No. 784,403. PATENTED MAR. 7. 1905.

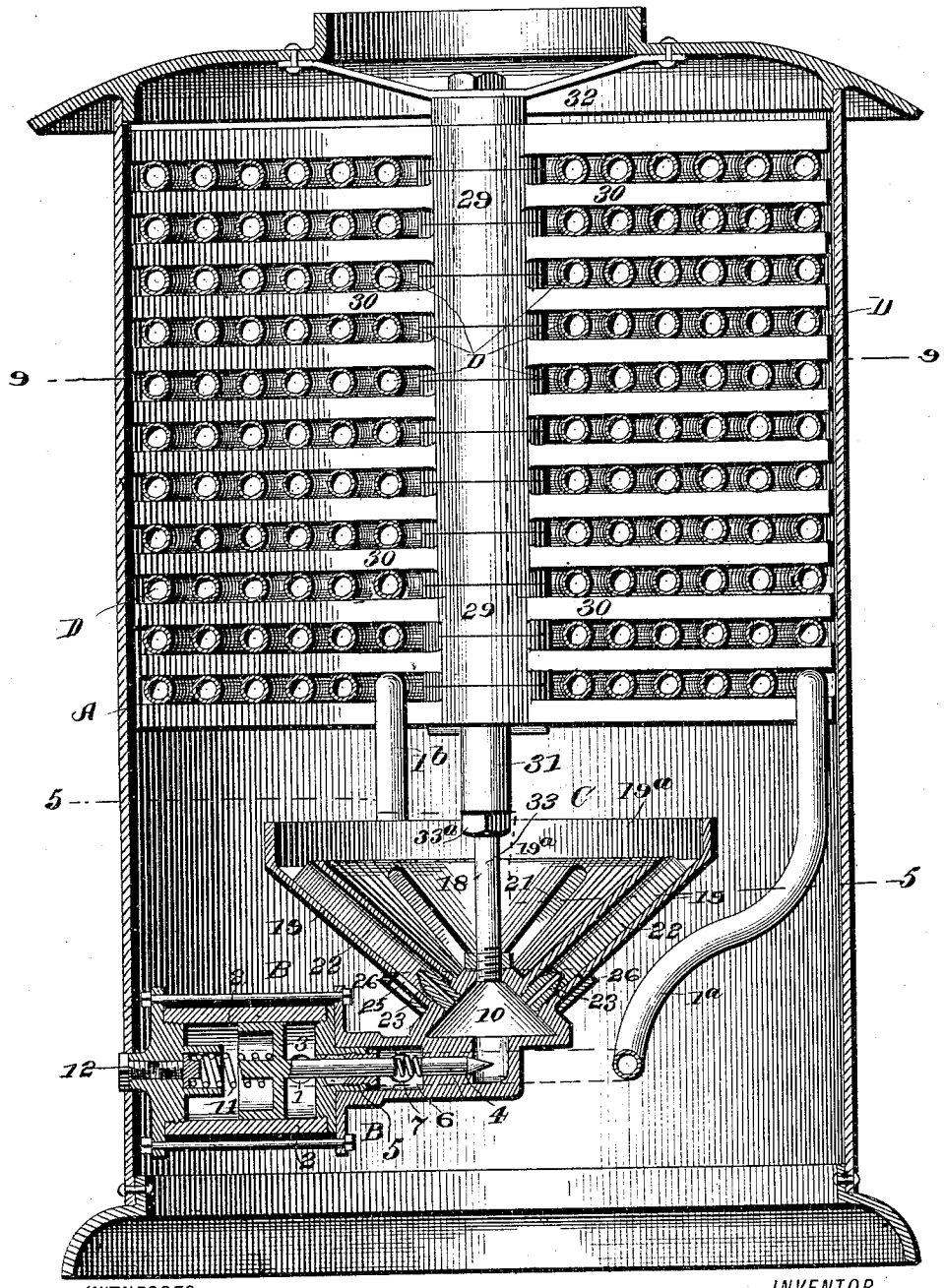
W. E. KAY.

WATER HEATER.

APPLICATION FILED NOV. 16, 1904.

4 SHEETS—SHEET 1.

Fig. 1



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No. 784,403. PATENTED MAR. 7, 1905.

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4 SHEETS—SHEET 2.

Fig. 3

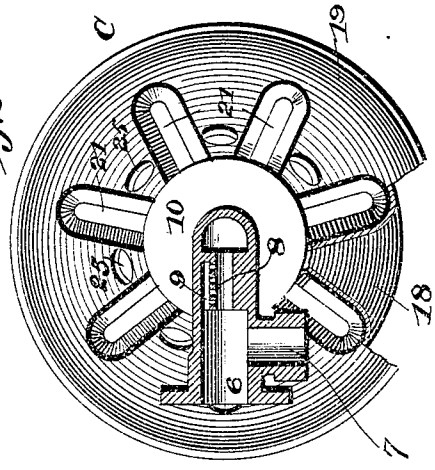


Fig. 4

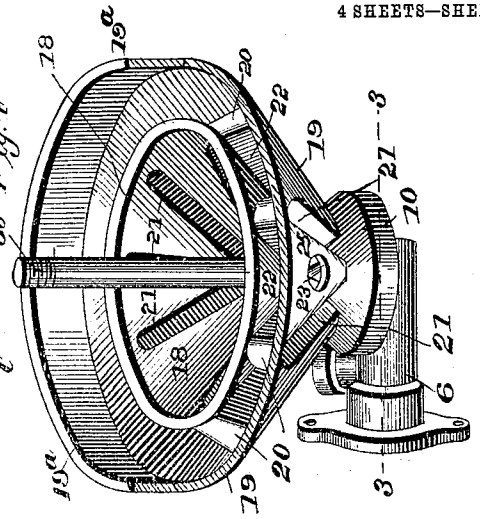
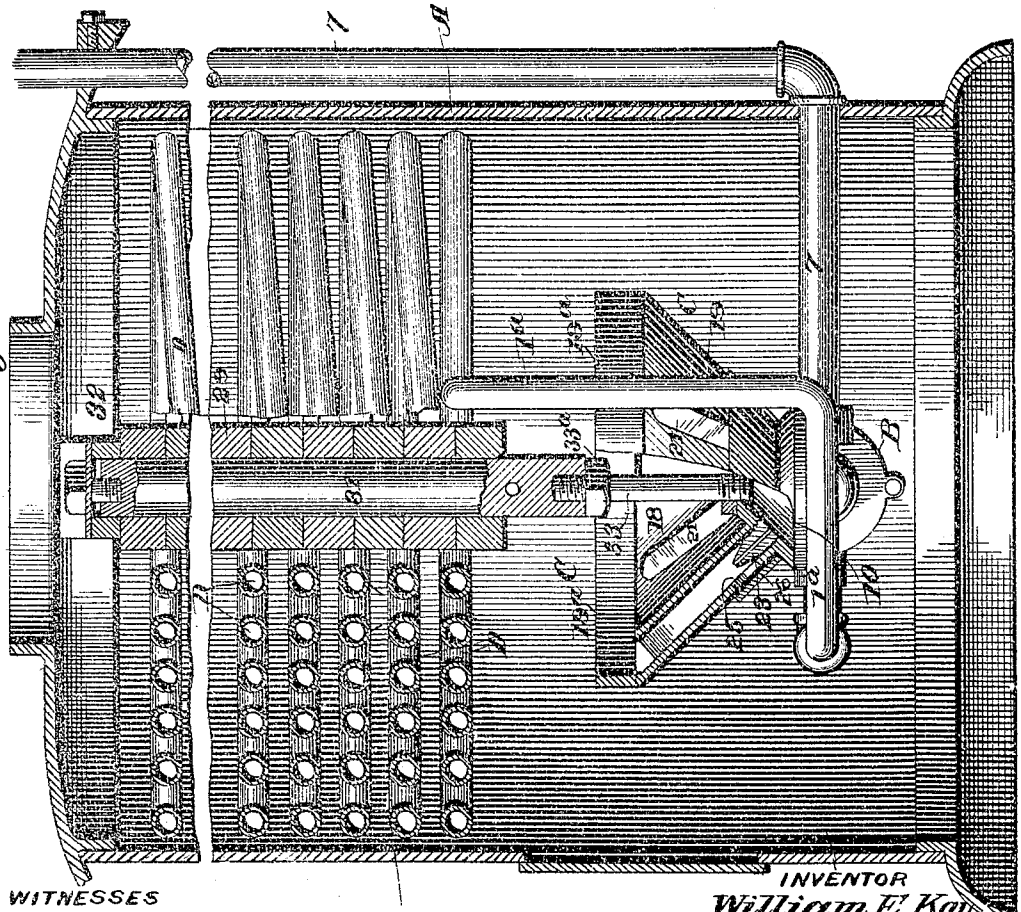


Fig. 2



WITNESSES

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4 SHEETS—SHEET 3.

Fig. 5

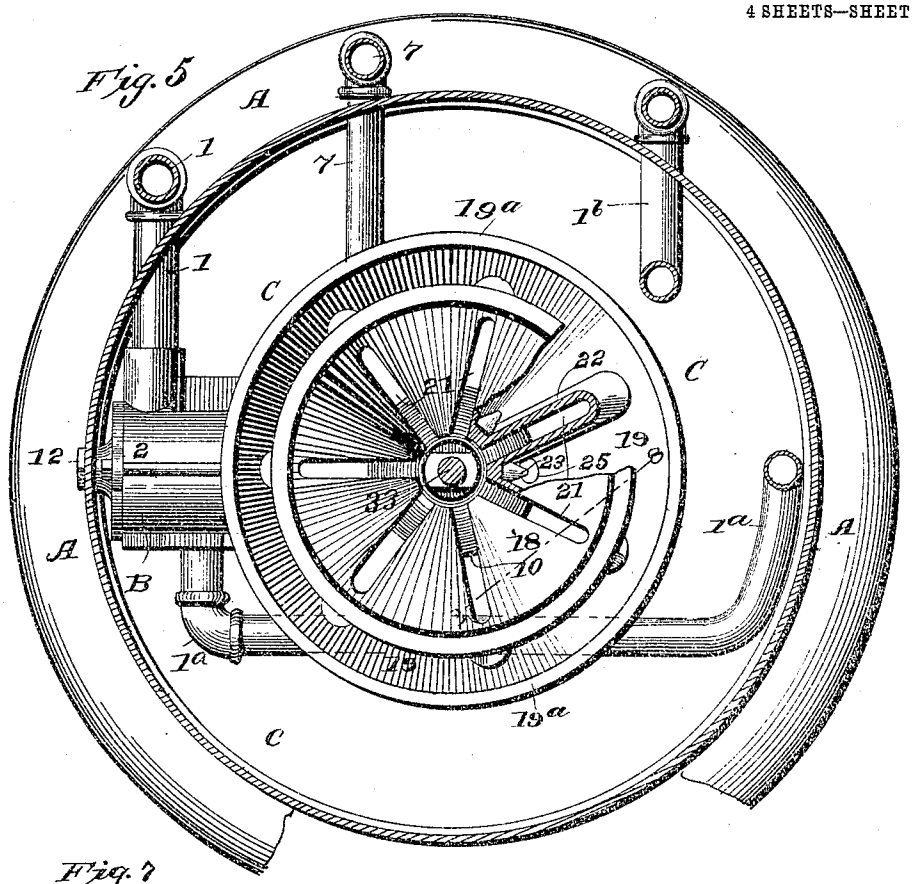


Fig. 7

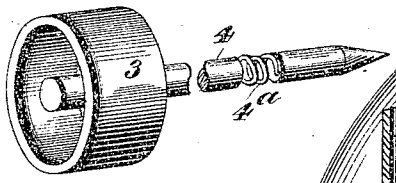
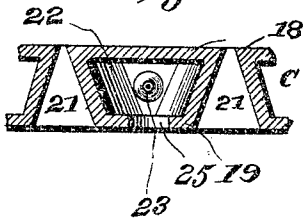


Fig. 8



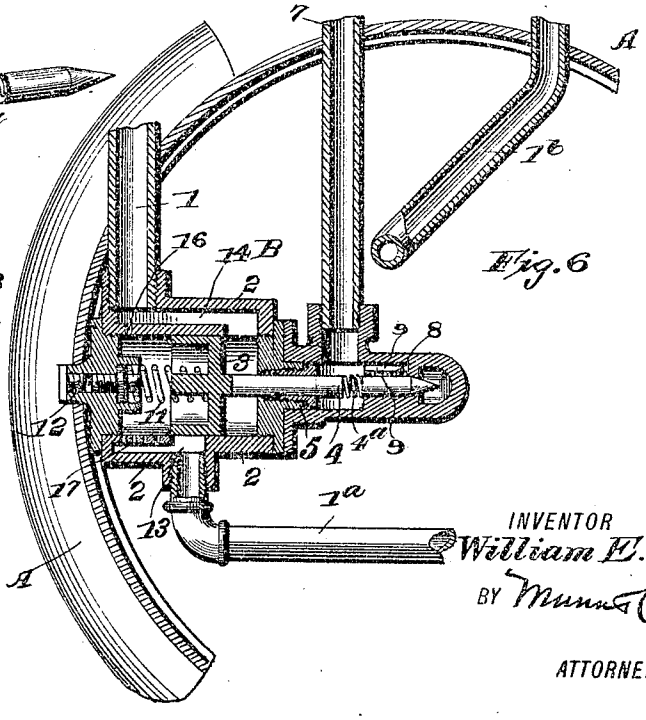


Fig. 6

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WATER HEATER.

APPLICATION FILED NOV. 16, 1904.

4 SHEETS—SHEET 4.

Fig. 9

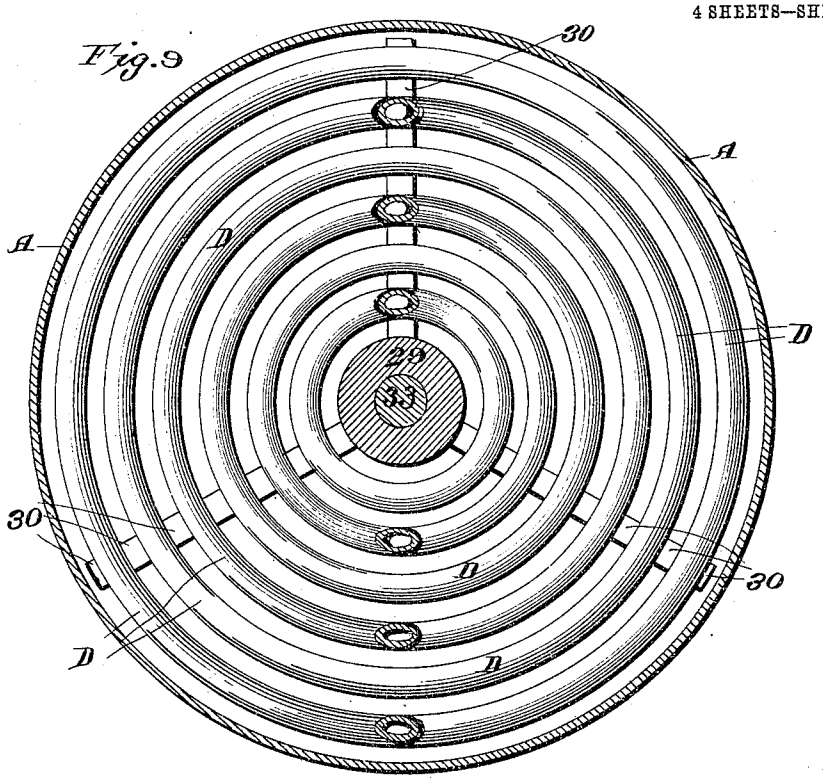


Fig. 10

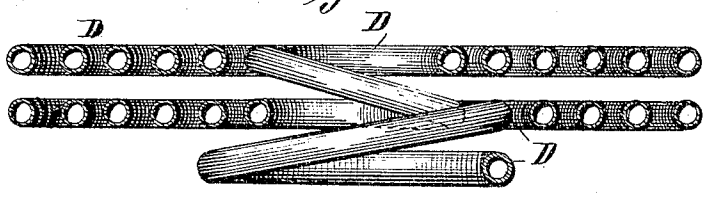
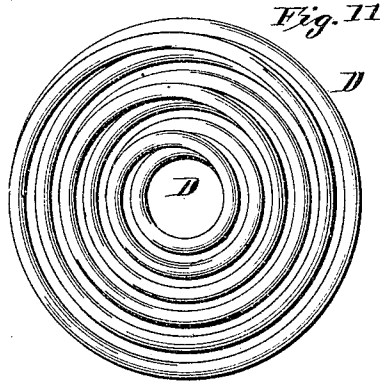


Fig. 11



WITNESSES:

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No. 784,403. Patented March 7, 1905.

UNITED STATES PATENT OFFICE.

WILLIAM EDWARD KAY, OF LORAIN, OHIO.

WATER-HEATER.

SPECIFICATION forming part of Letters Patent No. 784,403, dated March 7, 1905.

Application filed November 16, 1904. Serial No. 232,971.

To all whom it may concern:

Be it known that I, WILLIAM EDWARD KAY, a citizen of the United States, residing at Lorain, in the county of Lorain and State of Ohio, have invented a new Water-Heater, of which the following is a specification.

My invention relates to a water-heater adapted for use in barber-shops, bath-rooms, and other places where it is required to heat water in a very short time and in considerable quantity. The apparatus is so constructed that the volume of the heating medium consumed and the consequent amount of heat developed and utilized is varied proportionate to the quantity of hot water drawn off for use, this being effected automatically by a new regulating valve mechanism and new form of burner. These and other features and parts embodying the invention are hereinafter described and claimed, and illustrated in accompanying drawings, in which—

Figure 1 is a central vertical section of the heater. Fig. 2 is a view in which the casing is shown in central vertical section and the burner and water-coil are shown in part in section and in part in elevation. Fig. 3 is mainly a bottom plan view of the burner, a portion being shown in section taken on the line 3 3 of Fig. 4. Fig. 4 is a perspective view of the lower portion of the burner, part being broken away. Fig. 5 is an irregular horizontal section on the line 5 5 of Fig. 1. Fig. 6 is a horizontal section particularly illustrating the construction and arrangement of the valve mechanism. Fig. 7 is a perspective view illustrating the needle-valve and the piston connected therewith. Fig. 8 is a detail cross-section on the line 8 8 of Fig. 5. Fig. 9 is a horizontal section on the line 9 9 of Fig. 1. Fig. 10 is a sectional view illustrating the construction of the water-coil. Fig. 11 is a plan view further illustrating the arrangement of the coil.

A indicates a cylindrical sheet-metal casing; B, the valve mechanism for regulating inflow of water and combustible gas; C, the gas-burner, and D the water-heating coil, such operative parts B C D being detachably suspended within the casing, as will be hereinafter described.

Water is admitted by pipe 1 (see Figs. 5 and 6) to the cylinder 2, provided with a piston 3, arranged to slide therein. A pointed or needle valve 4 is rigidly connected with said piston and works in a stuffing-box, then traverses a chamber 6, to which gas is admitted by pipe 7, then enters a passage-way to which gas is admitted by a series of openings 8, communicating with a passage 9. Thence the gas passes to a conical burner 10 (see Figs. 1 and 2) and then to an inverted cone C. From the cylinder 2 water is conducted by pipe 1^a to the heating-coil D. A spiral spring 11 is arranged and supported behind the piston 3 and serves to hold the needle-valve 4 normally in the position shown in Figs. 1 and 6, by which all the gas-inlets 8 are closed. The compression and tension of said spring 11 are regulated by an adjusting-screw 12, which is accessible exterior to the casing A, as shown in Figs. 1 and 6. The conical point of the valve 4 is flexibly connected with the body or rear portion by a spiral spring 4^a. (See especially Fig. 7.)

The coil D terminates in an outlet-pipe 1^b, that passes through the casing A and in practice connects with a service-pipe. (Not shown.)

The piston 3 is normally balanced by pressure of water on its opposite sides, as will be understood from the following description. (See Fig. 6.) At diametrically opposite points the cylinder 2 is provided with side passages 14 and 13, one, 14 communicating with inlet 1 and the other with outlet 1^a. From such inlet-passage 14, a small opening 16 admits water to the space behind the piston 3, and a series of similar openings 17 allows discharge of water from such space into outlet-passage 13. Thus water-pressure is equal on opposite sides of the piston, and when no water is being drawn off from the coil D the piston 3 is in position to cut off communication between the inlet 14 and outlet 13, and the valve 4 also cuts off flow of gas through openings 8 into tube 10, that leads to the burner C; but when water is drawn off from the service-pipe a movement or current is established to supply its place in the coil D and connecting-pipe 1^a. Hence water is drawn through passage 15 and the communicating openings 17 from the space

behind the piston 3, and since the several openings 17 permit a much more rapid flow than can be supplied through the opposite opening 16 it is apparent the water-pressure on the back of the piston 3 is reduced as compared with that on the front of the piston, and hence the piston moves back a corresponding distance. Ordinarily this movement will be sufficient to open communication between pipe 1^a and the space in front of the piston, and thus a free and rapid flow of water to and through the coil D takes place. So soon as the discharge from the service-pipe is cut off the former conditions are reëstablished, the spring restoring the piston 3 and gas-valve 4 to their normal positions as quickly as the inflow of water through opening 16 restores the water-balance.

The burner C comprises a conical burner 10 and superposed inverted double cone, by which the gas and flame are distributed. The cone is formed of two parts 18 and 19, (see Fig. 4,) the smaller one, 18, being arranged within the other, 19, and separated therefrom by a narrow space. The upper edge of part 19 is extended vertically, as shown at 19^a. The said parts are rigidly connected by webs 20, the whole being cast integral. The webs 20 extend from the bottom of the double cone upward and are constructed to form passages 21, that allow free admission of air from the outside to the inside. (See Fig. 3.)

The fan-shaped spaces 22 between the webs 20 serve as gas passages or conduits, the gas discharging from the distributing-chamber 10 through nipples 23, that screw into the base-cone. (See Figs. 1 and 2.) The gas burns as it escapes from spaces 22, the flame being directed upward by the rim 19^a. Air is admitted to spaces 22 by openings 25, (see Figs. 1, 2, 3, and 4,) the same being formed in the outer cone member 19 at the base of the same. A circular slide 26, having like openings, (see Figs. 1 and 2,) is arranged outside the double cone, and by adjusting it the admission of air is regulated at will. The inverted double cone 18 19 is preferably cast integral with the conical chamber 10.

The coil D is constructed and arranged as follows: It is arranged in a series of spiral layers or convolutions, each supported upon a horizontal frame or "spider" formed (see Fig. 9) of a central hub 29 and three radiating arms 30, all in one piece. These spiders are in turn supported by means which will be presently described. The arms 30 are held the necessary distance apart vertically by the elongation of the hubs 29, whose ends are in contact, as shown.

The convolutions of the coil D are wound right and left—that is to say, beginning where the water-conducting pipe 1^a joins or merges into the coil the winding is from right to left, each convolution rising and winding or merging into the one above until the top of the coil is reached, when the winding is reversed and proceeds from left to right until the bottom is reached, when the winding is again reversed and proceeds again from right to left, and so on until the coil joins or merges into the discharge-pipe, 1^b (see Fig. 1,) which connects with the service-pipe.

All the working parts of the apparatus are arranged within the casing A and detachably supported therein by the following means: A rod 31 (see Figs. 1 and 2) is suspended concentrically with the casing from the top thereof by means of a hanger in the form of a strap 32, and the hubs 29 of the several spiders are arranged thereon as shown and supported by a cotter-pin inserted through rod 31. A smaller rod 33 is screwed into the lower end of the rod 31 in alinement therewith, and a jam-nut 33^a is applied to lock the parts together. To the lower end of this smaller rod 33 is attached the conical distributing-chamber 10, with which the water-cylinder 2 is rigidly connected, one head of the cylinder being preferably cast integrally with the chamber, as shown. It will be seen that by this means all the working parts are suspended detachably as relates to the casing A and that they are detachable from each other. I thus make provision for convenient assemblage of all the parts composing the water-heater, also for detachment of the same from each other, as may be required for repair or other purpose.

By the construction and arrangement of parts above described I provide a water-heater which fully utilizes the fuel consumed and automatically varies the supply and consumption of gas or other heating medium in direct proportion to the quantity of water passing through and drawn off from the coil. Thus a supply of hot water is produced with great economy and rapidity and maintained with great uniformity.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a water-heater, the combination with the gas-burner and a water-heater proper, of the water and gas regulating mechanism comprising a piston and its cylinder having a main water-inlet near its front end and a small water-inlet on one side in rear of the piston and an opposite water-outlet of greater capacity, a needle gas-valve rigidly connected with said piston and extending in the direction of movement thereof and working in a bearing having a gas-inlet that extends lengthwise of the valve near its conical end, a spring acting on the rear side of the piston, and pipe connections for water and gas, all operating as shown and described.

2. In a water-heater, the combination of the burner and a water-heater proper, a gas-conductor connected with the base of said burner, and having an elongated gas-inlet, a sliding valve arranged in line with the gas-inlet and

controlling admission of gas therefrom, a water-cylinder having a main water-inlet that communicates with its front portion, a smaller water-inlet and a relatively larger water-outlet arranged near the rear end of the cylinder, a slidable piston arranged between the main water-inlet and the smaller inlet and outlet, a spring acting on said piston to hold it normally in an intermediate position respecting the water-inlets, a water-outlet pipe connected with the cylinder and so arranged that the piston covers its mouth when in normal position, the said piston and gas-valve being connected so that they slide together, substantially as described.

3. In a water-heater, the combination with a burner, of a gas-conductor connected therewith and having a side passage provided with a series of gas-outlets, a needle-valve adapted to slide in said conductor and fitted in the bore with which said gas-outlets communicate, the arrangement being such that the gas-outlets are uncovered in proportion to the retractile movement of the valve, and a water-cylinder having a slidable piston which is connected with said gas-valve, water inlets and outlets being provided whereby the flow of water through the cylinder is proportionate to the volume of gas which passes the valve, substantially as described.

4. In a water-heater, the combination with a burner, of a gas-conductor and a needle-valve adapted to reciprocate therein, the said conductor having a passage arranged parallel to the valve and communicating throughout its length with the bore in which said valve reciprocates, and a water-cylinder and piston which is slidable therein and connected with the gas-valve, the cylinder being provided with differential inlets for admitting water to both sides of the piston for balancing the same, and a water-outlet communicating with the rear side of the piston, substantially as described.

5. In a water-heater, the improved burner, comprising a conical gas mixing and distributing chamber, and burner proper formed by a superposed and inverted double cone, the two conical parts being arranged one within the other and spaced apart, a series of air-openings formed in the outer part and gas-passages leading upward therefrom, the same being formed by and between partitions that extend upward between the two conical parts of the burner, substantially as described.

6. In a water-heater, the burner comprising a conical base portion having a distributing-chamber, and a body portion formed of inverted cones arranged concentrically and connected and spaced apart, a series of partitions ranging from the bottom upward and forming a series of gas-passages, and a series of air-openings formed in the outer cone and communicating with the said gas-passages, substantially as described.

7. In a water-heater of the class indicated, the combination, with an inclosing casing, and a hanger supported vertical from the top of said casing, of a series of independent and removable spiders each composed of a central hub applied to said hanger, and a series of radiating horizontal arms, for supporting the convolutions of a pipe-coil, substantially as described.

8. In a water-heater, the combination with the casing, and a central rod supported from the top thereof, of a series of spiders each comprising a central perforated hub and radiating arms, the several spiders being applied to said rod, and a water-coil formed of a series of spiral convolutions which are supported upon the arms of the spiders, in the manner described.

9. In a water-heater, the combination with the casing, of a hanger-rod arranged centrally and detachably connected with the top of the casing, a second rod which is detachably connected with the first-named one, a series of horizontal spiders supported upon the first-named rod, and a water-heating coil arranged on the said spiders, a burner, and water and gas regulating mechanism connected therewith, all supported detachably from the central hanger in the manner described.

WILLIAM EDWARD KAY.

Witnesses:
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