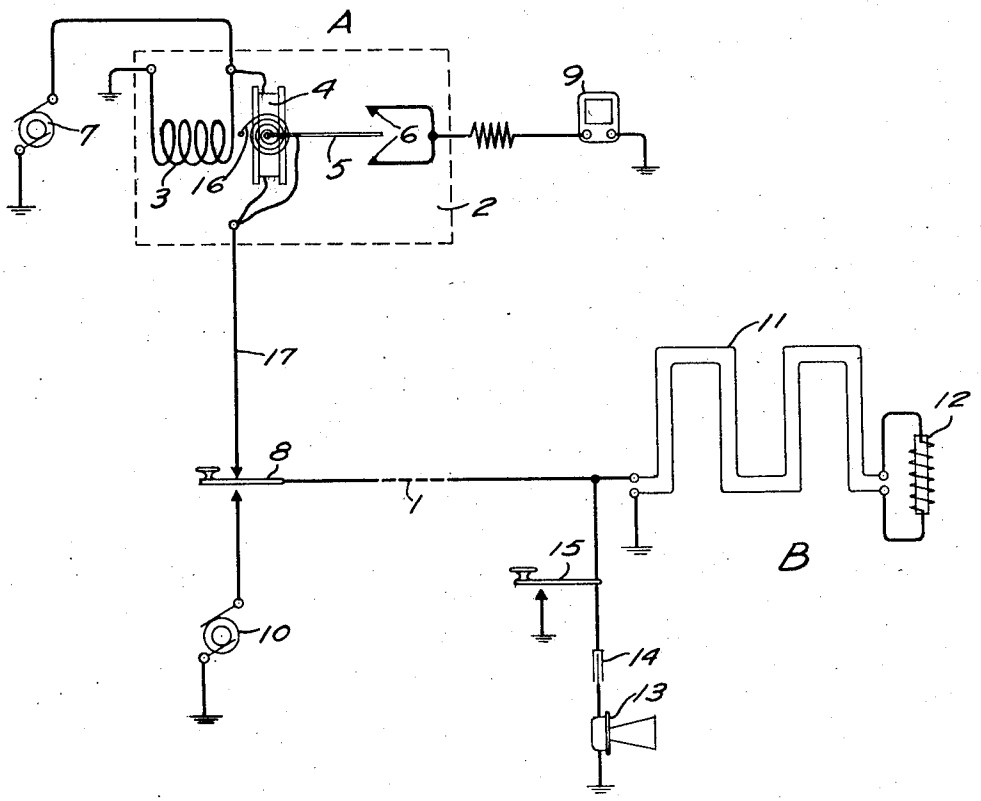
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A. M. CURTIS

ALARM SYSTEM

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ALARM SYSTEM.

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This invention relates to alarm systems and particularly to burglar alarm systems.

It is an object of the invention to provide a new and improved alarm system operating upon alternating current and in which it is impossible for an unauthorized person to substitute a resistance for the subscriber's alarm network and work unmolested for a considerable time.

Another object of the invention is to provide an alternating current alarm system in which the alarm is made to depend not only on the strength of the current in the line, but also on its phase relation to the supply voltage.

This alarm circuit is normally closed through a relatively low frequency A. C. generator at the central station through an A. C. galvanometer to the line circuit and thence through the protective network at the subscriber's station. An alarm device is connected across the line at the subscriber's station in such a manner as to be inoperable by the normally low frequency alternating current, but is designed to operate on a signaling current of an easily audible frequency. A second A. C. generator which provides the audible signaling frequency current is located at the central station and is adapted to be connected to the line circuit upon the depression of a key to cause the alarm device at the subscriber's premises to give a signal.

As an additional feature the invention provides a novel galvanometer circuit at the central station for closing a local alarm circuit thereat.

Other features and advantages of the invention will appear from a consideration of the following description taken in conjunction with the accompanying drawing which shows a diagrammatic view of a circuit embodying the invention.

Referring to the drawing, the invention in its preferred form consists of a central or control station A, and a local or subscriber's station B, interconnected by means of a single line wire 1, which, if desired, may be replaced by a pair of wires and the ground connection eliminated. At the central station A there is provided a galvanometer 2, having a field coil 3 and a moving coil 4. The moving coil 4 carries a pointer 5, which is adapted to move adjacent a suitable scale, not shown, between a pair of contacts 6. The field 3 of the galvanometer is excited locally by a relatively low frequency generator 7, which furnishes the alarm current to the line through a key 8. A signal 9, which may be a lamp or an annunciator drop or any other visible or audible alarm is also provided at the central station to be operated from the galvanometer contacts 6. A second generator 10 is also located at the central station and is adapted to be connected to the line circuit upon the depression of the key 8, this generator providing current of relatively high frequency to the line.

A network of wires 11 is provided at the subscriber's premises in the usual manner and is so disposed as to cover all probable points of ingress and so arranged that breaking or grounding a wire or crossing two wires of the network will cause an alarm. A choke coil 12 of proper impedance is connected in the network circuit in such a way that the joining of any two wires of the network will short-circuit the coil. A "howler" 13, which may be any type of electrically-operated telephone receiver or an electrically vibrated reed device, is connected across the incoming line through the condenser 14, which is of value necessary to prevent any noticeable noise being produced by the low frequency alternating current from the generator 7, which is used to operate the alarm 9, but passes the higher frequency signaling current of the generator 10. A signaling key 15 is also provided at the subscriber's station and is adapted to ground the incoming line when depressed, thus operating the galvanometer and hence the alarm signal 9 at the central station, allowing the subscriber at station B to signal the central station. The galvanometer 2 is so designed that the motion of its pointer 5 is practically dead beat. An adjustable spring 16 is attached to the moving coil 4 in order to compensate for the deflection of the galvanometer coil due to the normal current through the line.

When conditions are normal the alarm circuit may be traced from the main genera-

tor 7, through moving coil 4 of the galvanometer 2, conductor 17, key 8, line wire 1, one side of the network 11, choke coil 12, through the other side of network 11 to ground. The howler circuit at the station B has no appreciable effect on the operation of the alarm circuit as its impedance to the normal alarm frequency is very high. The field circuit of the galvanometer is bridged across the alarm frequency generator 7. As the effect of this circuit is negligible, the current in the line lags behind the voltage by an amount controlled by the inductance of the choke coil 12. On this account the current in the fixed coil 3, which is bridged across the generator 7 and the moving coil 4 are not in phase, and the deflection of the moving coil depends on both the strength and the phase of the current flowing through it. As pointed out above, the normal deflection of the galvanometer may be compensated and the galvanometer pointer brought to the midpoint of its scale by means of the spring 16. It is then evident that any change in either strength or phase of the line current will give a deflection of the pointer from its normal position. If a burglar enters the subscriber's premises, by breaking one of the network wires 11 the galvanometer pointer 5 will be deflected toward the open side contact by the spring, operating the alarm signal. If he short circuits the network the pointer will deflect to the ground side contact and also operate the alarm.

In this system it is impossible to avoid sounding an alarm by substituting a false network for the subscriber's network since all subscribers' lines and networks are different, and as various size choke coils are used to terminate each network, the current strength and phase angles in various lines will vary over a large range, probably from 10 to 50 m. a. and from 30 to 60 degrees. If a burglar should attempt to enter the protected premises without operating the alarm and it should be possible for him to work on the leads from the central station without being interfered with, he might determine the current in the line by inserting a milliammeter without opening the circuit. He then might gradually replace the subscriber's network by a resistance box in such a way that the line current would not be appreciably changed. It will be evident, however, that such a substitution would send an alarm due to the change in phase angle of the line current caused by shunting out the choke coil 12 in the subscriber's network. Since the alarm is operated by a change either in current or phase, the substitution of a false network for the subscriber's network would involve the measurement of the line current and phase angle, and there is no A. C. wattmeter in existence which will give an indication of the phase of such small currents and voltages as are commonly used on such an alarm line without sending an alarm.

The operation of this system by the subscriber and central office operator for the purpose of signaling each other is as follows: Upon closing his premises at night the subscriber may signal the central office operator by pressing and releasing his key 15, which operates the alarm 9 over a circuit extending from ground, through key 15, line wire 1, key 8, conductor 17, galvanometer coil 4, generator 7 to ground. The deflection of galvanometer coil 4 operates alarm 9 over a circuit extending from generator 7 through coil 4, pointer 5, contact 6, alarm 9, to ground. The central office operator could then note that the galvanometer pointer stood at the proper point and signal the subscriber by pressing the key 8 and causing the howler 13 to give an audible tone, the operating circuit for the howler extending from generator 10, through key 8, line wire 1, condenser 14, howler 13 to ground. When the subscriber enters his premises in the morning an alarm is sounded. He may, however, immediately signal the central office operator by pressing the key 15 and sending a suitable code signal which the operator may read on the galvanometer.

When an all-metallic circuit is used in this system the lines may be phantomed and by using more than one alarm and signal frequency, a multiplex system may be operated. This and other departures from the details herein shown and described will be obvious to those skilled in the art and accordingly it is not intended to limit the invention except as defined in the appended claims.

What is claimed is:—

1. An alarm system comprising a line circuit interconnecting a central station and a substation, an alarm device and a source of alternating current at said central station energizing said line circuit, a galvanometer at said central station, said galvanometer having its field coil excited locally by said source of current and its moving coil connected in series with said line circuit, and a spring for normally holding the movable coil against the torque exerted by the magnetic field in each of said coils, said movable coil being responsive to a change in the relation of the phase angle of the currents in the field and movable coils for operating said alarm device.

2. An alarm system comprising a line circuit interconnecting a central station and a substation, an alarm device, a source of alternating current at said central station, a choke coil at said substation connected to said line circuit, and a galvanometer at said central station having its field coil locally

excited by said source of alternating current and having its moving coil connected in series with said line circuit, and means for balancing said movable coil against the torque exerted by the currents in said coils whereby the moving coil is rendered normally ineffective with respect to said device but responsive to changes in the reactance of the choke coil and a consequent change in the phase angle of the currents in the field coil and the movable coil for causing the operation of said alarm device.

In witness whereof, I hereunto subscribe my name this 10th day of August A. D., 1922.

AUSTEN M. CURTIS.