ABSTRACT

A security system in which a central station is connected to a transmission loop having a plurality of series connected subscriber stations. Transmission and receiving means are located at the central station and each of the subscriber stations has means for receiving an interrogating signal from the central station and for responding with a signal indicating the condition of the alarm system at the subscriber location.

4 Claims, 3 Drawing Figures
INVENTORS.

PAUL A. BERT
LEO JEDYNAK
STANLEY E. GUIF

BY PARKER, CARTER & MARKEY
ATTORNEYS.
SECURITY SYSTEM INCLUDING MEANS FOR POLLING THE PREMISES TO BE PROTECTED

SUMMARY OF THE INVENTION

The present invention relates to a security system, in particular to a security system in which a plurality of subscriber stations are connected in a transmission loop to a central station which is arranged to sequentially and periodically poll the subscribers to monitor on site alarm systems.

Another purpose is a security system of the type described including means for locating a fault in the transmission loop.

Another purpose is a security system of the type described which is operable with a fault in the transmission loop.

Another purpose is a reliably operable, simply constructed security system of the type described.

Another purpose is a security system of the type described in which the transmitting and receiving apparatus at the central station can be switched from one side of the transmission loop to the other for use in locating a fault on the loop.

Another purpose is a security system in which each subscriber location includes means for receiving an interrogating signal, means for comparing said signal against the location's address, and means for responding to the interrogating signal, if the correct address was provided.

Another purpose is a security system in which each subscriber location is polled sequentially and at predetermined intervals.

Another purpose is a security system of the type described in which each subscriber station will automatically open the transmission loop at the subscriber's station, if that particular station has not been polled within a given time.

Other purposes will appear in the ensuing specification, drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated diagrammatically in the following drawings:

FIG. 1 is a diagrammatic illustration of a security system of the type described,

FIG. 2 is a diagrammatic illustration of a subscriber station, and

FIG. 3 is a diagram of typical interrogation and response signals used in the security system described herein.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 a central station is indicated at 10 and a plurality of subscriber stations are indicated at 12, 14, 16, and 18. The subscriber locations 12-16 are connected in series in a transmission loop, the transmitting side of the loop being indicated at 20 and the receiving side of the loop being indicated at 22. The central station contains both transmission and receiving equipment, as well as switching equipment to reverse the direction of transmission and reception. In addition, the receiving equipment will include means for processing the signals from the various subscriber locations to monitor on site alarm systems.

In operation, the central station will periodically and preferably sequentially poll each of the subscriber stations, and there may be any number of subscriber stations on a single loop. The received signals will give an indication at the central station of the condition of the alarm system at each station. The invention should not be limited to any particular number of subscriber stations and there may be as many as several hundred on a single loop.

At each subscriber station there may be any number of independent alarm systems. For example, there may be a fire detection sensor, a security sensor such as a burglar alarm, a sensor to detect water temperature or to monitor any other function located at the premises in question. The subscriber stations may be residences, they may be business establishments, or they may be small manufacturing facilities in which it is desired to monitor certain control functions during the off hours. Normally the various subscribers on the same loop will be those in which basically the same functions are monitored, although this is not necessary.

FIG. 2 illustrates the details of the transmission and receiving equipment at a subscriber's location. The contacts and arm of a line relay are indicated at 24 and in the embodiment shown the relay is normally in a closed position. On each side of the line relay 24 there are lines 26 and 28 connected to band pass filters 30 and 32 used to control the noise level of the received signal. In some applications the filters may not be necessary, as normally the noise codition of the loop is rather rigidly controlled by telephone company equipment.

Each of the filters 30 and 32 are connected to amplifiers 34 and 36 which are preferably field effect transistor amplifiers to provide as little loading as possible on the line. The amplifiers 34 and 36 are connected to a combiner amplifier 38 which in the normal situation will receive two identical signals, with its output consisting of positive and negative polarity pulses approximately 1 millisecond in duration. The combiner amplifier 38 is connected to a level sensor 40 which places a threshold value on the amplitudes of the positive and negative pulses at its input. Such a level sensor is desirable because of the various levels of attenuation and noise present in the system. The output of the level sensor is connected to a limiter 42 which clamps the levels of the positive and the negative pulses at desired values.

The limiter 42 is connected to an integrator 44 and to an address read circuit 46. In the example described hereinafter, the first pulse or reset pulse of the interrogating signal from the central station has twice the duration of a normal information pulse. This pulse duration is sufficiently long such that there will be an output pulse from the integrator. The integrator output pulse is fed to a processor reset 48 which initiates the address read cycle. The reset circuit 48 also starts the clock 50, which in turn controls the various circuits hereinafter described.

The pulse train or word sequence from the limiter 42 is directed to the address read circuit 46 and after the reset pulse has started operation of the clock and the address read circuit, the following nine pulses to the address read circuit are compared with the address for the particular subscriber station. As illustrated in FIG. 3, the reset or start pulse is indicated at 52 with the nine bit address indicated by bracket 54. When the nine bit address corresponds to the address for the particular location or station, there will be an output signal from the address decoder 56. The clock 50 is connected to
both the address read and the address decoder so as to coordinate their operation. If there is no correlation between the address in a particular signal and the address of a subscriber’s station, no further function will take place at that particular subscriber station.

If, however, there is coincidence in the address, there will be an output from the address decoder 56 directed to an alarm memory 58 and to a relay update and control 60. The relay control 60 controls the coil 62 for line relay 24. The line relay 24 will be maintained in the closed position, providing that the particular subscriber location is properly addressed at least once during a given time interval and the relay is commanded to be closed. In the event that there is no proper address to that location during the time interval in question, which may be anywhere from 15 to 30 seconds, the line relay will then open.

The clock 50 will trigger the alarm processor 64 into sending a signal indicative of the condition of the various alarm sensors 66, to the alarm memory 58. The alarm memory 58 is triggered by the output from the address decoder 56 and a pulse from clock 50. The output from alarm memory 58 goes to a code converter 70 which converts the information from a binary code signal into positive and negative pulses for transmission back to the central station. The signal from the code converter 70 is fed to a line driver 72 which in turn is connected to the transmission loop at the left-hand side of the line relay 24.

FIG. 3 illustrates one example of a message and reply between the central station and any one subscriber location. The initial reset pulse, which can be considered a 2-bit pulse, is indicated at 52. There is a 1-bit space 74 between the reset pulse 52 and the 9-bit address 54, a further 1-bit space indicated at 76 is followed by a 1-bit relay command 79 and a 1-bit space 81. Space 81 is followed by a 5-bit reply 78. The 21-bit message is completed by a 1-bit space 80 at the end of the 5-bit reply. The total message and reply is 21 bits, in the illustrative example, and it is possible in the loop described to have as many as 512 subscribers. The subscribers are periodically polled or addressed on a sequential basis with the result that each of the subscribers is polled or addressed at least once in any given time period. Not only does this permit the condition of the alarm sensors at each location to be closely monitored, but it also provides a means for locating any fault on the transmission loop.

In a normal situation, address signals are continually being sent by the central station to the various subscribers. All of the line relays are closed and the loop integrity is maintained. If there should be a fault on the line, for example a ground between subscribers 14 and 16 in FIG. 1, the address and reply to subscriber 12 may remain normal. However, there would not be sufficient signal strength at subscriber 14 because of the ground fault at its right-hand side, to operate the receiving equipment at that location. Thus, since subscriber 14 would not be addressed or polled during the time interval specified, its line relay would open. Since there is a ground to the right of subscriber 14, neither subscriber 14 nor 16 could be interrogated and their line relays would also open. In this event the switching equipment at the central station would reverse the direction of transmission so that line 22 would be both the transmitting side and the receiving side. First, subscriber 18 would be polled and the address and relay command bit to that station would cause its line relay to close. The same would take place at any locations between subscribers 18 and 16. Subscriber 16 would be polled, because the signal strength would be at a sufficient level to operate the receiving equipment because subscriber 16’s line relay would be open. However, as soon as subscriber 16’s relay is commanded to be closed, the ground fault would again be placed on the line. The central station would interpret this abrupt reappearance of the ground fault as evidence that the fault is adjacent to subscriber 16. The next addressing of subscriber 16 would include a command to its relay to stay open, thus isolating the ground fault from the line. A similar procedure would be used on the other side of the fault to isolate the fault on both sides.

If the fault should be an open between subscribers 14 and 16, all subscribers could be polled. Again, there would be a period of time necessary to locate the fault. First, assuming a normal direction of transmission, both subscribers 12 and 14 would be polled, but subscribers 16 and 18 could not. Once the direction of transmission was reversed, subscribers 18 and 16 could be polled. The system could be operated by alternately using the two sides of the loop in this manner until the fault is repaired.

Of importance in locating the fault is the fact that the line relay will drop out if a location is not polled within a given time. However, when that particular subscriber is subsequently polled, the line relay will be commanded to close or remain open by the relay update and control circuit 60. As shown herein, the line driver circuit 72, which directs the reply back to the central station, is connected to the left-hand side of the line relay. In some applications it may be desirable to connect this circuit to both sides of the line relay. In other applications it may be desirable to have an arrangement whereby as soon as the proper address is provided at the subscriber’s location, the relay update and control circuit closes a contact so that driver circuit 72 is connected to one or the other side of the line relay.

Although the invention has been described with certain time periods and certain address and reply signals, obviously the invention would not be so limited. What is important is to provide a central station, a transmission loop, and a plurality of subscriber locations connected in series in the loop. The subscribers are periodically polled to determine the condition of the alarm sensors located on the premises. The sequential polling combined with the line relay operation enables the central station to locate a fault and to continue transmission and operation of the security system regardless of the fault.

Whereas the preferred form of the invention has been shown and described herein, it should be realized that there may be many modifications, substitutions and alterations thereeto.

We claim:

1. A security system including a central station, a transmission loop connected to said central station, a plurality of subscriber stations connected in series in said loop, transmission means at the central station for periodically sending interrogating signals to each subscriber station, sensing means at each subscriber station, means for providing a signal indicative of the condition of said sensing means, means at each subscriber sta-
5 tion responding to the central station interrogating signals for sending a signal indicative of the condition of said sensing means, means for treating a fault on said transmission loop including a normally closed relay at each subscriber's station connected in said loop, and means at each subscriber's station responsive to and requiring periodic interrogating signals, for holding said relay in a closed position, and receiving means at the central station for said subscribers' signals.

2. The circuit of claim 1 further characterized in that said transmission means includes means for transmitting said interrogating signals sequentially and at predetermined intervals.

3. The circuit of claim 1 further characterized by and including means at the central station for reversing the direction of transmission on said loop.

4. The circuit of claim 1 further characterized by and including address means at each subscriber station for comparing each interrogating signal with the address for that subscriber station.

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