(No Model.) 2 Sheets—Sheet 1.

L. L. ROWE.

AUTOMATIC REGULATOR FOR LIQUID HEATERS.

No. 575,042. Patented Jan. 12, 1897.

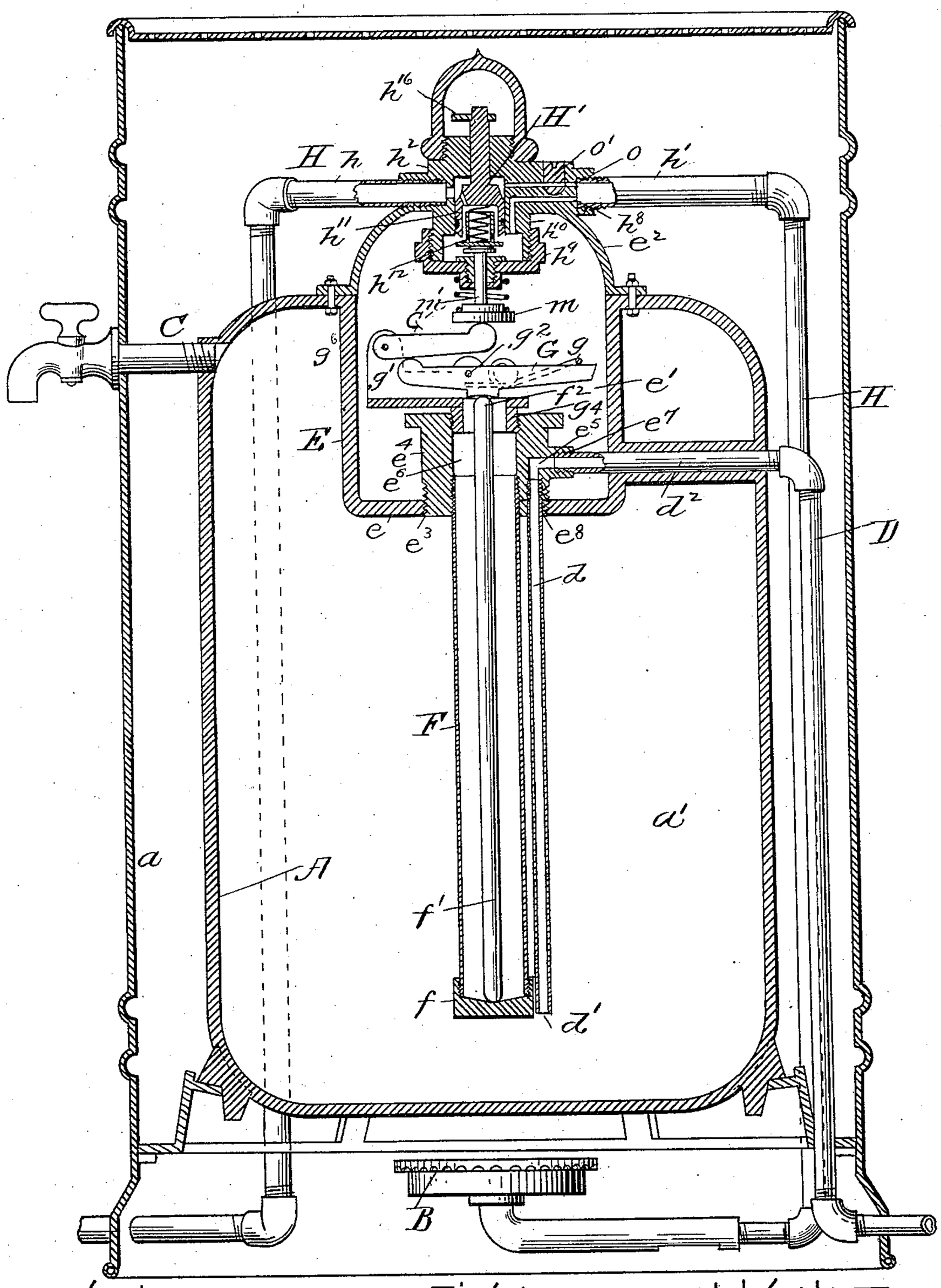

Fig. 1.

WITNESSES
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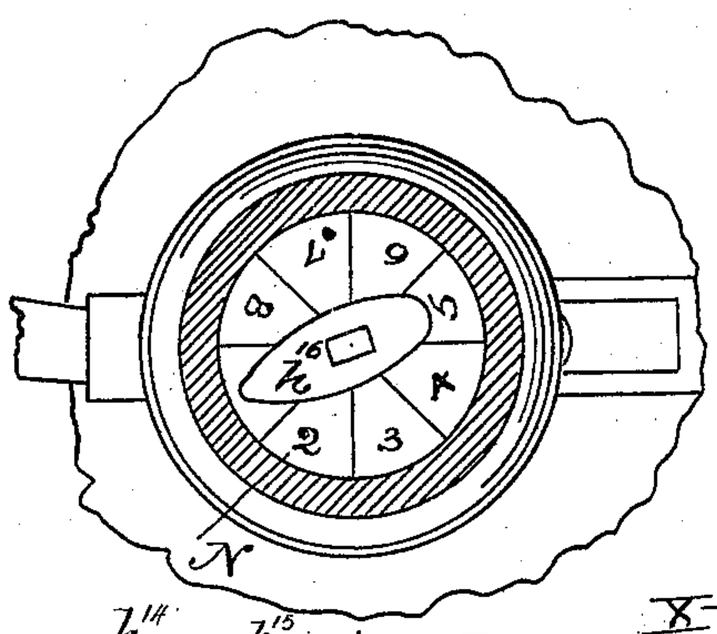

Fig. 3.

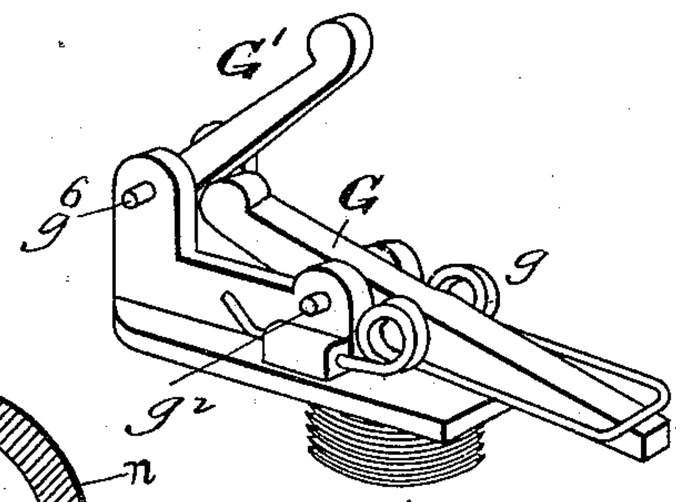

Fig. 4.

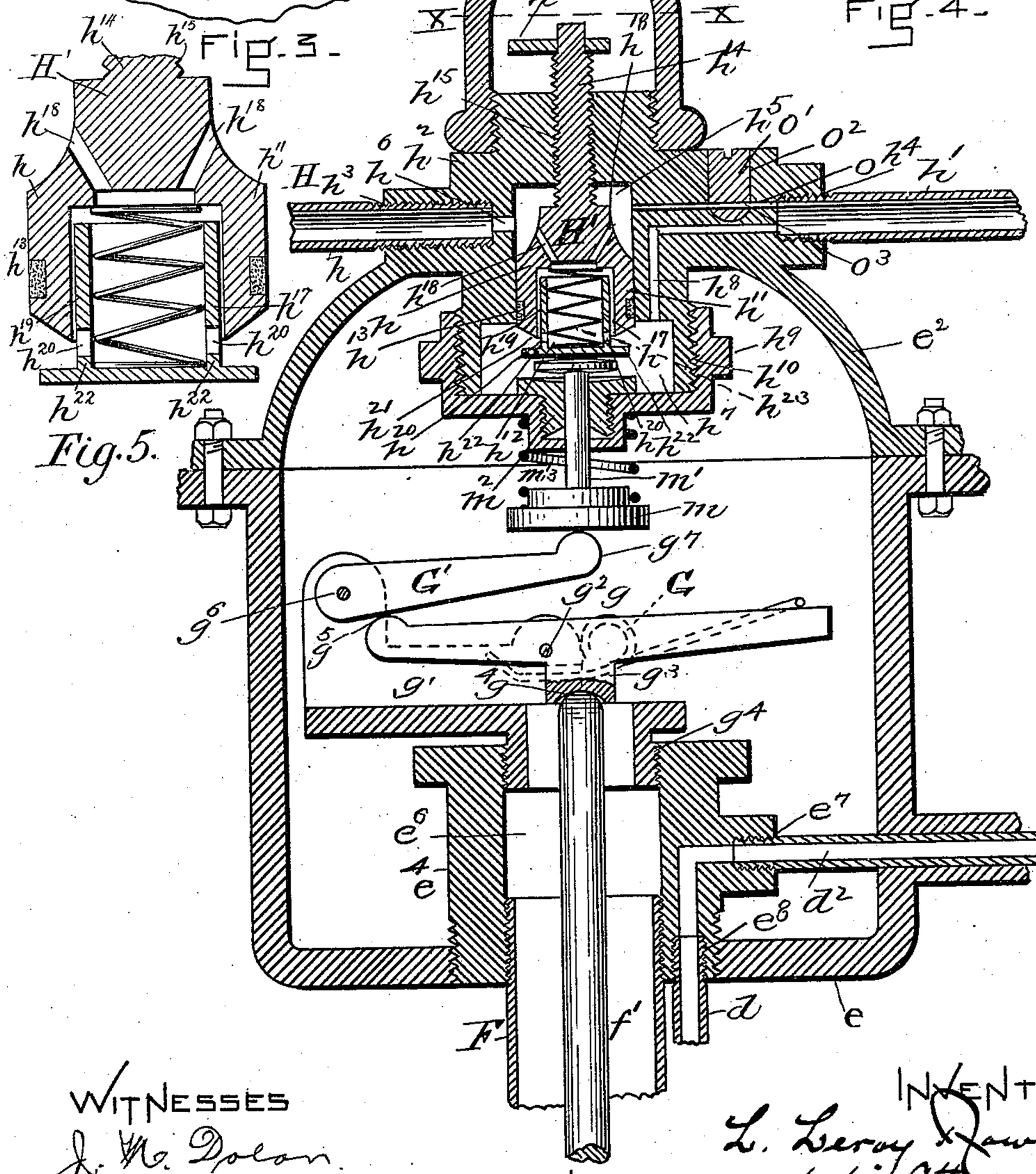

Fig. 5.

Fig. 2.

WITNESSES

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UNITED STATES PATENT OFFICE.

LEVI LEROY ROWE, OF BOSTON, MASSACHUSETTS.

AUTOMATIC REGULATOR FOR LIQUID-HEATERS.

SPECIFICATION forming part of Letters Patent No. 575,042, dated January 12, 1897.

Application filed June 7, 1893. Serial No. 476,824. (No model.)

To all whom it may concern:

Be it known that I, LEVI LEROY ROWE, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Automatic Regulators for Liquid-Heaters, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

The invention relates to that class of liquid-heaters in which the contents of a tank or suitable receptacle are heated by burning gas, and in which the supply of gas is automatically regulated or controlled by variation in the temperature of the liquid which it heats; and my invention relates to a tank adapted to hold liquid and to be heated by gas-jets, and having a liquid-inlet and a liquid-outlet, and provided with an extensible device comprising an extensible tube of copper or other metal extensible by variations in temperature, attached, preferably, to the upper end or top of the tank, to extend downwardly therein to near the bottom thereof, and communicating from its free end, by means of an inextensible rod, movement to valve-actuating devices arranged in the gas-supply pipe.

It further relates to the construction of the valve and to the connections between it and the actuating-rod.

It also relates to various other features of organization and construction, to which reference will hereinafter be made.

In the drawings, Figure 1 is a view in vertical section of a liquid-heater having the features of my invention. Fig. 2 is a detail view, enlarged, of the valve and its actuating devices. Fig. 3 is a view in horizontal section upon the dotted line $x\,x$ of Fig. 2 and a plan of parts below said line. Fig. 4 is a view in perspective of a portion of the mechanism intermediate the actuating-rod and the valve. Fig. 5 is a detail of portions of the valve mechanism, the same being drawn to an enlarged scale in order to represent more clearly some of the more minute features.

A is the tank or reservoir. It is made of any suitable metal, is suitably supported, is adapted to be heated by gas-jets supplied by the burner B, and has the cock C, by which its contents are drawn. It may or may not be inclosed within an outer shell a. Liquid is fed to the chamber a' of the tank or heater through the feed-pipe D, which preferably enters the cavity of the chamber of the tank near its upper end, and has a downward extension d, which opens into the chamber a' at its end d' near the bottom of the tank. The top of the tank is formed with a downwardly-extending cylindrical section E, having the bottom e, and the cavity e', formed by it, makes, in connection with the cap e^2, a chamber for holding the main parts of the valve and its actuating devices.

In the bottom e of the valve-chamber is formed the threaded hole e^3, into which is screwed a short stand or stud e^4, which extends upward into the valve-chamber e', and which has a small section e^5 of the fluid-feedway in it and the centrally-threaded hole e^6. Into this centrally-threaded hole is screwed the long tube F, of brass or other metal extensible by heat. This tube extends very nearly to the bottom of the tank, and its lower end is closed by a cap or cover f, which screws upon it. Within this tube is an inextensible rod f', the lower end of which is supported by the cap f, and the upper end f^2 of which is in contact with the lever G, which it supports against the downward thrust of the lever-spring g. This lever, which is pivoted to the bracket g' by pivot-pin g^2, has a downward-extending lug g^3, the under surface g^4 of which is rounded inwardly to rest upon the outwardly-rounded end f^2 of the rod f'.

The bracket g' has the threaded sleeve g^4, which screws into the threaded hole e^6 of the stand e^4, and the upper end of the rod f' extends through the hole provided by this sleeve. The stand e^4 has the lateral threaded hole e^7, which receives the inner end of the horizontal section d^2 of the feed-pipe, and also the threaded hole e^8, which receives the upper end of the vertical pipe-section d of the feedway. The supply-pipe d is therefore placed close to the extensible tube F, and this is of advantage in the operation of the device, as will presently appear.

H is the gas-supply pipe, in which or, rather, between the sections $h\,h'$ of which is the valve H'. The valve proper and the parts which coöperate with it comprise the upper section h^2 of the cap e^2, which has threaded holes h^3 h^4 for the reception, respectively, of the pipe-sections $h\,h'$ and the valve-chamber h^5, which opens downwardly, and the upper section of which is connected with the inlet-pipe h by means of the hole h^6. (See Fig. 2.)

Below the valve-chamber h^5 is another chamber h^7, larger in diameter than the chamber h^5, and which is connected with the pipe h' by the outlet h^8. This chamber h^7 is closed by the cap h^9, which screws upon the threaded downward-extending section h^{10} of the valve-casing.

The valve H' is composed of two parts, namely, a valve holder and adjuster h^{11} and the movable valve-section h^{12}. The holder or adjuster h^{11} is of a size to fit the chamber h^5 with a sliding fit, and it may have the packing h^{13} set in a recess to provide a tight joint between it and the wall of the chamber in which it is movable. It is provided with vertical movement in this chamber by means of the threaded stem h^{14}, which screws in the threaded hole h^{15} of the valve-casing and extends above it, and carries at its upper end the indicator and turning arm h^{16}.

The adjuster h^{11} has a cavity h^{17}, which opens downward and which is connected with the chamber h^5 by the holes or passages h^{18}. There extends into this chamber the cylindrical section h^{19} of the valve-section h^{12}. This fits the wall of the chamber h^{17} with a sliding fit. It is open at its top and has near its lower end the side openings h^{20}, which connect its cavity and the cavity h^{17} with the chamber h^7 when the valve has been moved sufficiently to bring the holes or any portions of them below the lower edge h^{21} of the adjuster h^{11}. The valve-section h^{12} also has the plate h^{22}, which closes the lower end of the cylindrical section and extends slightly beyond it. A spring h^{23}, which is contained in the chamber of the cylindrical section, bears against its closed end and also against the adjuster, and consequently acts to move the cylindrical valve-section away from the adjuster, and so acts when it is permitted so to do by the valve-controlling devices hereinafter specified.

It will be seen from what I have said that the gas for supplying the burner passes from the pipe h through the hole h^6 into the chamber h^5, thence through the holes h^{18} to the chamber h^{17}, thence through the openings h^{20} into the chamber h^7, and from thence through the passage h^8 to the pipe h'. To vary the quantity of gas fed, it is necessary to move the cylindrical valve-section h^{12} inward or outward in relation to the edge h^{21} of the valve-adjuster, as this movement will vary the size of the openings h^{20}, the openings being enlarged as the cylindrical valve-section is moved outward and decreased in size as it is moved inward, and it is to provide the valve-section with automatic movements determined by the temperature of the liquid that my invention particularly relates, and I will now describe how that is obtained.

The variation in the temperature of the liquid causes the tube F to be varied as to its length. As the temperature of the liquid increases the tube is extended; as it decreases or lessens it is shortened. This change in the length of the tube, which, it will be understood, is in constant contact with the liquid in the tank, being surrounded by it, varies the position of the rod-holding piece or cap f in relation to the sliding valve-section h^{12}, but, with the length of tube permissible, not enough to sufficiently actuate the same without the intervention of levers, by which the extensibility is converted into a movement of greater range than that of the said cap or support f. Consequently I have pivoted the lever G at the point indicated by the pivot-pin g^2, the fulcrum of said lever being much nearer the end of the rod f' than the point g^5, where the end of the lever bears against the second lever G'. This lever G' is pivoted at the point g^6 to the bracket g', which likewise increases the movement of the tube, and its free end g^7 bears against the head m of the push-rod m', this push-rod being additionally supported by a screw-stud m^2, which screws into the cap h^9. The upper end of this push-rod is enlarged and acts to support the head h^{22} of the cylindrical valve-section h^{21}. A spring m^3 surrounds the push-rod and maintains it in contact with the end of the lever g^7.

Generally as the liquid grows hotter it is desirable to decrease the supply of gas fed to the burner, and as it grows cooler to increase such supply. The ranges within which the valve shall be actuated to so operate are fixed in advance by the movement of the adjuster h^{11} upward or downward, according as it is desired that the operation shall begin at a low temperature or a higher temperature, the position to which the adjuster is moved being known by the relation which the pointer h^{16} bears to the figures of the indicating-dial N, these figures being upon the upper side of the valve-casing below the pointer, and, if desired, covered by the screw-cap n. (See Fig. 2.) The position of the adjuster having been fixed or determined, an increase in the temperature of the liquid will elongate the tube F and cause the inextensible rod f' to move downward slightly, which downward movement is followed by the downward movement of the lever G under the influence of its spring g. This causes the short end g^5 of the lever G to be lifted, the end g^7 of the second lever G' to be also lifted, the cylindrical valve-section to be pushed upward, and the valve-ports h^{20} to be partially or entirely closed. The reduction of the temperature of the liquid causes the tube to contract, the inextensible rod f' to be slightly

lifted, lifting the lever G, dropping its point g^5 and the point g^7 of the second lever, and permitting the springs m^3 h^{23} to move or permit to move downward the cylindrical valve-section h^{19}, thereby opening the ports of the valve.

By locating the inlet-pipe d close to the tube F it is made more quickly sensitive to variations in the temperature of the liquid. In order that the supply of gas may not be entirely cut off from the burner while it is in use, I have arranged a small passage o extending through the valve-casing from the upper part of the chamber h^5 directly to the feed-pipe h', so that a small volume of gas may pass from the pipe h^3 through the chamber h^5 directly to the pipe h' through the passage o. This passage o may be closed by a valve o', which is in the nature of a short round spindle let into the round hole o^2 in the valve-casing, the hole extending across the line of the passage o, and which spindle o' has a hole o^3, which by the turning of the spindle is brought into line with the passage o to provide a continuous passage or out of line with it to close the passage.

It will be noted that the direct as well as the indirect discharge of gas from the chambers h^5 and h^7 is directly into the open end of the outlet-pipe, the two passages o and h^8 being parallel. Under this construction neither of the two passages operates to oppose or check the discharge from the other.

In use the liquid is fed into the chamber of the tank or reservoir, the gas-burner is lighted, the adjuster set, and the spindle o' turned to open the inlet o. Variations in the temperature of the liquid will then automatically govern the main supply of gas fed to the burner.

The spring h^{23} is used because of the possibility of the cylindrical section not dropping readily to gravity alone and because of the possibility of its becoming stuck in its highest position.

I would not be understood as limiting myself to the precise features herein described entering into the construction of the valve and its operation, but may use in lieu thereof any suitable mechanical equivalents therefor.

I would not be understood as confining my invention to liquid-heaters having gas-burners, as the same principle is applicable to the control of fuel in liquid as well as gaseous form.

I have described the employment of a tube which is extensible by heat. I do not confine myself, of course, to the particular shape of the extensible device, as it is not necessary that it be in tubular form; neither do I confine myself to the employment of a material which is extensible by heat, because any material which is contractible by heat and extensible by cold will answer as well.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States—

1. In a liquid-heater, the valve-casing h^2, having the gas-chambers h^5 and h^7, the upper adjustable section h^{11} of the valve within the chamber h^5, and encircling the chamber h^{17}; the inlet h^6 in the body of the valve-casing, and discharging into the chamber h^5; the body of the casing of the valve H′, having the passage h^{18}, connecting the chamber h^5 with the chamber h^{17}; the movable cylindrical section h^{12}, within the chamber h^{17}, and provided with the lateral ports h^{20}; and the push-rod m', actuated as described, and supporting the cylindrical section h^{12}; in combination, substantially as and for the purposes set forth.

2. In a liquid-heater, the combination of the valve-casing; the section h^{11} of the valve, having the chamber h^{17}, and the inlets h^{18} thereto; the slidable section h^{12}, of the valve, having a cylindrical portion, to enter the chamber h^{17}, and provided with ports h^{20}, one or more; and the push-rod m', actuated by the means described; substantially as and for the purpose specified.

3. In a liquid-heater, the casing e^4, attached to the diaphragm e, as specified, having a central threaded hole in which is screwed an extensible tube F, to project downwardly into the liquid-holding tank, and into the upper end of which is screwed a bracket g', having the sleeve g^4, and supporting the levers of the valve-actuating mechanism; as and for the purposes described.

4. In a liquid-heater, the combination of the support e^4, the extensible tube F, its foot or end f, and the inextensible rod f'; with the lever-bracket g', having a sleeve g^4 to screw upon the support e^4, and affording means for the adjustment of the position of the levers in relation to the end of the inextensible rod; substantially as described.

5. In a liquid-heater, the valve-casing having the chambers h^5 h^7, the section h^{11} of the valve, contained in the chamber h^5, the cap h^9 and the support m^2 mounted therein, for guiding the push-spindle m', the slidable section h^{12} of the valve, and the inlet and outlet passages in said casing, and the ports in the two sections of the valve; as and for the purposes described.

6. In a liquid-heater, the support e^4, attached to the top of the tank, and having a hole or passage e^5, and an extensible tube carried by said support, in line with said passage; and a liquid-supply pipe, also carried by said support; as and for the purposes described.

7. In a liquid-heater, the combination with the tank A, of the chamber E, extending from the upper extremity of the tank, downwardly into the same, and provided in its lower portion with the upwardly-extending tube-supporting section e^4; the tube F, depending from the section into the tank, the liquid-

supply pipe, having the sections D, d^2, and d, the latter extending downward along the air-tube, to the lower extremity thereof; the rod f' within the air-tube, and rounded at its upper extremity; the lever G, having rounded bottom cavity as described, and eccentrically pivoted as shown; the lever G', eccentrically pivoted upon the bracket g', and operating in connection with the push-rod; and the valve H', upon the push-rod; substantially as described.

L. LEROY ROWE.

Witnesses:
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