C. I. BAKER.

AUTOMATIC HOT WATER HEATER.

APPLICATION FILED SEPT. 11, 1917.

1,376,853.

Patented May 3, 1921.

3 SHEETS—SHEET 1.

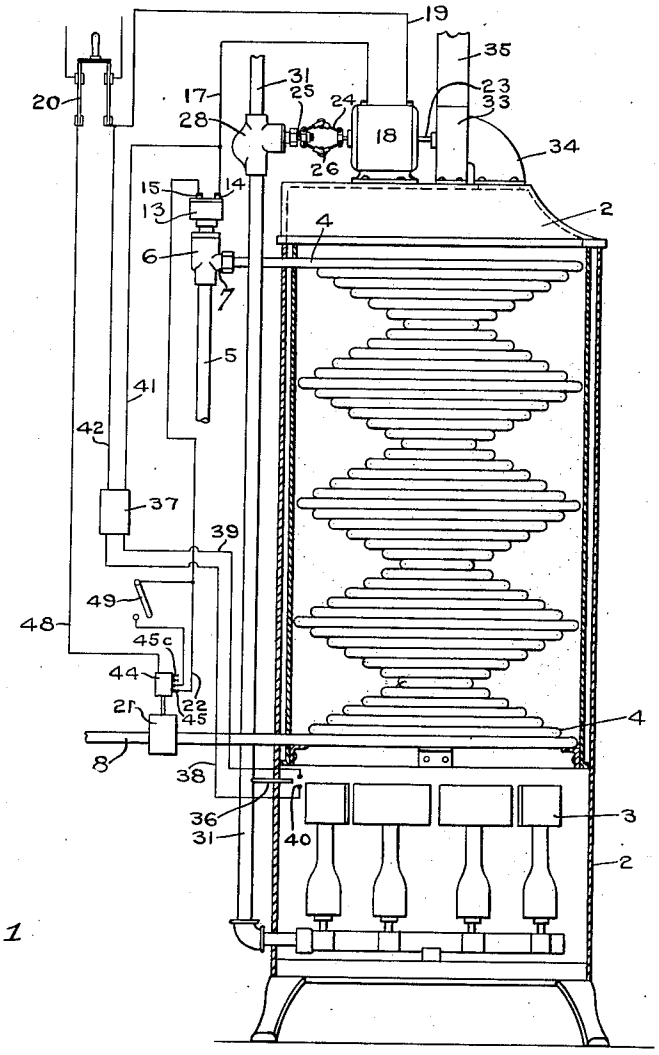

FIG.-1

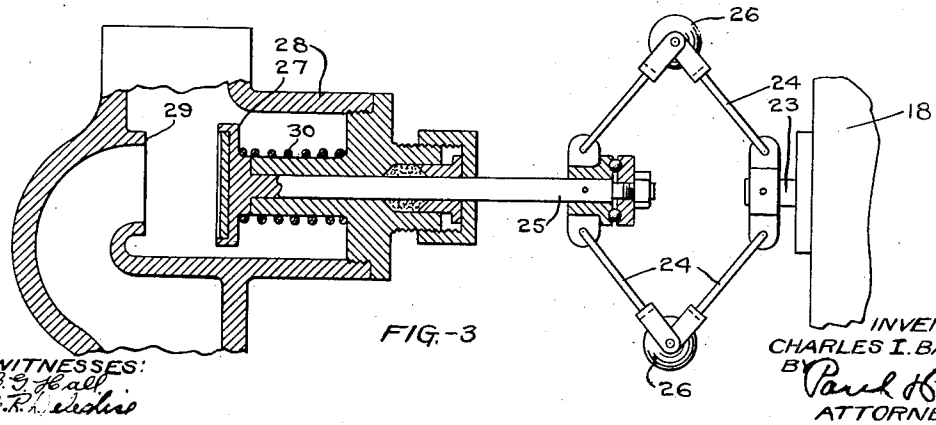

FIG.-3

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M. R. Medlin

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3 SHEETS—SHEET 2.

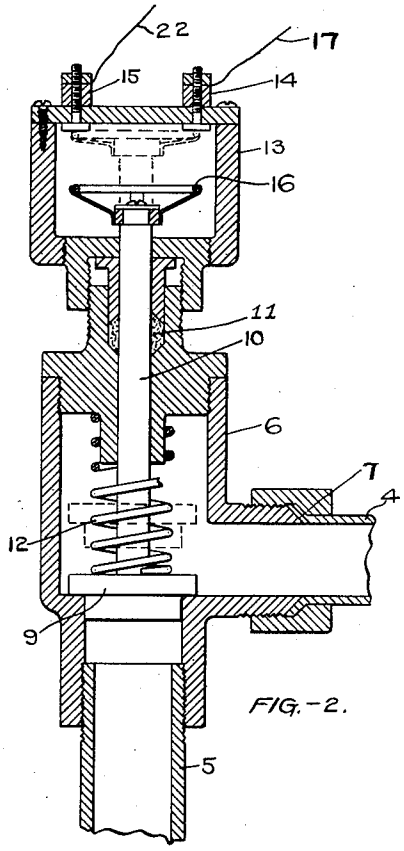

FIG.-2.

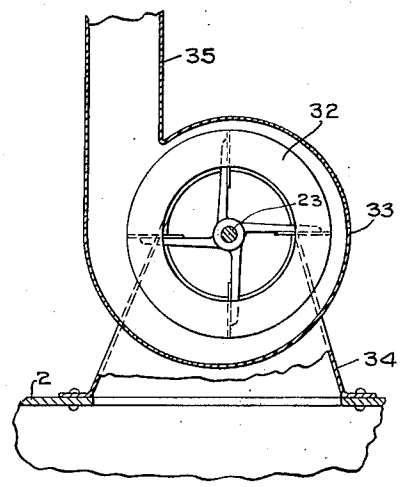

FIG.-5.

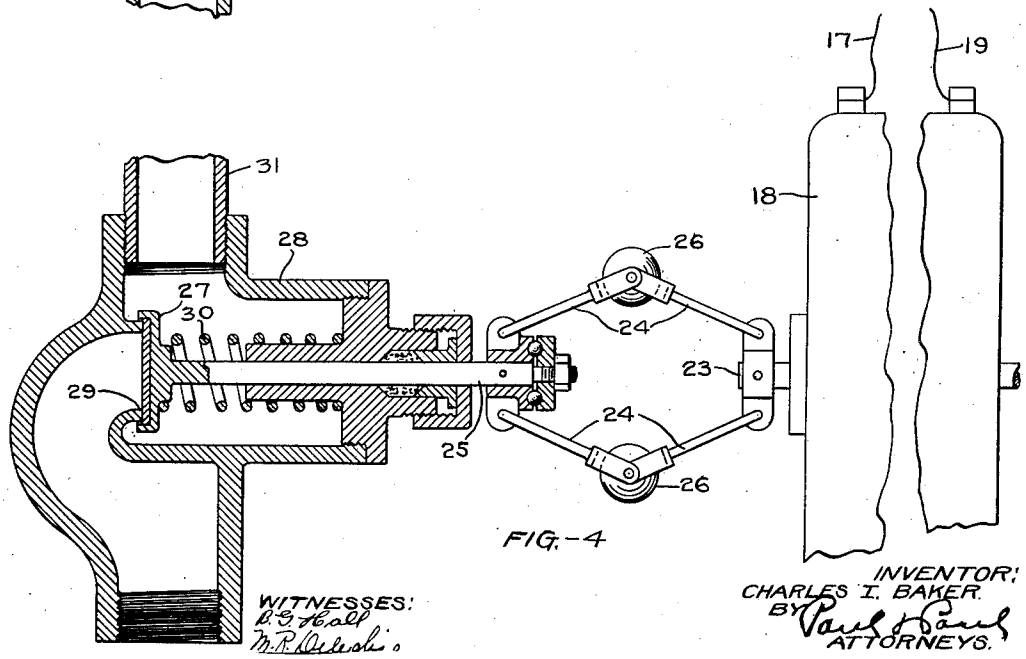

FIG.-4.

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3 SHEETS—SHEET 3.

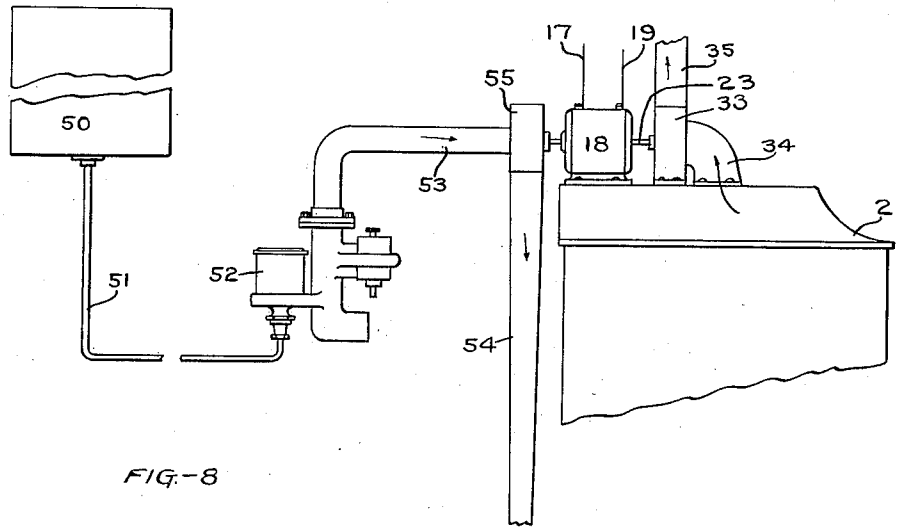

FIG.-8

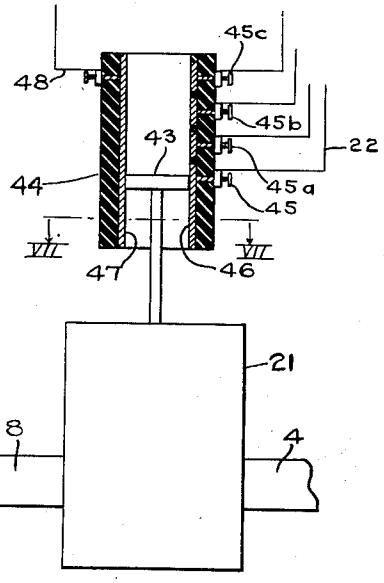

FIG.-6.

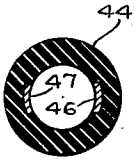

FIG.-7.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC HOT-WATER HEATER.

1,376,853. Specification of Letters Patent. Patented May 3, 1921.

Application filed September 11, 1917. Serial No. 190,697.

To all whom it may concern:

Be it known that I, CHARLES I. BAKER, a citizen of the United States, resident of St. Paul, county of Ramsey, State of Minnesota, have invented certain new and useful Improvements in Automatic Hot-Water Heaters, of which the following is a specification.

My invention relates to automatic water heaters in which there is an automatic control of the flow of fluid fuel, such as natural or artificial gas, to the burners where it becomes ignited, and the general object thereof is to improve the construction and operation of such heaters to the end that their efficiency will be increased and the dangers involved in their use will be minimized.

It is usually required that such heaters be connected to a draft flue or chimney to dispose of products of combustion and to carry unignited fuel from the heater in case such fuel enters the heater as by leakage or otherwise. Hence, an important consideration when installing a heater is that it be set where it will have a good draft. The most favorable installation is when a heater can be set as close as possible to the faucet of most frequent use, because the amount of hot water remaining in the distributing system when flow has ceased is a measure of the amount of gas wasted at each intermittent demand for hot water. However, it is frequently impossible to obtain the required draft for a heater set in the most favorable position. Accordingly, a specific object of my invention is to provide a hot water heater which may be installed in the most favorable position regardless of the position of the flue or chimney, and which will give service with a minimum of fuel expense.

Hot water heaters of the type contemplated herein usually have a continuously burning pilot light to which fuel gas flows independently of the automatic controlling mechanism of the heater, resulting in a continued consumption of fuel. Occasionally the pilot light goes out, and many of the explosions in automatic water heaters are due to haste and carelessness in attempting to relight an extinguished pilot light. One of the prevailing causes of the extinguishment of pilot lights is down drafts, which occur both when the heater flue is independent of, or is connected to, a house furnace chimney. To eliminate the usual waste of fuel by the continuous burning of pilot lights, and to prevent explosions, it is a further object of my invention to provide a hot-water heater in which the pilot light will not burn when no fuel is flowing to the heater, but will be lighted when fuel is caused to flow to the burner, and in which down drafts will not be present to extinguish the pilot light in case it continues to burn by reason of gas leakage through the gas control valve.

In the accompanying drawings, forming part of this specification, the invention is illustrated in its adaptability to an automatic water heater of the instantaneous type: Figure 1 is a vertical sectional view through a hot water heater; Fig. 2 a vertical sectional view, showing the mechanism for closing an electric circuit by means of the water pressure when the hot water faucet is opened; Fig. 3 a detail sectional view, showing the connection of the motor with the gas valve; Fig. 4 a view corresponding to Fig. 3, showing the gas valve in its closed position; Fig. 5 a detail sectional view of the exhaust fan casing and fan; Fig. 6 a detail view of the thermostatic switch for controlling the operation of the motor according to the temperature of the water; Fig. 7 a transverse sectional view of the thermostatic switch, the plane of view being indicated by the line VII—VII, Fig. 6; and Fig. 8 a view illustrating the apparatus used with gasolene, or other suitable volatile fluid, as a fuel.

In the drawings, 2 represents the casing of the heater, 3 the burners thereof and 4 the water heating coil, all of any ordinary or preferred construction, this part of the apparatus being substantially the same as the heaters now in general use. 5 represents the water intake pipe connected in the usual way with the city supply. 6 is a casing, having a pipe connection at 7 with the upper end of the coil 4, the lower end of the coil being connected through a thermostat with a discharge pipe 8 which extends to the hot water faucets of a building supply system.

A valve 9 is provided in the casing 6 having a stem 10 that is slidable in a suitable packing 11 and is normally held on its seat by a compression spring 12. A casing 13 is mounted above the stem 11 and is provided with binding posts 14 and 15 and within said casing on the stem 11 is a suitable circuit closer 16, which, when the stem is raised to the upper part of the casing 13, will con-

tact with the posts 14 and 15. The binding post 14 has a conductor 17 leading to one pole of a motor 18, and a conductor 19 leads from the other pole of the motor to a controlling switch 20. When, therefore, the circuit is closed between the posts 14 and 15, the motor 18 will be set in motion, subject of course to the position of the thermostat hereinafter explained.

The shaft 23 of this motor is connected to a valve stem 25 by means of a centrifugal element in the form of a pair of pivoted toggle arms 24, said arms being mounted to fold and carrying weights 26, which, when the motor shaft revolves, fly outwardly through centrifugal force and move the valve stem 25. A valve 27 within a casing 28 is carried by said stem and is normally held on its seat 29 by a spring 30. The valve casing 28 is mounted in the gas supply pipe 31 which leads from a gas meter or other source of fuel supply to the burners 3, and through which pipe the fuel gas is delivered to the heater. The spring 30 holds the valve 27 on its seat, as indicated in Fig. 4, and positively shuts off the flow of gas through the supply pipe. As soon, however, as the motor 18 is set in motion, outward movement of the weights 26 will open the gas valve against the compression of its spring and allow gas to flow to the burners.

The other end of the motor shaft 23 is attached to a fan 32 within a casing 33, which casing has a trunk 34 communicating with the top of the heater and a pipe 35 extending to the open air or to a suitable chimney flue. The operation of this fan creates an induced draft or suction within the heater and draws the burned gases or products of combustion from the heater and discharges them at any desired point.

The manner of closing the circuit to start the motor, and the mechanism employed for accomplishing this part of the operation, may be modified in various ways, and I may employ different means for opening the gas supply valve and simultaneously creating a suction in the heater.

The gas supply pipe 31 has, at a point beyond the valve 27, a branch tube 36 for conducting a small stream of gas to a point close to the burners, and an induction coil or any other suitable sparking device 37 has conductors 38 and 39 leading to sparking points 40 within the heater casing and in proximity to the branch tube 36 and burners 3. The induction coil also has conductors 41 and 42 in multiple with the motor circuit, so that when the circuit through the motor is closed and the gas valve opened, a stream of sparks will be formed between the points 40 to ignite the gas at the branch tube and at the burners.

A thermostatic device 21, which may be of any suitable construction which I have not thought necessary to illustrate herein as it forms no part of my present invention, is located in the hot water line and controls an electric switch having a circuit closer 43 that is slidable within a cylindrical member 44 in response to thermostatic expansion and contraction. The member 44 is provided with a series of binding posts 45, 45^a, 45^b and 45^c. As shown, the conductor 22 leads from the binding post 15 to the binding post 45 which communicates with a conducting plate 46 mounted in the insulating cylinder 44, and a conducting plate 47 is mounted in the opposite surface of the cylinder 44 and is connected by a conductor 48 with the switch 20. The binding posts 45^a, 45^b and 45^c also communicate with conducting plates, which are insulated from each other and from the plate 46 and are in the path of the circuit closer 43. A switch 49 is provided in circuit with the conductor 22 and the binding post 45^a, so that when desired, a circuit may be established through the binding post 45^a and the conductor 48. The depth or thickness of the circuit closer 43 is greater than the insulation between the graduated binding posts. It will be necessary for the circuit closer 43 to be moved, by the expansion of the thermostat, beyond the conductor plate 46 before the circuit will be opened, and, if the switch 49 is closed, the circuit closer 43 will have to move beyond the plate attached to the binding post 45^a to open the electric circuit. Additional switches may be used for the binding posts 45^b and 45^c.

This graduated thermostatic switch provides for a higher water temperature before the motor circuit is broken and the gas and spark shut off. The operator, through the switch 49 will be able to adjust the maximum degree of water temperature in a simple manner without changing any thermostatic tension or graduating the gas flow with its corresponding decrease of heater efficiency.

In Fig. 8 I have illustrated a modified construction, which consists in providing a tank 50 for a liquid fuel, the tank having a pipe connection 51 with a carbureter 52. The pipe 53 leads to a gas supply pipe 54 through a fan 55 driven from the motor 18 which is connected with the electric circuits in the manner described with reference to Fig. 1. When the motor is running, the fan 55 will draw in the carbureted gas for delivery through the pipe 54 to the burners. The ignition of the fuel will take place as already described. The heater may use any liquid or gaseous fuel, the supply being controlled by a motor-driven fan and delivered to the combustion chamber under pressure to give normal or forced combustion.

In the operation of the heater, the open-

ing of a hot water faucet will release the water pressure to open the water valve 9, close the motor circuit in the manner described and start the motor 18. The revolving of the motor shaft 23 will cause the governor arms and weights to be thrown outwardly and open the gas supply valve 27 against the compression of its spring. At the same time the primary circuit of the induction coil 37 will be closed to form a series of sparks in the secondary circuit at the burners and branch tube 36, igniting the gas as it flows out of the tube and the burners.

Simultaneously with the admission of gas to the heater, a suction will be established in the vent trunk 34 and the products of combustion will be drawn out of the heater chamber and discharged into the open air or a suitable chimney flue which, of course, may be located any reasonable distance from the heater. When the water in the coils becomes heated a predetermined temperature, the motor circuit will be broken through the thermostatic device, and the stopping of the motor will allow the spring 30 to close the gas supply valve 27 and shut off the supply of gas. This operation will take place even while the hot water faucet is open, thereby preventing heating of the water to a danger point. As long, however, as the circuit remains closed through the thermostatic device and the hot water faucet is open, the operation of the motor will continue and gas will be supplied to the burners and heating of the water will be carried on.

The branch tube 36 is a safety element and is so positioned that it is between the gas supply valve and the burners and at every point higher than the gas orifices in the burners and will therefore continue to burn should there be a very slow leak through the gas supply valve when it is closed. This will prevent any possible accumulation of gas in the heater when the exhaust fan has stopped and also will be a bright signal of a leakage of gas.

In the modified construction, the starting of the motor will simultaneously create a draft in the heating chamber and also draw the carbureted air through the supply pipe and deliver it to the burners at any desired pressure. The heater in the modification differs only in that it makes its own gaseous fuel from a liquid and delivers such fuel to the burners by means of a fan instead of a gas supply controlled through supply valves.

With these improvements to the automatic gas water heater in general use I can have absolute control over the admission of gas to the burners and govern such admission by the water temperature and can readily change the limit of the water temperature. By making the ignition of the pilot light automatic with the admission of gas, a cause of explosions due to carelessness on the part of the user becomes eliminated. Also, in having a positive induced draft the heater can be placed in the position most favorable to the system of house plumbing without regard to the position of the chimney flue. Also, the lack of draft in the heater when idle gives a greater operating efficiency because the hot water remaining in the heater will be surrounded by hot burned gases and thus retain its temperature much longer than in heaters having a continuous draft. Also, there being no false air opening at the top of the heater and there being little if any draft in the heater when not in use, warm air will not continuously be drawn out of the house.

I claim:

1. The combination, with an automatic water heater having fluid fuel and flue connections, and a water-supply conduit extending to and through the heater; of an electric motor, an electric switch operated by means responsive to the flow of water through said conduit for starting and stopping said motor, an electric circuit for said motor having terminals for connection with a source of electrical energy, and an exhaust fan operated by said motor for creating a suction to remove the products of combustion from the heater.

2. The combination, with an automatic water heater having gas and flue connections, and a water-supply conduit extending to and through the heater; of a gas supply valve, an electric motor having a circuit and operatively connected to said gas valve, two electric switches in series with said electric motor, means whereby one of said electric switches will be actuated by flow of water through said conduit for starting and stopping said motor, and means whereby the other switch will be operated through variations in the temperature of the heated water, and an exhaust fan connected with said motor for removing the products of combustion from said heater.

3. The combination, with an automatic water heater having gas and flue connections, and a water-supply conduit extending to and through the heater; of a gas valve, an electric motor having a circuit and operatively connected to said gas valve, a switch operated by means responsive to the flow of water through said conduit for starting and stopping said motor, an induction coil in parallel with said motor circuit and having sparking points in its secondary circuit for igniting the fuel at the heater burners, and an exhaust fan driven from said motor for removing the burned gases from said heater.

4. The combination, with an automatic water heater having gas, water and flue connections, of a gas supply valve, an electric

motor operatively connected to said gas supply valve, an induction coil having means for causing a spark at the burners simultaneously with the opening of the gas supply valve, parallel electric circuits for said motor and coil, two electric switches in series with the motor circuit, means actuated by the flow of water for operating one switch, and means controlled by the temperature of the water for operating the other switch.

5. The combination, with an automatic water heater having gas and water supply pipes and valves therefor, and means for normally holding said gas supply valve in its closed position, of an electric motor and circuit therefor, an electric switch for starting and stopping said motor, a centrifugal element connected with said electric motor and said gas supply valve for opening said valve against the resistance of said closing means, and an exhaust fan driven by said motor for creating an induced draft in said heater.

6. The combination, with an automatic water heater having gas and water supply conduits and valves, of an electric switch operated by the flow of water through the water supply conduit, an electric motor having a circuit controlled by said electric switch, a centrifugal element operatively connected with the rotor of said electric motor for opening said gas supply valve, and an exhaust fan connected with said motor for producing an induced draft in the heater and removing the products of combustion therefrom.

7. The combination, with an automatic water heater having fuel gas and water supply conduits and valves therefor, and having a flue connection; of a motor operatively connected with said fuel gas valve, means made operative by the flow of the water through the water supply conduit for starting said motor to open the gas valve, and means operated by said motor for creating a suction to remove the products of combustion from the heater through said flue connection, whereby draft is created through said heater only during the flow of fuel to the heater.

8. The combination, with an automatic water heater having gas and water supply pipes and valves therefor and provided with an exhaust flue for the products of combustion, of an electric motor operatively connected with said gas valve, a fan operated by said motor for removing the products of combustion from the heating chamber, an electric circuit for said motor, and means actuated through the opening of the water valve for closing said electric circuit to open said gas valve and start said fan.

9. The combination, with an automatic water heater having fuel gas and water supply pipes and valves therefor, and an exhaust flue leading from the heating chamber, of an electric motor operatively connected with said gas valve, a fan connected with said motor, an electric circuit for said motor, a circuit closer actuated through the opening of the water supply valve, an induction coil in said circuit having sparking points adjacent the burners of said heater, and a branch tube leading from said gas supply pipe and terminating near said sparking points.

10. The combination, with an automatic water heater having gas and water supply pipes and valves therefor, and an exhaust flue leading from the heating chamber, of an electric motor operatively connected with said gas supply valve and having an electric circuit, an exhaust fan driven by said motor for creating a suction in said heating chamber, a circuit closer in said circuit actuated through the opening of a hot water faucet, and an electric igniter comprising sparking points adjacent the burners of said heater and controlled by said circuit closer.

11. The combination, with an automatic water heater having gas and water supply pipes and valves therefor, and means for normally holding said gas supply valve in its closed position; of an electric motor and circuit therefor, an electric switch for starting and stopping said motor and made operative by the opening of a hot water faucet, a centrifugal element connected with said electric motor and said gas supply valve for opening said valve against the resistance of said closing means, and an exhaust fan driven by said motor for creating an induced draft in said heater.

12. The combination, with an automatic water heater having gas and water supply pipes and valves therefor, and means for normally holding said gas supply valve in its closed position, of an electric motor and circuit therefor, an electric switch for starting and stopping said motor, a thermally controlled electric switch for starting and stopping said motor, a centrifugal element connected with said motor and said gas supply valve for opening said valve against the resistance of said closing means, and an exhaust device driven by said motor for creating an induced draft in said heater.

13. The combination, with an automatic water heater having water and gas supply pipes, of a gas supply valve, a centrifugal device for opening said valve, a spring for normally holding said valve in its closed position, an electric motor for rotating said centrifugal element to open said valve, an electric circuit for said motor, two switches in series with said motor, means actuated through the flow of water to the heater for operating one of said switches, means controlled by the temperature of the heated water for operating the other switch, and an

exhaust fan connected with said motor for removing the products of combustion from said heater.

14. The combination, with an automatic water heater having water and gas supply pipes, of a gas supply valve, a centrifugal device for opening said valve, a spring for normally holding said valve in its closed position, an electric motor for rotating said centrifugal element to open said valve, and an electric circuit for said motor, two switches in series in said circuit, means actuated through the flow of water to the heater for operating one of said switches, means controlled by the temperature of the heated water for operating the other switch, an exhaust fan connected with said motor for removing the products of combustion from said heater, and an induction coil in multiple with said electric motor and having sparking points in its secondary circuit adjacent to the burner of said heater for igniting the gas at the burner.

15. The combination, in a water heater, of a water container having a heating surface and a water supply connection, a burner having a fuel supply connection, a fuel valve in said fuel supply connection, a centrifugal element for opening said fuel valve, a fan for creating an induced draft for removing the products of combustion from the heater, an electric motor for simultaneously operating said fan and said centrifugal element, an electric circuit for said motor, and a controlling switch for connecting said circuit to a source of electric power.

16. The combination, with an automatic water heater, of a gas supply valve, an electric motor, mechanism operated by said electric motor for operating said gas supply valve, an electric circuit for said motor, means operated by the flow of water to the heater for closing said circuit, a thermostat positioned to be actuated by the rise and fall of the temperature of the heated water and an adjustable device for varying the degree of thermostat expansion required to open said electric circuit.

17. The combination, with an instantaneous automatic gas water heater, of an electric motor, two electric switches in series circuit with said motor, one switch operated by means responsive to the flow of water to the heater and the other operated by means responsive to the temperature of the heated water, an electric circuit for said motor, and means operated by said motor for withdrawing the products of combustion from the heater.

18. The combination, in a water heater having a gas supply valve, of an electric motor, an induced draft fan operated by said motor for removing the products of combustion from the heater, a centrifugal element also operated by said motor for opening said gas supply valve, a circuit having a switch for controlling said motor, a thermostat subjected to the temperature of the heated water and connected to said switch for operating it, and a manually operable switch for connecting said circuit to a source of power.

In witness whereof, I have hereunto set my hand this 29th day of August, 1917.

CHARLES I. BAKER.