling off of the carrier current when an interruption, caused by the sending of ringing impulses, takes place. Let it be assumed that a carrier frequency has been selected as a pilot channel, and that ringing impulses or interruptions are not taking place. Accordingly, carrier current will flow from station A to station B, and it will be amplified by the repeater D at station C. Since the tuned circuits 1—2 and 1—3 at the repeater station are adjusted for that carrier frequency which has been selected to function as the pilot channel, current of that frequency will flow into the indicating circuit and will be applied to the grid of the tube 4. If the Wheatstone bridge circuit has been balanced previously by the adjustment of the potentiometer 11 and by the proper proportioning of the filament current, no current will flow through the arm containing the galvanometer G and the winding of relay 14 when the normal carrier current is applied to the grid of the tube 4. If the line conditions between the terminal station A and the repeater station C are such that the pilot channel current, after being amplified by D, is above normal, the Wheatstone bridge network will be unbalanced by the flow of an abnormal current from the plate to the filament of the tube 4, and relay 14 will move its armature to its right-hand contact. This shunts the winding of the normally energized relay 15. Upon the falling back of the armature of the last mentioned relay, the circuit through the alarm device 16, represented as a buzzer, will be closed and an alarm will be given. The repeater attendant will thereupon adjust the repeater D so as to cut down the amount of amplification that is being given to the currents of all channels flowing therethrough.

If the line conditions are such as to cause a diminution in the pilot channel current between A and C, that current, when amplified by D, will be below normal, and the Wheatstone bridge network will again be unbalanced. The armature of relay 14 will be moved to its left-hand contact, which will close the circuit through the winding of relay 17. This will cause the attraction of its armature and will thereby close the circuit through the winding of the time-relay 18. This relay may be of the type having a dash-dot associated therewith, by which it can be made slow-acting, and its time of operation may be thus controlled. However, any well-known type of controllable, slow-acting relay may be employed. If, in the case I am considering, the transmission level of the carrier remains at such low value for the predetermined time required for relay 18 to act, an indication would be given by the operation of the alarm 19. If, on the other hand, the carrier current representing the pilot channel is caused to fall in value, due to the interruption of the carrier to send a ringing impulse over the line between stations A and B, it is, of course, undesirable to have the alarm 19 operate each time such an interruption occurs. This is cared for by the adjustment of the time-relay 18. Relay 14 will, of course, respond to such interruptions and close its left-hand contact, thereby operating relay 17 and energizing the winding of the time-relay 18. By adjusting relay 18 so that a longer time is required to close its contact than the duration of the interruption of the pilot channel current during the transmission of a ringing impulse, the operation of the alarm 19 is thereby prevented.

While this invention has been disclosed in a particular form, it is to be understood that such form is purely schematic, and that the invention is capable of embodiment in other forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a pilot channel indicating system, the combination with a transmission circuit over which is transmitted a current of a predetermined frequency constituting a pilot channel, of an indicating circuit connected thereto having means responsive to a variation of predetermined magnitude in level of the pilot channel, and a delay device to ren-

der said indicating circuit unresponsive to transient variations.

2. In a pilot channel indicating system, the combination with a transmission circuit over which is transmitted a current of a predetermined frequency constituting a pilot channel, of an indicating circuit connected thereto including a Wheatstone bridge network balanced for the normal level of the pilot channel and indicating devices responsive to variations in level of a predetermined magnitude, and a delay device connected with said indicating circuit to render said indicating devices unresponsive to transient variations.

3. In a pilot channel indicating system, the combination with a source of alternating current constituting a pilot channel, of a Wheastone bridge network comprising ratio arms, a third arm including the plate-filament circuit of a vacuum tube, a fourth arm including an impedance simulating that of the third arm, a source of plate voltage connected with the junction of the ratio arms, a source of filament current, a marginal relay connected across the said bridge between opposite corners thereof, means to connect the said sources to the plate and filament of the said tube, and means controlled by the said marginal relay to indicate an abnormal level of the pilot current.

4. In a pilot channel indicating system, the combination with a source of alternating current constituting a pilot channel, of a Wheatstone bridge network comprising ratio arms, a third arm including the plate-filament circuit of a vacuum tube, a fourth arm including an impedance simulating that of the third arm, a source of plate voltage connected with the junction of the ratio arms, a source of filament current, a marginal relay connected across the said bridge between opposite corners thereof, means to connect the said sources to the plate and filament of the said tube, and means controlled by the marginal relay to indicate a subnormal level of the pilot current, the said means including a delay-device to withhold the operation of the indicator until the current at the subnormal level persists a predetermined length of time.

5. In a volume indicating system, the combination with a source of current normally of fixed value but adapted to vary therefrom, an indicating circuit connected with said source and having means responsive to a variation of predetermined magnitude in said current, and a delay device to render said indicating circuit unresponsive to transient variations of the said predetermined magnitude.

6. In an indicating circuit, the combination with a vacuum tube having plate, filament and grid electrodes, of a Wheatstone bridge network comprising ratio arms, a third arm including the plate-filament part of said vacuum tube, a fourth arm containing an impedance matching that of the said third arm, a source of plate voltage connected with the apex of said ratio arms, an electromagnetic device connected between the junction of the first and third arms and the junction of the second and fourth arms, an indicating device controlled by said electromagnetic device and responsive to a current in said third arm exceeding a predetermined value, another indicating device controlled by said electromagnetic device and responsive to a current in said third arm falling below a predetermined level, and means connected with said other indicating device to delay its operation until the said electromagnetic device has remained operated a predetermined length of time.

In testimony whereof, I have signed my name to this specification this 18th day of September, 1928.

RALPH W. DEARDORFF.