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No. 846,502. PATENTED MAR. 12, 1907.

J. G. NOLEN.

FIRE ALARM SYSTEM.

APPLICATION FILED SEPT. 24, 1903.

3 SHEETS—SHEET 1.

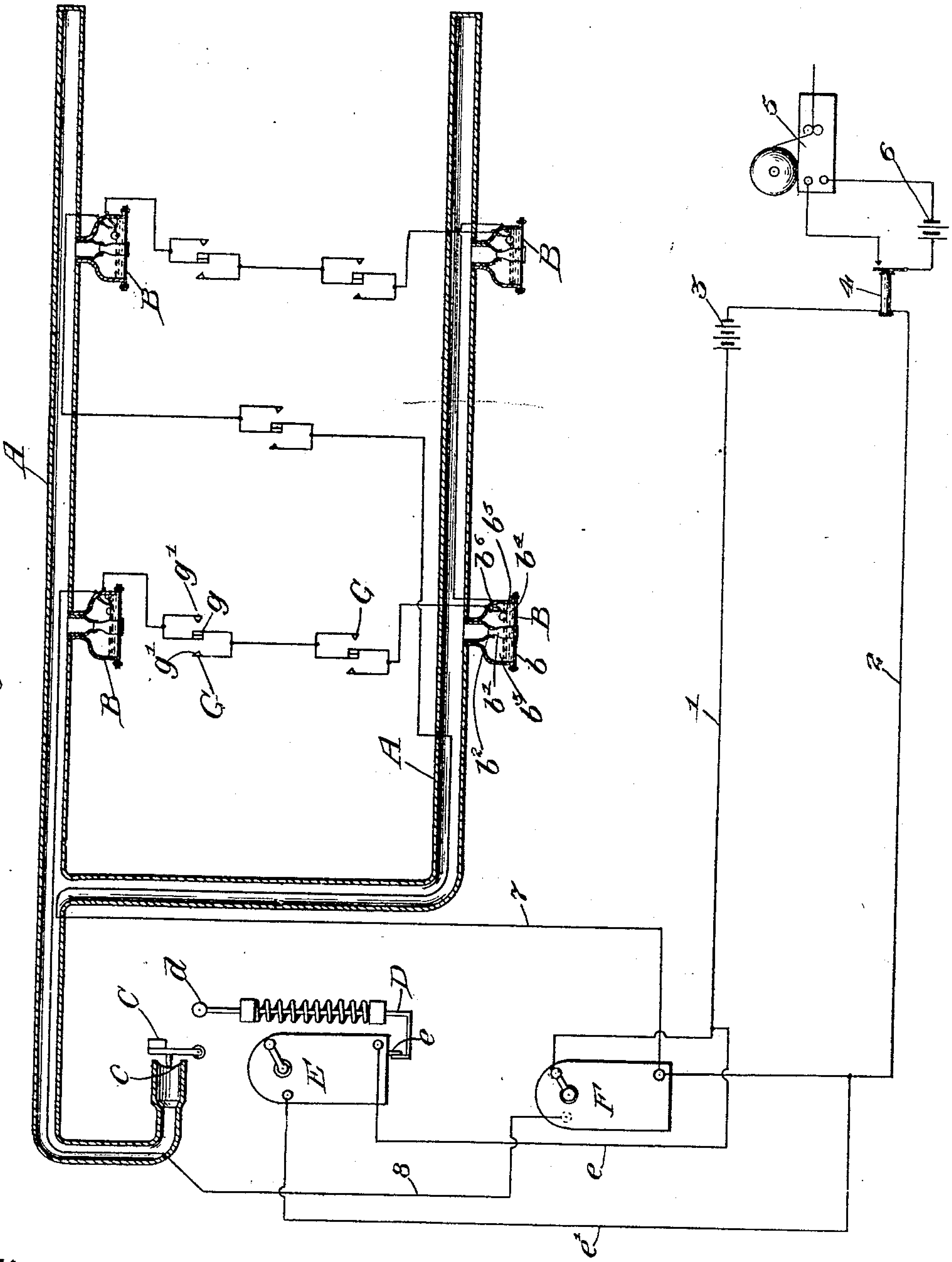

Fig. 1.

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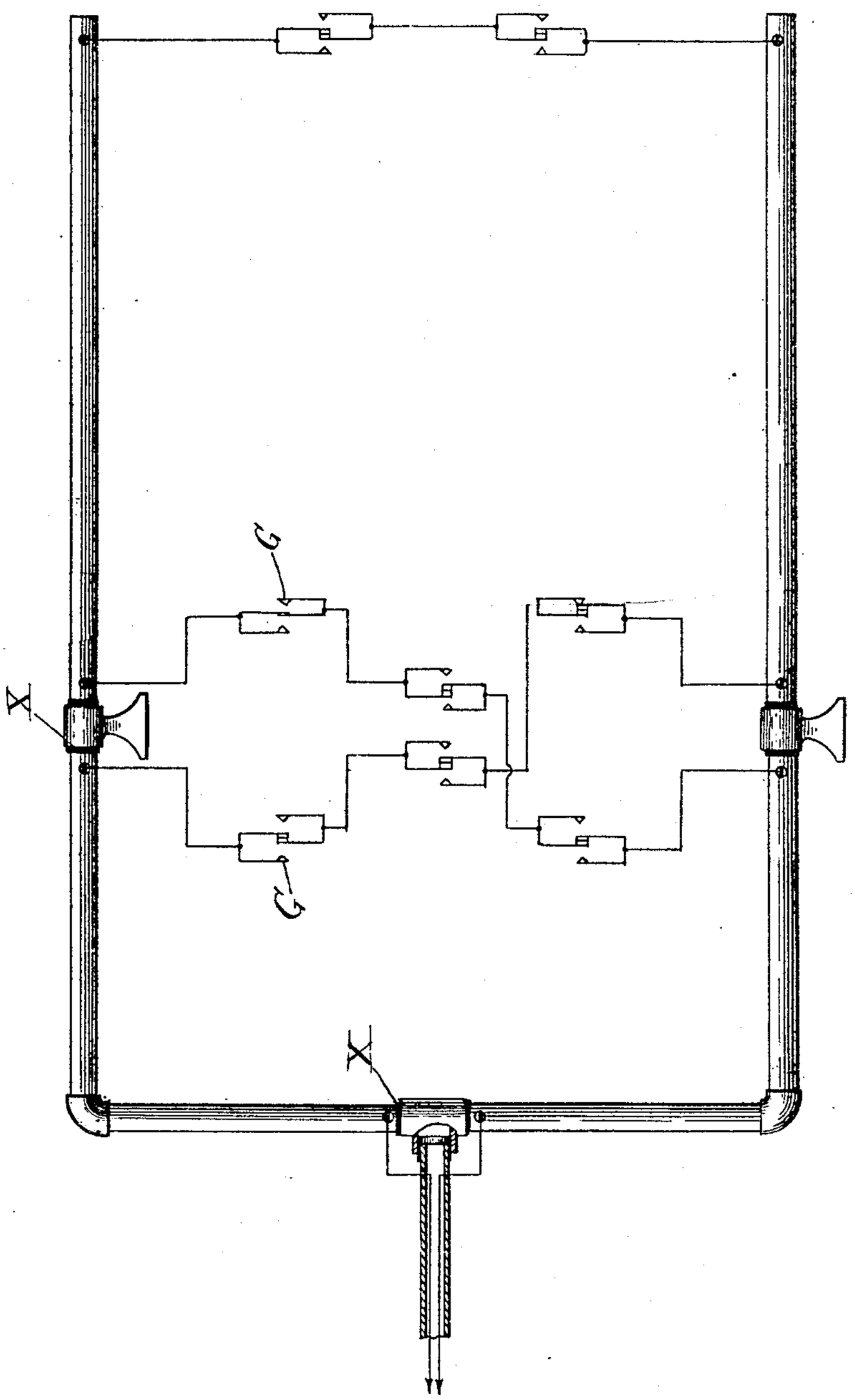
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 4.

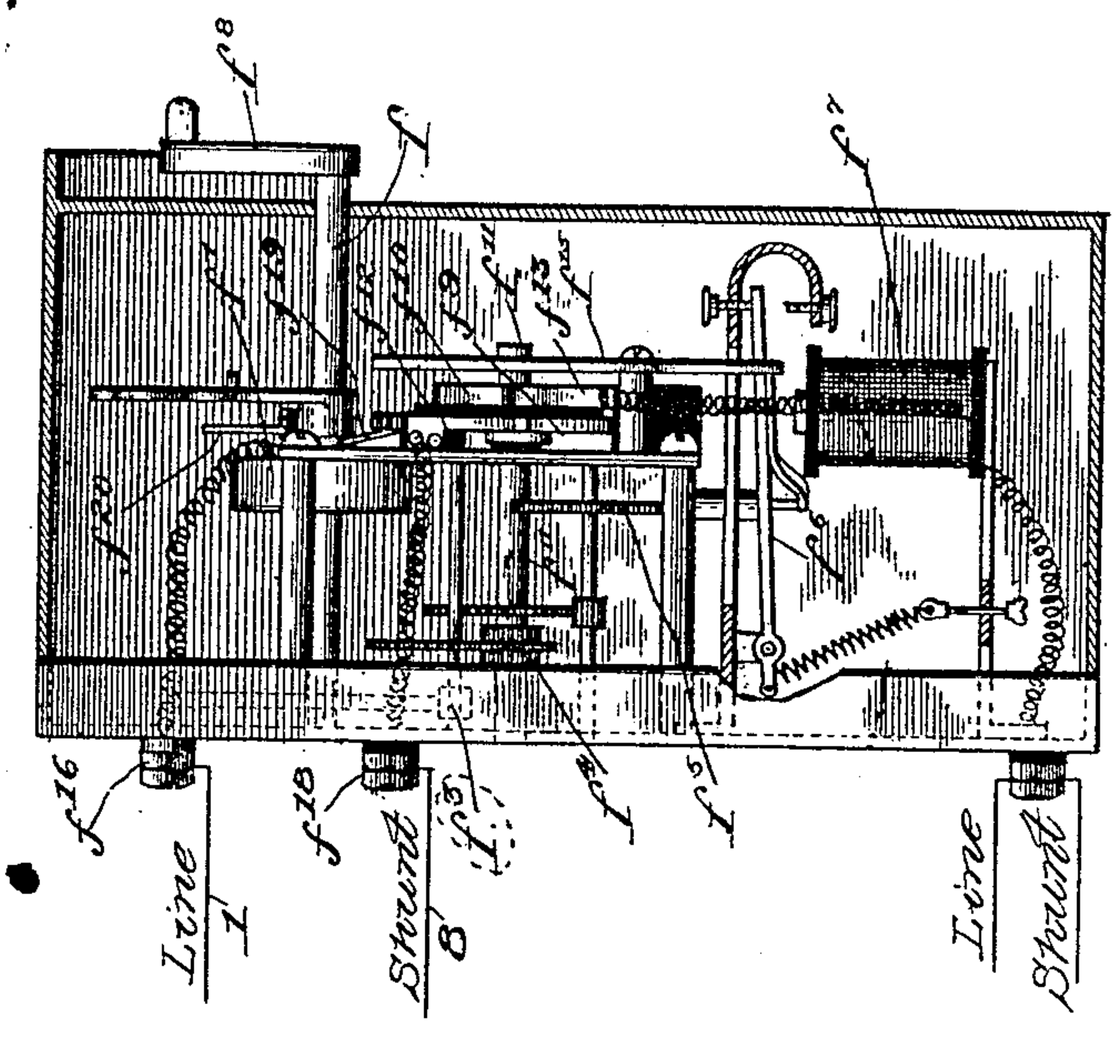
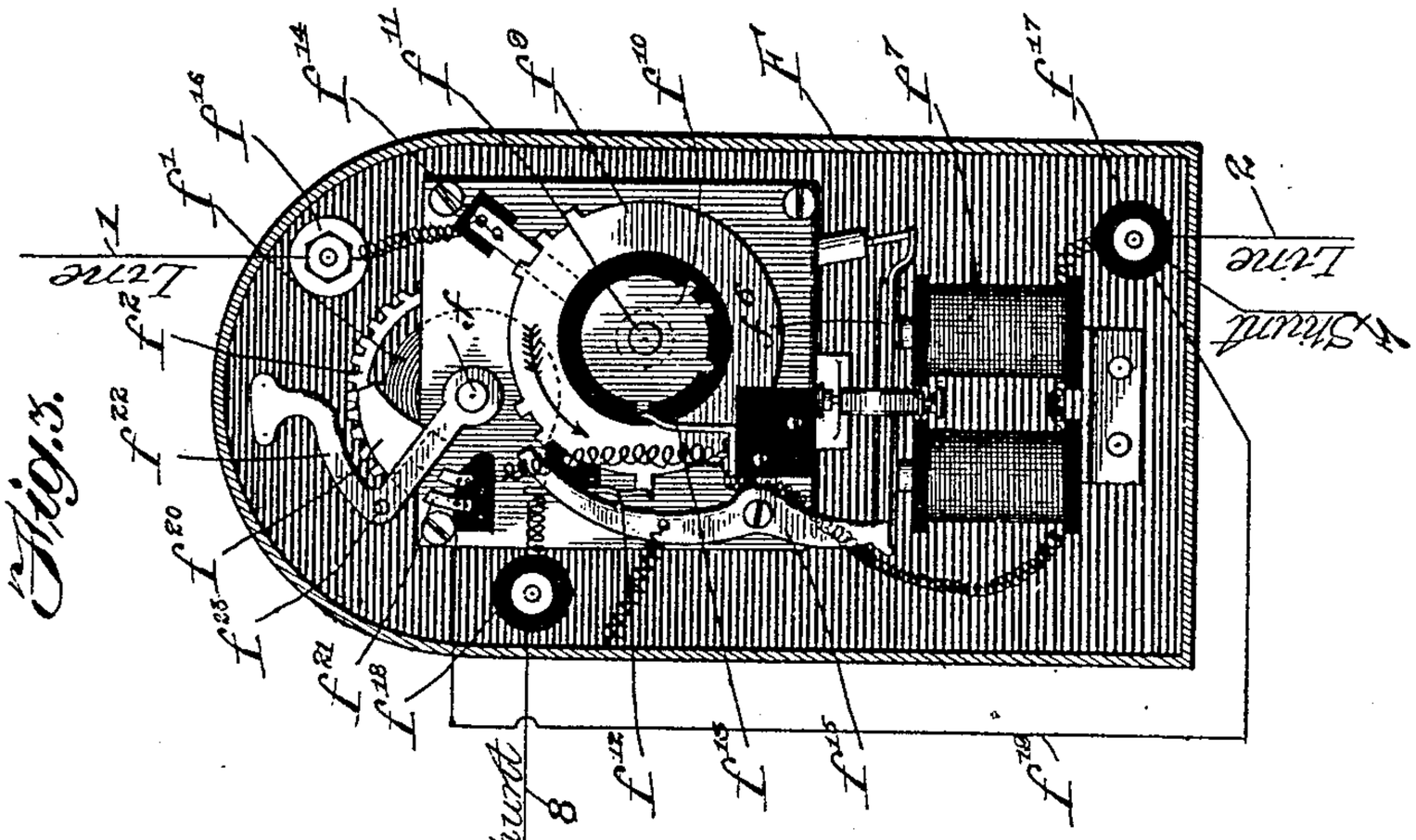


Fig. 3.



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UNITED STATES PATENT OFFICE.

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FIRE-ALARM SYSTEM.

No. 846,502. Specification of Letters Patent. Patented March 12, 1907.

Application filed September 24, 1903. Serial No. 174,462.

To all whom it may concern:

Be it known that I, JAMES G. NOLEN, a citizen of the United States of America, and a resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Fire-Alarm Systems, of which the following is a specification.

My invention contemplates a fire-alarm system involving the combination of means for both electrically and pneumatically operating signal-transmitting mechanism in case of fire in the building where the signal initiating and transmitting devices are located, the arrangement being such that a break in the circuits of the electrical signal-initiating devices, or even in the piping of the pneumatic apparatus for operating the signal-transmitting mechanism, will cause the transmission of a signal of a very different character from that which is transmitted by the same mechanism when any of the signal-initiating devices are operated by fire.

My improved fire-alarm system therefore involves an arrangement whereby the same mechanism may be employed for supervising the piping of what is commonly known as a "Ludlow" system and also the wiring of what is commonly known as a "Cook-Nolan" system.

In the accompanying drawings, Figure 1 is a diagram illustrating a combined pneumatic and electrical fire-alarm system embodying the principles of my invention. Fig. 2 is a diagram illustrating another method of combining the electrical circuits with the piping. Figs. 3 and 4 are respectively a front and a side elevation of the master-box or signal-transmitting mechanism employed for supervising the wiring and transmitting the signals in the electrical portion of the system and also for supervising the piping of the pneumatic or other fluid-operated portion of the system, the said master-box resembling an ordinary call-box both in form and construction, and the casing in each view being shown in section for the purpose of exposing the mechanism.

Referring to Fig. 1, my improved fire-alarm system comprises a system of piping A, which extends through the building to be protected and provided at different points with the signal-initiating devices B. These signal-initiating devices each comprise a flexible diaphragm *b*, which constitutes the lower wall of the box-like signal-initiating device and which carries a valve-plug *b'*, adapted normally to engage the valve-seat b^2, thus closing the outlet from the chamber b^3. This chamber is partially filled with a volatile or explosive liquid b^4, adapted when subjected to heat to generate sufficient pressure in the chamber to cause an outward bulging of the diaphragm B and to thereby cause the valve-plug *b'* to disengage the valve-seat b^2 and open the passage leading from the said chamber to the piping A. A swinging float b^5 is mounted in the chamber b^3, and if this chamber contains the proper amount of liquid the said float normally engages the contact b^6; but if the liquid has partially evaporated said float then falls and opens the electric switch, and this switch, which consists of the float and its adjacent contact, is of course opened in a similar manner when the liquid is exploded or rapidly volatilized by heat in case of fire. The means by which these signal-initiating devices B effect a transmission of a signal to a distant station consists, preferably, of a drop C and a spring-held trigger D, adapted to normally engage the escapement *e* of the call-box or signal-transmitting device E. Whenever one of the devices B is subjected to heat, the sudden generation of a pressure expands the air in the piping with sufficient force to cause the drop C, which, it will be observed, can be arranged directly in front of the mouth at the open end of the pipe or in engagement with a flexible diaphragm *c* across such open mouth to swing down and strike the upper end *d* of the trigger D. The box E, which may be an ordinary call-box, is normally in a wound-up condition, and consequently its escapement *e* when thus released causes the well-known make-and-break device in this box E to transmit a signal over a circuit including the wires *e'*, 1, and 2, the circuit including the battery 3 at the distant central station and including also the relay 4. The recorder or signal-receiving device 5 can be of the usual and well-known construction and can be located in a local circuit including the local battery 6 and the contacts of the relay 4. When the box E produces a make-and-break action in this line-circuit, such make-and-break action is repeated or extended by the action of the

relay 4 to the local circuit, including the recorder or signal-receiving device 5.

It will be seen that the wires 1 and 2 are also connected with a second box F, which may be similar in construction to the box E, with the exception of a few additional parts, as will hereinafter appear. This box F is also connected with the shunt-wires 7 and 8, which, it will be observed, are preferably arranged to lead through the piping as much as possible and which include the aforedescribed switches, consisting of the floats b^5 and the contacts b^6, and which also include the thermostats or signal-initiating devices G. These signal-initiating devices G are provided with contacts g, which are normally soldered together, so as to provide a closed shunt-circuit around a magnet in the master-box F, to be hereinafter described, and are also provided with additional contacts g', whereby when a thermostat is operated by the heat of the fire it opens the shunt-circuit and instantly thereafter closes such circuit. In this way the devices G when subjected to heat are capable of setting the normally wound-up clockwork in the box F in motion, so as to transmit a signal over the line-circuit to a distant central station, and are also capable of then instantly reclosing the shunt-circuit, and thereby maintaining the electrical continuity of the shunt, so as to make it available for use as a portion of a signaling-circuit, which latter will also be hereinafter more fully described.

Whenever the liquid in one of the devices B falls below the proper level from any cause whatever, the float b^5 opens the shunt-circuit and thereby causes the box F to transmit a signal to headquarters, and as the shunt when thus opened is not reclosed the signal is, as will hereinafter appear, of a distinct and radically different character from the signal which is transmitted when one of the thermostats G is operated. In this way the attendant at the distant or central station is enabled to supervise the system throughout and to detect not only breaks in the shunt-wires, but also breaks in the piping, and in addition the leakage or escape of the liquid from any of the devices B.

If desired, the piping can be combined with the wiring of the shunt, as shown in Fig. 2. In this case the different sections of the piping are connected with the couplings or joints through the medium of insulation X, so as to prevent short-circuiting, and the shunt-wires are connected in series with these different pipe-sections. In this way the piping actually constitutes a portion of the shunt-circuit in which the thermostats G are located, and such being the case a break in the piping is sure to cause the transmission of a distinctive signal to the distant or central station.

In Figs. 3 and 4 the construction of the master-box F involves the usual crank-shaft f, upon which is mounted a clock-spring f' and a gear-wheel f^2. This gear-wheel meshes with a pinion f^3 on another shaft, and this shaft is in turn connected by suitable gearing f^4 with the usual and well-known escapement f^5. Normally the lower end of this escapement is engaged by a spring-held armature f^6, adapted to be attracted and drawn downward by a magnet f^7. The spring can be wound up by rotating the shaft f through the medium of the usual crank f^8, and when wound up this spring is capable of driving the clockwork, and thereby rotating the two contact-wheels f^9 and f^{10}. The wheel f^9 is insulated from the shaft f^{11} while the smaller wheel f^{10} is electrically connected with said shaft. A spring contact-finger f^{12} normally engages a tooth on the periphery of the wheel f^9, while a similar finger f^{13} normally engages a tooth on the periphery of the wheel f^{10}. Both of these contact-fingers are insulated form the metallic framework of the structure, and a third and similarly-insulated contact-finger f^{14} is adapted to bear against the smooth back of the wheel f^9. A spring-held locking-lever f^{15} is adapted to engage and hold the armature f^6 in a depressed position as soon as said armature is attracted by the energizing of the magnet f^7. The line-wire 1 leads to a binding-post f^{16}, which is electrically connected with the metal casing and framework of the box, while the line-wire 2 leads to a binding-post f^{17}, which is insulated from the casing of the box. The shunt-wire 7 also leads to the binding-post f^{17}, and the shunt-wire 8 leads to an insulated binding-post f^{18}. One terminal of the magnet f^7 is connected with the spring contact-finger f^{13}, while its other terminal is connected with the binding-post f^{17}. The finger f^{12} is connected with the binding-post f^{18}, and the finger f^{14} is connected with the binding-post f^{16}. Thus it will be seen that normally the magnet f^7 constitutes part of the line-circuit in which the battery 3 is located and that for this reason it would remain normally energized were it not for the closed shunt of low resistance which extends around it and which consists of the shunt-wires 7 and 8, thermostats G, and the float-operated switches in the devices B. Therefore it will be seen that normally the current traverses the shunt around the said magnet, thus keeping the said magnet normally deënergized. Normally the clockwork at the box F is wound up and is maintained in such condition by reason of the armature f^6 engaging the lower end of the escapement f^5. When a thermostat is operated, the said shunt is momentarily broken, and the current of the line-circuit is then allowed momentarily to pass through the magnet f^7, causing the armature f^6 to move downward, allowing the clockwork to rotate the wheels f^9 and f^{10}. Imme-

diately upon the energizing of the magnet and the consequent downward movement of the said armature the lever f^{15} engages said armature and holds it down away from the escapement, thereby allowing the clockwork to run down. It may be stated here that said clockwork always runs down, whether it be for the purposes of transmitting a fire-alarm or merely for the purpose of transmitting a signal indicating the presence of a break in the piping or in the shunt-circuit. As the thermostats close again immediately after opening the shunt-circuit, the shunt therefore remains intact, its electrical continuity is preserved, and it remains available for use as a portion of the circuit through which the make-and-break action produced by the wheel f^9 is transmitted through the line-circuit and employed to operate the relay 4. Thus in case of fire there is first a definite series of makes and breaks caused by the wheel f^9 in the circuit including the shunt, and after this there is a further make-and-break action produced in the line-circuit which does not include such shunt and which is caused by the wheel f^{10}; but should a break occur in one of the shunt-wires or in the piping to such an extent to break the shunt then the magnet is energized and caused to release the clockwork, and the latter then transmits a signal through the line-circuit; but in this case the shunt is still open, and consequently the wheel f^9 does not produce a signaling action, and the usual make-and-break action in the line-circuit is produced by the wheel f^{10}. There is a marked difference between a signal for fire and a signal which merely indicates a break in the shunt-circuit or a break in the piping and a consequent break in the shunt-wiring. In this way the attendant at the central station receives a signal whenever fire occurs in any of the buildings in which the system is installed and also receives a signal whenever the system has been rendered inoperative at any point through the breaking of a shunt-wire. In other words, the attendant has complete supervision over the entire system.

In order that it will not be necessary for the wheel f^{10} to transmit signals through the coils of the magnet f^7, I provide a small or local shunt f^{19}, which is normally open, but which is adapted to be closed by the engagement of the insulated piece of metal f^{20} when the latter engages the two contacts f^{21}. This insulated piece of metal f^{20} can be mounted on the arm f^{22}, which swings with the main crank-shaft when the clockwork is released. In this way the resistance of the said magnet-coils is eliminated from the circuit through which the wheel f^{10} transmits a signal whether such signaling result from fire or from a break in the shunt-circuit. It will also be seen that the pin f^{23} on the arm f^{22} is adapted to strike the upper end of the lever f^{15}, and thereby cause the said lever to release the armature f^6 at about the moment the clockwork reaches the limit of its operation. In this way the box, as previously stated, is always allowed to fully run down, and in order to wind it up or to set it it is only necessary to rotate the crank-shaft in the usual and well-known manner, the armature f^6 being ready to catch and hold the escapement to prevent the clockwork from operating as soon as the mechanism is wound up and the crank-handle reaches the limit of its movement.

I claim as my invention—

1. A fire-alarm system comprising suitable piping, fluid-actuated signal-initiating devices connected with said piping, a signal-transmitting device adapted to be set in operation by the generation of pressure in the piping, a second signal-transmitting device, thermostats connected with said second signal-transmitting device, a battery and suitable circuit connections for normally maintaining a flow of current through said thermostats, and a signal-receiving apparatus suitably connected with both of said signal-transmitting devices, the circuit connections being such that a break in the piping will cause a break in the circuit of said thermostats.

2. A fire-alarm system comprising suitable piping, a number of box-like signal-initiating devices connected with said piping, each of said signal-initiating devices having a flexible diaphragm and a normally closed valve, the chamber of each box-like signal-initiating device containing a suitable quantity of volatile or explosive liquid, a normally closed float-operated switch in the chamber of each of said box-like signal-initiating devices, a signal-transmitting device adapted to be operated by the generation of pressure in said piping, another signal-transmitting device, thermostats connected in series with said float-operated switches, said rheostats and switches being connected with said last-mentioned signal-transmitting device, suitable circuit connections, means for normally maintaining a flow of current through said switches and thermostats, and suitable signal-receiving apparatus connected with both of said signal-transmitting devices.

3. A fire-alarm system, comprising suitable piping, a number of box-like signal-initiating devices connected with said piping, each signal-initiating device being provided with a normally closed valve and a diaphragm for operating said valve, each of said signal-initiating devices containing also a suitable quantity of volatile or explosive liquid adapted when subjected to heat to cause said diaphragm to open said valve, a normally closed float-operated switch in the chamber of each of said signal-initiating devices, a signal-transmitting device adapted to be

set in operation by the operation of any one of said signal-initiating devices and the consequent generation of pressure in the piping, a second signal-transmitting device provided with an electromagnet for releasing its normally wound-up mechanism, a low-resistance shunt extending around said magnet, a plurality of thermostats, said shunt including said normally closed switches and thermostats, a battery and suitable circuit connections for normally maintaining a flow of current through said switches and thermostats, and a suitable signal-receiving apparatus connected with both of said signal-transmitting devices.

4. A fire-alarm system comprising suitable piping, signal-initiating devices adapted to generate pressure in said piping upon the application of heat thereto, a signal-transmitting device adapted to be set in operation by the generation of pressure in said piping, another signal-transmitting device involving an electromagnet for releasing its normally wound-up clockwork, and involving also means for producing an electrical make-and-break action, a suitable number of thermostats, each thermostat being adapted when subjected to heat to open a circuit and then immediately close the same, a shunt of low resistance extending around said magnet and including said thermostats, a battery and suitable circuit connections for normally maintaining a flow of current through said thermostats, and suitable signal-receiving apparatus connected with both of said signal-transmitting devices.

5. A fire-alarm system comprising a system of piping provided with means for generating pressure therein on the application of heat to such means, an electrical fire-alarm system having thermostats capable of breaking the normal path of the current and of maintaining the electrical continuity of the circuit after such break, signal-receiving apparatus, suitable signal-transmitting devices, and suitable means and circuit connections for normally maintaining a flow of current through said thermostats, the circuits of said thermostats being to an extent identified with said piping, whereby a break in the piping is practically certain of producing a break in the circuit, and whereby the signal-receiving apparatus and signal-transmitting devices may be employed for not only producing fire-alarms but also for supervising both the electrical apparatus and the said piping.

6. In a fire-alarm system, in combination, a piping system provided with means for generating pressure therein when unduly heated, thermostatic switches operable to any undue amount of heat, electric signal-transmitting means associated with the thermostats and piping system for actuation by the generation of pressure in the piping or operation of the thermostatic switches, signal-responsive apparatus, and suitable circuit connections including a source of current-supply.

Signed by me at Chicago, Cook county, Illinois, this 21st day of September, 1903.

JAMES G. NOLEN.

Witnesses:

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WM. A. HARDENS.