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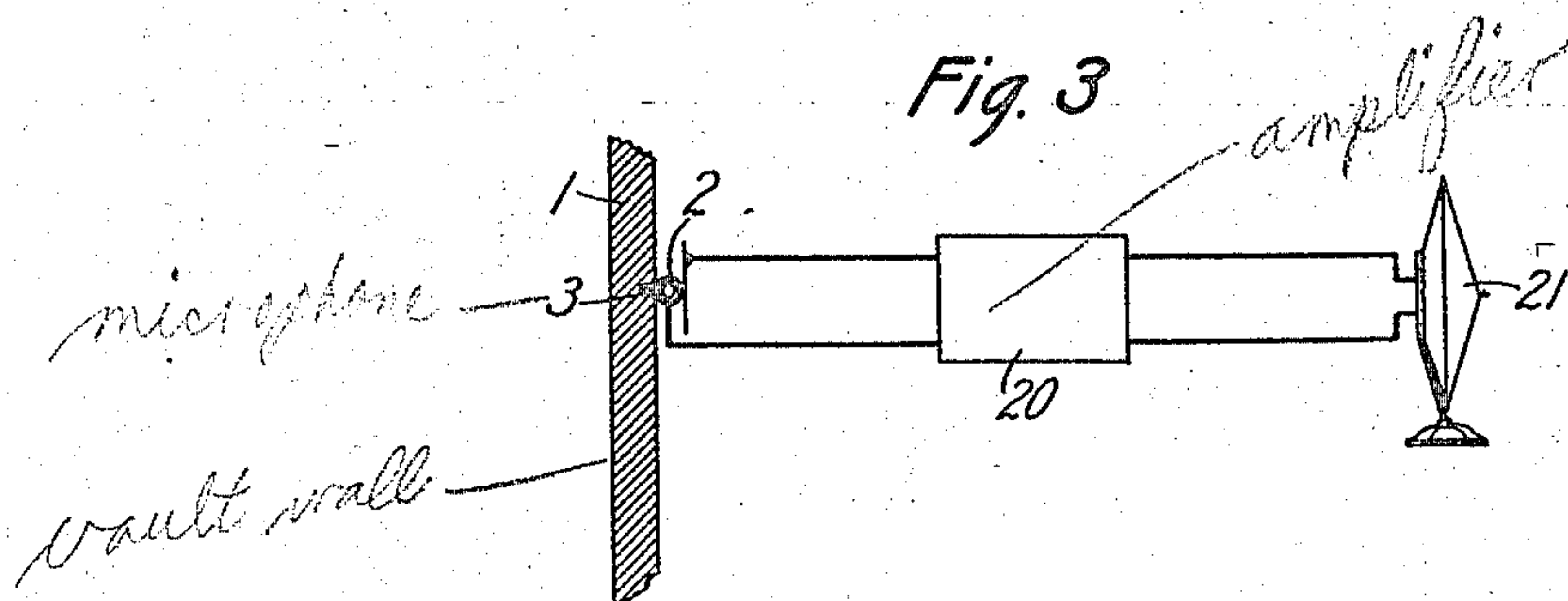
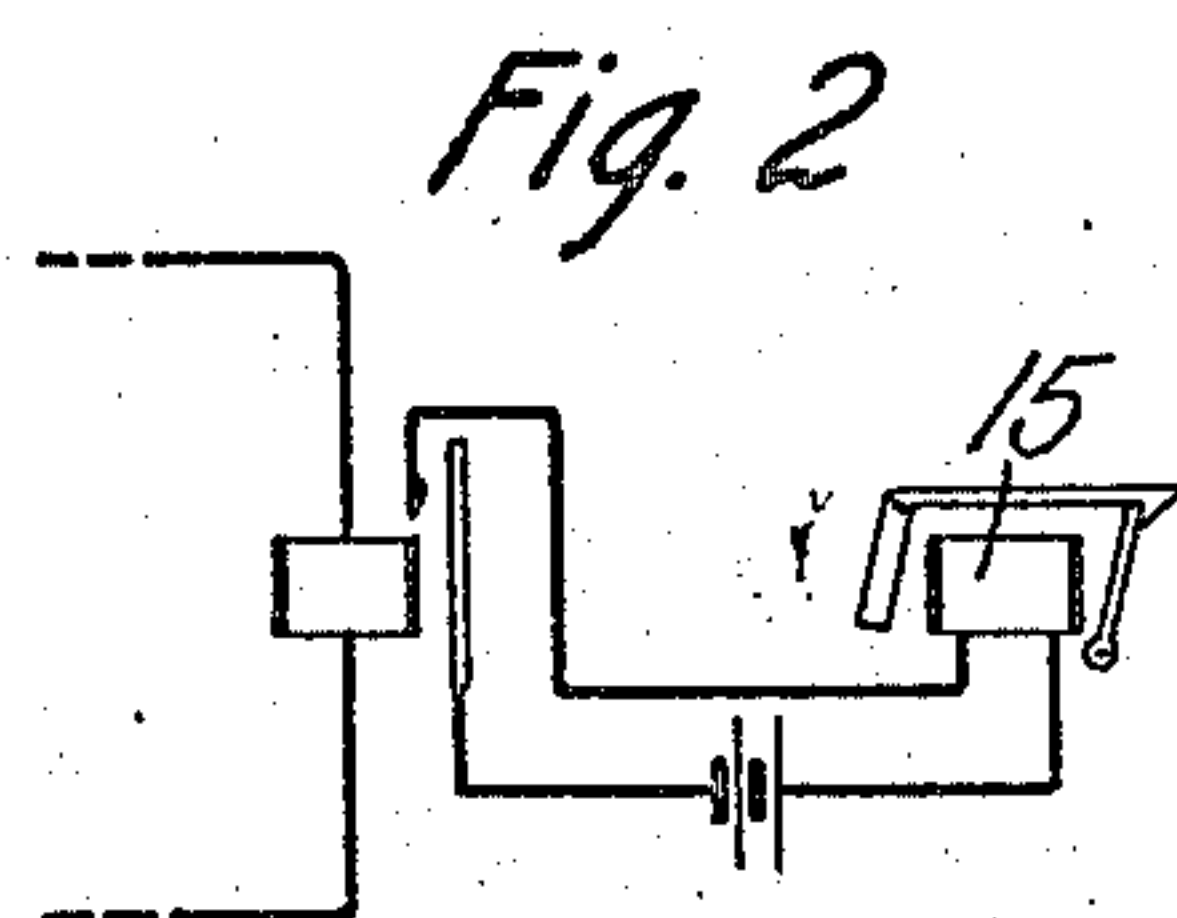
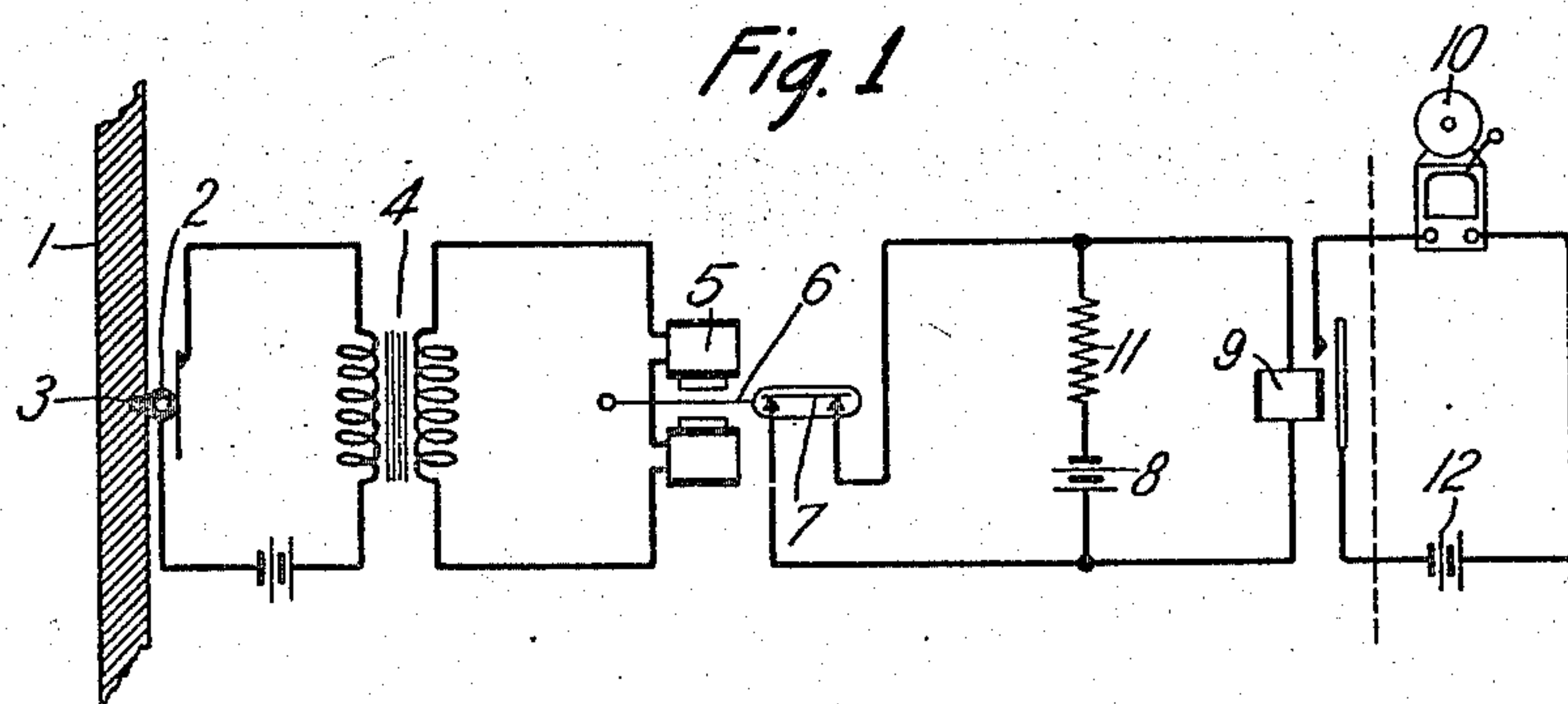
June 10, 1930.

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1,762,973

ALARM SYSTEM

Filed April 28, 1926



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UNITED STATES PATENT OFFICE

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ALARM SYSTEM

Application filed April 28, 1926. Serial No. 105,089.

This invention relates to alarm systems, and more particularly to systems for the protection of vaults, and the like, from burglary.

5 An object of the invention is to enable the detection of vibrations, or other disturbances in a vault or other structure.

Another object of the invention is to enable a distinction to be made, in the detection of vibrations, between vibrations set up in the structure itself and vibrations set up in the air adjacent to the structure.

The practice heretofore followed in alarm systems for vaults and the like, was to employ a sound detector such as a sensitive tele-
15 phone transmitter which was located in or about the vault to be protected, and was responsive to sound waves in the air, emanating from disturbances in or about the vault.

20 This type of transmitter was also responsive to vibrations received from all directions and produced by disturbances around the outside of the building in which the vault was located, thereby rendering the alarm systems
25 of this character susceptible to many false alarms.

According to the present invention a more highly efficient and reliable alarm system is attainable by employing a detector, preferably of the inertia microphone type, so ar-
30 ranged that the vibration responsive element thereof is secured to the wall or shell of the vault, or other structure to be protected. By this method it follows that a direct and more
35 dependable coupling is secured between the alarm system and the disturbance, which latter may be caused by any instrument such as a hammer, drill, chisel, torch or the like, used to force an entrance into the protected
40 structure. The microphone here employed is designed to respond only to those vibrations having frequencies within a particular range as produced in the protected structure by someone tampering with the walls there-
45 of. In this way sound waves or vibrations produced by disturbances other than those in the walls of the structure, may be made practically ineffective to actuate the microphone since such an instrument may be made
50 non-responsive to sound waves in the air.

In this arrangement it has also been found, by several tests and experiments, that the microphone is practically non-responsive to vibrations produced by passing subway
trains, trucks and the like, and that false
55 alarms which are registered in systems heretofore due to the tendency of the microphones therein to flutter or move in response to vibrations at right angles to their axes, have been entirely eliminated. The manner
60 in which this has been effected will be hereinafter described.

The invention further contemplates the use of a relay tuned to respond to electric currents set up by the vibrations detected by
65 the microphone. This relay is preferably tuned to respond to a definite band of frequencies of vibrations and to respond less sensitively to vibrations of other frequencies. The relay in operating, renders effective an
70 alarm to give notice that the structure is being molested.

The above and other objects and advantages of this invention are set forth in the following description and appended claims
75 and may be more readily understood if considered in conjunction with the accompanying drawing illustrating the invention, in which Fig. 1 shows a complete system ac-
80 cording to this invention for operating an alarm device at a distant point in response to the vibrations produced by disturbances in the vault or similar structures, Fig. 2 shows a different form of alarm signal applied to the system shown in Fig. 1, and Fig. 3 shows
85 a modified form of the system of Fig. 1 in which amplifying means may be employed for operating a loud speaking device at the distant point.

Referring now to Fig. 1 of the drawing, 90 the protective system consists of a series of circuits comprising a local circuit which includes a highly sensitive transmitter 2, mounted on the interior portion of wall 1 of the vault with the movable element of the
95 transmitter affixed to the wall. A type of transmitter that may be adapted for use in this invention is disclosed in Patent No. 1,426,757 granted to C. R. Moore on August 22, 1922. The Moore type microphone is
100

preferably adapted for this invention because it is designed to be highly sensitive and responsive to those components of an acting vibration which lie along the button axis and is very insensitive to components at right angles to its axis. Sound waves in the air produce exceedingly little effect on such a microphone on account of its small dimensions and comparatively large mass and stiffness and because of the nearly equal exposure on both sides. In this way even very loud sounds do not actuate the alarm. Disturbances caused by subway trains, and the like, tend to vibrate the vault structure as a whole and hence actuate it at a frequency far below that for which the microphone is designed and is most efficient. Moreover such disturbances are very largely along a vertical line, whereas the axis of the button is mounted horizontally. The button therefore being designed so as to respond only to forces along its axis will not respond to these ground vibrations. A blow or other shock, however, applied to the structure sends a wave or vibration through the material of the structure itself, such disturbances being found to contain much energy of frequencies within the range to which the microphone is designed to be most responsive. Such a disturbance in traveling through and along the wall will cause motions at the wall surface perpendicular to the wall itself and hence actuate the microphone in a direction along its axis, i. e., motions to which it is particularly sensitive. A transformer 4 has its primary winding included in the local circuit and a secondary winding included in a second circuit that also contains an alternating current relay 5 of the inertia type such as the one disclosed in the co-pending application of Henry W. O'Neill filed December 31, 1921, Serial No. 526,152. This type of relay is likewise adapted for this invention inasmuch as it is designed to be tuned for any particular range of frequencies and therefore can readily be made to respond to that range for which the microphone is tuned. A third normally closed circuit is arranged in parallel paths from a source of current 8 and a resistance 11 in series. One of these paths extends through a winding of a relay 9 and the other through a pair of contacts at relay 5, the characteristics of this circuit being such that relay 9 will not operate when the path extending through the contacts of relay 5 is closed. An alarm circuit, including alarm 10 and source of current 12, is associated with the contacts of relay 9 so that when relay 9 is energized, the alarm 10 is actuated.

It will be apparent that when anyone attempts to break through the walls or door of a vault equipped with an arrangement of this kind, any slight tapping with an instrument, such as a hammer or chisel, will set up vibrations in the structure, which in turn will ac-

tuates the movable element 3 of transmitter 2 connected to the structure. The actuation of the transmitter 2 produces corresponding variations in the current passing through the local circuit connected through the elements of the transmitter. Current is thereby produced in the secondary winding of transformer 4 to operate the alternating current relay 5 and cause the armature 6 thereof to vibrate in unison with the variations of the current in the transmitter 2. Fixed to the free end of armature 6 is a contact breaking device comprising a pair of contacts interconnected by a loosely supported link member 7 which is arranged to be agitated by the vibrations of the armature. As the member 7 is agitated a normally closed circuit path extending through battery 8 and resistance 11 is opened. In parallel with this circuit path is a path including relay 9, which is designed to remain in non-operated condition when the contacts in the contact making device are closed, and energized to operate its armature when these contacts are opened. When therefore, these contacts are opened the armature of relay 9 will actuate to close the alarm circuit to operate the alarm device 10 accordingly. The operation of the alarm indicates to an attendant that someone is attempting to break into the vault.

The alarm signal may be of any desired type, for example, a visual signal such as drop 15 which is shown in Fig. 2. In this case it is evident that but a single disturbing knock or short vibratory movement of the structure will be sufficient to open the contacts of relay 5 to operate relay 9 for a sufficiently long period to cause the drop 15 to release its shutter. Thus the slightest disturbance of the structure in the nature of a vibration thereof of sufficient intensity to open contacts 7 will cause a record to be made at a distant point, and it is evident that such records may be made permanent by any well known method of recording.

In Fig. 3 is shown an alarm system in which any well known amplifying means, indicated diagrammatically at 20, may be employed in conjunction with the transmitter 2, shown in Fig. 1. By these means it is possible to intensify current vibrations, received from the transmitter, sufficiently to cause the operation of a loud speaking device 21 at the distant point.

By means of the foregoing arrangement of an alarm system higher efficiency of operation is attained than has heretofore been accomplished by systems devised for similar purposes. Although the transmitter has been shown with its movable member affixed directly to the wall of the protected structure it is understood that the system would be equally efficient should it be desired to attach the movable element of the transmitter to some form of coupling member such as a

5 bracket or a reed which may of itself be either mounted on the wall or suspended from the ceiling and be tuned to the frequency band of greatest interest and which may be so designed as to match the high impedance of the wall with the lower impedance of the transmitter button.

What is claimed is:

10 1. In a protective system for vaults, the combination with a vertical wall thereof of an electric circuit including a vibration detector mounted on the wall, and having its contacts adapted to be operated only by mechanical vibrations substantially perpendicular to the wall and within the frequency
15 range to which the wall readily responds, a relay tuned to respond only to current variations of the frequencies produced by said detector, and alarm means controlled by the
20 operation of said relay.

2. In a protective system for vaults, the combination with a vertical wall thereof of an electric circuit including a vibration responsive device having contacts and alarm
25 means responsive to the operation of the contacts, the device being mounted on the wall and having its contacts adapted to be opened only by vibrations substantially perpendicular to the wall and within the frequency
30 range to which the wall readily responds.

3. In a protective system for vaults, the combination with a vertical wall thereof of an electric circuit including a vibration responsive device having contacts, a circuit
35 closing relay responsive to the operation of the contacts and an alarm responsive to the operation of the circuit closing device, the device being mounted on the wall and having
40 its contacts adapted to be opened only by vibrations substantially perpendicular to the wall and within the frequency range to which the wall readily responds.

In witness whereof, I hereunto subscribe
45 my name this 27 day of April A. D. 1926.

HALSEY A. FREDERICK.

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