(No Model.) 2 Sheets—Sheet 1.

L. WALDO.

CIRCUIT CLOSER.

No. 267,287. Patented Nov. 7, 1882.

fig. 1

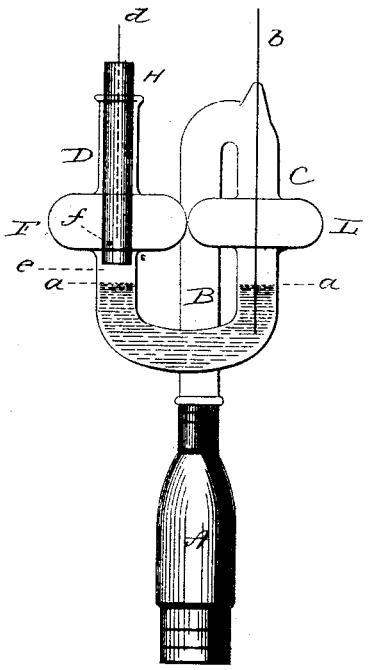


fig. 2

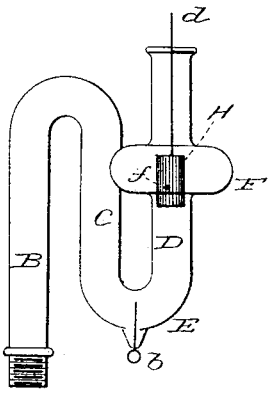
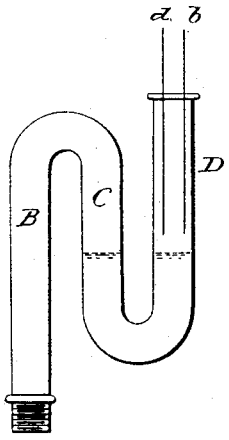


fig. 3



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(No Model.) 2 Sheets—Sheet 2.

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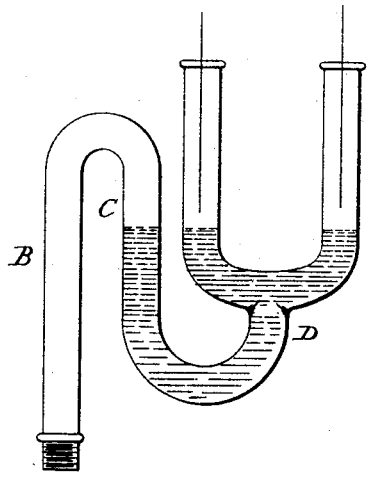
Fig. 4



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UNITED STATES PATENT OFFICE.

LEONARD WALDO, OF NEW HAVEN, CONNECTICUT.

CIRCUIT-CLOSER.

SPECIFICATION forming part of Letters Patent No. 267,287, dated November 7, 1882.

Application filed August 21, 1882. (No model.)

To all whom it may concern:

Be it known that I, LEONARD WALDO, of New Haven, in the county of New Haven and State of Connecticut, have invented a new improvement in devices for imparting an impulse received through gas or similar medium; and I do hereby declare the following, when taken in connection with accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a side view; Figs. 2, 3, and 4, modifications.

This invention relates to an improvement in devices for giving a signal at one point from an impulse received from a distant point through a medium inclosed in a tube, with special reference to the employment of cast-iron gas-mains and branches, or other similar arrangement of pipes or tubes, the object being to close and break an electrical circuit at or near the point where the signal is to be given, the signaling mechanism being in the said electrical circuit, and with special reference to synchronizing clocks, but applicable to other purposes; and the invention consists in a U-shaped tube filled with mercury to a level above the bend, one leg in connection with the medium through which the impulse is to be received, the opposite leg being constructed with a bulb or enlargement, the circuit-wires arranged relatively to the mercury, so that the impulse received in one leg of the U will cause the mercury to rise until contact is made with both wires through the mercury and the circuit closed, as more fully hereinafter described.

I illustrate my invention as applied to gas-tubing in the usual manner of applying gas-burners, A representing the socket, which is attached to the gas-pipe. Opening from this socket, and consequently from the pipe, is a tube, B, preferably of glass, extending upward, then bent downward, and again upward, forming two vertical parallel legs, C and D, connected by a bend, E. Mercury is introduced into the two legs—say to a line, *a a*. In the first leg, C, stands a wire, *b*, its lower end extending to the bottom of the tube, and so as to be immersed in the mercury. This wire forms one part of the electrical circuit. Through the other leg, D, is a second wire, *d*, which extends down toward, but not so as to reach, the mercury. This wire forms the other line of the electrical circuit. The surface of the mercury in the leg C is exposed directly to the gas which comes from the gas-pipes, hence is subjected to the pressure of that gas, and its natural pressure will cause the mercury to rise in the other leg, D, say, to the point *e*, which is slightly below the lower end of the wire *d* standing in the leg D. Now, suppose the pressure of the gas to be suddenly increased, the mercury will be thrown still higher into the leg D, and so as to meet the wire *d* standing therein. So soon as the mercury meets the wire *d* the circuit is closed, and when the pressure is removed the mercury will fall, and the circuit be consequently broken. Hence an impulse or sudden increased pressure given at any point in connection with the gas-pipes will be imparted to the mercury, and cause it to rise and close the circuit and hold it closed until the impulse or increased pressure is removed.

To automatically limit the length of time of connection, as well as to make that time adjustable in the instrument itself, I construct the leg D with a bulb or enlargement, F, and introduce through the leg an inner tube, H, of iron, wood, paper, glass, or any material which is not affected by contact with the mercury. This inner tube closely fits the leg, and extends down below the bottom of the bulb F through the inner tube, H, into the bulb, and at the bottom of the bulb a small aperture, *f*, is made. The end of the wire *d* is above this aperture, as seen in Fig. 1. The impulse given to the mercury will throw it up into the inner tube, H, above the aperture *f*, to make the connection, as before described. The pressure on the impulse being continued, the mercury will gradually flow through the aperture *f* and distribute itself in the bulb, so as to bring the level below the lower end of the wire *d* and break the connection, it being understood that the aperture *f* is so small as not to interfere materially with the rise of the mercury under the first impulse, but simply such as will permit the mercury to escape or flow out from the tube after the connection has been made. By this arrangement, if the pressure which imparts the impulse be prolonged, the circuit will be broken.

The aperture *f* may be regulated as to size

by pressing the tube H downward or drawing it upward. By forcing it downward the bottom of the bulb will cut off a certain portion of it. Raising it will open it to a greater extent; or it may be cut off entirely. Thus the time of the connection may be regulated at the instrument itself. In the case of the employment of gas-pipes this bulb will afford a relief in case of sudden, unexpected, or out-of-time pressures at the gas-works. The connection may be made, but will soon be automatically broken, notwithstanding the pressure may be continued for considerable time. These sudden or unexpected pressures, while they must occur in gas-works, being thus relieved, do not interfere materially with the working of the apparatus in connection with clocks, for the reason that it is only at a certain time, and that for a very limited space, that the synchronizing is produced—say at twelve o'clock, or when the minute-hand arrives at twelve o'clock. A connection made at other times would not have any effect upon the clock. If for other signals, however, the connection made would impart the signal the same as when properly given; but for general purposes such unexpected pressures would not materially interfere with the proper operation of the device. To provide against the sudden and greatly reduced pressure—as by collapse, reaction, or sudden break—I provide a similar bulb, L, in the other leg, C, so that should the reverse action occur the mercury which is drawn up through the leg C will flow into the bulb, and thereby be prevented from passing into the tube E and escaping. To provide against the great pressure which might be produced by explosion I make a large opening in the inner tube, near the top of the bulb, or cut it off entirely, as seen in Fig. 2, so that if the pressure be so great as to cause the mercury to rise to that elevation it will overflow into the bulb, and thereby prevent accident.

The wire *b* may be introduced through the upper end of the leg C, as seen in Fig. 1, or it may be introduced in the bend E, as seen in Fig. 2, it only being essential that one wire shall be in constant connection with the mercury, while the other is introduced into the tube to such an extent that the mercury will not reach it; but when under a certain pressure contact will be made between the mercury and the second wire.

The synchronizing mechanism for clocks, in which the adjustment is performed by connection into the electric circuit, is too well known to require description or illustration in this application.

I have described this impulse-receiver as arranged in connection with a gas system; but it may be arranged with a similar system of pipes with some other medium than gas—such, for instance, as air.

If the aperture *f* be sufficiently large to permit the mercury to flow freely through it into the bulb, it may in some cases make the connection of too short duration. If, however, the aperture be reduced, I find that the mercury will not pass through it into the bulb. Hence a difficulty arises unless some provision be made to overcome it. To obviate this difficulty and permit the small aperture, I fill the bend of the U up to a level slightly above the aperture *f*, and so that there will be a surface of the mercury in the bottom of the bulb always present, thus forming a constant mercurial connection through the aperture, whereby the flow will be free through the aperture in the rise or fall of the mercury. By this mercurial connection through the aperture I am enabled to make the aperture very small and proportionately prolong the time of connection.

While I prefer the arrangement described, whereby one end of the circuit-wire stands constantly in the mercury, connection being made with the other end by pressure, causing the mercury to rise toward the end to be connected, the construction may be as seen in Fig. 3, in which the two wires are introduced into the same leg, D, standing above the surface of the mercury. In this case, in the normal condition of the apparatus neither wire is in contact with the mercury; but when the impulse is imparted, as before described, then the mercury rises and makes contact with both wires and closes the connection in that one leg; or, if it is desired that the two ends of the wire shall be more perfectly separated, the leg D may be divided, forming a second U or branches, into each branch of which one of the wires may be introduced, as seen in Fig. 4.

I claim—

1. The herein-described device for automatically breaking and closing an electrical circuit by means of an impulse through gas or similar medium, consisting of a U-shaped tube filled with mercury to a level in each leg above the bend, one leg in connection with the medium through which the impulse is to be received, the circuit-wires arranged relatively to the mercury substantially as described, and whereby the impulse received in one leg of the U will cause the mercury to rise in the other leg until contact is made with both wires through the mercury and the circuit closed, the leg opposite that in which the impulse is received constructed with a bulb or enlargement above the normal level of the mercury, with a small aperture opening from the tube into said enlargement below the end of the wire standing therein, substantially as described.

2. The herein-described device for automatically breaking and closing an electrical circuit by means of an impulse through gas or similar medium, consisting of a U-shaped tube filled with mercury to a level in each leg above the bend, one leg in connection with the medium through which the impulse is to be received, the circuit-wires arranged relatively to the mercury substantially as described, and whereby the impulse received in one leg of the U will cause the mercury to rise in the other leg until contact is made with both wires through the mercury and the circuit closed, the leg opposite that in which the impulse is

received constructed with a bulb or enlargement above the normal level of the mercury, a tube in said leg extending down below the end of the wire therein, and having an aperture opening into the bulb, and whereby said aperture may be adjusted as to size, substantially as and for the purpose described.

3. The herein-described device for automatically breaking and closing an electrical circuit by means of an impulse through gas or similar medium, consisting of a U-shaped tube filled with mercury to a level in each leg above the bend, one leg in connection with the medium through which the impulse is to be received, the circuit-wires arranged relatively to the mercury substantially as described, and whereby the impulse received in one leg of the U will cause the mercury to rise in the other leg until contact is made with both wires through the mercury, and the circuit closed, the leg in which the impulse is received constructed with a bulb or enlargement above the level of the mercury, substantially as and for the purpose described.

4. The herein-described device for automatically breaking and closing an electrical circuit by means of an impulse through gas or similar medium, consisting of a U-shaped tube filled with mercury to a level in each leg above the bend, one leg in connection with the medium through which the impulse is to be received, the circuit-wires arranged relatively to the mercury substantially as described, and whereby the impulse received in one leg of the U will cause the mercury to rise in the other leg until contact is made with both wires through the mercury and the circuit closed, the leg opposite that in which the impulse is received constructed with a bulb or enlargement above the normal level of the mercury, a tube in said leg extending below the end of the wire, with a small aperture opening from the tube into said enlargement below the end of the wire standing therein, the leg in which the impulse is received constructed with a bulb or enlargement above the level of the mercury, substantially as described.

5. The herein-described device for automatically breaking or closing an electrical circuit by means of an impulse through gas or similar medium, consisting of a U-shaped tube filled with mercury to a level in each leg above the bend, one leg in connection with the medium through which the impulse is to be received, the circuit-wires arranged relatively to the mercury, substantially as described, and whereby the impulse received in one leg of the U will cause the mercury to rise in the other leg until contact is made with both wires through the mercury and the circuit closed, the said leg opposite that in which the impulse is received constructed with a bulb or enlargement above the normal level of the mercury, the tube extending up into said enlargement above the end of the wire therein and opening into the said enlargement above the end of the wire, substantially as described.

LEONARD WALDO.

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