No. 608,339. Patented Aug. 2, 1898.

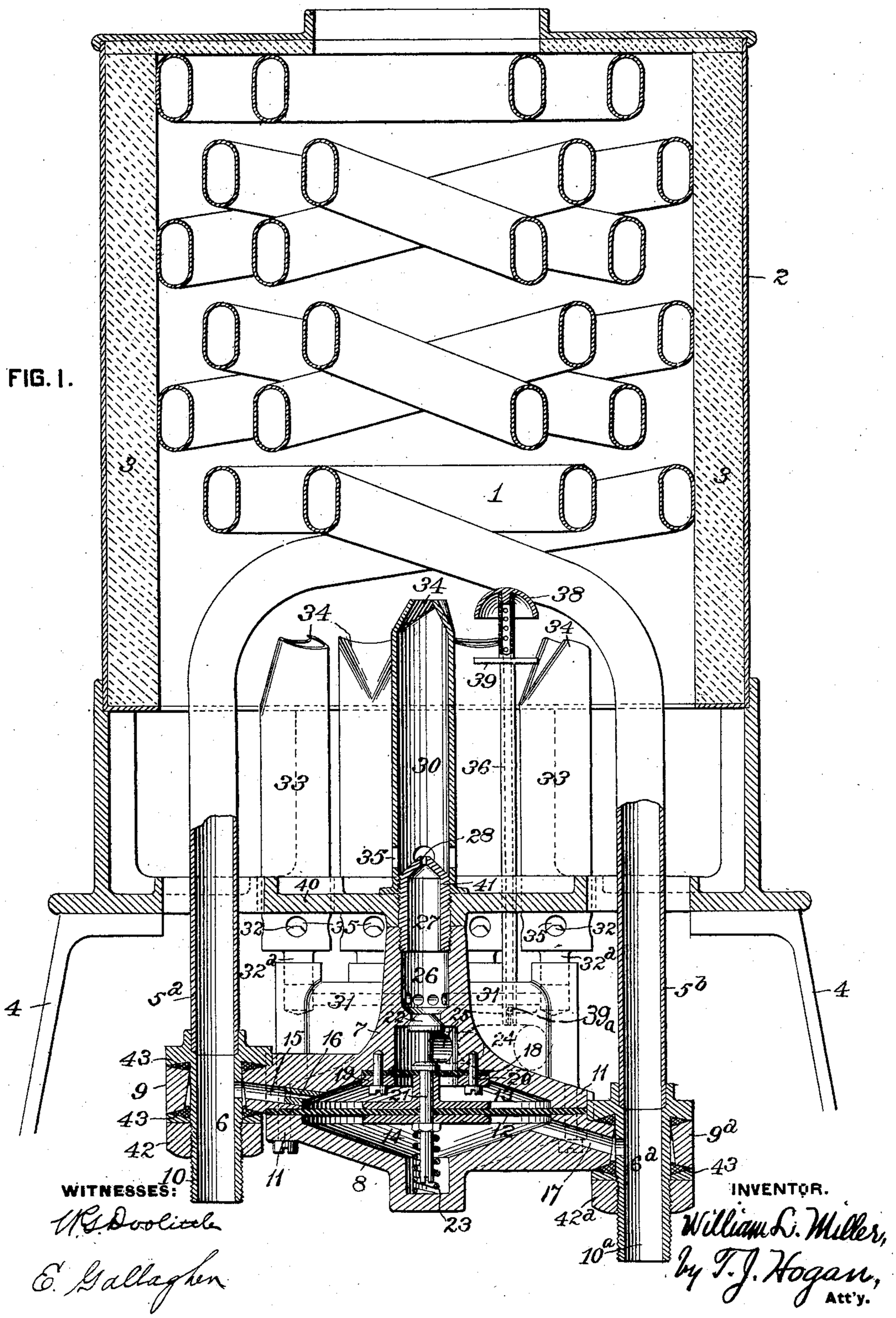
W. L. MILLER.

AUTOMATIC WATER HEATER.

(Application filed Jan. 6, 1898.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.



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(No Model.) 2 Sheets—Sheet 2.

FIG. 2.

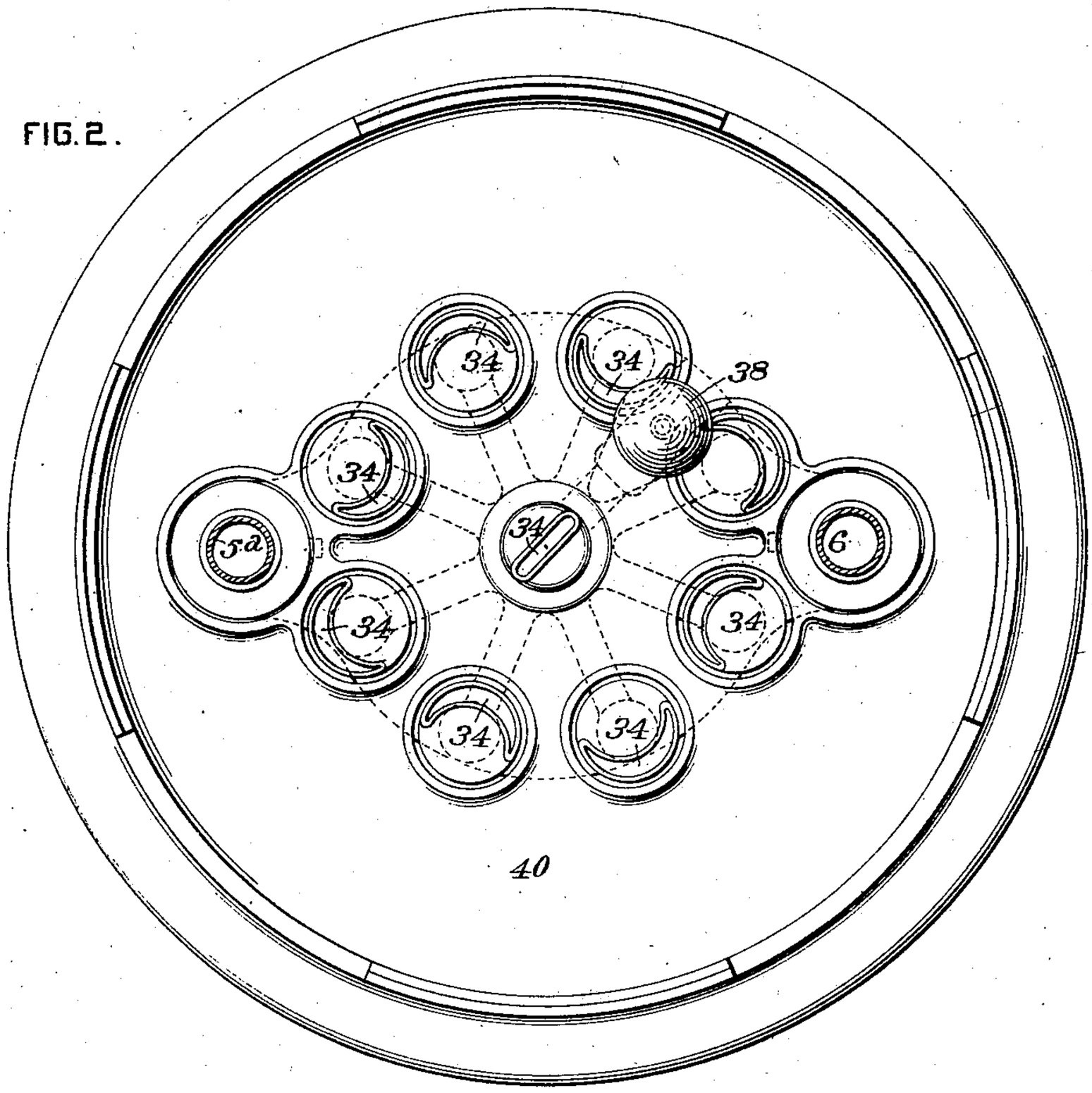
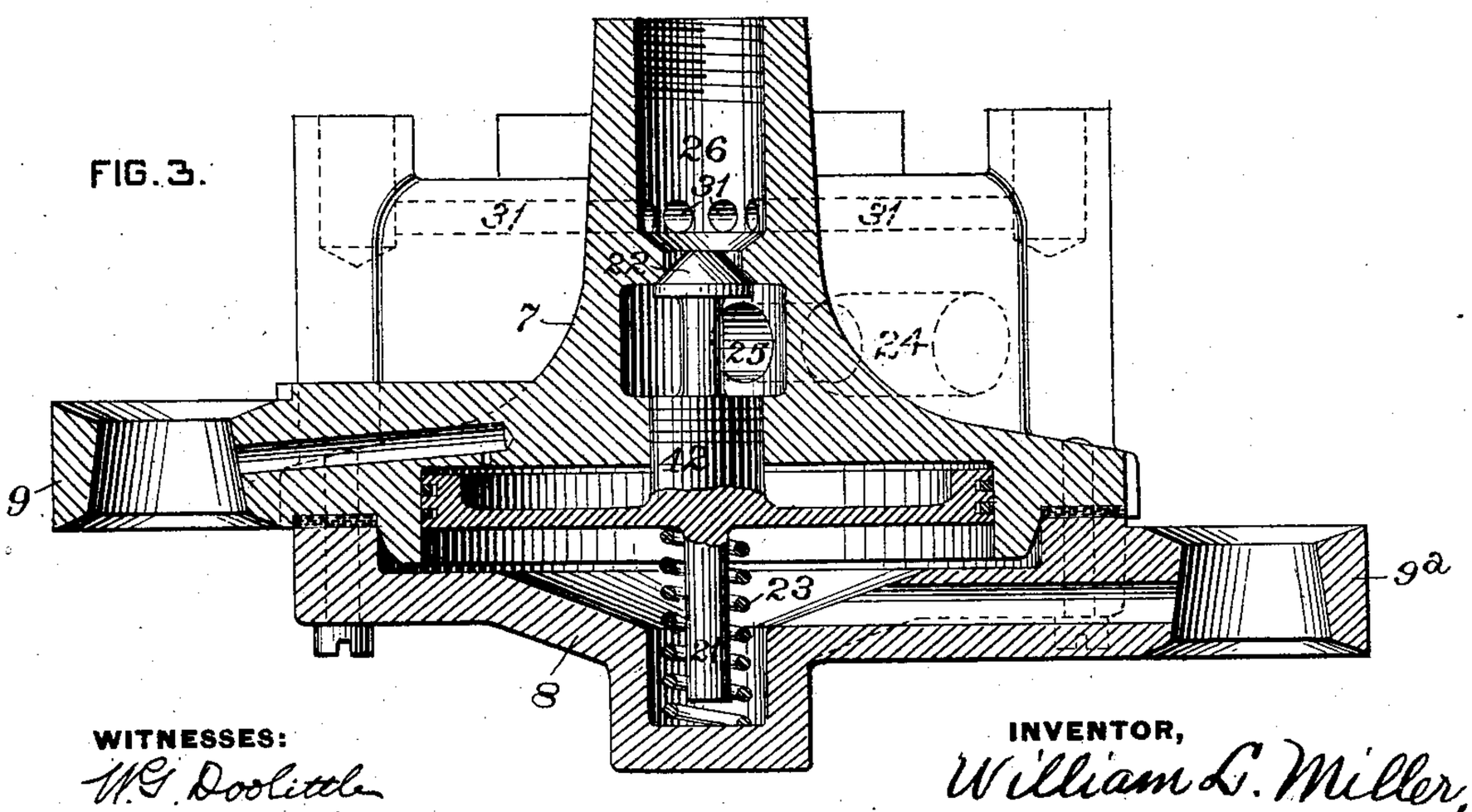


FIG. 3.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC WATER-HEATER.

SPECIFICATION forming part of Letters Patent No. 608,339, dated August 2, 1898.

Application filed January 6, 1898. Serial No. 665,735. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. MILLER, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Automatic Water-Heaters, of which improvement the following is a specification.

The object of my invention is to provide an improvement in automatic water-heaters.

To this end my present invention consists in a new and improved instantaneous automatic water-heater, in new and improved means for regulating the supply of heat to the water-receptacle, in new and improved burners, and in certain combinations and features of construction, all as hereinafter fully set forth.

My present invention particularly relates to certain improvements in an instantaneous automatic water-heater, such as is fully described in my pending application, Serial No. 653,670, filed October 1, 1897—an automatic water-heater in which the supply of heat to a water-receptacle in which the water is to be heated is controlled by variations in the pressure of the water in the outlet-pipe or a passage from the water-receptacle caused by opening or closing or partly opening or closing one or more valves or faucets in the outlet pipe or passage.

In the accompanying drawings, which illustrate an application of my invention, Figure 1 is a central vertical sectional view constructed in accordance with my invention; Fig. 2, a top plan view of the regulator-casing and of the burners attached thereto, and Fig. 3 a central vertical section through a modified form of regulator.

Referring to the drawings, a heating-coil 1 is shown inclosed in a casing 2, preferably lined with non-conducting material 3 and supported on standards 4. In the drawings I have shown the heating-coil formed of a tube or pipe which is flattened or approximately elliptical in cross-section, but having its end portions 5^a and 5^b circular in cross-section. This tube or pipe is made of thin copper or other good conducting material. This particular form of tubing or piping is preferable to the usual piping heretofore employed in water-heaters, and the object in giving the piping the particular form referred to is to increase the heating effect by increasing the heating-surface relative to the quantity of water contained in the coil without increasing the length of the pipe. I do not, however, desire to be limited to the particular form of piping or tubing above described, as it may sometimes be more convenient to employ the usual style of piping, which is circular in cross-section throughout its length.

The inlet end 5^a of the coil is connected with one end of the branch pipe from the water-supply main, and these pipes are at all times in open communication with one another through passage 6. The outlet end 5^b of the coil is also connected with the regulator and in open communication through passage 6^a with an outlet-pipe which leads to the outlet-valves or faucets through which the hot water is drawn for use. As shown in Fig. 1, the regulator comprises an upper portion 7 and a lower portion 8. The upper portion 7 is provided with means for connecting the inlet end 5^a of the coil and the end of the branch pipe from the water-supply main with the regulator, and the lower portion 8 is provided with similar means for connecting the outlet end 5^b of the coil and the outlet-pipe which leads to the outlet-valves or faucets with the regulator. The connecting means comprise unions 9 and 9^a, rigidly secured to the lower ends of the coil, and are each respectively connected with screw-threaded short pipes 10 and 10^a. The inlet end 5^a of the coil and the branch pipe from the water-supply main are connected with the regulator by union 9 and the outlet end 5^b of the coil and the outlet-pipe which leads to the valves or faucets by the union 9^a. The upper and lower portions 7 and 8 of the regulator are secured together by bolts 11, and between them is clamped a movable abutment or diaphragm 12, which divides the interior into two chambers 13 and 14. The upper chamber 13 is at all times in open communication with the water-supply main and with the inlet end of the heating-coil through the passages 6 and 15 and a very small passage 16. The object in making the passage 16 of such small diameter will be fully hereinafter pointed out, as this passage forms a characteristic feature in the present invention.

The lower chamber 14 is at all times in open

communication through passage 17 with the outlet-pipe which leads to the valves or faucets through which hot water is drawn for use.

Above the movable abutment or diaphragm 12 is a small diaphragm 18, securely held in place between the upper portion of the regulator and an annular plate 19 by small screws 20. The two diaphragms 12 and 18 are connected together by means of a stem 21 and plates and nuts, or they may be connected by any suitable means which will cause them to move together. A gas-controlling valve 22 is secured to the upper end of the stem 21 and is adapted to be moved by the diaphragms. The small diaphragm 18 separates the upper water-chamber 13 from the gas-valve chamber. The valve is normally held closed by the upward pressure of the water on the under side of the diaphragm 12 and by the upward pressure of the spring 23, and in case of the water being shut off from the main or of any breakage of the pipes the gas-valve will be closed by the spring 23.

A gas-supply pipe is connected with a passage or opening 24 in the upper portion of the regulator-casing. Gas passes from the passage 24 through a passage 25 into the valve-chamber. The valve 22 controls the supply of gas to the cylindrical distributing-chamber 26, from which chamber some of the gas flows through passage 27 to jet-orifice 28 and thence to the central burner 30 and some through the radial passages 31 to the several jets 32 of the nipples 32^a, secured to the upper portion of the regulator, and thence to the burners 33. The central burner 30, as well as the other burners 33, are preferably cylindrical in shape and are provided with openings 34, through which the mixed air and gas pass from the interior of the burners and at which openings the gas is ignited. All of the burners are provided near their lower ends with openings 35, through which air is admitted, the air-openings in each burner being on about the same plane as the horizontal plane on which the jet-orifice of the burner is situated. The upper portion of the central burner 30 is preferably shaped to form an elliptical orifice, and the other burners have their respective upper portions preferably shaped so as to form crescent openings. These openings are clearly shown in Fig. 2. The openings at the upper ends of the burners are formed by compressing the edges of an ordinary piece of pipe, so as to reduce the size of the opening to any required degree, so as to obtain the best results. The upper end of the central burner has its opposite sides pressed toward one another, so as to bring the opening in a central position, and the other burners have the openings formed in them by indenting one side only. The outer circle of burners all have their crescent-shaped openings all turned in different directions, so as to provide a good distribution of flame.

A pipe 36 leads from the interior of the passage 24 and is provided at its upper end with a pilot-burner having a plug-cap, with a curved or hooded extension thereon forming a flame spreader and deflector 38 and a deflector 39 for protecting the flame from currents of air. The pipe 36 is provided with air-openings 39^a, and a jet-orifice for gas is located near the lower end of the pipe. The small light from this pilot-burner is kept constantly burning for the purpose of igniting the gas from the openings of the burner 30 and the burners 33. In case of any explosion of gas in the upper part of the chamber or any downward or upward drafts of air the flame of the pilot-light will be protected by the deflectors 38 and 39, and the form of the upper hood or curved cap 38 is such that it will also prevent the flame from being blown out by any lateral draft of air, the inner surface of the hood acting as a deflector.

In Fig. 3 of the drawings I have shown a modified form of heat-regulator, the essential difference being that in this instance I employ a piston 42 for moving the valve 22 in place of the diaphragms 12 and 18, above described.

A characteristic feature of the present invention is the means shown for maintaining the desired pressure of water in the upper water-chamber 13, and the primary object of this construction is to maintain a uniform pressure within the chamber, said pressure being practically unaffected by the variation of the pressures in the coil or in the lower water-chamber 14 or the pressure in the outlet from the coil. This construction renders the regulator exceedingly sensitive to the variations in the pressure of water in the outlet-pipe caused by opening or closing or partly opening or closing a valve or faucet through which hot water is drawn for use. I am enabled to maintain this uniform pressure in the upper water-chamber 13 by means of the small passage 16, the cross-section of which is considerable less than the cross-section of the passage 15, which latter passage is much less in cross-section than the passage 6, with which it is in open communication. As the variation in the pressure within the chamber 13 in the construction of the regulator and its passages above described depends on the size of the passage in immediate communication with the chamber, it is evident that the smaller this passage the less liable is the pressure within the chamber to variation. By making this passage 16 quite small, as shown, the pressure within the chamber 13 is practically invariable so long as the pressure in the main is constant, and no sudden variation in the pressure in the chamber 13 will be caused by variations of the pressure in the coil. The constant pressure acting on the upper side of the diaphragm 12 will unseat the gas-valve when a reduction of pressure is made in the pipe leading to the faucet, and this movement

will be effected immediately on such reduction and independently of the flow through the passage 6 or through the coil.

The branch pipe from the water-supply main with which the passage 6 communicates is usually connected with the cold-water faucets, and when those faucets are opened or closed a sudden variation of pressure is liable to be effected in the passage 6; but with my improved construction no such sudden variation will be felt above the abutment 12 on account of the restricted passage 16. Any reduction of pressure in the passage 6, caused by opening one or more faucets, even if it should be felt above the abutment or diaphragm 12, would ordinarily not cause any objectionable effects, as it would only cause the gas-valve to be held more tightly to its seat and the reduction would not be sufficient to prevent the opening of the gas-valve when one or more of the hot-water faucets were opened; but it often happens that in closing the cold-water faucets a sudden rise of pressure is caused in the passage 6 by what may be termed a "ramming" action of the water, the flow of which has been suddenly checked by closing the faucet, and it is in this connection that my improvement is specially advantageous, as the restricted passage 16 prevents a corresponding rise or sudden variation of pressure above the diaphragm 12, and thereby prevents the unseating of the gas-valve by any manipulation whatever of the cold-water faucets.

The new and improved burners above described form an important feature in the present invention, and their arrangement under the heating-coil, as shown in the drawings, is a very desirable arrangement, enabling the flame to come in contact with the coil at various points along the surface of the coil, thereby insuring a very quick heating of the water passing through the coil. I have shown a central burner and a series of burners arranged in a circle having as its center the center of the central burner.

The outer burners are secured to the upper part of the regulator-casing by means of the screw-threaded nipples 32^a and project into the interior of the casing 2 through holes in the base 40. The upper portion of the regulator-casing is secured to the base-plate 40 by means of the screw-threaded nipple 41, which forms the nozzle of the central burner, and when the ends of the coil are secured, as shown, to the regulator the coil, the regulator, and the burners are supported from the nipple 41. By removing the lower nuts 42 and 42^a and the lead or other suitable washers 43 the coil may be lifted out through the top of the casing 2, and the regulator may then be detached from the base 40.

The parts 9 and 9^a are rigidly secured to the lower ends of the pipes 5^a and 5^b by brazing or otherwise, and a tight joint is made around the short pipes 10 and 10^a by means of the washers 43 and nuts 42.

By the construction of my heater as herein described and shown by the drawings the water from the supply-main has a free and uninterrupted passage to the faucet in the service-pipe through which hot water is drawn for use. Water from the main is supplied to the heater through the branch pipe from the main through passage 6 and will fill the water-chamber 13 above the diaphragm 12 and the heating-coil $1^\times$, the chamber 14 below the diaphragm 12, the outlet-pipe from the coil, and the service-pipe in which the faucets for drawing off the hot water from the heater are located. When no water is being drawn from the heater, the pressure in both the chambers 13 and 14 is such that the gas-valve 22 will be kept closed by the differential water-pressure on the diaphragms and by the pressure of the springs 23. When it is desired to use hot water, an outlet-valve is opened. This immediately causes a reduction of pressure in the lower chamber 14, causing the opening of the gas-valve 22 and permitting gas to flow to the distributing-chamber 26 and from thence through passage 27 to the central burner 30 and through pipes 31 to burners 33. Air is admitted to the several burners through openings 35, and as the mixed air and gas escape through the openings in the top of the burners the mixture will be ignited by the flame from the pilot-burner on the small pipe 36.

I claim as my invention and desire to secure by Letters Patent—

1. In an automatic water-heater, the combination, with a receptacle for water to be heated having an inlet and an outlet pipe, of a heat-regulator comprising an abutment or diaphragm whose movement controls the supply of heat, a restricted passage for the admission of water from the inlet-pipe to the chamber on one side of the abutment, and a comparatively free passage through which the chamber on the other side of the abutment communicates with the outlet-pipe, or passage, substantially as set forth.

2. In an automatic water-heater, the combination, with a heating-coil, of a movable abutment, for controlling the supply of heat thereto, one side of which is exposed to pressure from the inlet to the coil by means of a restricted passage for preventing sudden variations of pressure on that side of the abutment by variations of the pressure or flow in the inlet passage or coil, and the other side of the abutment being exposed to the pressure in the outlet, substantially as set forth.

3. In an automatic water-heater, the combination, with the water-receptacle having an inlet and an outlet pipe, a heat-regulator comprising a movable abutment adapted to be operated by variation of pressure in the outlet, said regulator having passages communi-

cating with the inlet and outlet pipes, the passage in immediate communication with the regulator from the inlet being much smaller than the corresponding passage from the outlet, substantially as set forth.

4. In an automatic water-heater, the combination, with the water-receptacle having an inlet and an outlet pipe, a heat-regulator adapted to be operated by variation of pressure in the outlet, said regulator connected with the inlet and outlet pipes, an abutment or diaphragm dividing the interior of the regulator into an upper and a lower water-chamber, passages communicating with the two chambers from the inlet and outlet pipes, the passage from the inlet in immediate communication with the upper water-chamber being much smaller than the corresponding passage from the outlet to the lower chamber, substantially as set forth.

5. In an automatic water-heater, the combination, with a water-receptacle having inlet and outlet passages, of a heat-regulator, a movable abutment dividing the interior of the regulator into an upper and a lower water-chamber respectively communicating with the inlet and outlet passages, a fuel-passage in the regulator-casing above the upper water-chamber and separated therefrom by a diaphragm, a fuel-distributing chamber in the regulator above the fuel-passage, a valve for controlling the admission of fuel to the distributing-chamber operated by the movable abutment, substantially as set forth.

6. In an automatic water-heater, the combination, with the water-receptacle having inlet and outlet pipes, of a heat-regulator in communication with the inlet and outlet pipes, a movable abutment within the regulator-casing, a fuel-supply passage and a fuel-distributing chamber in the regulator, a series of independent burners attached to the regulator, passages through the regulator connecting the distributing-chamber with the burners, and a valve for controlling the supply of fuel to the distributing-chamber and operated by the movable abutment, substantially as set forth.

7. In an automatic water-heater, the combination, with the water-receptacle having inlet and outlet pipes, of a heat-regulator, an abutment or diaphragm dividing the interior of the regulator into an upper and a lower water-chamber, a second diaphragm connected to the first so as to form a differential pressure device, passages communicating with the two chambers from the inlet and outlet pipes, a fuel-passage in the regulator-casing communicating with a fuel-distributing chamber, a valve for controlling the supply of fuel to the distributing-chamber, and means connecting the diaphragms or abutments and the valve, substantially as set forth.

8. In an automatic water-heater, the combination, with a water-receptacle having inlet and outlet passages, a heat-regulator, a fuel-passage and a fuel-distributing chamber in said regulator, a valve between the fuel-passage and the distributing-chamber, a movable abutment within the regulator-casing controlled by variations of pressure in the outlet-passage, a stem connecting the valve and the movable abutment whereby the movement of the abutment governs the movement of the valve, burners, and means of communication between the fuel-distributing chamber and the burners, substantially as set forth.

In testimony whereof I have hereunto set my hand.

WILLIAM L. MILLER.

Witnesses:
THOMAS EWING, Jr.,
W. G. DOOLITTLE.