No. 623,689. Patented Apr. 25, 1899.

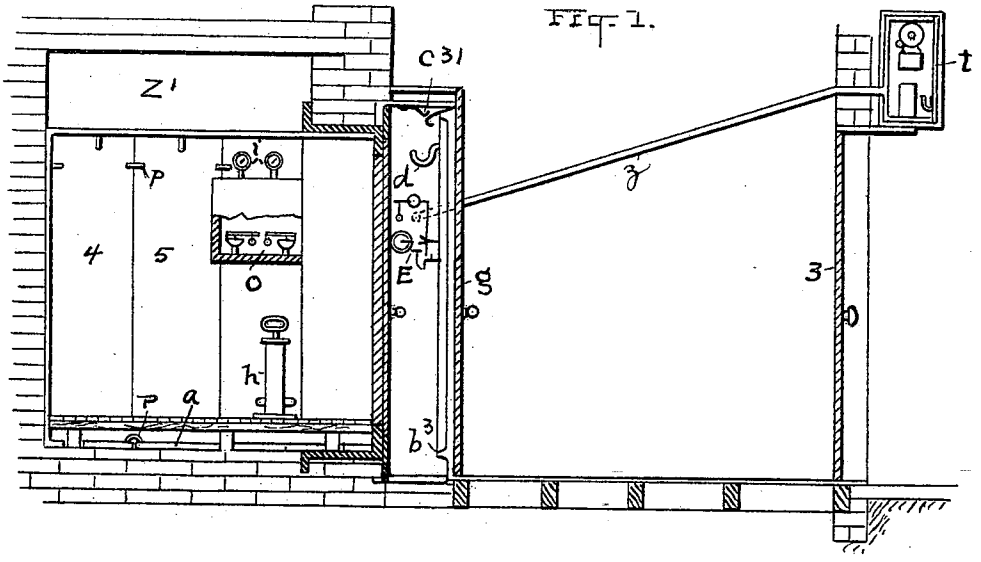
F. C. SMITH.

PNEUMATIC ELECTRIC SAFE OR VAULT PROTECTION.

(Application filed Apr. 24, 1897.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



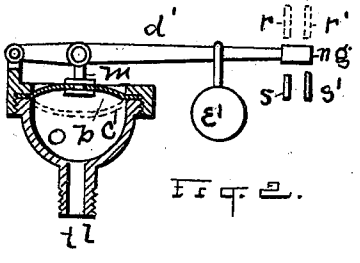




Fig. 2.

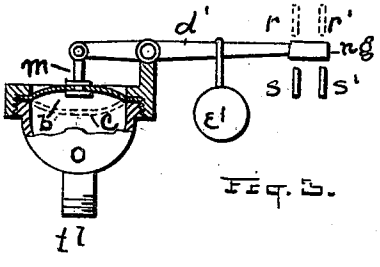



Fig. 3.

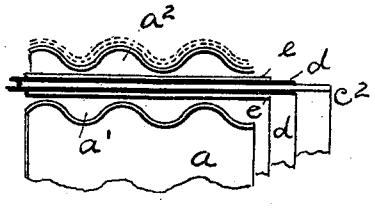



Fig. 5.

Attest
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(No Model.) 3 Sheets—Sheet 2.

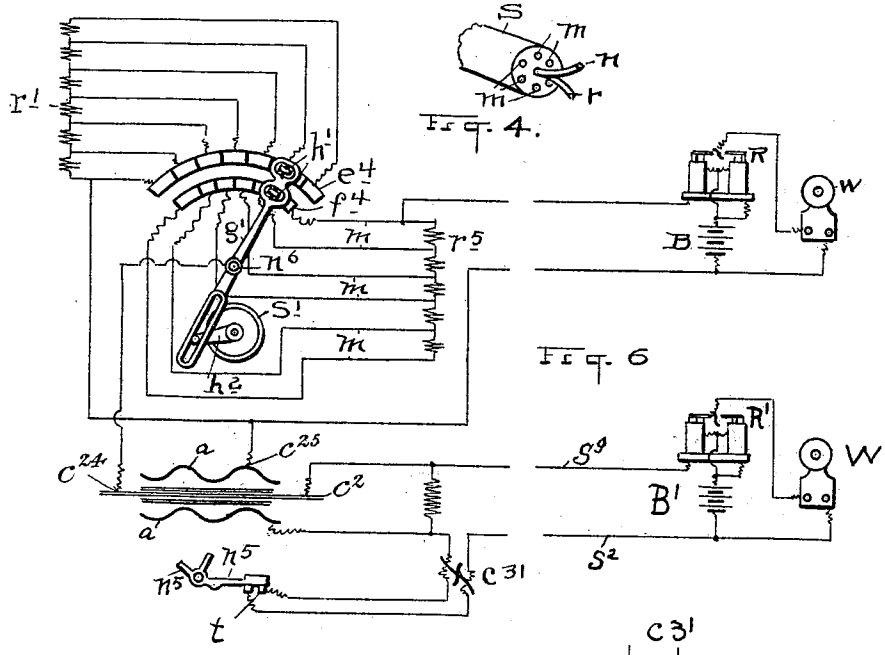

Fig. 4.

Fig. 6

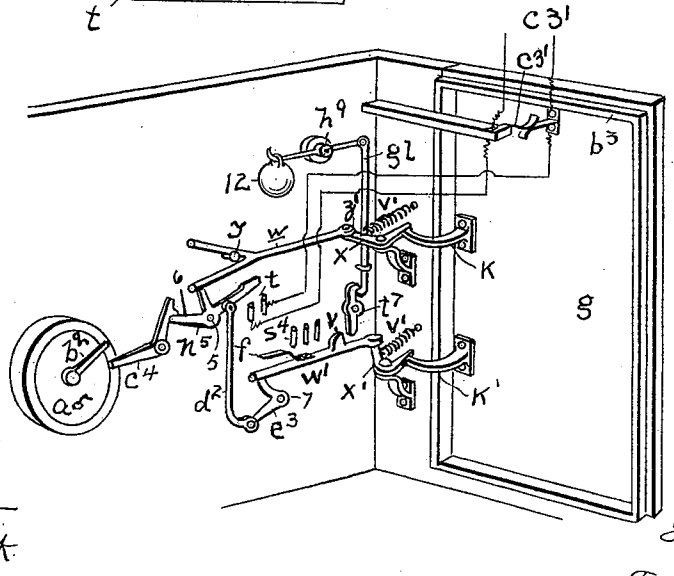

Fig. 11.

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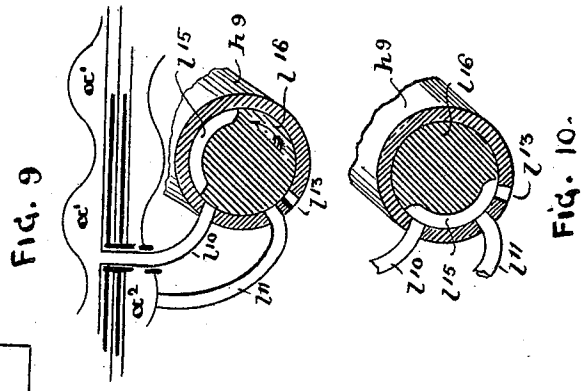

Fig. 9



Fig. 10.

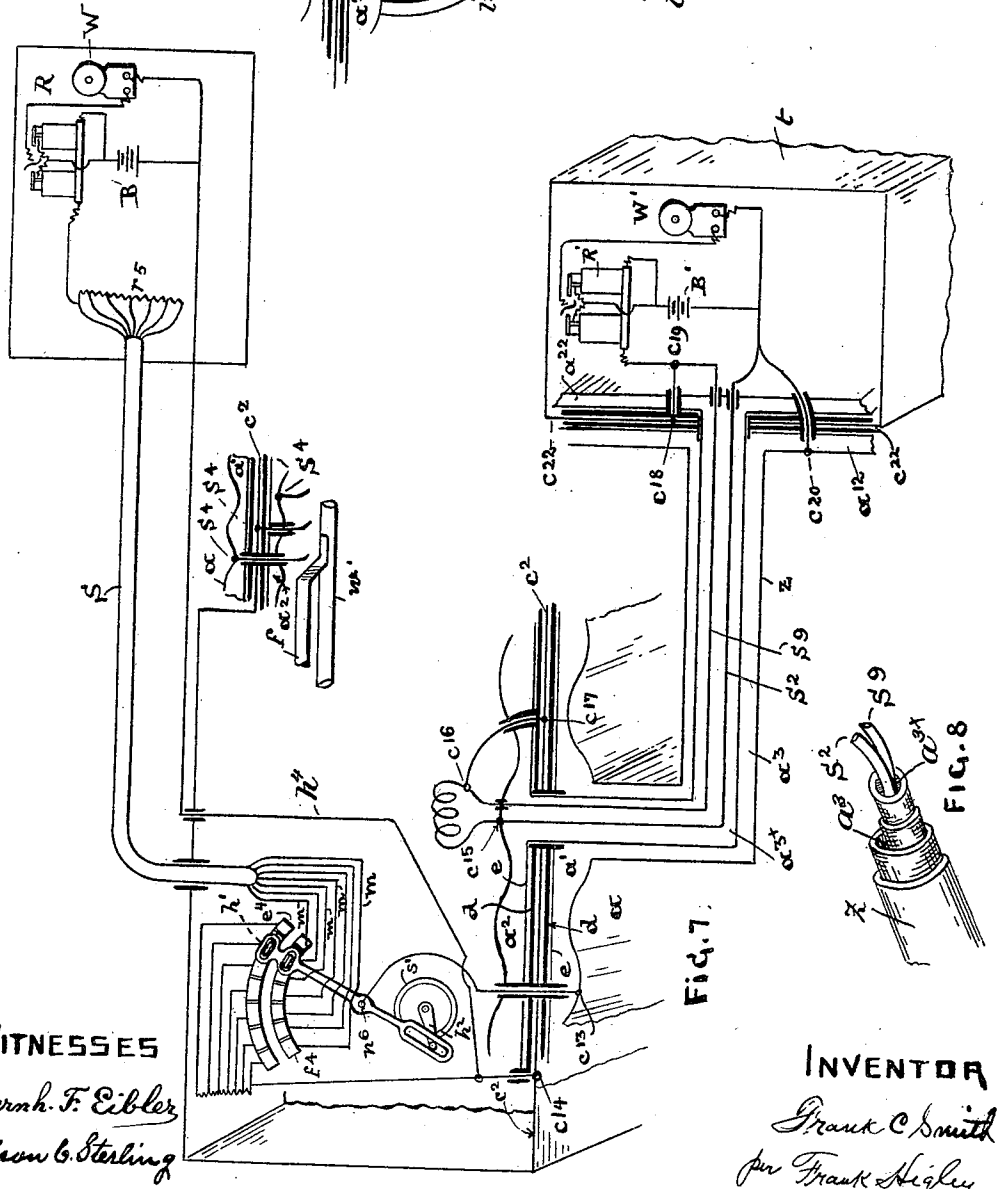

Fig. 7.



Fig. 8

WITNESSES

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# UNITED STATES PATENT OFFICE.

FRANK C. SMITH, OF DELAWARE, OHIO.

## PNEUMATIC ELECTRIC SAFE OR VAULT PROTECTION.

SPECIFICATION forming part of Letters Patent No. 623,689, dated April 25, 1899.

Application filed April 24, 1897. Serial No. 633,788. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK C. SMITH, a citizen of the United States, residing at Delaware, in the county of Delaware and State of Ohio, have invented a new and useful Improvement in Pneumatic Electric Safe or Vault Protection, of which the following is a specification.

My invention relates to the protection of bank-vaults, bank-safes, and other safes by alarm devices; and the object of my invention is to provide a suitable means by which any attempt to tamper with the safe or vault or its alarm or alarm connections will cause the sounding of the alarm.

My invention is based principally upon the fact that air or gas or any other fluid confined at a pressure exceeding that of the atmosphere will escape and lower its pressure if an opening is made into the vessel in which it is confined, and also that if the pressure in such confining vessel is less than the outer air or if there be a partial or perfect vacuum in the vessel the outer air will flow into the vessel if an opening is made into it.

In my invention advantage is taken of the outflow and inflow of air, gas, or other fluid in or between the pressure and vacuum chambers to operate by suitable devices an alarm upon any attempt to tamper with the safe, vault, or alarm.

In this specification and the claims thereof the term "pressure-chamber" is intended to refer to a chamber in which air, gas, or other fluid is confined at a pressure greater than that of the surrounding atmosphere and the term "vacuum-chamber" is intended to comprehend a chamber containing air or other fluid at a pressure less than the surrounding atmosphere or a chamber exhausted to a partial or perfect vacuum.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of that part of the device located in the bank and showing an alarm-bell connected with the bank-vault. Figs. 2 and 3 are vertical sections of the pressure-regulators. Fig. 4 is a view of the cable employed to inclose the wires *m* shown in Figs. 6 and 7. Fig. 5 is a view in perspective of a section of the air and vacuum chambers which surround the vault or safe. Fig. 6 is a view showing the device employed to prevent tampering with the wires of the alarm and showing the system of electric circuits connecting the safe or vault with the alarm-bell and also the alarm at the residence or other desired point. Fig. 7 is a detail view of the electrical connections of the alarm. Fig. 8 is a perspective view of the pipe *z* connecting the safe or vault with its alarm. Figs. 9 and 10 are detail sectional views of the two-way cock $h^9$ shown in Fig. 11, Fig. 9 showing the cock closed and Fig. 10 showing the cock open. Fig. 11 is a side elevation of the device for operating the alarm when the vault or safe door is opened burglariously.

Like letters and figures refer to like parts in the several views.

In the drawings, in Fig. 1, is shown a side elevation of a bank-vault. The vault Z′ is lined with a hollow double casing made of a material suitable for conducting electricity and made secure against leakage.

The casing, Fig. 5, is made with two parts or chambers, one chamber *a′* being for the purpose of holding air, gas, or other fluid at a pressure above that of the atmosphere and the other chamber $a^2$ being exhausted to a pressure less than the atmosphere or a vacuum. This casing covers the entire vault and vestibule to be protected and also the inner side of the vault-door or a special outer door, as *g* in Fig. 1. The outer sheets of the casing are preferably corrugated or of a suitable irregular surface to strengthen the same and render it more difficult to penetrate the outer sheet without change of pressure in the pressure-chamber. The casing, Fig. 5, has the pressure-chamber composed of two parts—the outer wall *a* and the inner wall *e*—and has the inner chamber composed of two parts—the outer wall and the inner wall *e*. Between the inner walls *e* of the pressure-chamber and vacuum-chamber is a sheet $c^2$ of suitable material to conduct electricity and separated from sheets *e e* by insulation *d d*. For convenience the casing or lining is preferably made in sections, as 4 and 5 in Fig. 1, and each section connected by short pipes or passages, as P in Fig. 1; but, if desired, the entire casing or lining may be made in mechanically one piece.

To allow for a tight flexible connection between the vault-casing and the casing of the inner side of the door, a connection is made by a piece of rubber pipe $d^3$, Fig. 1, of sufficient length to allow the opening of the door. A piece of rubber pipe, as explained, connects the pressure-chamber of the vault with that of the door and another piece connects the vacuum-chambers of vault and door.

An iron or secure box $t$ is located over the street-door 3 of the bank, as shown in Fig. 1, or in any other suitable place. The box $t$ contains an alarm-bell operated electrically and set in operation by an electric circuit which operates a relay which releases the spring operating the bell-director by local circuit in the usual manner. The box $t$ may contain the battery, or the battery may be placed in the vault, where it will be more free from weather influences.

The alarm-box $t$ is lined with a double casing of the same kind as the vault. Connecting the pressure and vacuum chambers of the vault with those of the alarm-box is a pipe $z$. (Shown in Figs. 1 and 7.) This pipe has within it another smaller pipe containing alarm-wires $S^2$ and $S^9$, as shown by Figs. 7 and 8. The inner pipe is insulated from the outer pipe by insulation material, and the walls of the pipes are made of material suitable for conducting electricity. The space between the pipe $z$ and the outer wall of the inner pipe is connected with the pressure-chamber of the vault and alarm-box, and the space in the inner pipe is connected with the vacuum-chamber of the vault and alarm-box, as is shown in Fig. 7.

In Fig. 1 at O and Figs. 2 and 3 are shown the pressure-regulators, which consist of hollow drums or chambers O, the lower opening $t'$ of the chamber shown in Fig. 2 being connected to the pressure-space of the vault-lining and the lower opening $t'$ of the chamber shown in Fig. 3 being connected with the vacuum-space of the lining. Covering the heads of the chambers O are flexible diaphragms $b$, Figs. 2 and 3, held in place by suitable means and made secure against leakage. The diaphragms are of rubber or other suitable material and are connected by a stem $m'$ to a lever $d'$, having weight $e'$.

$h$ in Fig. 1 is an air and vacuum pump for maintaining the pressure and vacuum in the lining, which pressure and vacuum are shown by gages $i$. (Shown in Fig. 1.)

By means of the weights $e'$, attached to the levers $d'$ of the pressure-regulators, these levers may be so regulated that any change of pressure in either vacuum or pressure chamber will cause a movement of the lever $d'$, connected by a diaphragm $b$ with such chamber. These levers through the body of the regulators are electrically connected to the pressure and vacuum chambers. The contact-point $s$ (shown in Figs. 2 and 3) is connected with the wall of the vacuum-chamber and the contact-point $s'$ with the central sheet $c^2$, Fig. 5, and the contact-point $r'$, Figs. 2 and 3, is connected with the wall of the pressure-chamber and the contact-point $r$ with the central sheet $c^2$. (Shown in Fig. 5.) The movement of either of the levers $d'$, caused by increase or decrease of pressure in the air or vacuum chamber, contacts the lever end $n\,g$ with two of the short-circuit contact-points $s\ s'$ or $r\ r'$, thus short-circuiting the alarm system connected with the vacuum and pressure chambers and the central sheet $c^2$, as hereinafter shown.

The manner of electrically connecting the casing of the vault and alarm-box $t$ and the wires $S^2$ and $S^9$ with the alarm in box $t$ is shown in Fig. 7. In the box $t$ are shown the battery B', bell W, and double-balance relay R'. In Fig. 7 the casing of the alarm-box $t$ is shown of the same construction as the casing of the vault, the central sheet $c^{22}$ corresponding with the central sheet $c^2$ of the vault, the pressure-chamber $a^{12}$ corresponding to the pressure-chamber $a'$ of the vault, and the vacuum-chamber $a^{22}$ corresponding to the vacuum-chamber $a^2$ of vault. The vacuum-chambers of vault and alarm-box are connected by the space $a^{3+}$ in the pipe $z$, and the pressure-chambers of vault and alarm-box are connected by the space $a^3$ in the pipe $z$, as is shown in Fig. 7. As shown in this figure also, the bell W' is connected with the relay R'. The relay R' is connected at $c^{20}$ with the outer wall of box $t$ and through pipe $z$ with the wall $a$ of the vault-casing. At $c^{18}$ and $c^{19}$ the relay R' is connected with the central sheet $c^{22}$ and at $c^{16}$ and $c^{17}$ with the central sheet $c^2$. The relay R' is also connected with wires $S^2$ and $S^9$ and through wire $S^2$ with the wall of the vacuum-chamber at $c^{15}$. The walls of the vacuum-chamber and the pressure-chamber and the central sheet between these chambers being electrically connected with the alarm, as shown, the tool of the burglar operating to cut a hole in the casing must necessarily pass through the walls of both pressure and vacuum chambers and through the central sheet interposed between the two chambers, thus short-circuiting the alarm system connected with the relay R' and the alarm system shown in Fig. 7 as connected with the vault-casing at $c^{13}$ and $c^{14}$, which will be more fully described hereinafter.

If desired, movable valves, disks, or pistons, with suitable regulating devices, might be substituted for the diaphragms shown in Figs. 2 and 3 and connected with suitable mechanism to set in operation an alarm on any variation of pressure in the chambers.

In place of the casing or lining constructed as before explained a safe or vault might be incased in a network of pipes containing vacuum-chambers and pressure-chambers, as before described.

I do not wish to limit my invention to the exact form of vacuum and pressure chambers herein shown and described or the exact manner shown of applying these chambers to the

vault and its connections, it being apparent that changes in the form of the chambers or the location of the same with reference to the vault or structure to be guarded might be made without departure from the invention herein described and claimed.

In Fig. 1 at E and $c^{31}$ are shown the devices which set in operation the alarm when the door $g$ is opened burglarously. Fig. 11 is a side elevation in detail of these devices. On closing the door $g$ for the night the clock-movement $a^5$, Fig. 11, would be wound up and the finger $b^2$ set at the proper position. The door $g$ has a hollow lip or flange $b^3$ projecting inwardly about one and one-half inches all around the door, so that the door is closed against the introduction of anything, when the door proper has yet an inch and one-half to move to close it entirely. When the door is closed, as shown in Fig. 11, the arm $k$, fastened to the door, comes in contact with the bell-crank $x$, as shown. This bell-crank is pulled to the right by the spring $v'$ and its arm $z'$ is advanced by the arm $k$ during the final closing of the door $g$. Another similar arm $k'$, having bell-crank $x'$, stands in the same position below the arm $k$. (Shown in Fig. 11.) The bell-crank $x'$ is connected with piece $w'$ and the bell-crank $x$ with the piece $w$. The final closing of the door $g$ results in advancing the pieces $w$ and $w'$ to the left. This movement by contact of the lower arm of $w$ with the arm of lever $n^5$, pivoted at 5, rotates the lever $n^5$ until its arm 6 engages with the lever $c^4$, where it is held in position until the contact of arm $b^2$ of the clock with the lever $c^4$ at the desired time releases lever $n^5$. The piece $w$ has an upper incline arm resting on a pin $y$, which carries that end of $w$ up and clear of lever $n^5$ after moving it the desired distance. The connecting-arm $d^2$ by the movement of $n^5$ moves the bell-crank $e^3$, pivoted at 7, raising its upper arm on which the piece $w'$ rests. The piece $w'$ is provided with a spring contact-piece $f$ and lug $v$. Now if the door be opened, with the lever $n^5$ hooked up and held by $c^4$, the alarms of both bank and residence circuits would be set off by the contact-piece $f$ contacting with the three contact-points $s^4$ which are connected with the pressure and vacuum chambers and the central sheet $c^2$, as shown in Fig. 7. The lug $v$ by the raising of the piece $w'$ would on opening the door contact with the trigger $t^7$ and release the piece $g$ $l$, fastened to the two-way cock $h^9$, opening into the pressure and vacuum chambers, thus allowing the weight 12 to act and rotate the cock $h^9$, opening it for the escape of the air or other fluid out of the pressure-chamber and into the vacuum-chamber, thus again closing the circuit for the alarm through the action of the pressure-regulators. The two pieces $t'$, Fig. 11, are also shown in Fig. 6. The two pieces $c^{31}$, Fig. 1, are also shown in Figs. 11 and 6 and are both in circuit, so that the separation of the pieces $c^{31}$ when the lever $n^5$, Fig. 11, is raised would open the circuit and cause the alarm to ring. It will be seen in Figs. 1 and 11 that the contact-pieces $c^{31}$ are fastened, one of the pieces to the door and the other to the vault-lining, but are insulated from both. After the clock $a^5$ has released the lever $n^5$ it falls into place, closing the circuit at $t'$, which was also closed at $c^{31}$, so that the door $g$ can be opened without ringing the alarm, as the release of lever $n^5$ has also through the arm $d^2$ lowered the bell-crank $e^3$ and the piece $w'$, thus allowing the contact-pieces $f$ and lug $v$ to pass without contact under $s^4$ and $t^7$. During the time it is desired that the vault or safe door be opened the circuit is kept closed by the lever $n^5$, resting on the two pieces $t'$, the pieces $c^{31}$ being separated by the opening of the door $g$. On closing the door the two pieces $c^{31}$, Figs. 1, 11, and 6, contact just before the lever $n^5$ is moved, so as to close the circuit at $c^{31}$ before it is open at $t'$. It is thus apparent that when the door $g$ is closed and lever $n^5$ is hooked up by trigger $c^4$ the door cannot be opened without sounding the alarm until such time as trigger $c^4$ is released by finger $b^2$ of the clockwork, when the door may be opened without setting in operation the alarm.

When it is not desired to extend the alarm-wires to the residence through the pipe $z$, as before shown, then the alarm-wires may be carried from the vault to the residence through the cable $s$. (Shown in Figs. 4 and 7.)

The alarm-wires $n$ and $r$ are shown in Fig. 4 and would be electrically connected with an alarm at the residence, and wire $r$ would be connected with the central sheet $c^2$ (shown in Fig. 5) and wire $n$ with the wall of the pressure or vacuum chamber. The wires $n$ and $r$ would pass from the residence to the vault through the cable S. (Shown in Figs. 4, 6, and 7.) In Figs. 6 and 7 the wires $n$ and $r$ are not shown; but the manner of connecting these wires for alarm purposes with the residence-alarm and the central sheet $c^2$ and the wall of the vacuum or pressure chamber is obvious. The wires $n$ and $r$ in the cable S would be surrounded and protected by the wires $m$. (Shown in Figs. 4, 6, and 7.) As shown in Fig. 7, the wires $m$ are connected with relay $r$ at residence and pass through the cable S, which contains alarm-wires $n$ and $r$, and each wire $m$ is connected with one of the blocks of the segment $f^4$. Connected with each block of the segment $e^4$ is a wire, which is connected to sheet $c^2$ at $c^{14}$ and which also by return-wire $h^4$ is connected with the battery B and relay R at the residence, as shown in Fig. 7. If desired, the blocks of segment $e^4$ may be connected with the inner wall of casing at $c^{25}$ and arm $g'$ with central sheet $c^2$ at $c^{24}$, as is shown in Fig. 6.

In Figs. 6 and 7 is shown the mechanism for preventing any interference with the wires in the cable S. It consists of two segments $e^4$ and $f^4$, each segment insulated from the other and each segment composed of blocks

insulated from each other, a swinging arm $g'$ swinging on a pin at $n^6$ and constantly moved back and forward by means of a clockwork S', rotating a crank $h^2$, which engages with the open slot in the lower end of the arm $g'$. The upper end of $g'$ has one or more sliding or rolling contact points or pieces $h'$, so arranged that they slide or roll over the segments $e^4$ and $f^4$, and when the contact of $h'$ is with the center of a block of the lower segment, $h'$ will be straddle of two of the blocks of the upper segment and resting on both. This device is placed in the bank-vault and connected with the battery B and relay R, as shown. By the movement of the arm $g'$ a given amount of resistance is cut out at the residence, and the reverse, thus keeping the total resistance of the circuit practically the same. As the contact pieces or points $h'$ move over the segments $e^4$ and $f^4$ they cut out one step of resistance in wires $m$ at $r'$, Fig. 6, and cut in one step in wires $m$ at $r^5$, and the closing of the circuit between the two segments will cut out one step only, thus keeping the resistance of the circuit within the range of the adjustment of the relay. If the resistance of each step is ten ohms and the relay is adjusted to require a change of eleven ohms to operate it, the short circuit caused by the contact-piece $h'$ being in contact with the two blocks at once will not operate the relay. Any substantial variation of resistance of the circuit through the wires $m$, however, increases or decreases the flow of current, closes the local circuit, and sets off the alarm.

The advantage of the constant shifting of the resistance in wires $m$, caused by the sliding contact-points $h'$ on the segments $e^4$ and $f^4$, is apparent. If the resistance in the wires $m$, connecting vault with residence, were not shifted, as before stated, a burglar might easily measure the electrical current and resistance in the wires $m$ and having measured the resistance in the system prepare an equal dummy resistance, which he could switch into the system as a substitute for the residence system, thus rendering the alarm inoperative and allowing him to attack the wires $n$ and $r$ in the cable by the same means and open the safe, if not otherwise guarded. With my device the constant shifting of the current in the wires $m$ renders it impossible to measure the current and resistance in the wires $m$, and any attempt to cut out any resistance in the circuit will vary the resistance and cause the alarm to operate.

What I claim, and desire to secure by Letters Patent, is—

1. In combination, an alarm, and a safe or vault provided with a pressure-chamber and a vacuum-chamber, the walls of the chambers being constructed of an electrical conductor and being electrically connected with the alarm, substantially as and for the purposes described.

2. In combination with a safe or vault and its alarm, a pressure-chamber and a vacuum-chamber the walls of which are constructed of an electrical conductor and are insulated from each other, an electrical conductor interposed between the chambers, the chambers and conductor being electrically connected with the alarm, substantially as and for the purposes specified.

3. A covering for the wires connecting the safe or vault with its alarm, consisting of an outer and an inner tube constructed of an electrical conductor and being insulated from each other, one of the two chambers formed by the tubes, containing air gas or other fluid under pressure, the other being exhausted to a partial or total vacuum, the walls of the tubes being electrically connected with an alarm, substantially as shown and described.

4. In combination with a safe or vault, a door having arm K connected by bell-crank with piece W, and arm K' connected by bell-crank with arm W' having contact-piece $f$ and lug $v$, contact-points $s^4$, lever $n^5$, bell-crank $e^3$, arm $d^2$, trigger $l^7$, piece $g\ l$ operating two-way cock $h^9$, lever $c^4$ operated by clock-movement $a^5$, all arranged substantially as shown and for the purposes described.

5. In combination, a relay and an alarm connected therewith, the segments $e^4$ and $f^4$ composed of blocks insulated from each other, wires $m$ electrically connected with the relay and the blocks of the segments $f^4$, an electrical connection between the alarm and blocks of the segment $e^4$, contact-piece $h'$ engaging the insulated blocks of the segments $e^4$ and $f^4$, and connected with the lever $g'$ operated by clockwork $s'$, substantially as shown and for the purpose described.

FRANK C. SMITH.

Witnesses:
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A. L. SMITH.