

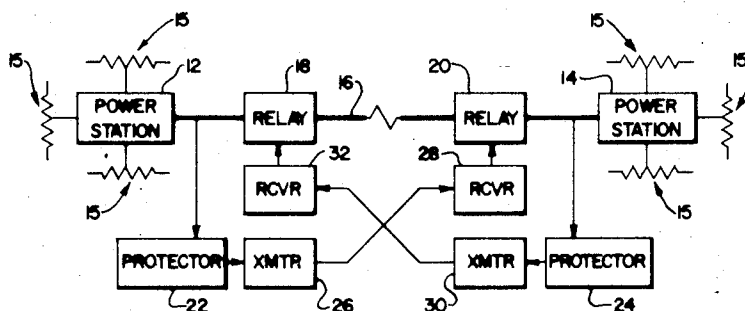
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[56] **References Cited**
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[54] **TRANSFER TRIP SYSTEM USING QUADRATURE CARRIER MODULATION WITH COHERENT DETECTION**
10 Claims, 3 Drawing Figs.

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 179/15 BC, 325/63, 325/113, 325/394, 324/127,
 317/14, 317/18, 340/310
 [51] Int. Cl. **H04b 3/00**
 [50] Field of Search 317/60, 14,
 18, 27, 36; 325/60, 63, 113, 67, 394; 179/150 R;
 324/96, 117, 126, 127; 340/201, 207, 224, 253,
 310

ABSTRACT: A quadrature carrier transfer trip system comprising a transmitter for generating at least two independent information signals over the same channel, the information signals being in quadrature with one another, a receiver for providing an output signal defining the information signals generated by the transmitter, and means for communicatively connecting the transmitter and receiver. The receiver is provided with a phase-locked loop for recovering the correct carrier signal from the received data and holding this correct carrier while a trip signal is being generated by the transmitter.



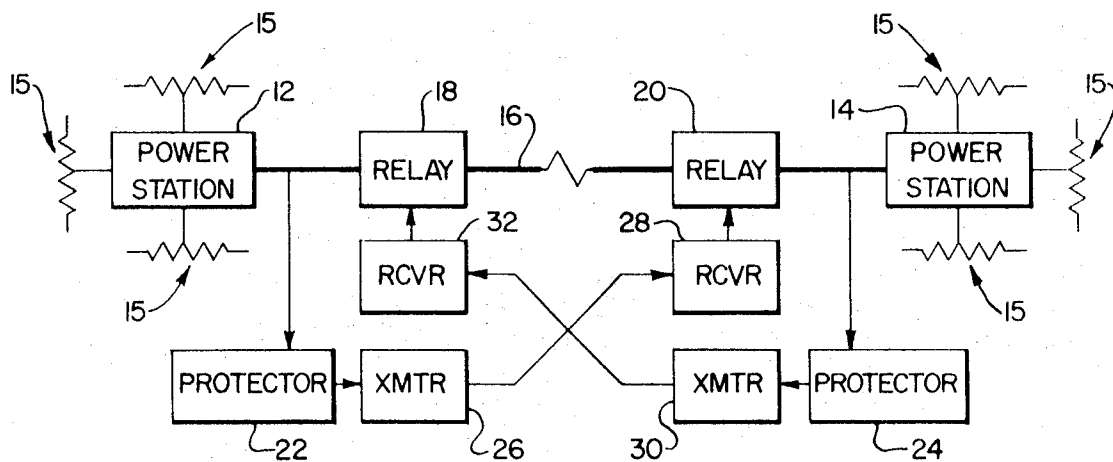


FIG. 1

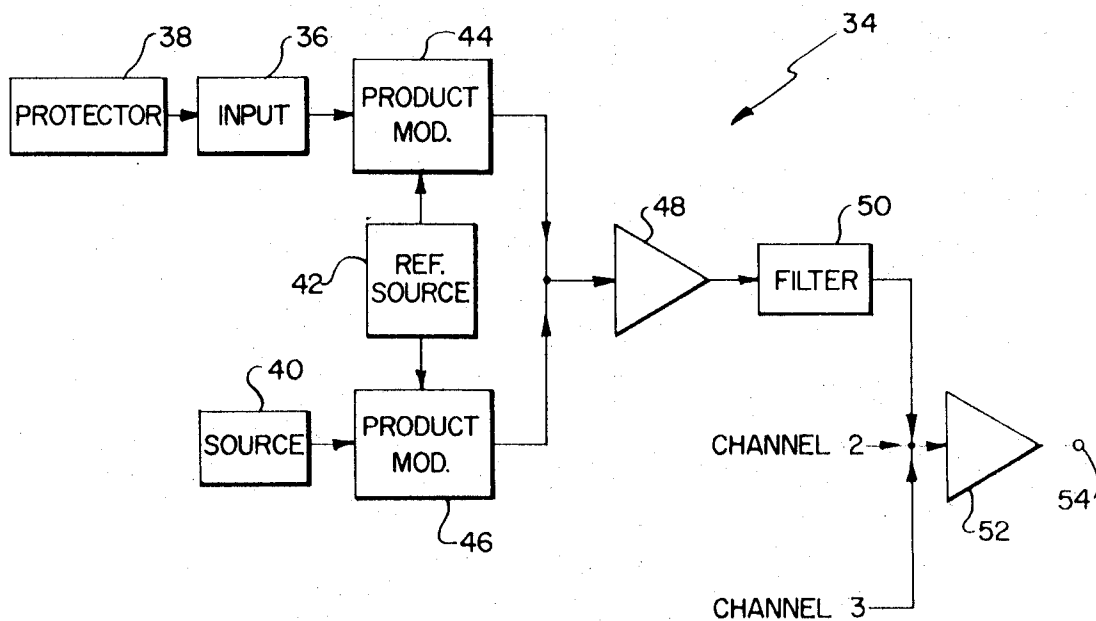
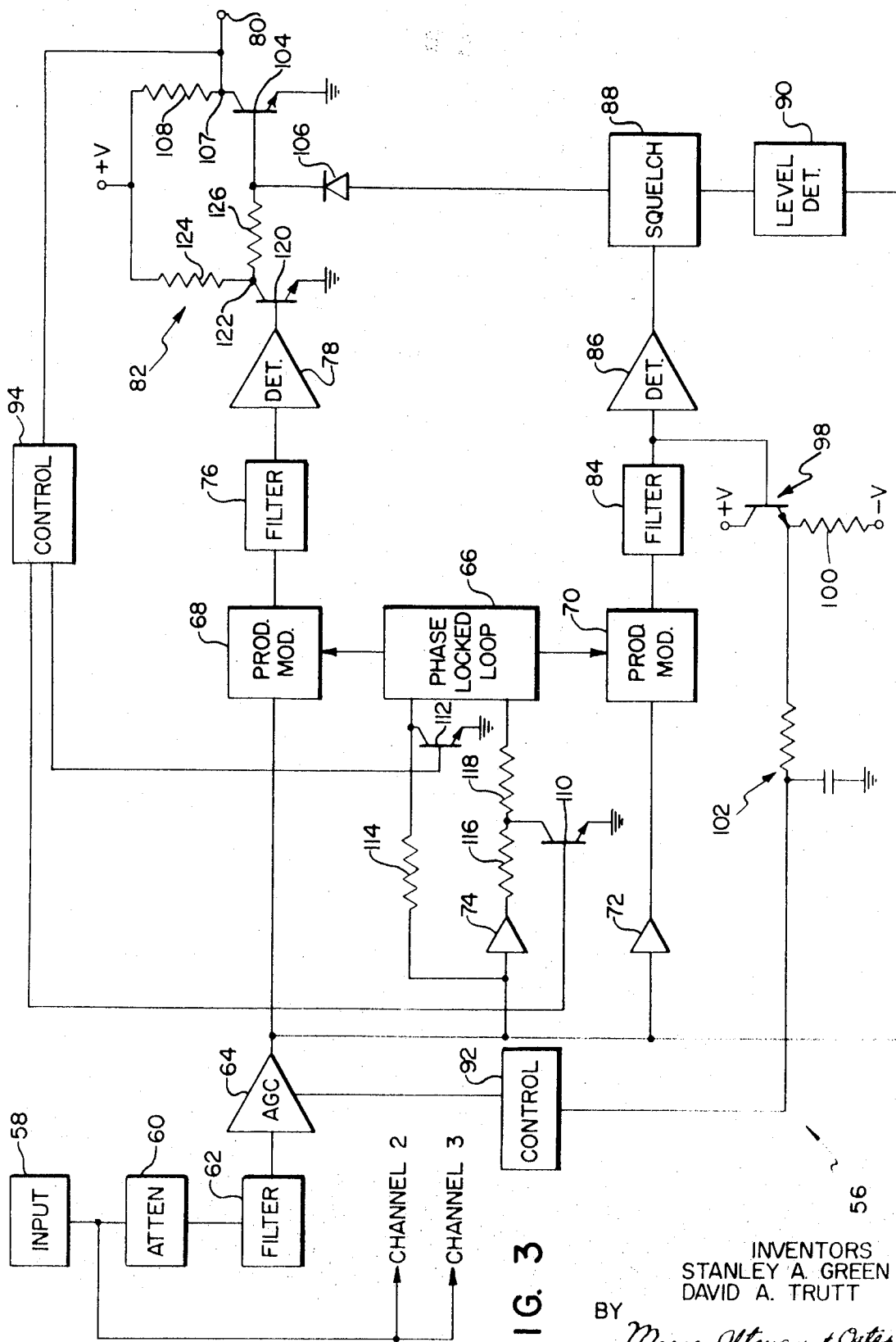


FIG. 2

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TRANSFER TRIP SYSTEM USING QUADRATURE CARRIER MODULATION WITH COHERENT DETECTION

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to transfer trip systems used in the electric utility industry and, more particularly, to such systems employing quadrature carrier coherent detection techniques. A trend in electric utility operation is the construction of tie lines of ever greater capacity linking larger aggregations of loads and generating capacity into a single, interconnected grid network. The economic incentive motivating this trend is twofold, first, to improve system loading by averaging the load over larger and larger geographical areas and secondly, to take advantage of more economical sources of electrical energy which may be remote from large population centers. The economic advantages to be gained by expanding the networks have resulted in a decreased margin of system ability. As the networks become more complex, stability problems impose an increasing demand on the protective relay and associated transfer tripping equipment.

Presently, it is almost universal practice to provide some sort of transfer tripping scheme as well as directional and distance relaying at both ends of the circuit. Modern practice makes use of audio tones for conveying the transfer tripping information. As the power grid network becomes more complex, it is necessary to multiplex several tripping channels on one audio-grade circuit. If the protective relaying system is to operate satisfactorily, the tone channel used for transfer tripping should have a degree of security and reliability comparable to the primary relay itself, and should operate swiftly so as to contribute as little additional delay as practical to the fault clearing action of the relaying system.

Communication data transmission channels have been used for transfer tripping systems. However, the objectives of data transmission and transfer tripping differ in two important respects. In data transmission, the rate at which data may be transmitted through the channel is maximized and therefore the filters are designed for wide bandwidth and very steep skirts. Filters of this type have many sections which make them electrically equivalent to a delay line. Accordingly, although this delay is usually of no consequence in a data system, it is of grave concern in a transfer trip system. Secondly, the decision circuitry of a data receiver is designed in such a manner that, even in the presence of heavy obscuring noise or other interference, it prefers to make a wrong decision rather than to make no decision at all. This philosophy cannot be countenanced in the case of a transfer trip system. In a transfer trip system, a trip decision is presented by the receiver at such time that, there is a clear and unequivocal indication of a trip signal being transmitted.

Generally, the tone channels used for transfer trip systems are of the frequency shift type. However, with the increasing use of microwave channels in protective relaying, difficulties have been encountered with transient frequency disturbances which occur whenever the microwave equipment switches from its main oscillator to its standby oscillator. The resulting phase of frequency disturbance of the system causes a spurious shift in the frequency modulated channels, in consequence of which erroneous signals are produced. Also, noise encountered on the transmission facility will cause the system to generate an erroneous output. In order to overcome these difficulties, receivers having dual information channels, one shifting up for trip and the other shifting down for trip, and a third out of band pilot channel to monitor noise, have been employed. Out of band noise receivers have not proved entirely successful since there is no guarantee that noise will appear in the pilot channel at the same time it is interfering with the transfer trip channel. The additional equipment added to a basically unsuitable system results in a system which is complex, difficult to adjust, and of dubious reliability.

An object of the present invention is to provide a quadrature carrier coherent detection transfer trip system which is

characterized by a transmitter for generating at least two independent information signals over the same channel, the information signals being in quadrature with one another, a receiver for providing an output defining the information generated by the transmitter, and means for communicatively connecting the transmitter and the receiver. The combination of transmitter, receiver and communicating means is such as to provide a self-monitoring transfer trip system having a high degree of reliability and without the requirement for outboard noise detectors and frequency shift detectors external to the basic channel.

The invention accordingly comprises the system and apparatus possessing the construction and combination of elements, and arrangements of parts that are exemplified in the following detailed disclosure, the scope of which will be indicated in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the present invention reference should be had to the following detailed description, taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a block diagram of a transfer trip system embodying the present invention;

FIG. 2 is a block diagram of the transmitter of FIG. 1; and
FIG. 3 is a block diagram of the receiver of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A typical link in an electric utility interconnecting grid network, as illustrated in FIG. 1, is comprised of power stations 12 and 14, each station feeding a plurality of loads 15, power being transferred from one station to the other station via communicating means, for example a transmission line 16, a relay 18 serially connected to transmission line 16 in the immediate vicinity of power station 12, and a relay 20 serially connected to transmission line 16 in the immediate vicinity of power station 14, each relay being capable of electrically isolating its respective power station, protectors 22 and 24 electrically interposed between power station 12 and relay 18, and station 14 and relay 20, respectively, for indicating a malfunction, a transmitter 26 operatively connected to protector 22 for generating a signal in response to the output of protector 22, a receiver 28 communicatively connected to transmitter 26 for providing an output signal responsive to the signal at the output of transmitter 26 for controlling relay 20, a transmitter 30 operatively connected to protector 24 for generating a signal responsive to the signal at the output of protector 24, and a receiver 32 communicatively connected to transmitter 30 for providing an output signal responsive to the signal at the output of transmitter 30 for controlling relay 18. A typical transmitter, illustrative of transmitters 26 and 30, and a typical receiver, illustrative of receivers 28 and 32, are shown in FIG. 2 at 34 and FIG. 3 at 56, respectively.

Generally, transmitter 34 comprises an input 36 for receiving a signal from a protector 38, a source 40 for providing a reference signal, a reference source 42 for providing an in phase and a quadrature signal, a product modulator 44 connected to input 36 and reference source 42 for modulating the signal as at the output of input 36 with the in phase component of the signal as at the output of reference source 42, a product modulator 46 connected to source 40 and reference source 42 for modulating the signal as at the output of source 40 with the quadrature component of the signal as at the output of reference source 42, a summing amplifier 48 connected at the outputs of product modulators 44 and 46 for adding the modulated signals as at the output of product modulators 44 and 46, and a filter 50 connected at the output of amplifier 48 for removing interference signals from the signals as at the output of summing amplifier 48. If additional channels are employed a summing amplifier 52 is connected at the output filter of each channel in such a manner that the output infor-

mation signals of each channel is combined in summing amplifier 52 and presented at an output 54.

Generally, receiver 56 comprises an input 58 for receiving the information signals generated by transmitter 34, and attenuator 60 connected to input 58 for lowering the signal level as at input 58, a band-pass filter 62 connected to the output of attenuator 60 for removing unwanted noise components and signals from the signals as at the output of attenuator 60, an automatic gain control 64 connected to the output band-pass filter 62 for providing a substantially constant signal, a phase-locked loop 66 operatively connected to the output of automatic gain control 64 for receiving the correct carrier signal from the information signals as at input 58, a product modulator 68 connected to the output of automatic gain control 64 and a first output of phase-locked loop 66 for modulating the signal as at the output of automatic gain control 64 with the in phase component of the recovered carrier signal as at the first output of phase-locked loop 66, a product modulator 70 operatively connected to the output of automatic gain control 64 via a phase shifter 72 and a second output of phase lock loop 66 for modulating the signal as at the output of phase shifter 72 with the quadrature component of the recovered carrier signal as at the second output of phase-locked loop 66, a phase shifter 74, for example a 90° phase shifter, operatively interposed between automatic gain control 64 and phase-locked loop 66 for selectively phase shifting the signal as at the output of automatic gain control 64 prior to its application to phase-locked loop 66, a low pass filter 76 connected at the output of product modulator 68 for removing interference signals as at the output of product modulator 68, a detector 78 connected to the output of filter 76 for detecting the character of the information signals from transmitter 34, an output 80 operatively connected to comparator 78 via an inhibitor 82 for rendering available a signal responsive to the signal as at the output of detector 78, a low pass filter 84 connected at the output of product modulator 70 for removing interference signals as at the output of product modulator 70, a detector 86 connected at the output of filter 84 for sensing the signal as at the output of filter 84, a squelch circuit 88 connected to the output of detector 86 and an input of inhibitor 82 for controlling the signal as at the output of inhibitor 82, a level detector 90 having its input connected to the output of automatic gain control 64 and its output connected to an input of squelch circuit 88 for controlling the state of squelch circuit 88 as a function of the signal level as at the output of the automatic gain control 64, a control 92 having its input operatively connected to the output of filter 84 and its output connected to an input of automatic gain control 64 for governing the signal as at the output of automatic gain control 64, and a control circuit 94 electrically interposed between the output of inhibitor 82 and the input of phase-locked loop 66 for specifying the signal as at the input of phase-locked loop 66.

In operation, a trip or guard signal is applied from protector 38 to input 36. A trip and guard signal being of the type that results in electrical disengagement and engagement, respectively, of the transmission line from the power source. In one example, a guard signal is represented by a 3-volt DC level and a trip signal is represented by a square wave having a negative 3 to a positive 3 volts amplitude variation and a frequency range between 10 and 50 hertz. This insures that a trip signal will eventually propagate through the system even if the receiver is squelched initially due to a noisy channel. In the illustrated example, a 3-volt DC level from source 40 is employed as a noise-monitoring signal which is independent of the trip and guard signals, and allows a fixed reference to be placed on the channel for noise detection and frequency translation detection purposes. Both the information signal (trip or guard) and the noise-monitoring signal are applied to product modulators 44 and 46, respectively. The signals as at the input of product modulators 44 and 46 are modulated with the in phase and quadrature components, respectively, of the signal generated by reference source 42, for example an oscillator running at the center frequency of the channel being used. Ac-

cordingly, the signal as at the outputs of product modulators 44 and 46 are in quadrature with one another and consequently there is no interference between these two signals. The signal as at the output of product modulators 44 and 46 are applied to summing amplifier 48 wherein they are added and adjusted so that their total signal level properly interfaces with the transmission medium being used. The signal as at the output of summing amplifier 48 is applied to a filter 50 wherein the components of the data signal which would interfere with adjacent channels are removed. The signal as at the output of filter 50 is applied to summing amplifier 52. If additional channels were being utilized, their respective output signals would be applied also to summing amplifier 52. The signal as at the output of summing amplifier 52 is made available at an output 54.

In receiver 56 of FIG. 3, the transmitted information signal as at 58 is applied to attenuator 60 wherein the signal level is lowered to a point to where it is small enough to operate over the linear portion of automatic gain control 64. The signal as at the output of attenuator 60 is applied to automatic gain control 64 via band-pass filter 62, in consequence unwanted noise and interfering signals are removed. The signal as at the output of automatic gain control 64 is regulated by the signal as at the output of filter 84 of the noise channel. The signal as the output of filter 84 is applied to the base of a transistor 98, while a positive voltage is applied to the collector and a negative voltage is applied to the emitter via a resistor 100. The signal as at the junction of the emitter and resistor 100 is applied to an input of control 92 via RC network 102 having large time constant so that automatic gain control 64 responds very slowly to amplitude variation as at the output of filter 84. The signal as at the output of automatic gain control 64 is applied directly to product modulator 68 and is applied to product modulator 70 via a phase shifter 72. In order to insure that the system always has the proper carrier phase appearing at the output of phase-locked loop 66, 90° phase shifter 74 is connected between the output of automatic gain control 64 and the input of phase-locked loop 66.

When receiver 56 is squelched, a signal as at the output of squelch circuit 88 is applied to the base of a transistor 104 via a diode 106 in consequence transistor 104 conducts and the voltage at a junction 107 of a resistor 108 and the collector of transistor 104 decreases. The signal as at junction 107 is applied to control 94 wherein a positive signal is applied to the base of a transistor 110 and a negative signal is applied to the base of a transistor 112 so that transistor 110 is in a conducting state and transistor 112 is in a nonconducting state. The signal as at the output of automatic gain control 64 is applied to phase-locked loop 66 a resistor 114 and the signal as at the output of 90° phase shifter 74 is applied to phase-locked loop via resistors 116 and 118. Since the junction of resistors 116 and 118 is electrically connected to ground through conducting transistor 110, the received carrier is not phase shifted by 90°. At such time phase-locked loop 66 has corrected to its new phase, receiver 56 responds as if a guard signal has been transmitted. If receiver 56 is not squelched, transistor 110 is in the nonconducting state and transistor 112 is in the conducting state, in consequence the received carrier is phase shifted by 90° prior to being applied to phase-locked loop 66. The function of phase-locked loop 66 is to recover the correct carrier signal from the received data and hold this correct carrier while a trip signal is being sent.

The signal as at the input of product modulator 68 is modulated by the in phase component of the signal as at the first output of the phase-locked loop 66, in consequence the quadrature components of the signal as at the output of product modulator 68 are canceled by being product modulated with the quadrature tone. The signal as at the output of product modulator 68 is applied to low pass filter 76 and thereafter to detector 78, which is biased in favor of a guard condition, wherein a trip or guard signal is detected. The signal as at the output of detector 78 is applied to output 80 via inhibitor 82. When the signal as at the output of detector 78 is positive, a

transistor 120 is in the conducting state in consequence the signal as at a junction 122 of the collector of transistor 120 and resistors 124 and 126 decreases. The decreasing signal as at junction 122 causes transistor 104 to be in a nonconducting state so that the signal as at output 80 is high or a trip indication. When a guard signal is applied to input 58, transistor 120 is in the nonconducting state and transistor 104 is in the conducting state, in consequence the signal as at output 80 is low or a guard indication. As previously stated, the signal as at the output of automatic gain control 64 is applied to level detector 90 so that if the signal as at the output of automatic gain control 64 decreases or increases outside a specified limit, squelch circuit 88 is activated and the signal as at output 80 appears as a guard indication.

The noise-monitoring signal is applied through phase shifter 72, for example a 45° phase shifter, to product modulator 70 wherein it is modulated with the quadrature component of the recovered carrier signal as at the output of phase-locked loop 66, in consequence noise on the channel is linearly modulated down to baseband and will be observed as a component riding on the DC level. The signal as at the output of product modulator 70 is a constant DC level which is independent of whether a guard or trip signal is applied at input 58. Whenever the amplitude of this DC level is less than or exceeds preset limits, detector 86 triggers squelch circuit 88 so that the signal as at output 80 is applied to standard output circuitry (not shown) which interfaces with the power utility.

Since certain changes may be made in the foregoing disclosure without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description and shown in the accompanying drawings be construed in an illustrative and not in a limiting sense.

What is claimed is:

1. A quadrature carrier transfer trip system for an interconnecting power grid network having at least first and second power stations, said system comprising:
 - a. at least first and second transmitter means, each said transmitter means generating at least two independent informations over the same channel, said information signals being in quadrature with one another, said first transmitter means operatively connected to the first power station and said second transmitter means operatively connected to the second power station;
 - b. at least first and second receiver means, said first receiver means communicating with said second transmitter means for providing an output signal defining said information generated by said second transmitter means, said second receiver means communicating with said first transmitter means for providing an output signal defining said information generated by said first transmitter means; and
 - c. means operatively connected to said first and second receiver means and the first and second power stations for isolating the power stations from one another, the first power station being isolated from the grid network in response to said output signal from said second receiver means and the second power station being isolated from the grid network in response to said output signal from said first receiver means.
2. The system as claimed in claim 1 wherein each said first and second transmitter means comprises:
 - a. an input having a first signal applied thereto;
 - b. a source for providing a second signal;
 - c. a reference source for providing a reference signal;
 - d. first means operatively connected to said input and reference source for modulating said first signal with the in phase component of said reference signal;
 - e. second means operatively connected to said source and reference source for modulating said second signal with the quadrature component of said reference signal;
 - f. a summing amplifier operatively connected to said first and second means for adding the modulated signals as at the output of said first and second means;

- g. filter means connected to said summing amplifier for removing interference signals from the signal as at the output of said summing amplifier; and
- h. output means electrically connected to said filter means for rendering available the signal as at the output of said filter.
3. A quadrature carrier transfer trip system comprising:
 - a. transmitter means for generating at least two independent information signals over the same channel, said information signals being in quadrature with one another;
 - b. receiver means for providing an output defining said information generated by said transmitter means; and
 - c. means for communicatively connecting said transmitter and receiver; said receiver means including:
 - i. an input having a signal applied thereto;
 - ii. an automatic gain control operatively connected to said input for providing a substantially constant signal at its output;
 - iii. a phase-locked loop for recovering the correct carrier signal from the signal as at said input;
 - iv. first means connected to the output of said automatic gain control and a first output of said phase-locked loop for modulating the signal as at the output of said automatic gain control with the in phase component of the signal as at the first output of said phase-locked loop;
 - v. second means operatively connected to the output of said automatic gain control and a second output of said phase-locked loop for modulating the signal as at the output of said automatic gain control with the quadrature component of the signal as at the second output of said phase-locked loop;
 - vi. a phase shifter connected to the output of said automatic gain control and the input of said phase-locked loop;
 - vii. a first filter connected to the output of said first means for removing interference signals as at the output of said first means;
 - viii. a first detector connected to the output of said first filter for detecting the signal from said transmitter means;
 - ix. output means operatively connected to said first detector for providing a signal responsive to the signal as at the output of said first detector;
 - x. an inhibitor connected between the output of said detector and the input of said output means for controlling the signal as at said output means;
 - xi. a second filter operatively connected to said second means for removing interference signals as at the output of said second means;
 - xii. a second detector connected at the output of said second filter for sensing the signal as at the output of said second means; xiii. a squelch circuit having a first of its inputs connected to said second detector and its output connected to said inhibitor for controlling the signal as at the output of said inhibitor;
 - xiv. a level detector having its input connected to the output of said automatic gain control and its output connected to said squelch circuit for controlling said squelch circuit as a function of the level of the signal as at the output of said automatic gain control; and
 - xv. control means connected between the output of said inhibitor and the input of said phase-locked loop for controlling the signal as at the input of said phase-locked loop.
4. The receiver as claimed in claim 3 wherein said first and second means are product modulators.
5. A quadrature carrier transfer trip system comprising:
 - a. transmitter means for generating at least two independent information signals over the same channel, said information signals being in quadrature with one another;
 - b. receiver means for providing an output defining said information generated by said transmitter means; and

- c. means for communicatively connecting said transmitter and receiver; said receiver means including:
- i. an input having a signal applied thereto;
 - ii. an attenuator operatively connected to said input for lowering the signal level at said input;
 - iii. a first filter operatively connected to said attenuator for removing unwanted noise components and signals from the signal as at the output of said attenuator;
 - iv. an automatic gain control for providing a substantially constant signal at its output, the output of said filter being connected to the input of said automatic gain control;
 - v. a phase-locked loop for recovering the correct carrier signal from the signal as at said input;
 - vi. first means connected to the output of said automatic gain control and a first output of said phase-locked loop for modulating the signal as at the output of said automatic gain control with the in phase component of the carrier signal as at the first output of said phase-locked loop;
 - vii. second means operatively connected to the output of said automatic gain control and a second output of said phase-locked loop for modulating the signal as at the output of said automatic gain control with the quadrature component of the carrier signal as at the second output of said phase-locked loop;
 - viii. a 45° phase shifter connected to the output of said automatic gain control and the input of said second means;
 - ix. a 90° phase shifter connected to the output of said automatic gain control and a first input of said phase-locked loop;
 - x. a second filter connected to the output of said first means for removing interference signals as at the output of said first means;
 - xi. a first detector connected to the output of said second filter for detecting the character of the signal from said transmitter means;
 - xii. output means operatively connected to said first detector for providing a signal responsive to the signal as at the output of said first detector;
 - xiii. an inhibitor connected between the output of said detector and the input of said output means for controlling the signal as at said output means;
 - xiv. a third filter operatively connected to said second means for removing interference signals as at the output of said second means;
 - xv. a second detector connected at the output of said third filter for sensing the signal as at the output of said second means;
 - xvi. a squelch circuit having a first of its input connected to said second detector and its output connected to said inhibitor for controlling said inhibitor;
 - xvii. a level detector having its input connected to the output of said automatic gain control and its output connected to said squelch circuit for controlling said squelch circuit as a function of the level of the signal as at the output of said automatic gain control; and
 - xviii. first control means connected between the output of said inhibitor and the input of said phase-locked loop for controlling the signal as at the output of said phase-locked loop.
6. The receiver as claimed in claim 5 wherein said inhibitor includes:
- a. a first transistor having its base connected to the output of said first detector;
 - b. a second transistor having its base resistively connected to the collector of said first transistor, the collector of said second transistor being connected to said output;
 - c. a diode having its cathode connected to the base of said second transistor the anode of said diode being connected at the output of said squelch circuit;
 - d. the signal as at said output being specified by the conduction states of said first and second transistors.

7. The receiver as claimed in claim 5 wherein said receiver includes:
- a. a first transistor having its base connected to a first output of said first control and its collector resistively connected to between the output of said 90° phase shifter and the first input of said phase-locked loop;
 - b. a second transistor having its base connected to a second output of said first control and its collector resistively connected to the output of said automatic gain control and a second input of said phase-locked loop.
8. The receiver as claimed in claim 5 wherein said receiver includes:
- a. second control means having its output connected to an input of said automatic gain control for regulating the signal as at the output of said automatic gain control; and
 - b. an RC network electrically connected between the input of said detector and the input of said second control for specifying the signal at the output of said second control.
9. The quadrature carrier transfer trip system comprising:
- a. a first input having a first signal applied thereto;
 - b. a source for providing a second signal;
 - c. a reference source for providing a reference signal;
 - d. a first product modulator operatively connected to said first input and reference source for modulating said first signal with the in phase component of said reference carrier signal;
 - e. a second product modulator operatively connected to said source and reference source for modulating said second signal with the quadrature component of said reference carrier signal;
 - f. a summing amplifier operatively connected to said first and second product modulators for adding the modulated signals as at the output of said first and second means;
 - g. first filter means connected to said summing amplifier for removing interference signals from the signal as at the output of said summing amplifier;
 - h. first output means electrically connected to said first filter means for rendering available the signal as at the output of said first filter;
 - i. a second input having an information signal applied thereto;
 - j. a second filter operatively connected to said second input for removing unwanted noise components and interference signals from the information signal as at said second input;
 - k. an automatic gain control for providing a substantially constant signal at its output, the output of said second filter being connected to the input of said automatic gain control;
 - l. a phase-locked loop for recovering the correct carrier signal from the information signal as at said second input;
 - m. a third product modulator connected to the output of said automatic gain control and a first output of said phase-locked loop for modulating the signal as at the output of said automatic gain control with the in phase component of the carrier signal as at the first output of said phase-locked loop;
 - n. a fourth product modulator operatively connected to the output of said automatic gain control and a second output of said phase-locked loop for modulating the signal as at the output of said automatic gain control with the quadrature component of the carrier signal as at the second output of said phase-locked loop;
 - o. a 90° phase shifter connected to the output of said automatic gain control and the input of said phase-locked loop;
 - p. a third filter connected to the output of said third product modulator for removing interference signals as at the output of said third product modulator;
 - q. a first detector connected to the output of said third filter for detecting the character of the information signal as at said second input;
 - r. second output means operatively connected to said first detector for providing a signal responsive to the signal as at the output of said first detector;

- s. an inhibitor connected between the output of said first detector and the input of said second output means for specifying the signal as at said second output means;
- t. a fourth filter operatively connected to said fourth product modulator for removing interference signals as at the output of said fourth product modulator;
- u. a second detector connected at the output of said fourth filter for sensing the signal as at the output of said fourth product modulator;
- v. a squelch circuit having a first of its input connected to said second detector and its output connected to said inhibitor for controlling the state of said inhibitor;
- w. a level detector having its input connected to the output of said automatic gain control and its output connected to said squelch circuit for controlling said squelch circuit as a function of the level of the signal as at the output of said automatic gain control;
- x. first control means connected between the output of said inhibitor and the input of said phase-locked loop for controlling the signal as at the output of said phase-locked

loop; and

- y. second control means operatively interposed between the input of said second detector and the input of said automatic gain control for regulating the signal as at the output of said automatic gain control.

10. The quadrature carrier transfer trip system as claimed in claim 9 wherein said system includes:

- a. a first transistor having its base connected to a first output of said first control and its collector resistively connected to between the output of said 90° phase shifter and the first input of said phase-locked loop;
- b. a second transistor having its base connected to a second output of said first control and its collector resistively connected to the output of said automatic gain control and a second input of said phase-locked loop;
- c. the conduction states of said first and second transistors specifying the signal as at the first and second inputs of said phase-locked loop, respectively.

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