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AUTOMATIC FIRE AND BURGLAR ALARM SYSTEM FOR TELEPHONE SUBSCRIBERS

Filed Dec. 23, 1949 2 Sheets-Sheet 1

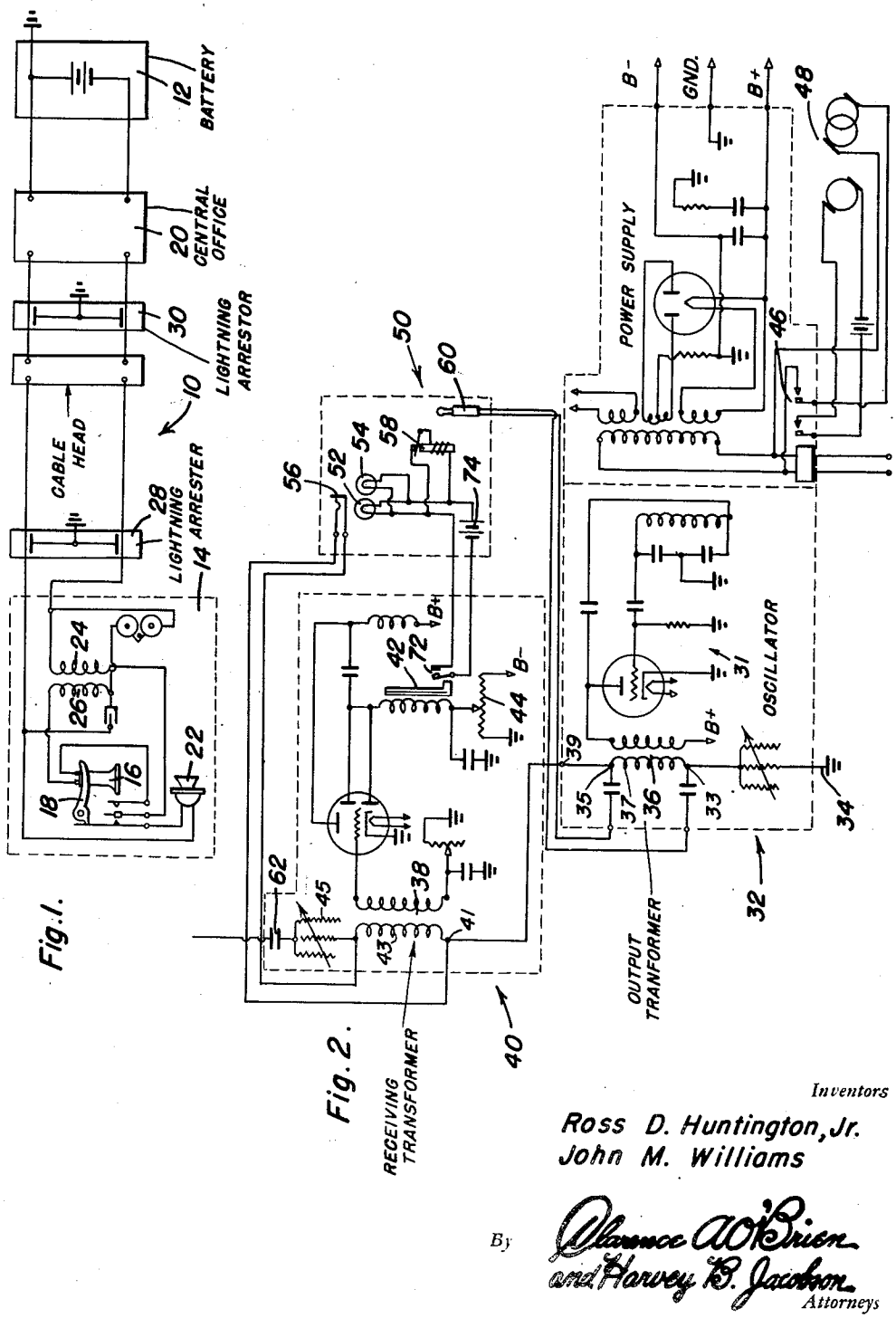


Fig. 1.

Fig. 2.

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2 Sheets-Sheet 2

Fig. 3.

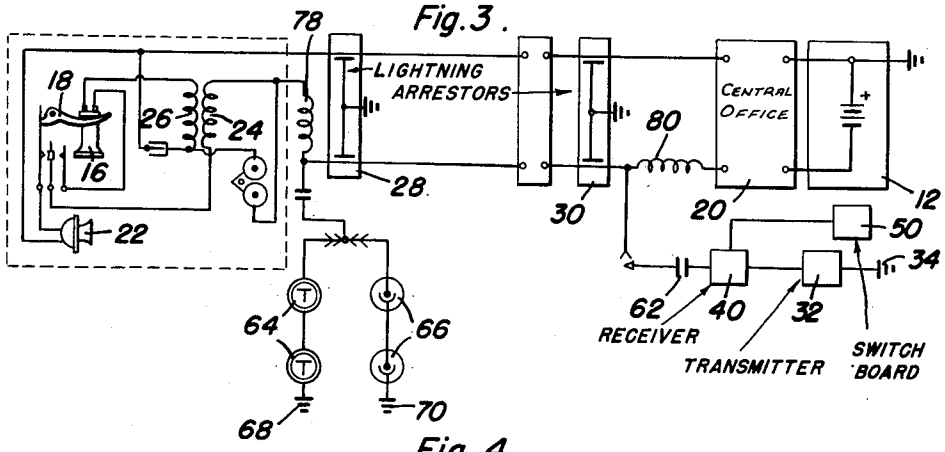


Fig. 4.

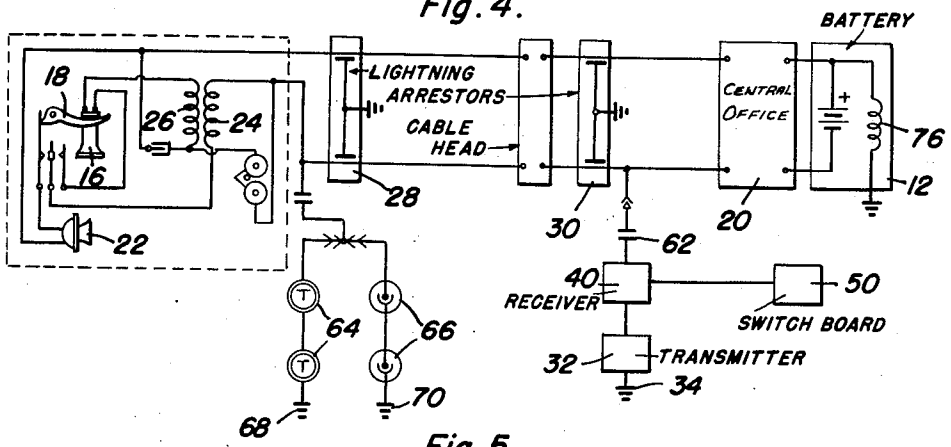
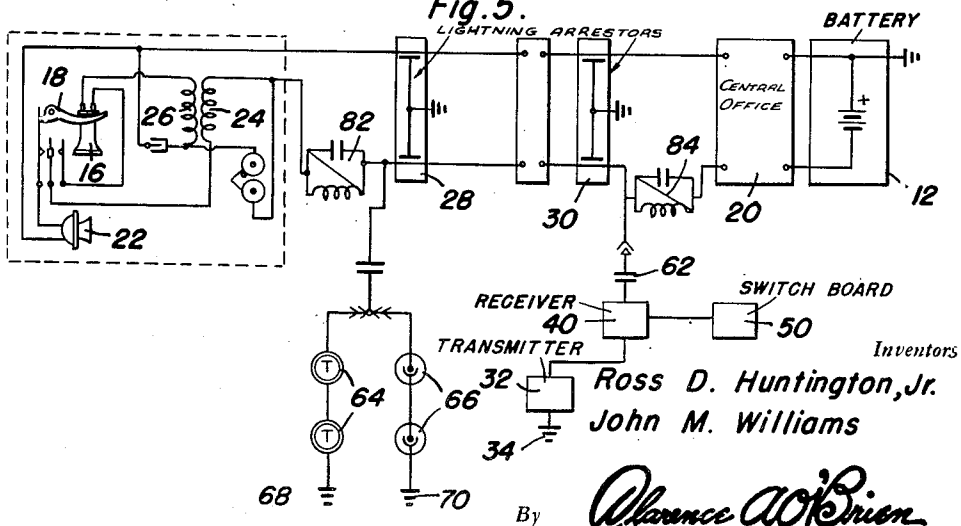


Fig. 5.



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AUTOMATIC FIRE AND BURGLAR ALARM SYSTEM FOR TELEPHONE SUBSCRIBERS

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Application December 23, 1949, Serial No. 134,716

6 Claims. (Cl. 179—5)

This invention relates to an alarm signal system, and more particularly to a closed circuit fire or burglar alarm system which may be installed in conjunction with a telephone subscriber's existing circuit and equipment.

An object of the invention is to provide a burglar alarm signal system which will operate warning signals at a central telephone station when a protective circuit is broken by an unauthorized entrance into protected premises. The burglar alarm system utilizes a part of the telephone subscriber's physical wire circuit for one half of the closed circuit system, while the other half of the closed circuit is completed through the ground or earth.

A further object of the invention is to provide a fire alarm signal system which will operate warning signals at a central telephone station when an area protected by a number of thermostatically operated switches becomes hot enough to actuate one or more of said switches which open a normally closed alarm circuit. The fire alarm system utilizes a part of the telephone subscriber's physical wire circuit for one half of the closed circuit alarm system, while the other half of the closed circuit is completed through the ground or earth.

Yet another object of the invention is a closed circuit fire or burglar alarm system which will operate even if the power supply should fail for any reason.

Yet another object of the invention is to provide an alarm system of the type indicated which involves only very minor changes in the existing telephone subscriber service equipment.

A further object of the invention is to provide a closed circuit telephonic fire or burglar alarm system, which will make use of a single signal transmitter, generating an alarm actuating signal to power a number of alarm subscribers' circuits. It is a further object of the invention to provide a signal generating transmitter of an alarm actuating signal in a centrally located location in the telephone office serving the alarm subscribers.

Still further objects of the invention reside in the provision of an automatic fire or burglar alarm system for telephone subscribers that is simple in construction, strong, durable, highly efficient in operation, easy to install, capable of being supervised and serviced at a central station, and which will be relatively inexpensive to the user.

These together with the various ancillary objects of the invention which will become apparent as the following description proceeds, are attained by this telephonic fire or burglar alarm system, preferred embodiments of which have been illustrated in the accompanying drawings, by way of example only, wherein:

Figure 1 is a circuit diagram of a conventional and prevalent type of manual telephone subscriber's circuit; the dial type telephone only needs the addition of pulsing contacts of a dial to convert the manual telephone to a dial type. The block diagrams represent either manual or dial telephone equipment;

Figure 2 is a circuit diagram of the alarm signal transmitter and the receiver equipment for one subscriber adapted to be selectively installed in the telephone circuit shown in Figure 1; and

Figures 3, 4, and 5 are circuit diagrams showing the various means in which the alarm actuating signal is kept in its proper path in the telephone circuit.

In Figure 1 a circuit diagram of a telephone subscriber's circuit is shown upon which the alarm system comprising the present invention is adapted to be superimposed. The

circuit diagram shown in Figure 1 applies to either the manual or dial types of telephone service. It is relatively unimportant which type of telephone the subscriber has as only a portion of the wire from the telephone office to the subscriber is used for the alarm system. One side of this circuit is connected with the negative side of the battery. The other side of the circuit and the positive side of the battery are grounded. The main battery of this subscriber's telephone office generally designated by reference numeral 10 is indicated schematically at 12 and is grounded at its positive side. The alarm is adapted to be superimposed on the negative side of the subscriber's telephone circuit as part of the path to transmit the alarm control or actuating signal.

The telephone subscriber's circuit 10 includes a subscriber's telephone station 14 provided with a receiver 16 which normally engages the conventional hook switch 18 controlling the circuit connection with the equipment 20 at the central telephone office which is either of the dial or manually operated switchboard type. When receiver 16 is lifted from the hook 18 it will place the transmitter or microphone 22 in series with the coil 24 of the transformer and will also connect the receiver 16 and coil 26 in proper relationship to coil 24. Conventional lightning arresters 28 and 30 are provided for the telephone subscriber's station and for the telephone office station.

The holding of conversations on the circuit protected by the alarm circuit will in no way affect the function of the alarm system. A conversation or an off the hook condition at the subscriber's location will not disable the alarm circuit even if the circuit is placed in the trouble plugging out board.

The signal supplying unit of the alarm system is the alarm transmitter, generally indicated by reference numeral 32. The transmitter in this case is a vacuum tube oscillator indicated generally at 31 and an output transformer 36 including a secondary winding 37 having a ground terminal 33 and an output terminal 35. The oscillator 31 generates a signal of 10,000 cycles per second or higher according to the desires of the manufacturer or user. The transmitter unit may be either crystal controlled or not as the manufacturer or user may wish. For utilization in the type of alarm system using frequency rejection filters, crystal control should be used. One output terminal 33 of the transmitter's output transformer 36 is grounded at 34. Thus one line of the alarm circuit is completed through the ground to the subscriber's station, the other line is completed through one wire of the subscriber's wire circuit. The output terminal 35 of the secondary 37 of the transmitter's output transformer 36 is run to a common terminating strip 39 where the input terminal 41 of the primary winding 43 of the alarm subscriber's receiver transformer 38 is terminated. While the transmitter unit 32 is common to a number of alarm circuits; each subscriber to the alarm service must have its own small receiver unit 40.

The receiver unit 40 is a simple vacuum tube amplifier unit whose output controls a sensitive plate current relay 42 to actuate the alarm signal. The receiver unit and the relay have sensitivity controls indicated at 44. A similar control is provided in the biasing circuit of the grid of the vacuum tube. The variable impedance matching pad 45 indicated in the receiver, in the output line, is utilized to match the impedance of the receiver unit and transmitter to that of the wire circuit serving the alarm subscriber. Any method of impedance matching may be used as long as a means is provided for proper matching.

Provision is made for automatic power switching in the case of a power failure, thus insuring alarm protection during commercial power failure. An automatic power shifting relay 46, or any commercial type of power shifting equipment, is used to shift from the normal commercial power supply to emergency power supply supplied by a dynamotor 48 or any other convenient type of motor generator. This automatically assures alarm protection should the commercial power fail. The relay 46 automatically switches the dynamotor 48 into operation when the commercial power fails and the switch would cut off the dynamotor when the commercial power is restored.

A switchboard generally indicated by reference numeral **50** is provided at the central station and comprises two alarm lights **52** and **54** for each subscriber and a test jack **56**. The lamps **52** and **54** are connected in parallel so as to insure a signal should one lamp fail. The solenoid buzzer **58** is also provided to operate when any receiver unit records an alarm condition. The buzzer may be common to all receiver units or one may be furnished for each one, as desired.

The test jack **56** allows the transmitter's output signal to be fed through plug **60** into any receiver unit. If any receiver should indicate any alarm condition it can be verified by plugging plug **60** into jack **56**; and if the lights go out and the buzzer stops the alarm originally indicated in authentic, and not a possible receiver failure.

Condenser **62** is provided for two purposes. The first is to keep the normal direct current of the telephone system from being shunted to ground and causing a trouble condition on the subscriber's telephone. The second purpose is to keep the normal ringing current for the subscriber's bell from being shunted to ground also. This is accomplished by using a capacitor of a reactance value high enough to keep the twenty cycle ringing current from seeking a ground through condenser **62**, instead of the low reactance path of the subscriber's ringer circuit. The frequency of the transmitter's output is very high relative to that of the ringing current utilized and therefore condenser **62** will offer low resistance or reactance to the flow of transmitter carrier current.

Bimetallic or other thermally operated switches **64** (Figures 3–5) are positioned as desired by the subscriber to the alarm service in the locations he desires, and any one of these switches will open by the application of heat. The nature and location of the switches is determined by the specific conditions providing at the premises to be protected. Additionally, photo-electrically operated switches **66** may be used in lieu of the thermally operated switches **64**. The thermally operated switches or the photo-electrically operated switches are connected across the negative side of the telephone subscriber's line and are grounded as shown at **68** or **70** (Figures 3–5). Only one service, either fire or burglar, may be used at one time. But the other side of the subscriber's telephone circuit could be treated as the one previously mentioned. Moreover, two systems could be used on the same side of the line at the same time by the use of different frequencies, and filters to keep the fire and burglar signals separated as they pass through either respective control switches. Crystal controlled transmitters would be essential to this application.

The alarm system is actuated by the carrier frequency current from the transmitter **32** passing through the output transformer **36** (Figure 2) and through the input transformer or the receiver unit, the alarm relay **42** (Figure 2 being held in an open position while carrier current flows in a continuous circuit. The signal flows through condenser **62** and is directed to the subscriber's line. Means are provided in the telephone circuit which keep the carrier alarm current in its proper path by preventing it from reaching a false ground in the telephone office. These means in no way hinder the normal usage of the telephone but serve only to keep the alarm signal in the alarm circuit. Thus the alarm signal is directed through the alarm switches **64** or **66** to the ground **68** or **70** and thence back to the transmitter through the ground **34** (Figures 3–5). With this circuit complete, the alarm relay **42** (Figure 2) is held in an open or inoperative condition and the lights **52** and **54** and the buzzer **58** on the control board **50** are not actuated. Should any of the alarm control switches **64** or **66** open the circuit, the current through the receiver input is interrupted and the alarm relay **42** will drop its armature allowing contacts **72** to close which completes a circuit through battery **74** to the lights **52** and **54** and the buzzer **58**. The attendant at the control board **50** manually takes the plug **60** which is powered by the transmitter's transformer **36** and plugs it into the jack **56** associated with the lighted lamps **52** and **54**. If the lamps go out it is an indication that the subscriber's receiver unit is functioning normally and that the alarm is authentic. From a number stenciled on the face of the lamp, the attendant notifies the fire company or the police department, calls the party where the alarm originated, and arranges to have the subscriber's line tested by telephone company personnel for any unusual trouble conditions.

The means for preventing passage of the alarm signal to the ground are best shown in Figures 3 through 5 and perform the same function in each case. As shown in Figure 4, the alarm signal is kept from reaching a false ground by the transmitter frequency choke **76**. The choke **76** is placed directly in the ground lead of the telephone signal battery and is capable of passing all of the current of the normal telephone signal load. The inductance of the choke **76** if of a value which will attenuate the carrier signal but will not affect the normal telephone operation.

Referring now to Figure 3, it will be seen that the means used comprises chokes **78** and **80** which are inserted directly into the subscriber's line at his station and at the central station. The chokes **78** and **80** thus isolate a section of the subscriber's line and the alarm circuit must be completed through the switches **64** or **66** or both.

In Figure 5, there is shown the application of transmitter frequency rejection filters **82** and **84** which are so placed as to insure passage through the burglar or fire alarm switches. The frequency rejection filters **82** and **84** are tuned to the same frequency as the transmitter **10**. When a signal from the transmitter attempts to pass through either unit **82** or **84**, they offer a very high resistance and force the signal through the alarm circuit.

Obviously the transmitter can be a crystal controlled unit for absolute frequency stability. Furthermore it is within the contemplation of this invention to use the alarm signal for call reminder circuits actuated by clock mechanisms opening the alarm circuit. Additionally, it is within the contemplation of the invention to use transistors to replace any of the vacuum tubes or circuit operations. The device may be used equally well to provide practical protection for homes, offices, factories, warehouses or any location which can be served by a main line telephone service. Hotels could use the device to protect each room or utilize a unit to protect a group of rooms which would sectionalize any fire condition immediately. The alarm system as shown is designed to serve only main line subscribers, though systems with different frequencies and tune units could be used on party line service.

Since numerous modifications will readily occur to those skilled in the art after a consideration of a foregoing specfication and accompanying drawings, it is not intended to limit the invention to the precise embodiment shown and described, but all suitable modifications of this telephonic alarm system may be resorted to which fall within the scope of the appended claims.

Having described the invention, what is claimed as new is:

1. For connection to a telephone system having a central station, a customer's substation and a telephone line extending between the central station and the customer's substation, at least one side of said telephone line being insulated from ground, a signalling system comprising a transmitter including a relatively high frequency wave generator and an output transformer, said output transformer having a ground terminal and an output terminal, a receiving station located in said central station, said receiving station including a receiving transformer including a primary winding and a relay responsive to current flow in said receiving transformer, a coupling capacitor, circuit means including said primary winding of said receiving transformer and said coupling capacitor in series circuit relation for connecting the output terminal of said output transformer to the insulated side of said telephone line, signal switches located adjacent to the customer's substation, circuit means including a coupling capacitor connecting said signal switches to said insulated side of said telephone line, and a ground return circuit between said switches and the ground terminal of said output transformer.

2. For connection to a telephone system having a central station, a subscriber's substation and a telephone line extending between said central station and said substation, at least one side of said telephone line being ungrounded, a signalling system comprising a transmitter, said transmitter including a signal frequency generator and an output transformer including a primary and a secondary winding, said primary winding being connected to said generator, the secondary winding of said output

transformer including a ground terminal and an output terminal, a receiving station, said receiving station including a receiving transformer including a primary and a secondary winding, a relay connected across said secondary winding of said receiving transformer whereby said relay is responsive to current flow in the primary winding of said receiving transformer, a coupling capacitor, a transmitting circuit including said receiving transformer and the primary winding of said coupling capacitor connected in series circuit relation for connecting the output terminal of said output transformer to said ungrounded side of said telephone line, signal switches in proximity with said substation, a second coupling capacitor, a signal control circuit including said signal switches and said second coupling capacitor connected in series circuit relation with said ungrounded side of said telephone line and a return circuit between said signal control circuit and the ground terminal of said output transformer.

3. For connection to a telephone system having a central station, a subscriber's substation and a telephone line extending between said central station and said substation, at least one side of said telephone line being ungrounded, a signalling system comprising a transmitter, said transmitter including a signal frequency generator and an output transformer including a primary winding connected to said generator, said output transformer including a secondary winding having a ground terminal and an output terminal, a receiving station, said receiving station including a receiving transformer including a primary and a secondary winding, a relay connected across the secondary winding of said receiving transformer whereby said relay is responsive to current flow in the primary winding of said receiving transformer, a coupling capacitor, a transmitting circuit including the primary winding of said receiving transformer and said coupling capacitor connected in series circuit relation for connecting the output terminal of said output transformer to said ungrounded side of said telephone line, signal switches in proximity with said substation, a second coupling capacitor, a signal control circuit including said signal switches and said second coupling capacitor connected in series circuit relation with said ungrounded side of said telephone line and a return circuit between said signal control circuit and the ground terminal of said output transformer, a signal device and a circuit including said relay for energizing said signal device.

4. For connection to a telephone system having a central station, a subscriber's substation and a telephone line extending between said central station and said substation, at least one side of said telephone line being ungrounded, a signalling system comprising a transmitter, said transmitter including a signal frequency generator and an output transformer, including a primary and a secondary winding, said primary winding being connected to said generator, the secondary winding of said output transformer including an output terminal, a receiving station, said receiving station including a receiving transformer, said receiving transformer including a primary and a secondary winding, a relay connected across said receiving transformer secondary winding whereby said relay is responsive to current flow in the primary winding of said receiving transformer, a coupling capacitor, a transmitting circuit including the primary winding of said receiving transformer and said coupling capacitor connected in series circuit relation for connecting the output terminal of said output transformer to said ungrounded side of said telephone line, signal switches in proximity with said substation, a second coupling capacitor, a signal control circuit including said signal switches and said second coupling capacitor connected in series circuit relation with said ungrounded side of said telephone line and a return circuit between said signal control circuit and the ground terminal of said output transformer, a signal device and a circuit including said relay for energizing said signal device, an impedance matching pad connected in the series circuit between said output transformer and said telephone line.

5. For connection to a telephone system having a central station, a subscriber's substation and a telephone line extending between said central station and said substation, at least one side of said telephone line being ungrounded, a signalling system comprising a transmitter,

said transmitter including a signal frequency generator and an output transformer, said transformer including a primary and a secondary winding, said primary winding being connected to said generator, the secondary winding of said output transformer including a ground terminal and an output terminal, a receiving station, said receiving station including a receiving transformer, said receiving transformer including a primary and a secondary winding, a relay connected across the secondary winding of said receiving transformer whereby said relay is responsive to current flow in the primary winding of said receiving transformer, a coupling capacitor, a transmitting circuit including the primary winding of said receiving transformer and said coupling capacitor connected in series circuit relation for connecting the output terminal of said output transformer to said ungrounded side of said telephone line, signal switches in proximity with said substation, a second coupling capacitor, a signal control circuit including said signal switches and said second coupling capacitor connected in series circuit relation with said ungrounded side of said telephone line and a return circuit between said signal control circuit and ground terminal of said output transformer, a signal device, a circuit including said relay for energizing said signal device, an impedance matching pad connected in the series circuit between said output transformer and said telephone line, chokes inserted between said transmitting circuit and said central station and between said signal control circuit and said substation.

6. For connection to a telephone system having a central station, a subscriber's substation and a telephone line extending between said central station and said substation, at least one side of said telephone line being ungrounded, a signalling system comprising a transmitter, said transmitter including a signal frequency generator and an output transformer including a primary winding connected to said generator, said output transformer including a secondary winding having a ground terminal and an output terminal, a receiving station, said receiving station including a receiving transformer, said receiving transformer including a primary and a secondary winding, a relay connected across the secondary winding of said receiving transformer whereby said relay is responsive to current flow in the primary winding of said receiving transformer, a coupling capacitor, a transmitting circuit including the primary winding of said receiving transformer and said coupling capacitor connected in series circuit relation for connecting the output terminal of said output transformer to said ungrounded side of said telephone line, signal switches in proximity with said substation, a second coupling capacitor, a signal control circuit including said signal switches and said second coupling capacitor connected in series circuit relation with said ungrounded side of said telephone line and a return circuit between said signal control circuit and the ground terminal of said output transformer, a signal device, a circuit including said relay for energizing said signal device, an impedance matching pad connected in the series circuit between said output transformer and said telephone line, chokes inserted between said transmitting circuit and said central station and between said signal control circuit and said substation, an auxiliary circuit for directly connecting said receiving transformer across said output transformer.

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