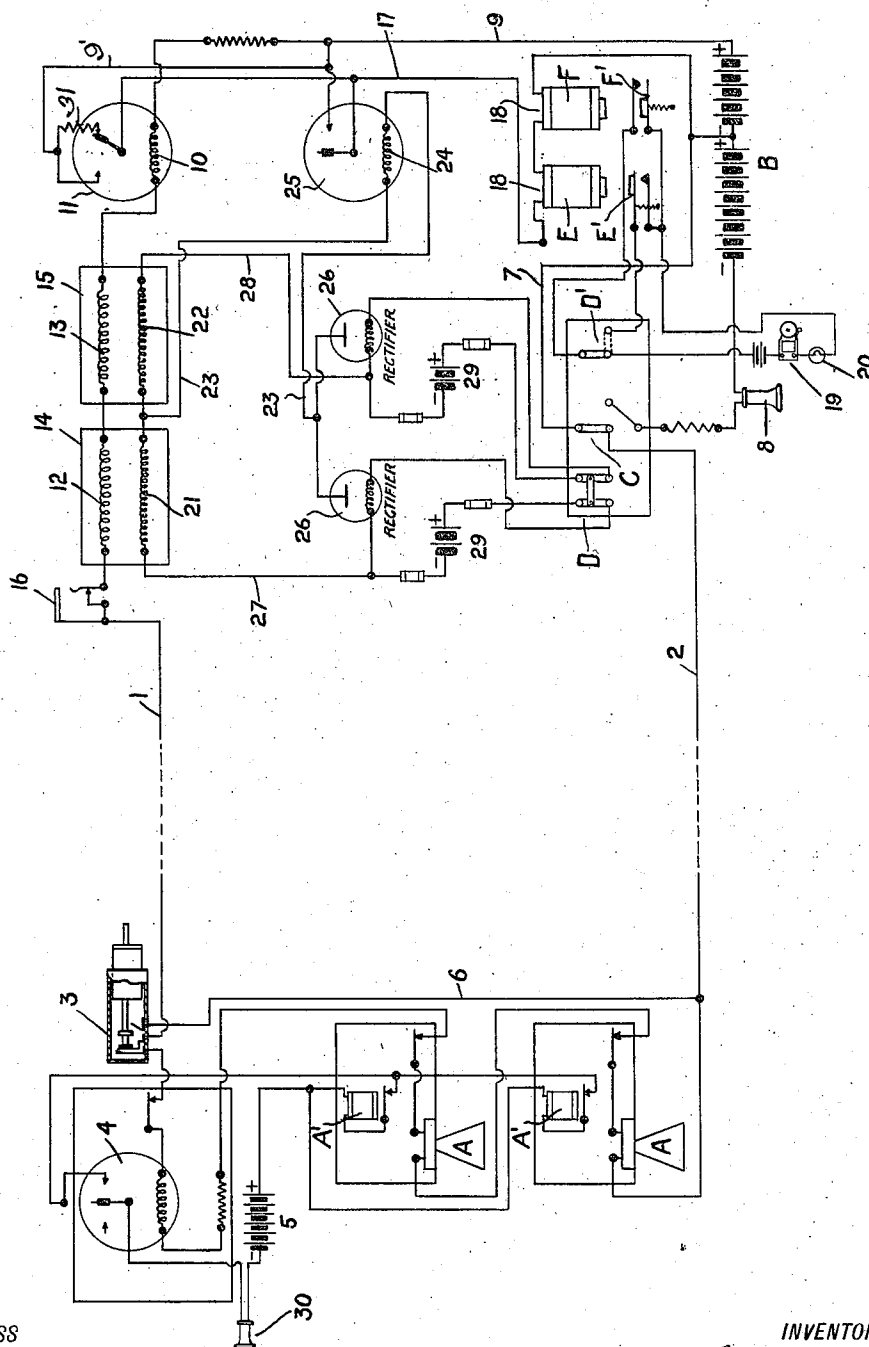


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R. M. HOPKINS
SIGNALING SYSTEM
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SIGNALING SYSTEM.

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To all whom it may concern:

Be it known that I, RICHARD M. HOPKINS, a citizen of the United States of America, and a resident of Rutherford, in the county of Bergen and State of New Jersey, have invented a certain new and useful Signaling System, of which the following is a specification.

This invention relates generally to alarm systems or detection systems, more especially to systems for the protection of vaults and the like from burglary, and is designed to give a positive and reliable automatic electrical indication at a central office when any attempt is made to break into or enter vaults protected by it. By this system the ordinary expensive wire or foil linings covering the walls, ceilings, and floors of vaults is not required, and means is provided whereby sounds, inevitably made in attempts to break into or otherwise enter the protected premises, cause the sending of an alarm to the central station; moreover the arrangement of the apparatus and circuits is such as to provide means for hearing at the central station the sound or sounds responsible for the alarm. Furthermore, the system is such that conversations within the vault or premises protected may be heard, at the central station. The system herein described embodies improvements over the system for the same purpose set forth in the patent to myself and to J. F. D. Hoge, No. 1,192,312, dated July 25, 1916, and depends for its action upon the fact that if an entrance to a vault or other protected premises is forced, or an attempt made to enter, a noise of some kind will necessarily be made. This noise will cause the diaphragms of certain sensitive detectors placed in the vault to vibrate, and, in vibrating, to vary their respective resistances. In the system of the said prior patent, such detectors, when they operated, produced telephonic fluctuations in their circuits, which were rectified by rectifiers located in or about the protected premises, the rectified currents operating a relay by which signals were transmitted to the central station; but according to the present invention, these telephonic currents are transmitted, without rectification, to the central station and there affect, through suitable rectifying means, a

sensitive relay, whereby other apparatus is operated. By transmitting the telephonic currents produced by the detectors to the central station, not only are the more sensitive instruments of the system concentrated at the central station where they are readily supervised and maintained in efficient operative condition, but also it is possible for the central station operator to "listen in" whenever desirable, and thereby the central station operator may determine the character of the noises; also the central station operator may at any time "listen in" and hear conversations in the vault, if any.

Furthermore, by the transmission of telephonic currents, rather than relayed currents, to the central station, the system is rendered practically immune from the effects of sneak currents, induction from external sources, etc., and testing by the central station operator of the apparatus at the subscriber's station is rendered much more effective.

My invention consists in the novel arrangement of circuits, apparatus, and instruments, as hereinafter described and particularly pointed out in the appended claims.

The objects of my invention are to improve burglar or detection systems such as described; to make such systems more reliable, and more easily tested, and to increase the degree of supervision which may be exercised at the central station both over the instruments of the system and over what goes on in the protected premises; and to avoid disturbance from induction, sneak currents, and other external disturbances.

I will now proceed to describe my invention with reference to the accompanying drawing, showing, more or less diagrammatically, one particular embodiment of the invention; it being understood, of course, that the circuits and instruments are susceptible of considerable modification without departure from my invention.

In the drawing: A—A designate telephone transmitters, preferably of a very sensitive type; of which transmitters there may be as many as desired within the protected premises. In connection with each of these transmitters I usually provide a tap-
A' of the general nature of a telegraph relay or sounder, which relay or sounder is

employed as a sound producing device, which may be set in operation from the central station and by its operation will produce sounds which will be heard through the transmitter A and the circuit thereof. These relays are commonly located within the enclosures of the corresponding transmitters, and by the vibration produced by their operation tend to keep these transmitters in sensitive condition.

Current is supplied for the operation of these transmitters A by a battery B located at the central station, and customarily divided into two unequal portions, for reasons hereinafter described; the connection from the central station battery to the transmitters A being through trunk lines 1 and 2, which are customarily protected against induction either by being formed into a twisted telephone pair when located in cables, or by suitable transposition when overhead lines are employed; all as is well known in telephone practice. Customarily, the "incoming" trunk line 1, passes through the contacts of a "door protector" 3 (such door protector being one of the well known contact devices whereby the local instruments are cut out when the door of the vault is opened, and are placed in circuit again when the vault door is closed); thence the circuit passes through a combined ammeter and relay 4, located, usually, external to the vault, but in a position convenient so that the subscriber, upon closing the vault door, may note signals, if any, transmitted from the central station. This ammeter 4 also serves as a means for continuously supervising the subscriber's equipment from the central station; the test being obtained by increasing the current in the line sufficiently to cause this ammeter-relay to close circuit from a subscriber's battery 5 through the tappers A', so causing the tappers to operate and thereby produce sounds which, in turn, will cause the transmitters A to transmit telephonic currents to the central station, and there operate the central station indicating apparatus.

Usually, there is an "unprotected" period during the day, when the vault door is open, and therefore, when supervision from the central station is not desired, during such period the apparatus in the vault is cut out, and also short-circuited through line 6, by the door protector 3; during which period the armature of the ammeter 4 is against its back stop. But as soon as the vault door is closed, the short-circuit is removed, the transmitters A are connected to line, the armature of the ammeter 4 moves to its mid-position, and upon increase of current strength in the line, for test purposes, such armature will move against its front stop, so operating the tappers A' as described.

At the central station, trunk line 2 is connected to the switch arm of the switch C, by which that trunk line is connected normally to conductor 7 leading to the dividing point between the two sections of battery B; but by throwing the switch arm to its opposite position this trunk conductor 2 may be connected through the telephone receiver 8 to both sections of the battery B in series and thence through conductor 9, actuating coil of a delicate ammeter-relay 11, and primaries 12 and 13 of transformers 14 and 15 to a telephone jack 16, and thence, through conductor 1, back through the actuating coil of ammeter-relay 4, and the transmitters A to trunk line 2.

It will be noted that with the arm of the switch C in the normal position shown, only the shorter section of battery B is in the line circuit. For test purposes, by reversing the position of the switch arm, both sections of the battery are connected in circuit in series.

Ammeter-relay 11 serves as means for constantly indicating the strength of the line current and maintaining that line circuit under test.

The transformers 14 and 15 have secondaries, 21 and 22 respectively, which secondaries are connected in series with each other, with an intermediate tap wire 23 leading through the actuating coil 24 of a delicate relay 25 to the two plates of the rectifiers 26; the outer terminal of the secondary 21 being connected through a conductor 27 to the filament of one of these rectifiers, the outer terminal of secondary 22 being connected similarly by conductor 28 to the filament of the other rectifier. These rectifiers are provided with the usual batteries 29 in their filament circuits, controlled by a double arm switch D. It will be understood by those skilled in the art that these rectifiers together rectify the telephonic currents transmitted through the circuit 1—2 through the operation of transmitters A at the subscriber's station, and communicated inductively through the transformers 14 and 15 to the rectifier circuits 27—23 and 28—23 and to the actuating coil of relay 25. This relay, when actuated, closes circuit 9—17 through the coils of drop relay 18, so actuating indicating devices 19 and 20.

Drop relay 18 is an instrument comprising two magnets, E and F, together with shutter armatures E' and F' respectively, of which E' will drop and close contact when the magnetization of magnet E decreases below some predetermined minimum; while F' will be attracted and close contact when the magnetization of magnet F increases above some predetermined maximum. These armatures E' and F' control indicating devices 19 and 20 (which are

usually a bell and a lamp respectively) through a switch D'.

30 designates a telephone receiver at the subscriber's station, through which receiver the subscriber may listen to signals transmitted from the central station.

The switch D' is arranged to connect either the armature E' and its contact or the armature F' and its contact alternately to the circuit containing the indicating devices 19 and 20. During the protected period the switch D' is in the position indicated and when the armature F' is drawn upward against its contact by an abnormal current through the magnet F, the indicating devices 19 and 20 are thereby actuated. During the non-protection period, the switch D' is swung over to the other contact; thus disconnecting the armature F' and connecting the armature E' and its contact operatively, to the indicating circuit. Normally the armature E' is attracted by the magnet E and held away from its contact, but if the circuit 1—2 is broken or its resistance is greatly increased, the armature E' will drop and close the circuit through the indicating devices 19 and 20.

The operation of the system is as follows: Normally, the switch arms of switches C, D, and D' are in the positions shown, the short end only of battery B is to line, and the transmitters or detectors A are in circuit.

During the protected period the needle of the ammeter-relay 11 is against its right-hand contact, thus energizing the magnets E and F of the relay 18, through the conductors 9, 9' and 17. By reason of the resistance 31, the current flowing through the circuit is not strong enough to cause the magnet F to lift its armature F' and consequently the local circuit through the indicating devices 19 and 20 remains open.

Now, should sounds be produced within the vicinity of the detectors A, such detectors, by their operation, will transmit telephonic currents through circuit 1—2, and these telephonic currents, acting inductively through transformers 14 and 15, will produce currents in the circuits of rectifiers 26, which currents will be rectified by such rectifiers and will cause the needle of relay 25 to close circuit 9—17, thus shunting the resistance 31 and causing the current through magnet F to increase sufficiently to attract its armature F' and so causing indicating devices 19 and 20 to operate.

If the line 1—2 should become broken thus cutting off the current through coil 10, the needle of relay 11 will swing over to its left hand contact, thus shunting the resistance 31 and causing the current through magnet F to increase, thereby attracting its armature F' and closing the indicating cir-

cuit through indicating devices 19 and 20.

During the non-protective period the needle of the relay 11 is normally against its right hand contact so that the circuit is closed through the magnets E and F of the relay 18 and the armature E' is attracted and held away from its contact. During this non-protective period the switch D' is swung over to dotted line position, thereby bringing the armature E' and its contact into operative relation with the local circuit containing the indicating devices 19 and 20. If now, the circuit 1—2 becomes broken or its resistance is abnormally increased, the armature E' will drop from the magnet E and close the circuit which actuates the indicating devices 19 and 20.

Periodically, during the protected period, the central station operator should operate switch C, so throwing the full battery B into circuit and operating the sound producing devices A', thereby causing the detectors A to operate and deflect the needle of the ammeter relay 25, which deflection can be observed by the central station operator; also at such time the central station operator can hear the operation of these sound producing devices A' through the telephone receiver 8.

By connecting a portable telephone receiver (not shown) to the circuit 1—2, at the jack 16, the central station operator can at any time, during the protected period, hear what is going on in the protected premises. This jack 16 may be understood to be a diagrammatic representation of telephonic apparatus for this purpose.

When, at the conclusion of the non-protection period, the vault door is closed, the subscriber listening through his telephone receiver 30, may hear signals transmitted by the central station operator (by reversing the switch C), thereby assuring the subscriber that the system is in full operation and that his premises are under protection.

It will be noted that since telephonic currents are transmitted by the detectors A to the central station, such transmission will not be interfered with by tampering with telephonic lines 1—2 (except as such tampering may open the circuit), and, therefore, such tampering does not interfere with the transmission of signals by those detectors; and for the same reason, sneak currents, inductive disturbances, and the like will not interfere with the transmission of such signals by transmitters A. Furthermore, breaking or shorting of line conductors 1, 2, will cause a potential discharge in the primaries of induction coils 14 and 15, with consequent development of inductive "kick" in the corresponding secondaries, so causing the momentary operation of relay 25; so that the line circuit is not only under the supervision of balanced relay 18, but is

under the far more sensitive supervision of relay 25. Other advantages of the improved arrangement are as follows:

The batteries for supplying current to the transmitters A are located in the central station where they can be supervised and changed at any time.

The rectifiers, switch controlling apparatus, relays, etc. of a delicate nature, are located in the central station under supervision instead of in the subscriber's premises.

It is possible with the present system to connect a telephone receiver into the alarm circuit at the central station and hear conversations or noises in the vicinity of the vault.

With the present system the current is supplied to the transmitters from the central station, the current being supervised.

With the present system there is a visible indication that the rectifiers are in operative condition.

The present system is provided with an indicating meter installed in the subscriber's premises which registers the amount of current flowing through the microphones and is an indication to the subscriber of the condition of his protection.

What I claim is:

1. An alarm system, comprising a central station, a subscriber's station, a sensitive sound detector at the subscriber's station; a sensitive relay, an electric generator, and a transformer, at the central station; a single circuit connecting said stations and including said detector, said relay, said generator and the primary of said transformer; a current rectifier at the central station connected to the secondary of said transformer and an electro-responsive device in circuit with said rectifier and controlled by the rectified current.

2. In an alarm system as set forth in claim 1, a sensitive relay at the subscriber's station operatively connected to said circuit, and means at the central station for causing an increased current from said generator over said circuit, whereby the relay at the subscriber's station can be actuated from the central station for the purpose of transmitting a signal.

3. An alarm system comprising in combination a central station, a subscriber's station, a circuit connecting said stations, and including a source of current supply, one or more sensitive sound detectors connected to said circuit at said subscriber's station, a sensitive relay at the central station and means at the central station for operating said relay by telephonic currents transmitted from said detectors, and means at the central station for indicating material increase or decrease in line current strength, a relay at the subscriber's station arranged to be operated by material variation in current strength in said circuit, and sound producing means operatively associated with one of the detectors and controlled by said subscriber's relay and arranged to be set in operation thereby to cause operation of the corresponding detector.

4. An alarm system comprising in combination a central station, a subscriber's station, a circuit connecting said stations, and including a source of current supply, one or more sensitive sound detectors connected to said circuit at said subscriber's station, a sensitive relay at the central station and means at the central station for operating said relay by telephonic currents transmitted from said detectors, a sensitive relay at the subscriber's station and included in said circuit, a local circuit controlled by said subscriber's relay, the latter arranged to close said local circuit upon material change in line current strength from normal, sound producing means in said local circuit and in proximity to one of said detectors, and arranged to be operated by closure of the local circuit, and means at the central station for varying the strength of the line current to cause operation of said subscriber's relay and the sound producing means controlled thereby.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

RICHARD M. HOPKINS.

Witnesses:

GEO. BOSCH,
HARRY J. McCANN.