OR 1,192,312

R. M. HOPKINS & J. F. D. HOGE.
BURGLAR OR DETECTION SYSTEM.
APPLICATION FILED DEC. 6, 1915.

1,192,312. Patented July 25, 1916.

2 SHEETS—SHEET 1.

Fig 1.

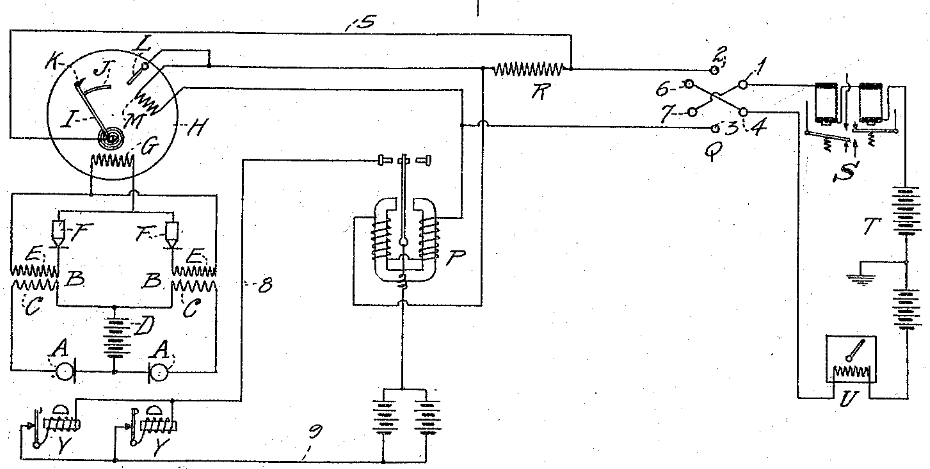


Fig 2.

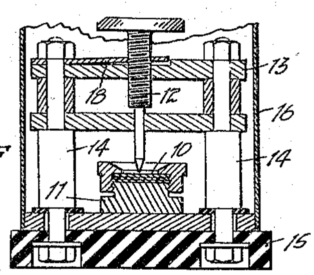


Fig 4.

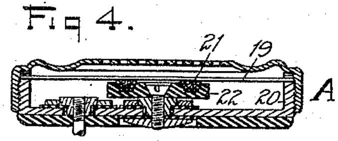


Fig 5.

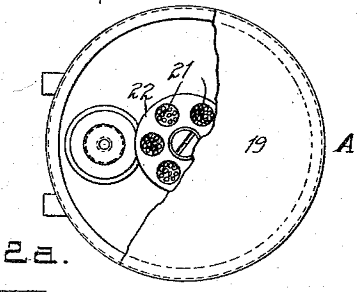


Fig 3.

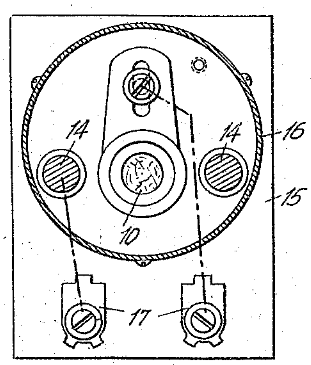
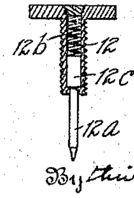


Fig 2a.



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2 SHEETS—SHEET 2.

Fig. 6.

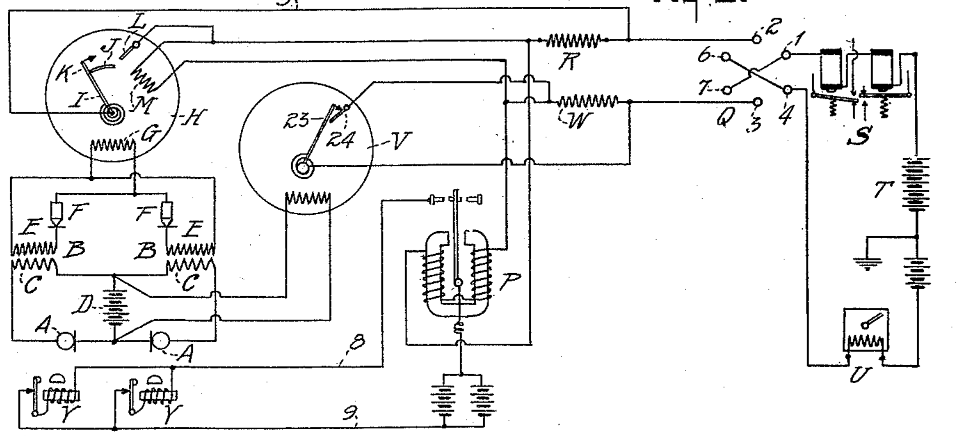


Fig. 7.

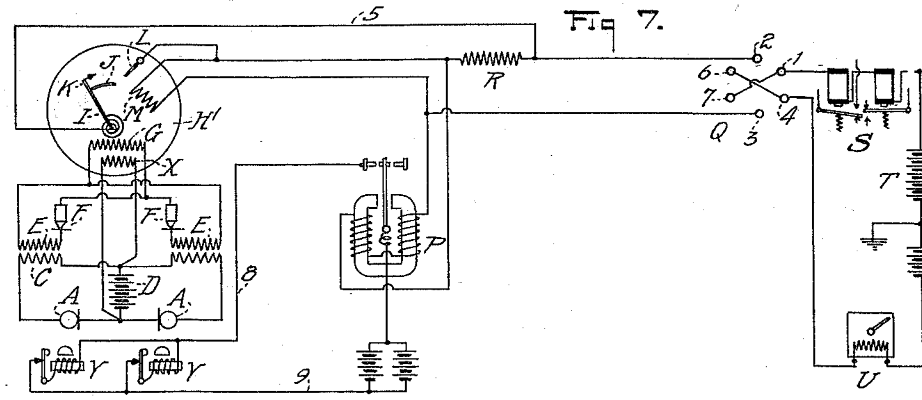
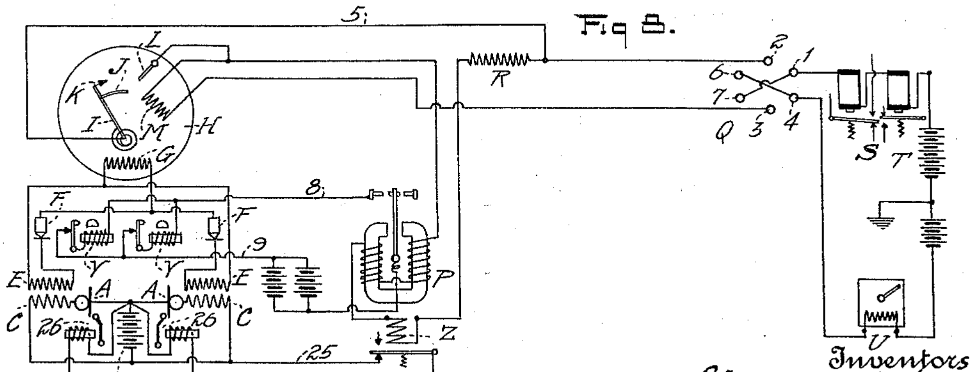


Fig. 8.



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UNITED STATES PATENT OFFICE.

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BURGLAR OR DETECTION SYSTEM.

1,192,312. Specification of Letters Patent. Patented July 25, 1916.

Application filed December 6, 1915. Serial No. 65,194.

To all whom it may concern:

Be it known that we, RICHARD M. HOPKINS and JOSEPH F. D. HOGE, citizens of the United States of America, and residents of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Burglar or Detection Systems, of which the following is a specification.

This invention relates generally to alarm systems or detection systems, and is particularly adapted for giving alarms upon the occurrence of feeble sounds; for which reason the system is termed a burglar alarm system, since occasion for the giving of a signal upon the occurrence of a slight sound usually arises only in connection with burglar alarms; however, the system is equally applicable for giving alarms in the event of occurrence of slight noises, due to causes other than the operations of burglars, and therefore in terming the invention a burglar alarm system, it is not the intention to limit the invention to burglar alarms only; the system being equally adaptable, for example, for giving alarms under conditions such that water flow, a fire, etc., will create a sound. However, the invention will be described herein with relation to its use as a burglar alarm system, it being understood that by such description is not limited to burglar alarms solely.

The invention comprises a relay or contact maker, preferably delicate in its nature, arranged to be actuated by one or more sound-detecting instruments, which are usually of the nature of a very delicate telephone transmitter, such transmitter or transmitters preferably acting upon the relay through an induction coil and a rectifier, whereby the current actuating the relay is rendered unidirectional.

The invention further comprises means whereby the operation of this delicate relay will cause the giving of a signal at a central station or other suitable point, and means whereby the system may be tested in its entirety and its operativeness determined positively by means operated at such central station or other suitable observing point.

The invention is described hereinafter with reference to the accompanying drawings illustrating more or less diagrammatically various embodiments of the invention, the novel features of the invention being pointed out hereinafter in claims.

In the said drawings: Figure 1 is a diagram showing one embodiment of the system. Fig. 2 shows a vertical section of one form of the rectifier which may be employed in the system. Fig. 2^a shows a central longitudinal section of the contact screws of the rectifier. Fig. 3 shows a horizontal section of the said rectifier. Fig. 4 shows a vertical section, and Fig. 5 a top view with parts broken away, of one form of telephone transmitter which may be employed conveniently in the system. Fig. 6 is a diagram similar to Fig. 1, illustrating the use of means to keep the local battery under constant test. Fig. 7 is a similar diagram illustrating the use of alternative means keeping the local battery under constant test and compensating for possible decrease of voltage of such local battery. Fig. 8 is a further diagrammatic view illustrating other alternatives.

Referring first to Fig. 1: A—A designate telephone transmitters, preferably of a sensitive type, for example the sensitive type hereinafter described; B—B designate induction coils comprising primaries C and secondaries E, the primaries being preferably of relatively low resistance, and the secondaries of relatively high resistance. D designates a source of current supply. Each transmitter A is connected in series with a corresponding primary C and with the source of current supply D. Each secondary E is preferably connected in series with the actuating coil G of a delicate relay H, of the general nature of a D'Arsonval milli-ammeter; a suitable rectifier F being also interposed in the said circuit of each secondary E. Various types of rectifiers may be employed, and while one particular suitable type of rectifier is described hereinafter, the invention is not limited to the employment of that particular type of rectifier.

It will be apparent that sounds which actuate the transmitters A, or any one of them, will cause variation of the resistance in the circuit or circuits of such transmitter or transmitters, thereby inducing in the corresponding secondary or secondaries E alternating currents which will be rectified by the rectifier or rectifiers F, so energizing the coil G and causing deflection of armature I of the relay H toward the right (with the said relay arranged as shown).

The armature of the relay H carries a plunger J adapted, when such armature is thrown over to the right as described, to enter holding coil M. Said armature also carries a contact point K, adapted, when the armature is so swung over to the right, to make contact with another contact point L; and when this contact is made, a signal is given at the central station, as hereinafter described. The holding coil M tends to "suck in" the plunger, J thereby insuring contact between K and L, as well as retaining the contact when produced, even though the sound which caused the deflection of the armature of the relay should cease. In practice the position of the coil M is adjustable, in order to adjust the action of such coil with respect to the armature.

It will be clear that the transmitters A operate independently of each other, and that the operation of either or both of these transmitters will cause the operation of the relay; and it will also be obvious that any desired number of transmitters may be connected as described to a single relay H.

At the central station there is a double balanced relay drop S, a double pole double throw switch Q, a galvanometer or other indicating instrument U, and a grounded battery T. At some convenient point, which will usually be in the building to be protected, there is a polar relay P, employed principally for testing purposes.

Current from the central station battery T flows normally through the coils of the drop relay S to contact 1 of the switch Q, and then through contact 2 of the switch and resistance R to the holding coil M, and also to the magnet coils of the relay P, in multiple, and thence back to the contact point 3 of the switch Q, the contact point 4 of that switch, and the indicating instrument U to battery T. Should a noise occur in the protected premises, one or another or possibly several of the transmitters A will be actuated, deflecting the armature of the relay H until the plunger J of that relay is brought within the influence of the holding coil M, whereupon the plunger J is sucked into the coil M, closing contact between K and L, thereby completing a circuit through conductor 5 and thence through coil M back to battery, the resistance R being shunted out, and as a result the line current being increased to such an extent as to actuate the drop S and also the indicating instrument U; the alarm being thus given. The armature of the relay H may be restored subsequently by hand, or (and particularly in testing) such armature may be released by throwing the switch Q to the open position indicated in Fig. 1, whereupon the holding coil M is deënergized and the customary retractile spring of the armature of relay H retracts the armature I, so breaking contact between K and L.

It is desirable that a system such as described shall be capable of periodic testing; in fact, the periodic testing of the system provides in large measure the protection desired; for if, on test, it appears that circuit conductors are broken, or the system otherwise inoperative, this in itself is so suspicious a circumstance as to call for immediate investigation.

For testing purposes the switch Q is thrown so that its contacts 2 and 3 may contact with contact points 6 and 7 respectively, thereby completing a circuit through the holding coil M of the relay H and also deflecting the armature of polar relay P so as to close a circuit 8—9 containing bells, buzzers or other sound producing devices, Y, each associated with a corresponding transmitter A. The sound produced by these sound producing devices Y, upon the closing of the circuit 8—9, will cause the said transmitters A to operate and thereby to cause the relay H to close contact K—L, thereby operating the drop S and the indicating instrument U, as previously described. Since testing switch Q is a pole changing switch, the normal position of which is such that contacts are closed normally between 1 and 2 and 3 and 4, it will be clear that the relay P normally prevents operation of the sound producing devices Y; but when this switch Q is thrown for testing, and the sound producing devices Y are operated, the detecting portion of the apparatus, viz:—the transmitters A and the relay H, are operated just as if a true alarm were being given; in other words, the entire alarm giving apparatus of the system is operated just as it would be in the giving of a real alarm.

The rectifiers F may be of any suitable type; but one type suitable for the purpose is shown in Figs. 2 and 3 and consists of a molybdenite crystal 10 held in a suitable adjustable mounting 11 and a contact screw 12 adapted to make contact with that crystal. It is a characteristic of this molybdenite crystal that some particular point or points of the crystal must be found by trial and test at which the crystal will give the desired rectifying action. Hence the crystal 10 is supported in the manner illustrated so that it can be moved to bring various portions under the point of the screw 12.

As illustrated particularly in Fig. 2^a, the point 12^a of the screw 12 is structurally separate from the screw, the latter being hollow and being provided with a spring 12^b tending to press the point 12^a down. By reason of this construction the pressure of the point 12^a against the crystal 10 produced by turning downward the screw 12, increases quite gradually with the turning down of that screw. By this means a wide adjustment of the pressure exerted by the point 12^a against the crystal 10 is obtained. The point 12^a has a head 12^c whereby when the screw 12 is turned upward, the point 12^a may be lifted from the crystal.

The screw 12 is mounted in a support 13, itself supported by pedestals 14 from a base plate 15; the apparatus as a whole being inclosed by a casing 16; suitable binding posts 17 (Fig. 3) being provided. A spring plate 18 engaging the screw threads of screw 12 insures a good electrical contact between one of the pedestals 14 and the screw; and also provides friction to prevent undesired turning of the screw. This spring also takes up any lost motion in the threads.

The telephone transmitter A, hereinbefore stated to be one type of delicate transmitter suitable for use in the system, comprises a carbon diaphragm 19 located within a suitable diaphragm case 20 and normally resting against very small and light carbon balls 21 located within pockets of a stationary carbon block 22; the carbon block forming one electrode and the diaphragm (electrically connected to the case 20) forming the other electrode, the variation of resistance due to varying pressure of the diaphragm upon the carbon balls, and varying arrangement of said balls, causing fluctuations of current strength in the circuit to which the transmitter is connected. A transmitter constructed in this manner has an electrical resistance which is very sensitive to sound, since any vibration of the diaphragm causes a rearrangement of the balls and a consequent change in the resistance of the transmitter. Obviously various variations of, and modifications of, the circuits of the system are possible.

Fig. 6 shows an arrangement wherein a volt meter V is provided, this volt meter having its actuating coil connected across the terminals of the transmitter battery D, the volt meter being arranged, when the voltage of the battery falls to a predetermined extent, to open a shunt connection 23—24, which normally shunts out a resistance W in the main circuit. The decrease in line current due to the opening of the shunt around this resistance, actuates drop relay S giving a trouble signal; the drop relay being, as will be understood, an instrument which gives one indication upon considerable increase in line current, and another indication upon considerable decrease in the line current, by means of this volt meter V, therefore, the transmitter battery is constantly under test.

In the arrangement shown in Fig. 7 a volt meter winding X is included in the relay H′; this volt meter winding influencing the armature, as well as the regular actuating coil G. The normal adjustment of the relay H′ is such that the action of the coil X is to hold the armature to the left against the tension of the armature spring, which in this case tends to move the armature toward the right. Now if the voltage of battery D falls the transmitters A will be less sensitive, and in their action will produce decreased deflections in the armature of the relay; but since the volt meter windings X of the relay are energized less strongly, owing to the decreased voltage of the battery, the rest position of the armature will be somewhat to the right of that position which the armature would occupy if the battery had full strength; from which it follows that, with a weakened battery, the armature has less distance to travel in the case of actuation of one or more of the transmitters A, before it comes under the influence of the magnetic field of the coil M. This arrangement therefore compensates for decrease in voltage of the local battery. If the battery voltage should fall to the limiting value, contact will be closed between K and L and a signal given.

In the arrangement shown in Fig. 8 the holding coil M of the relay H, and the magnet coils on the polar relay P are shown in series circuit arrangement instead of in multiple circuit arrangement as in the preceding views; and in the circuit of said holding coil M and magnet windings of relay P is also included the magnet of a relay Z, which relay controls a circuit 25 containing single stroke tappers 26 associated with the transmitters A in such manner that each time one of the tappers is operated it jars the transmitter and prevents any adhesion of the ball of that transmitter that might occur with time. This jarring may be accomplished conveniently by causing the armature of the tappers to strike the case of the transmitter A. This jarring is produced each time the line circuit is open and does not otherwise affect the operation of the circuits.

Certain features of the arrangement of circuits in the views illustrated have been dictated by the consideration that the holding coil M tends to give to the plunger J a definite polarity depending on the direction of current in the coil M, as a result of which the plunger J may acquire residual magnetism. As the system is intended to be tested very frequently, say for example, every fifteen minutes, this residual magnetism effect might under certain conditions be detrimental. However, in the arrangement shown the imparting of some residual magnetism to the plunger J is desirable, rather than detrimental, as will be seen from the following consideration: In testing, as previously explained, the operator throws the switch Q so as to reverse the line current from its normal direction; the result being, not only the energization of holding coil M, but also the actuation of the polar relay P and the consequent operation of the sound producing device Y. The sound thus produced actuates the transmitters A and the coil G deflects the armature I, causing the coil M to suck in the plunger J and make contact between the points K and L. It will be noted that in this testing the polarity imparted to the plunger J is the opposite of what it would be if the relay H were operated under normal conditions as distinguished from test conditions, to give a real alarm. The sucking in of the plunger J closes contact between K and L, giving a signal at the central station. The operator now throws the switch Q to the open circuit position, which causes deënergization of the holding coil M and permits the retractile spring of armature I to retract the armature, so withdrawing the plunger J from the coil M. The operator then throws the switch Q to the normal position, in which the coil M is energized with a polarity opposite that with which it was energized during the test. If now, one or more of the transmitters A be actuated by some sound, (it will be an abnormal sound such as should cause the sending of an alarm) and the armature I be deflected in consequence until its plunger J is within the field of influence of the holding coil M, the residual magnetism of the plunger J will assist in the drawing of that plunger into the coil M and so will assist in closing contact between K and L.

The system herein described has been devised particularly for the protection of safes and vaults, and, as will be seen from the above description, will give a positive and reliable indication, when any attempt is made to break into or enter the safe, vault or other premises protected by the system; for, no such safe, vault, or premises, can be broken into without the production of sound such as will operate one or more of the transmitters A. Because the transmitters of the system are operated by sound, and sound waves spread widely, a very few of the transmitters A will protect adequately a very considerable space. An advantage of the system is that it does not require the expensive wire linings covering walls, ceilings and floors of vaults and the like, such as have been required by most former protection systems. The absence of any such vault lining for this system makes it applicable without great expense to vaults already constructed. It will be noticed that the central station battery T is split, and grounded between its sections. As a result grounding of either of the main circuit conductors will increase the current strength through the drop relay S and decrease the current strength through the galvanometer U, so giving a trouble signal.

What we claim is:—

1. An alarm system comprising in combination a relay having an actuating coil, one or more sound detectors inductively associated with the relay actuating coil to cause actuation of that relay, and one or more rectifiers in the circuit or circuits through which the relay is operated by such detector or detectors, such rectifier or rectifiers serving to insure the supply to the actuating coil of the relay of uni-directional current.

2. An alarm system comprising in combination one or more induction coils, a sound detector connected to the primary of each such induction coil and arranged by its operation to vary the flow of current through that primary coil, a relay having an actuating coil in the circuit of the secondary of each such induction coil, a rectifier also in the secondary circuit of each such induction coil, and means operated by operation of the relay for sending an alarm.

3. An alarm system comprising a relay having a movable armature, one or more sound detectors arranged when operated to cause deflection of the armature of that relay, said relay having electro-magnetic holding means arranged to attract said armature when so deflected, means for energizing or deënergizing at will said electro-magnetic holding means, and means operated by deflection of the relay armature for sending a signal.

4. An alarm system comprising a relay having a movable armature, one or more sound detectors arranged when operated to cause deflection of the armature of that relay, said relay having a holding coil, the said armature having a core adapted to enter that coil and to be attracted thereby, means for energizing said holding coil, and means operated by deflection of the relay armature for sending a signal.

5. An alarm system comprising an electro-magnetic circuit closer having electro-magnetic means operable from a distant point to assist in the action of such circuit closer, one or more sound detectors arranged when operated to cause operation of such circuit closer, electrically operated sound producing means associated with at least one of said sound detectors, a current reversing switch, a polar relay controlling said sound producing means, and circuits controlled by such switch arranged with one polarity of current determined by that switch to energize the holding means of the first mentioned relay without operation of such sound producing means, and arranged with the other polarity determined by such switch to energize such holding means of the first mentioned relay, and also to oper-

ate the polar relay to cause operation of such sound producing means.

6. An alarm system comprising a relay having a movable armature, one or more sound detectors arranged when operated to cause deflection of the armature of that relay, said relay having a holding coil, the armature having a core adapted to enter that coil and to be attracted thereby, electrically operated sound producing means associated with at least one of said sound detectors, a current reversing switch, a polar relay controlling said sound producing means, and circuits controlled by such switch arranged with one polarity of current determined by that switch to energize the holding coil of the first mentioned relay without operation of such sound producing means, and arranged with the other polarity determined by such switch to energize such holding coil and also to operate the polar relay to cause operation of such sound producing means.

7. An alarm system comprising a relay having a movable armature, one or more sound detectors arranged when operated to cause deflection of the armature of that relay, said relay having electro-magnetic holding means arranged when energized to assist deflection of that armature, said relay having also contact means controlled by that armature, a circuit for energizing such holding means, such circuit extending from a distant point, and containing resistance, and having a circuit branch arranged to be closed by such relay contacts when the armature is deflected and arranged when so closed to shunt out the said resistance, and signal means operated by the increase of current in the circuit due to the shunting out of such resistance, to give a signal indication.

8. An alarm system comprising a relay having a movable armature, and an actuating coil therefor, one or more sound detectors and a source of current supply therefor, said detectors arranged when actuating to cause energization of such actuating coil and consequent deflection of the armature, said relay having also a volt meter coil connected across the terminals of said source of current supply, and arranged to influence said armature in a sense opposite to the influence of the said actuating coil on said armature, said relay having also means tending to move said armature against the action of said volt meter coil, whereby as the voltage of such source of current supply falls, and the sound detector or detectors become less sensitive the said armature moves to a position requiring less current strength in the actuating coil for said armature, to cause the operation of the relay.

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

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