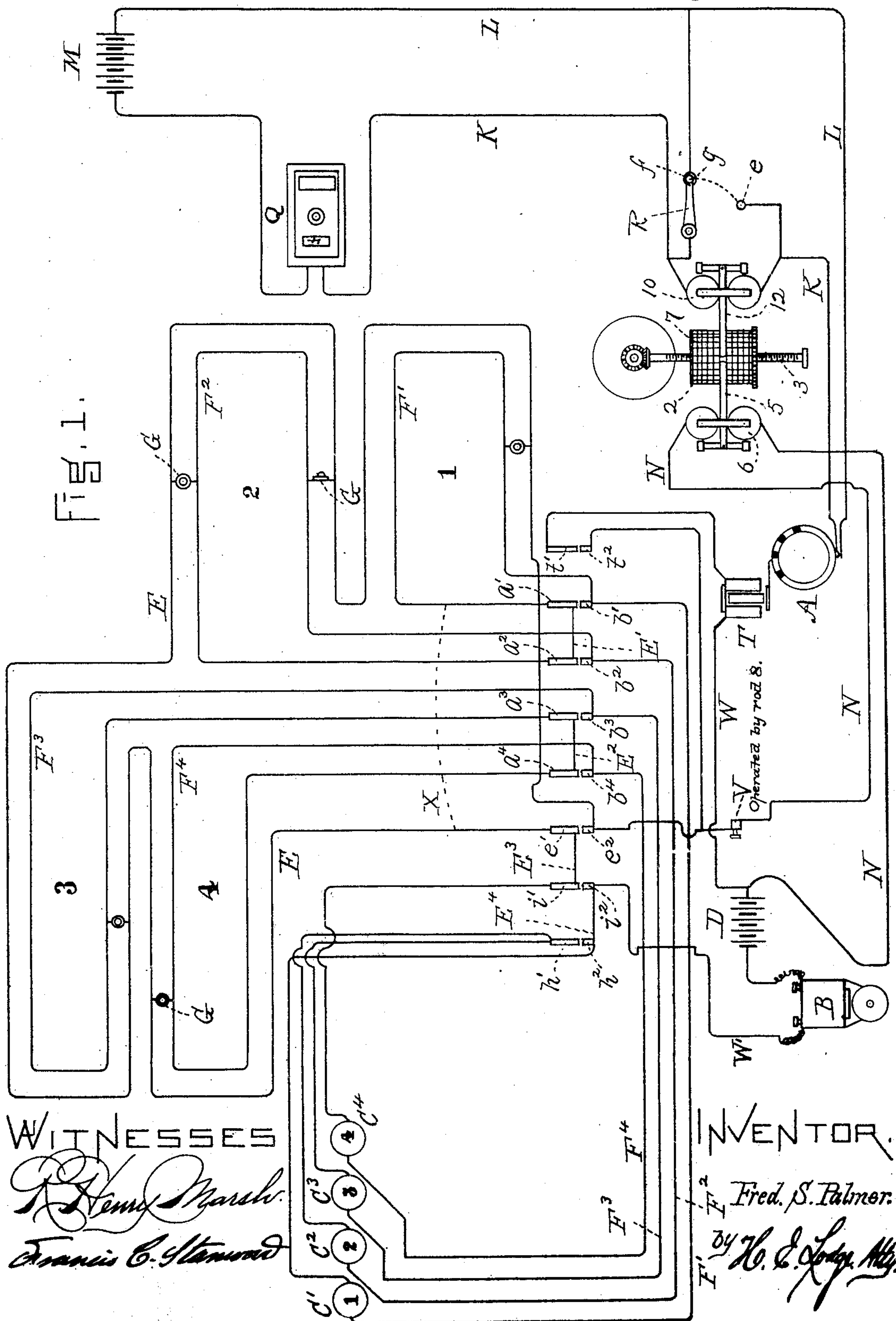


3 Sheets—Sheet 1.

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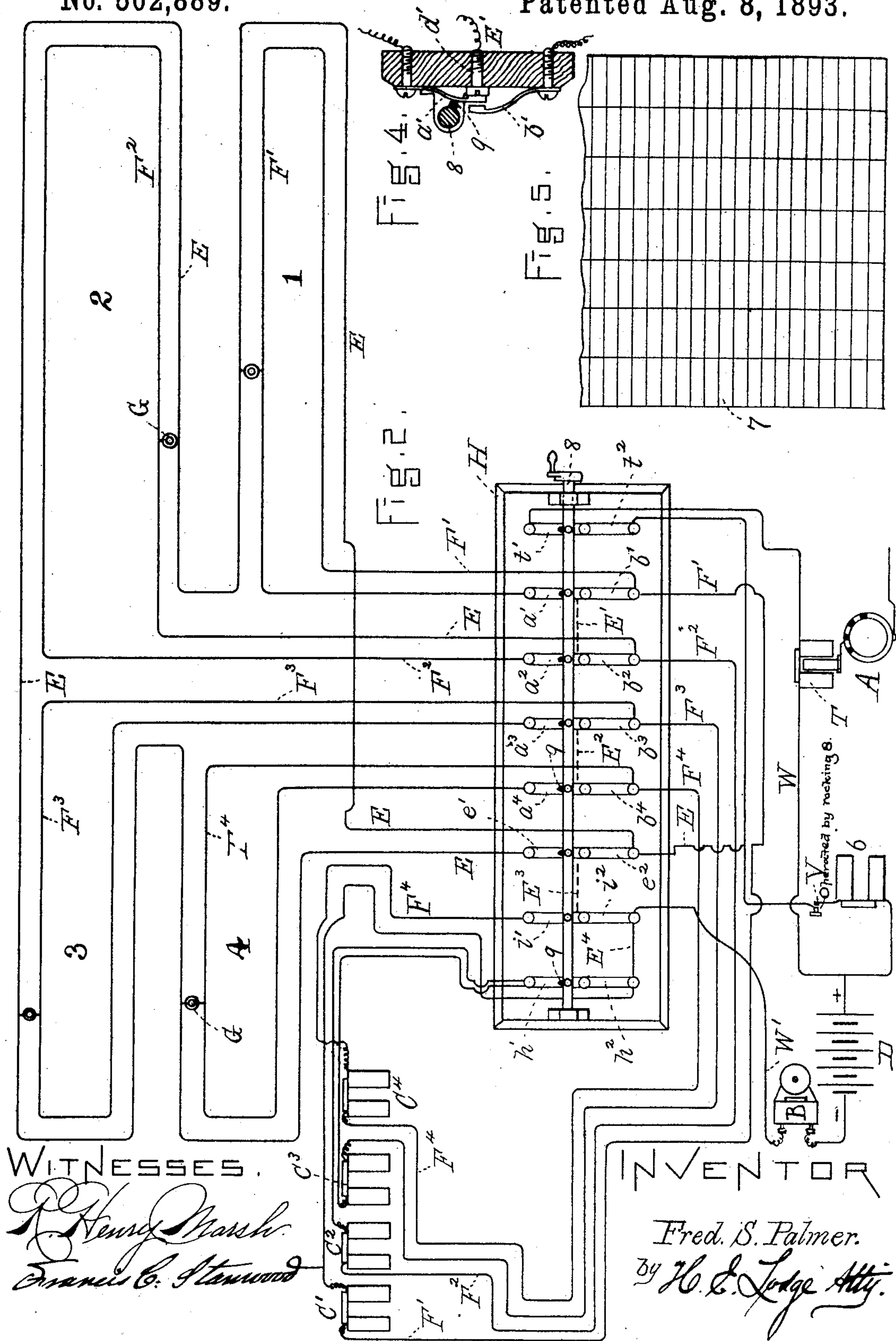
Patented Aug. 8, 1893.



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No. 502,889.



(No Model.)

3 Sheets—Sheet 3.

F. S. PALMER.
CIRCUIT TESTING APPARATUS.

No. 502,889.

Patented Aug. 8, 1893.

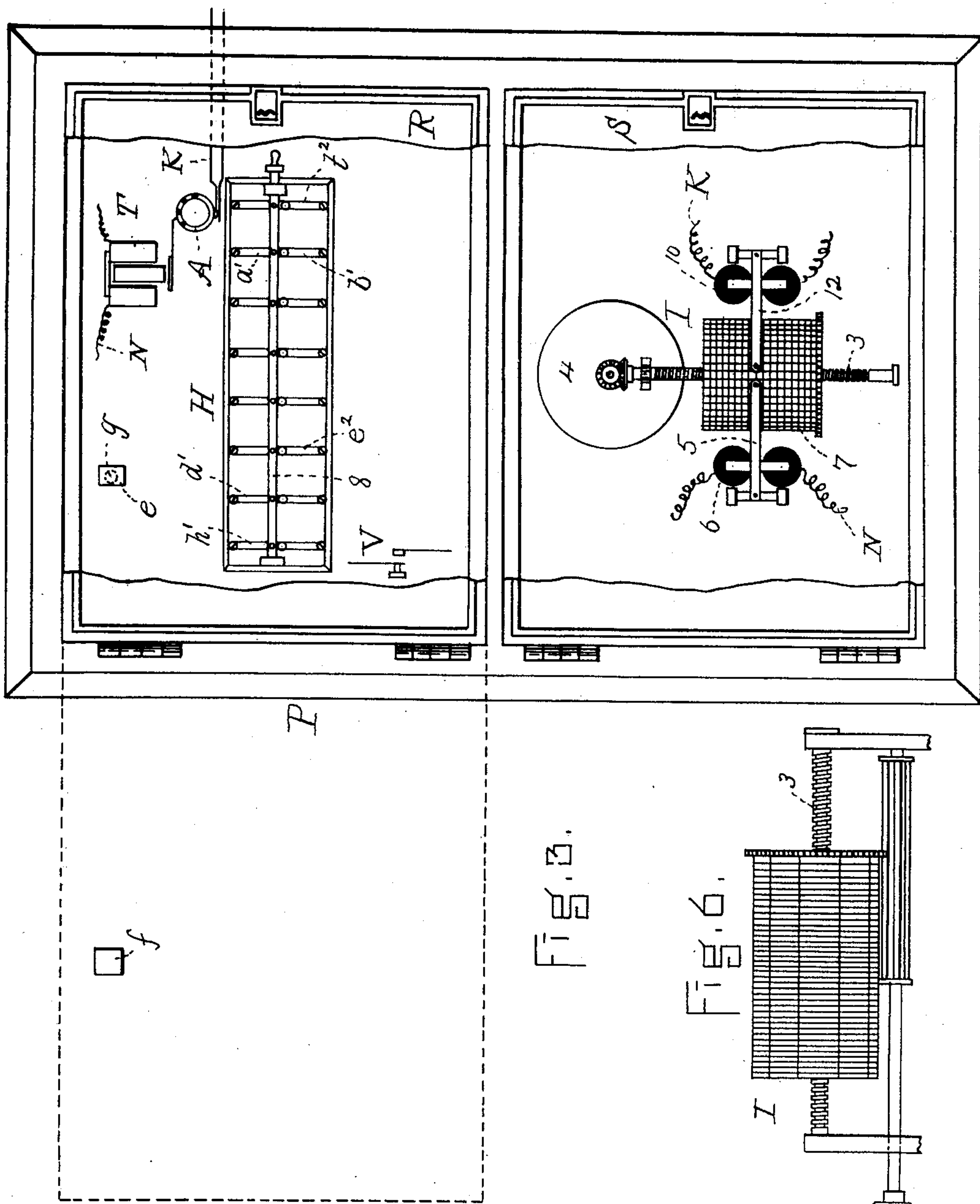
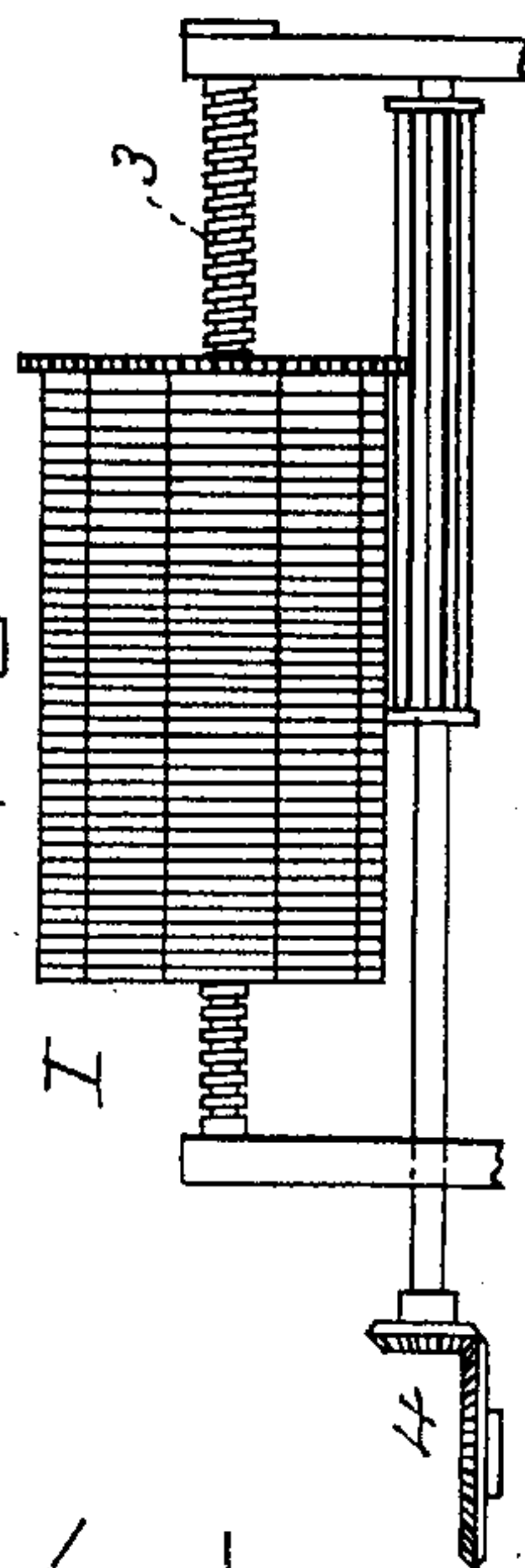


FIG. 1.

FIG. 6.



WITNESSES.

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CIRCUIT-TESTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 502,889, dated August 8, 1893.

Application filed March 20, 1893. Serial No. 466,921. (No model.)

To all whom it may concern:

Be it known that I, FRED S. PALMER, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Circuit-Testing Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

15 This invention relates to apparatus for testing wires which form a fire alarm system operated by thermostats and intended to indicate not only the building but likewise the floor in which the fire exists.

20 My invention is embodied in the general method of wiring by which every portion of every floor system is tested and no dead ends occur which may be out of order, and yet not included in the test. This portion of my invention consists in such an arrangement of wiring in combination with an operating switch, that the several systems which represent the respective floors are changed from multiple to series connection.

30 Further, my invention is to enable proper tests to be made, but prevents any fraudulent or fictitious test sheets to be provided at any later period, provided a record test for a certain day was demanded. In other words, the test must be made on the designated day or not at all. Under the present systems, fictitious tests may be made at any time and then dated to suit circumstances.

40 The drawings represent in Figure 1 a diagram of an apparatus and system for testing electric circuits in buildings and embodying my invention. The parts are positioned as representing a test, and my system is further represented in connection with a fire alarm circuit. Fig. 2 represents my system as applied to a building with the parts in normal. Fig. 3 represents a front elevation of a box containing the switch-board and test-recording apparatus, likewise embodying my invention. Fig. 4 is a vertical cross-section of the switch-board and circuit-closers. Fig. 5 is an enlarged view of the record sheet in part, de-

veloped. Fig. 6 is an enlarged view of the recording cylinder and operating mechanism.

Before particularizing I will briefly mention the prominent and characteristic features of my system. In the present instance it will be illustrated as applied to a four story building and the said floors are indicated by the numerals 1, 2, 3, 4. Reference letters referring to such particular floors will be designated by these numerals for exponents. The building is indicated by a special number by means of a transmitter A, which in times of fire is in electrical connection with the fire alarm system, while an alarm-gong B over the door calls attention to this building, and indicators or drops C' C² C³ C⁴ show on which floor the fire exists. This system works on a closed circuit and is furnished with an open circuit battery, D, a continuous outside wire E, common to all the floors, and individual inside floor wires F' F² F³ F⁴ together with thermostats G, which latter, when normal, are ready for short circuit. When a fire occurs a short circuit is created by this device and an alarm is rung in. Furthermore I provide a switch-board H, which operates, when a test is desired, to change the floor wiring normally in multiple into a system having the floor wires in series. Furthermore to record said tests, I provide a registering apparatus I, composed of a cylinder 2, mounted upon a screw-threaded rod 3, operated by clock mechanism 4, while a lever 5 and an electro-magnet 6 in the system serve to register the test on a paper strip 7, about the cylinder. This paper or recording sheet is divided by a series of vertical and horizontal lines; the horizontal spaces being provided for days in the week, and each row indicating successive weeks. As the cylinder advances vertically one space for each week, it is evident that a recording paper cannot receive a fraudulent test as would be the case, when a separate paper block is used for a single day. To render this recording device inaccessible except to duly authorized persons or to underwriter inspectors, I locate a box P formed with two compartments, having locked doors R. S. the lower one containing the registering apparatus, the upper the switch-board, the transmitter and its operating electro-magnet T. The act of opening and closing this

upper door R serves to perform certain duties in the way of making tests of the circuits comprising the system in the building, which will be hereinafter fully and completely described.

5 The lower door is simply to enable a fresh recording strip to be put on, or for repairs to the clock mechanism. This completes the essential elements necessary to the successful operation of a system for testing electric
10 circuits embodying my invention.

The above system, as before premised, is intended not only to indicate that a fire is in existence in a building, as well as to locate the particular floor, but to enable daily tests to
15 be made to determine its efficiency, while to render said system capable of sounding an alarm automatically, I have arranged to have it co-operate with a fire alarm system; this is shown in Fig. 1 as consisting of a closed circuit system, having the wires K. L. a battery
20 M, an alarm box Q located in an engine house, together with an electro-magnet 10, operating a lever 12 to puncture the recording sheet 7. The transmitter A. before mentioned as bearing
25 the number of the building, interconnects the store system with the fire system, said transmitter ordinarily being held stationary, but allowed to rotate whenever a short circuit is created by means of any thermostat located
30 in the building.

Having now mentioned the general features and elements grouped to form a complete heat protecting and fire alarm system, I will now particularize the several prominent elements, the method of wiring, as likewise the
35 several acts of testing or of giving an alarm, should a fire occur.

Normally the wiring of the several floors is in multiple and is controlled by an operating
40 switch-board H, provided with two sets of terminals $a' b'$, $a^2 b^2$, &c., shown more fully in cross section in Fig. 4. The switch proper consists of a rod 8 fitted with fingers 9 of insulating substance, in number to correspond
45 with the floors in the building, the upper terminals adapted by means of said switch to contact at certain specified times with posts $d' d^2 d^3$, having wires $E' E^2 E^3$. Normally the terminals $a' b'$ are in contact. The circuit-closer shown at V in Figs. 1 and 2 is composed of two spring plates which are brought
50 together (means not drawn) by rocking of the rod 8. Furthermore two terminals $e f$ are arranged to co-operate with a metallic plug g in the door shown in broken lines in Fig. 3; when the door R is closed, the current on the fire alarm circuit is by wire K, door R, plug
55 e , wire K, battery M and wire L, the plug g and e being in contact. Preferably the door is spring actuated or to be closed automatically to hold it shut except when a test occurs.

When the system is in condition for an alarm, but while no fire occurs, the parts are as represented in Fig. 2, the circuit closer
60 V is open, the transmitter A is held stationary, while the terminals $a' b'$, $a^2 b^2$ are in contact; the thermostats G prevent short circuits

through the several floors and the current from the battery D is as follows: from the positive end of the battery by line W through
70 magnet T to terminal t' to t^2 , thence by wire to closer V, open, where the current stops; hence transmitter is not released. Since the circuit-closer V is open the current advances to terminals $e^2 e'$ by outside line E through
75 each successive floor, as may be readily followed, and returns to the same point terminal e^2 . From the negative end of the battery by wire W' to terminals $i^2 i'$ to drop C⁴
80 by wire F⁴ to terminals $b^4 a^4$ through inside wire F⁴ on fourth floor. The current diverges from terminal i^2 and thence traverses the several drops and inside wires for the respective floors, first, second and third, in a manner
85 precisely similar to that described for the fourth floor.

The above conditions existing, I will now assume that the system is to be tested. The door R is unlocked and swung open, at this moment the plugs e, g are separated; after
90 this act the circuit closer V. is operated to unite terminals. I will first explain its action in the thermostat system and subsequently its effect on the fire alarm system. The explanation will now follow the diagram
95 in Fig. 1. where the parts are illustrated for a test, which now occurs by rocking of the switch-rod 8 to separate the terminals $a' b'$ $a^2 b^2$, as shown in Fig. 4. This act brings the shunt lines $E' E^2 E^3$ into activity and they
100 are accordingly indicated in full lines, while in Fig. 2 being dead, I have represented them in broken lines. From the positive end of the battery by W, to T, to terminal t' ,
105 where the current stops as the line is open; hence it proceeds by wire N. to magnet 6, actuates lever 5 (provided the wire is whole), makes a record; thence to V. by wire, E. to terminal e^2 , since terminal t^2 is open, then through the entire length of outside wire E to terminal
110 e' ; since this latter and e^2 are separated, the current continues across E^3 to i' , by wire F⁴ to drop C⁴ and on to terminal b^4 , testing the entire length of inside floor wire F⁴ back to terminal a^4 , whence it passes across E^2 to a^3
115 and courses through the inside wire F³ in third floor. From here it goes to terminal b^3 wire to drop C³, passing from terminal h' by wire to C² to terminal b^2 , through the entire wire F² in second floor, returning to a^2 across
120 wire E' to a' , testing wire F' in the first floor and emerges at b' , thence to drop C' through terminals h^2 , wire E⁴, terminal i^2 , wire W', alarm bell B to battery D.

In the electric system operating the fire
125 alarm, the resistance of the magnet 10 ordinarily when the door R is locked, compels the current to pass through the plug e . but during the act of testing and when the door is between the plugs e, f , and not in contact with
130 either, the current is forced through the magnet, when, if the fire alarm system is in proper working condition, the register is punctured by the lever 12. As soon as the door is fully

open the plugs *g* and *f* contact, and the current is diverted from magnet, and the battery is short circuited. When a fire occurs, the switch-board case *P* is presumably closed, the switch rod is in position for contact of the various terminals *a' b'*, *a² b²*; the circuit-closer *V* is open, while a thermostat *G* in the fourth floor has owing to the existence of a fire conducted the current along wire *E* to *F²* at this point. The current from the positive end of battery proceeds by wire *W* to magnet *T*, energizes the latter, lifts spring-stop and allows transmitter *A* to rotate, the current passing to terminals *t' t²*, wire *E*, terminals *e² e'* outside wire *E* to thermostat *G*, which is short circuited, thence to inside wire *F⁴* to terminal *b⁴*, drop *C⁴* to terminals *i' i²*, wire *W'*, alarm bell *B* to battery *D*.

Rotation of the transmitter when the magnet *T* is energized opens the fire alarm circuit *K L* and since it has a gravity battery, rings an alarm for every time it is opened, in the present instance four blows will be sounded. This will indicate to the fire apparatus the location of the building, and upon arrival of the apparatus the floor is shown by the drop *C⁴* being at danger, the gong *B* continuing to ring so long as the thermostat is in active operation.

The advantages of this system are many and obvious, since in making a test the several floor systems connected in multiple are changed to series. Hence every foot of wire throughout the building is tested. Again, at the time of making a test for the heat or thermostat system the fire alarm system is likewise tested, and further such tests are all recorded and the production of counterfeit ones prevented. Furthermore, the operation is very simple, the act of unlocking the door, opening of the same, rocking of the switch-rod, swinging of the door fully back, return of the rod to its usual position and closing of the door is all that is essential to a complete and thorough testing of both the thermostatic and fire alarm systems, combined with recorded date of the day when such tests were made, and whether said systems were normal or defective, and which one, or both.

The above description includes tests and operation of the systems, provided all wires are whole; in case of a failure to obtain a record, a break evidently exists. To locate such break I proceed as follows: Close the circuit from outside wire *E* by a loose wire *X*, successively to terminals *a' a² a³ a⁴*. Such inside wires *F' F²* as fail to sound alarm-gong *B* will indicate open circuits. (See Fig. 1.)

Such novel features as I have shown but not claimed I propose to introduce in subsequent applications.

What I claim is—

1. In circuit-testing apparatus, a continuous outside wire common to all floors, a group of inside wires, one for each floor electrically arranged in multiple, combined with a switch adapted to change such systems of wires from multiple to series in the act of testing, substantially as and for purposes explained.

2. In circuit-testing apparatus, a thermostat alarm system composed of a single outside wire and a number of independent floor wires electrically arranged in multiple, combined with a fire alarm system, a transmitter which electrically unites said systems at specified times, and a switch adapted to change the thermostat systems from multiple to series in the act of testing both systems simultaneously, substantially as specified.

3. In circuit-testing apparatus, a continuous outside wire having separable terminals, a group of independent floor wires likewise with separable terminals, and a group of alarm drops in the independent wires, combined with an operating switch shunt post *d' d²*, and wires *E' E²* therefrom to one set of terminals in the independent floor wires, together with test recording mechanism, substantially as stated.

4. In electric-testing apparatus, the combination with a thermostat alarm system, test-recording mechanism, an electro-magnet, and an operating register lever in said system, of a fire alarm system, an electro-magnet, and operating register-lever in said system, together with a switch and switch door whereby the act of opening the door and rocking the switch serves to test simultaneously both systems, substantially as described.

5. In circuit testing apparatus a continuous outside wire common to all floors, a group of inside wires, one for each floor, and arranged in multiple, combined with thermostats adapted to unite the inside wires with the common outside floor wire at specified times, and a transmitter operated at such times to connect with a fire alarm system, substantially as explained.

6. In circuit testing apparatus, a continuous outside wire common to all floors, a group of inside wires one for each floor electrically arranged in multiple, combined with a switch adapted to change such systems of wires from multiple to series, and a recording cylinder as described to receive a continuous and uninterrupted register of the changes of said systems from multiple to series, substantially as stated.

In testimony whereof I affix my signature in presence of two witnesses.

FRED S. PALMER.

Witnesses:

H. E. LODGE,
FRANCIS C. STANWOOD.