No. 640,273. Patented Jan. 2, 1900.

C. COLEMAN.

ACOUSTIC ALARM SYSTEM.

(Application filed Sept. 3, 1897.)

(No Model.)

FIG. 1

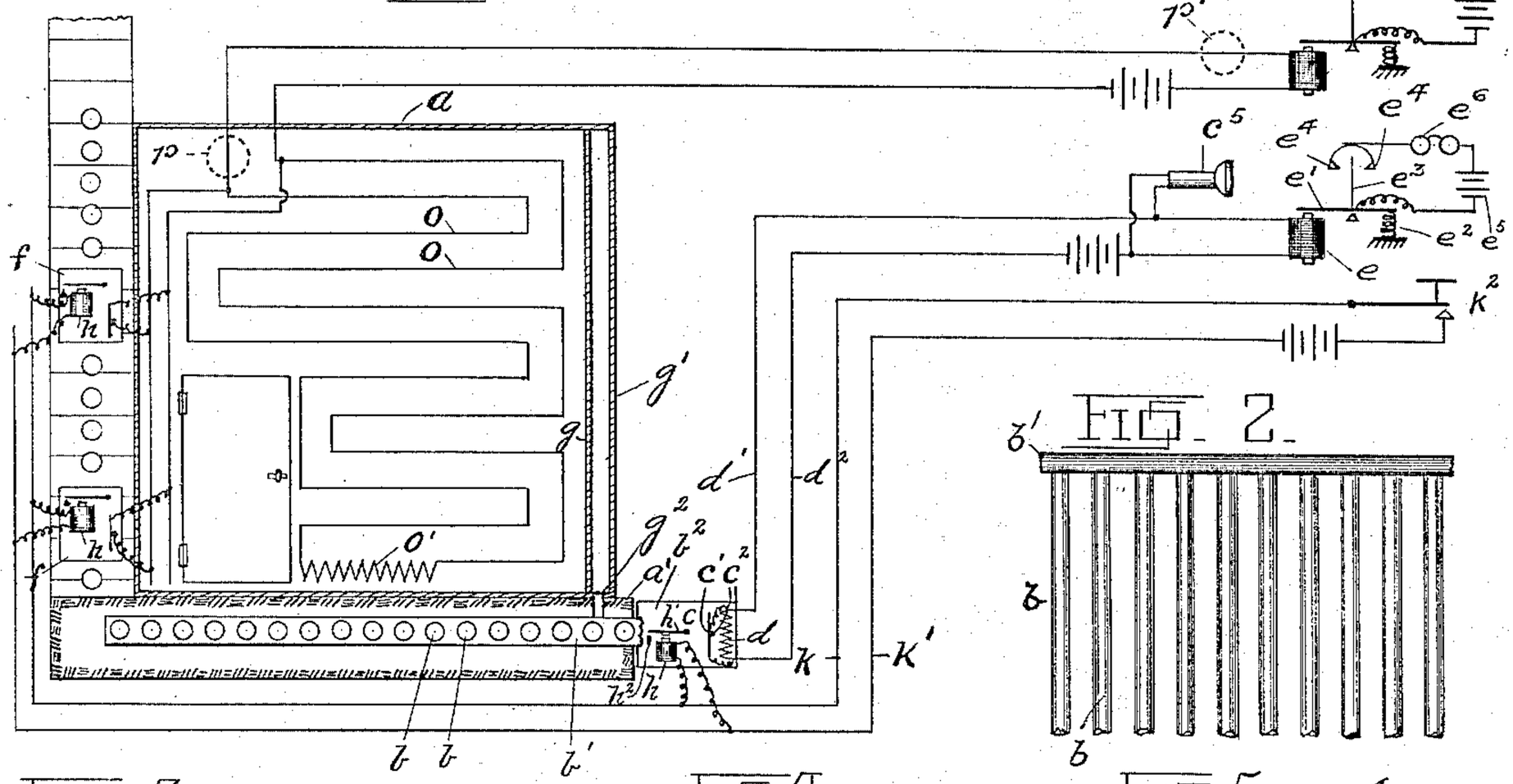


FIG. 2.

FIG. 3.

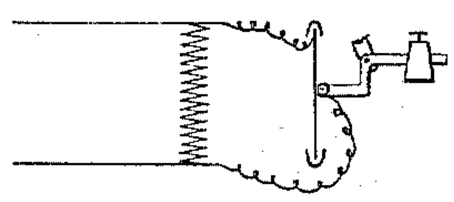


FIG. 4.

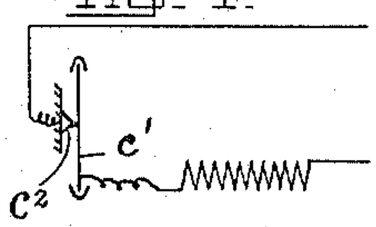


FIG. 5.

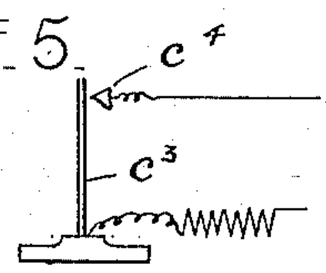


FIG. 6

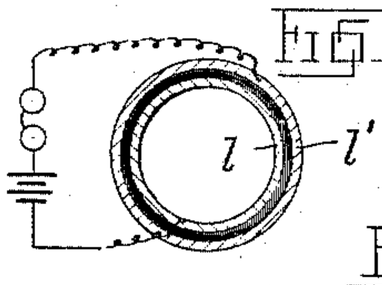


FIG. 7.

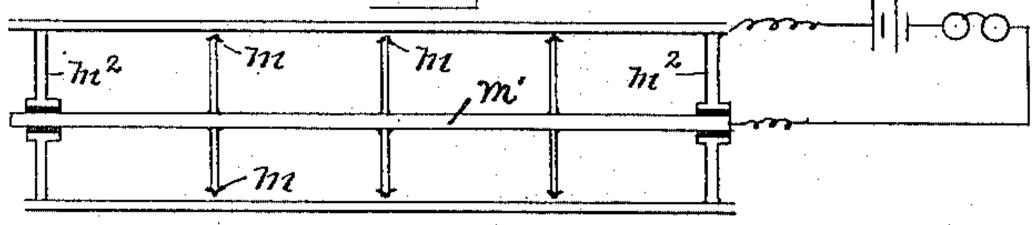
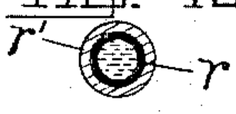


FIG. 10



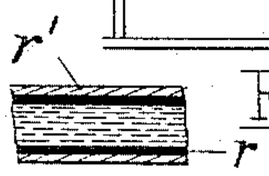


FIG. 12

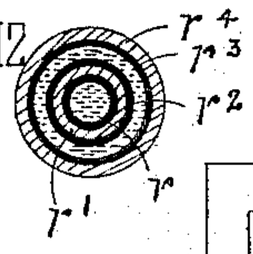


FIG. 11.

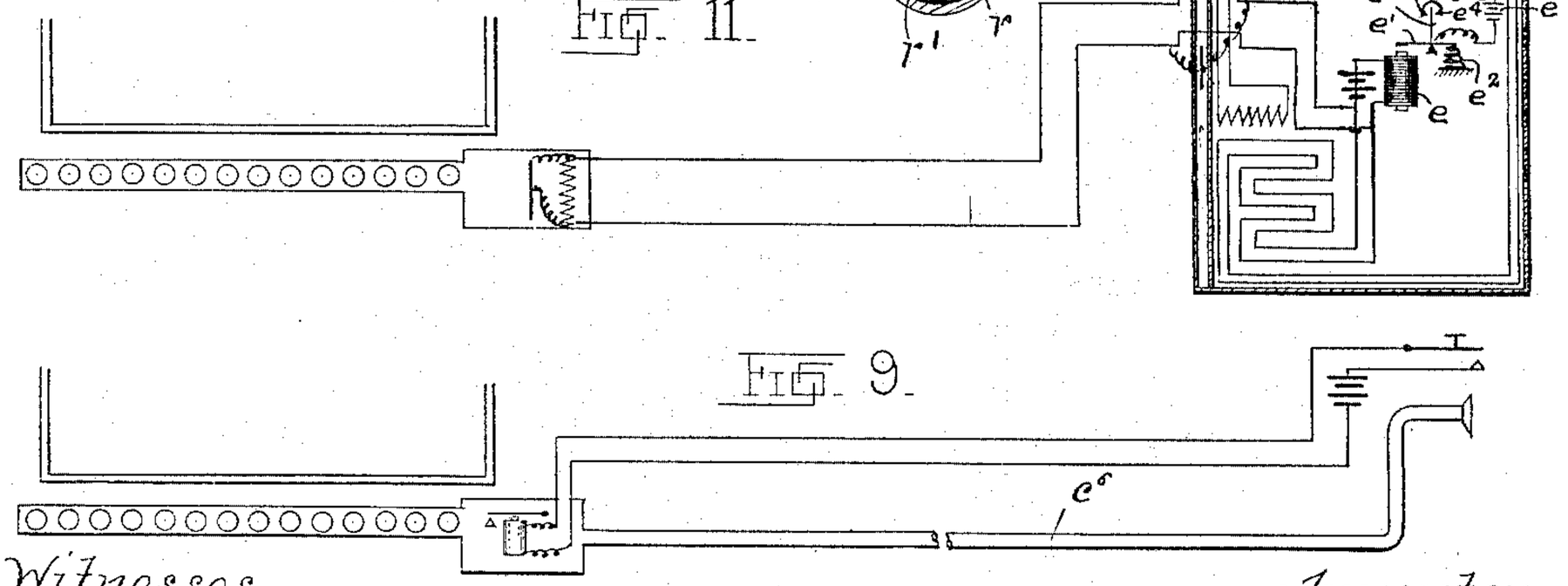


FIG. 8.

FIG. 9.

Witnesses
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M. R. Rochford.

Inventor
Clyde Coleman
By Ludington & Jones. Attys.

UNITED STATES PATENT OFFICE.

CLYDE COLEMAN, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, OF TWO-THIRDS TO THE BANKERS ELECTRIC PROTECTIVE COMPANY, OF SAME PLACE.

ACOUSTIC ALARM SYSTEM.

SPECIFICATION forming part of Letters Patent No. 640,273, dated January 2, 1900.

Application filed September 3, 1897. Serial No. 650,476. (No model.)

To all whom it may concern:

Be it known that I, CLYDE COLEMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Acoustic Alarm Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an acoustic alarm system more particularly adapted to the protection of vaults, safes, and similar inclosures.

My object is to provide means whereby any attempt to cut through or pierce the inclosing walls of the structure will serve to actuate a device responsive to sounds or vibrations to thereby transmit a signal or alarm to the central or alarm station.

In accordance with my invention the inclosing walls or barriers are provided with a series of acoustic chambers through which it will be necessary to pass in order to gain access to the vault by boring, drilling, or any of the means commonly employed for breaking into inclosed protecting structures. Within the acoustic chambers or subjected to the vibrations therein devices are provided which respond to sounds or vibrations produced in the chambers to thereby convey a signal to the alarm-station. For the responsive device a microphone is preferably employed, which is constructed so that the normal resistance therethrough is, say, two thousand ohms, which is adapted to be decreased to, say, five or six ohms when disturbed by sounds or vibrations. The microphone may be arranged to short-circuit a resistance in an electric protective circuit or otherwise change the normal condition of the circuit to transmit an alarm to the alarm-station. Any attempt to pierce the walls of the vault will thus act to sound an alarm.

In order to test the system, I provide rheotomes or other sound-producing devices in connection with the acoustic chambers and connect them with an actuating device exterior to the acoustic chamber and independent of the alarm-transmitting means, whereby a prearranged sound may be produced to determine whether or not the alarm system is intact and capable of responding to sounds or vibrations. In the preferred form of testing device I provide a sounder within the acoustic chamber operated by an electromagnet which is connected in a circuit extending to the alarm-station, where a key or switch is provided for throwing the sounder into operation.

My invention further contemplates a housing for the alarm protected by the alarm system against entrance and associated with the acoustic chambers protecting the vault, so that an attempt to cripple the alarm will be frustrated, and, further, an improved form of cable containing the conductors of the protective circuit so constructed that any attempt to tamper with the conductors of the cable will act to sound the alarm.

In the accompanying drawings, Figure 1 is a view of a vault protected by an acoustic alarm system in accordance with my invention. Fig. 2 is a plan view of a portion of the acoustic tubes. Fig. 3 is a detail view of the microphone responsive device. Fig. 4 is a detail view of a circuit-opening responsive device. Fig. 5 is a detail view of a circuit-closing responsive device. Fig. 6 is a cross-section of one of the acoustic tubes. Fig. 7 is a longitudinal sectional view of one of the acoustic tubes. Fig. 8 is a view of a modification, showing an inclosed alarm device. Fig. 9 is a view of a modication, showing a mechanical telephone. Fig. 10 is a cross-section of one of the cables employed. Fig. 11 is a longitudinal section thereof. Fig. 12 is a cross-section of a modified form of cable.

Like letters refer to like parts in the several figures.

The vault *a* is illustrated as resting upon a foundation *a'*, of concrete or masonry, forming part of the inclosing wall of the vault. Within the foundation a series of pipes or tubes *b b* are embedded, which are placed at a short distance apart and extend throughout the length of the vault to thus afford a barrier which must be passed in order to gain

access to the vault from beneath. The tubes *b b* are connected by a transverse pipe or tube *b'* to form a system of interconnected acoustic chambers, and within a box b^2, connected with tube *b'*, is provided a microphone *c*, having a diaphragm *c'* and carbon contact c^2 or, instead, any other device responsive to sounds or vibrations within the acoustic chambers. I have illustrated the responsive device in connection with one form of electric protective circuit; but it will be understood that it is equally applicable to other forms. The microphone-contacts are placed in the present instance in multiple with a resistance *d*, included in an electric circuit *d' d²*, extending to the alarm-station and there connected with any desired form of signal device, as a magnet *e*, acting upon an armature-lever *e'*, balanced by a spring e^2 and carrying a pointer or arm e^3, adapted to vibrate between contacts e^4 e^4 to close the local circuit containing the battery e^5 and bell e^6. Upon an increase or decrease of the current in the protective circuit the local circuit is closed to sound the alarm. Any noise or vibration within the acoustic chambers will thus actuate the microphone to lower the resistance thereof and short-circuit the resistance *d*, thus actuating the alarm.

Instead of forming the acoustic chambers from interconnecting tubes or pipes they may be formed by the placing of boxes *f f* within the walls or otherwise forming acoustic chambers which must be passed and disturbed in an attempt to pierce the wall. On the right the acoustic chamber is shown in the form of a hollow wall produced by the metal plates *g g'* of the vault being placed at a short distance apart. The chamber thus formed is shown as connecting with the acoustic chambers *b b* by means of pipe or tube g^2.

In order to test the acoustic responsive device and to determine whether the system is intact and operative, a sounder, as a rheotome or similar device, is placed within the acoustic chamber. In the present instance the sounder comprises an electromagnet *h*, having a pivoted armature-lever *h'* arranged to strike a stop h^2 to produce a sound. These rheotomes are placed within the several acoustic chambers, and are preferably connected by means of conductors *k k'* with a key or switch k^2 at the central station for throwing the sounders into operation when desired. Any tampering with the responsive device or with the circuits can thus be detected. If the alarm-circuits be cut, the signal will not be conveyed when the sounder is operated. Likewise the cutting of the conductors connecting with the sounder will prevent the signal from being given when it is attempted to make a test. These conditions will indicate that the system is out of order or that the same has been tampered with. The sounder should be operated by means independent of the means for transmitting the alarm to the alarm-station, and where the alarm is transmitted electrically to the alarm-station and the sounder is electrically operated the sounder should be operated by a separate circuit, or otherwise arranged so that its operation is independent of that of the alarm.

Instead of employing a responsive device in the form of a microphone a circuit-opener may be employed, as shown in Fig. 4, in which the vibration of the diaphragm *c'* serves to open the circuit through the contact c^2 to sound the alarm. In Fig. 5 a reed c^3 is adapted when vibrated to make contact with contact c^4 to thus close an alarm-circuit and sound an alarm.

A telephone-receiver c^5 may be employed as the signal device to respond to the sounds or vibrations produced in the acoustic chambers, or a mechanical telephone may be employed, Fig. 9, a tube c^6 being extended from the acoustic chambers to an earpiece at the alarm-station.

To protect the acoustic tubes or chambers against being cut or severed, I preferably provide an electrical protection for the tubes, which may consist of an inner metal coating or layer *l*, Fig. 6, separated by insulation *l'* from the body of the tube, the layer and tube forming opposite terminals of an alarm-circuit adapted to be closed together by any instrument used to pierce the tubes to thereby sound the alarm.

To prevent the tubes from being bent to the side, I preferably arrange contacts therein adapted to be closed together to close an alarm-circuit upon the bending of the tube. Thus contacts *m m*, Fig. 7, may be mounted upon a rod *m'*, supported and insulated in bearings m^2 m^2. The contacts rest near the inner face of the tube and are brought into contact therewith when the tube is bent to close the alarm-circuit.

The acoustic barrier as disclosed herein may be employed for protecting all the walls of the vault against entrance or may be employed for some of the walls only, other walls being protected electrically or in other manner, or acoustic as well as electrical barriers may be employed to thus afford a double protection.

In Fig. 1 the vault is shown as provided also with an electrical barrier consisting of electrical conductors *o o* in circuit with a resistance *o'*, the circuit extending to alarm mechanism at the alarm-station, which may be of the type above described. Instead of employing a protective circuit of a fixed nature variable rheostats or other variable devices may be included in circuit, as illustrated diagrammatically by the circles *p p'*, in accordance with the prior art.

The acoustic barrier is particularly advantageous for protecting the bottom inclosing walls of vaults, since vaults often contain contents which cannot be readily removed to permit the laying of an electrical barrier upon the floor. In such cases the acoustic tubes can be readily inserted into holes bored through

the foundation material and an impervious barrier thus produced.

As illustrated in Fig. 8, the conductors of the protective circuit extend to an alarm inclosed within a housing which is protected against entrance by means of the electric protective circuit which envelops and surrounds the alarm mechanism, so that any attempt to enter the housing to tamper with the alarm mechanism will sound the alarm. Any noise or vibrations produced in the acoustic chambers inclosed in the walls of the vault will thus effectually act to sound the inaccessible alarm mechanism. The protective circuits inclosing the alarm mechanism are shown diagrammatically, and it will be understood that any arrangement of the circuits and any form of conductors may be employed which will sound the alarm when tampered with. When desirable, the alarm-housing may be provided with acoustic chambers in the walls to sound the acoustic alarm when entry is attempted.

In order to prevent tampering with the protective conductors extending between the protected structure and the alarm-station, I have devised a novel form of cable comprising an inner tube r, of rubber or similar flexible material, which is filled with mercury or other conducting fluid. Surrounding this tube is a sheath r', of lead or other conductor. The mercury thus forms one conductor and the lead the other, and any attempt to pierce the cable will permit the mercury to flow into contact with the lead sheath and short-circuit the circuit to sound the alarm. Where a number of circuits are to be employed, a second rubber tube r^2 may surround the sheath r' and a second body of mercury may be placed in the annular space between this rubber tube and a rubber tube r^3, surrounding the same, and upon the exterior of the outer tube may be placed an outer lead sheath r^4.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an alarm system, the combination with the foundation-wall of a vault or other inclosure to be protected, of a series of interconnecting acoustic tubes embedded therein, and a signaling device at the alarm-station responding to sounds or vibrations in said acoustic tubes, substantially as described.

2. In an alarm system, the combination with the foundation-wall of a vault or other inclosure to be protected, of a series of interconnecting acoustic tubes embedded therein, a microphone associated with said tubes, an electric circuit extending therefrom to an alarm-station and a responsive device thereat actuated by said microphone, substantially as described.

3. In an alarm system, an electric protective circuit extending between the vault or other inclosure to be protected and the alarm-station, a microphone, a resistance in parallel therewith, and a signal device at the alarm-station operated by the shunting of the controlling-current by the microphone to alter the current and actuate the signal device, substantially as described.

4. In an alarm system, the combination with a vault or other inclosure to be protected, of a series of acoustic chambers in the wall thereof, a responsive device, as a microphone, responsive to sounds or vibrations produced in the acoustic chamber, a signal device at the central station, electrical connections between the same and the responsive device, and a sound-producing device situated within the acoustic chamber and means at the central station for actuating said sound-producing device to produce a signal, substantially as described.

5. In an alarm system, the combination with a vault or other inclosure to be protected, of a series of acoustic chambers in the wall thereof, a responsive device, as a microphone, within the acoustic chamber, a signal device at the central station, an independent inclosure therefor having an acoustic chamber in the wall thereof, a responsive device, as a microphone, within the acoustic chamber, and electrical connections between said signal device and the responsive devices in said acoustic chambers, substantially as described.

6. In an alarm system, the combination with a vault or other inclosure to be protected, of a series of interconnecting tubes embedded in the wall thereof said tubes being provided with outer and inner relatively-insulated sheaths, an electrical alarm adapted to be sounded by the closing of said sheaths together, and a responsive device, as a microphone, placed within the chamber formed by said interconnecting tubes, and a signal device connected with and responding to the actuation of said responsive device, substantially as described.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

CLYDE COLEMAN.

Witnesses:
W. CLYDE JONES,
M. R. ROCHFORD.