T. J. RADKE.

WATER HEATER.

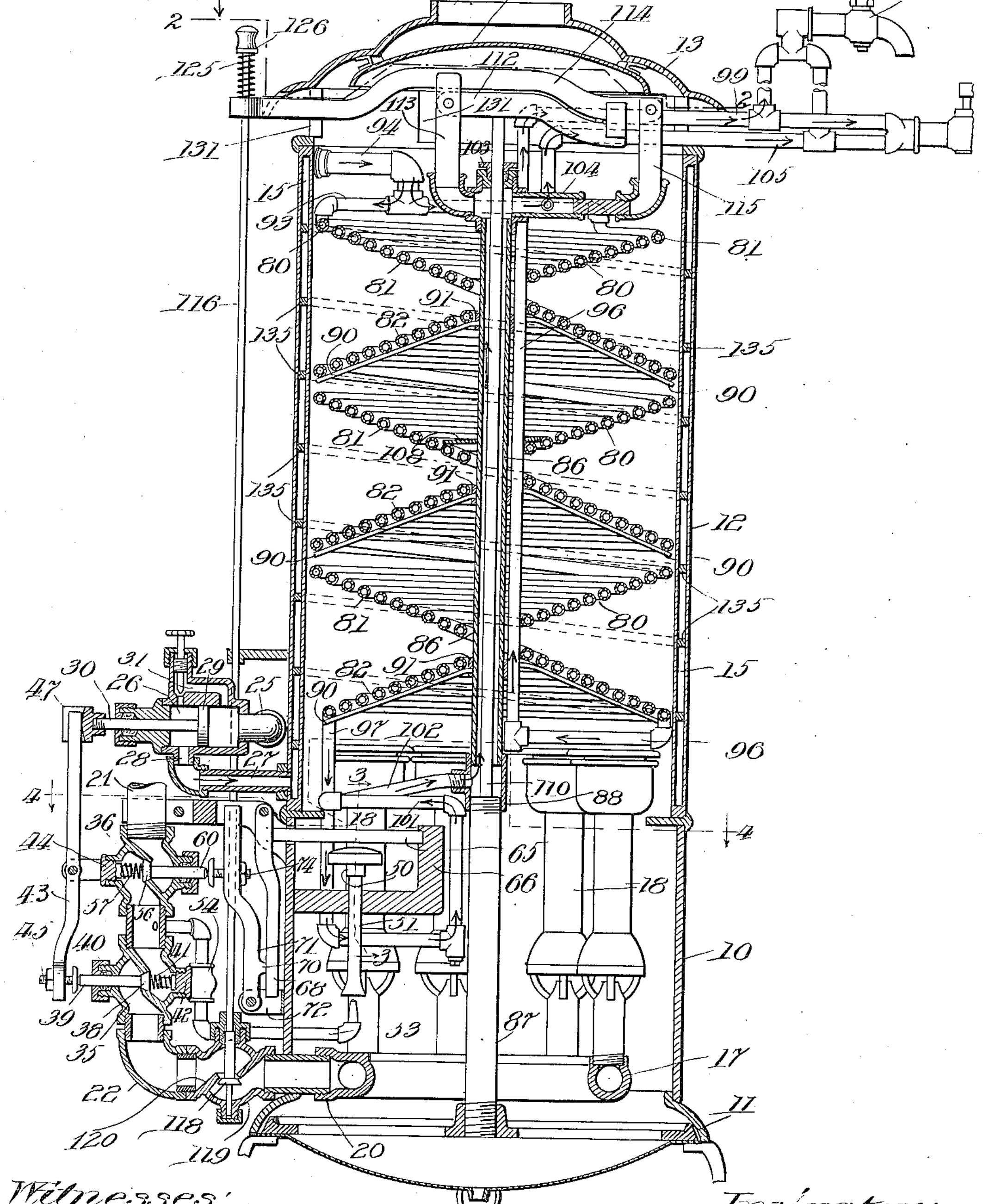
APPLICATION FILED AUG. 16, 1909.

972,717.

Patented Oct. 11, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

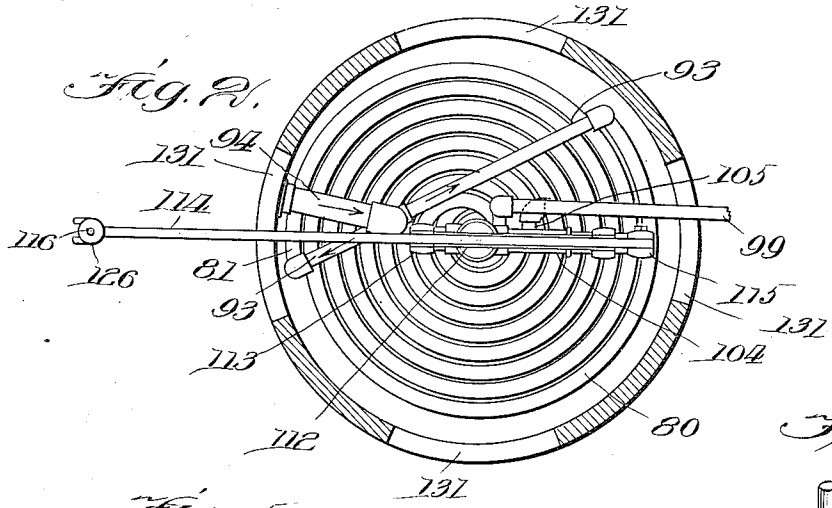


Fig. 3.

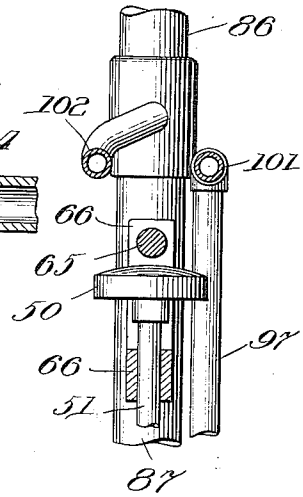


Fig. 5.

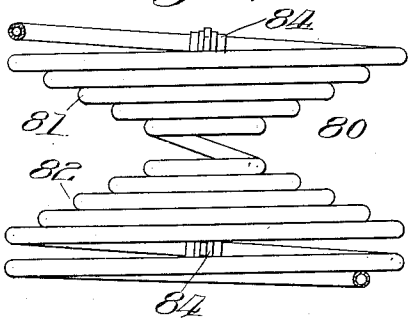


Fig. 6.

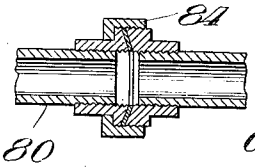
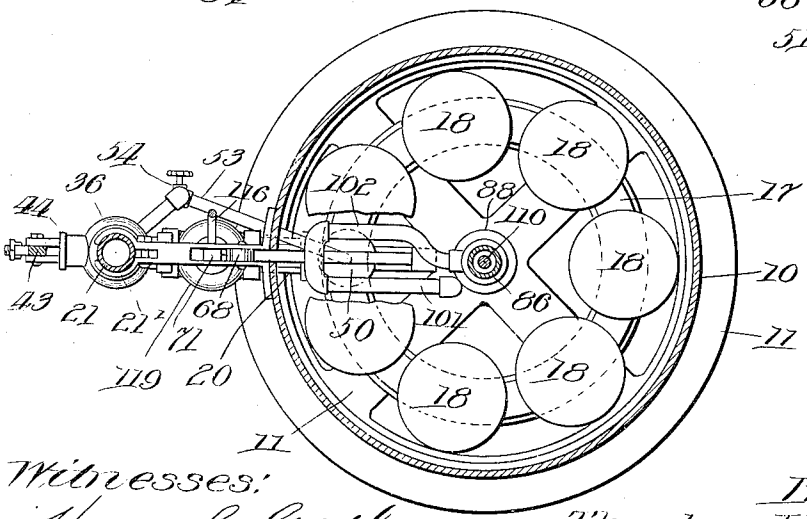


Fig. 4.



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UNITED STATES PATENT OFFICE.

THEODORE J. RADKE, OF OAK PARK, ILLINOIS.

WATER-HEATER.

972,717. Specification of Letters Patent. Patented Oct. 11, 1910.

Original application filed April 22, 1909, Serial No. 491,449. Divided and this application filed August 16, 1909. Serial No. 512,941.

To all whom it may concern:

Be it known that I, THEODORE J. RADKE, a citizen of the United States, and who is a resident of Oak Park, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Water-Heaters; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in water heaters for domestic uses of that kind in which cold water, taken from a cold water service pipe or like source of supply, is circulated through a system of coils, contained in a suitable casing or shell on its way to a hot water outlet or outlets, and is heated in said coils while passing therethrough by the application of heat from suitable burners placed below the coils; the arrangement being such that the cold water is quickly heated to the required temperature, and as fast as it flows through the coils to the draw-off faucet. Water heaters of this character embrace one or a plurality of main burners for furnishing heat to the coils which are automatically supplied with gas when cold water is admitted to and flows through the coil and from which the gas is cut off when the flow of cold water to the coil is cut off, and a pilot burner which remains lighted during the normal operation of the heater to light the main burners when gas is supplied. The operation of drawing water from the coil through a draw-off faucet, automatically admits cold water to the inlet side thereof and gas to the main burners, and to light said main burners to heat the water as it flows through the coils. In heaters of this character as heretofore made, the water in the coil cools, after a period of inaction, and it is necessary when drawing water from the device to draw off all the water from the pipe or coil between the burners and draw off faucet before hot water begins to flow at the faucet.

Among the objects of the invention is to provide within the device a self-contained circulation loop or conduit, embracing the heater coils, which extends to the draw-off faucet at the outlet side of the coils, and to place a portion of this loop under the influence of the pilot burner, or other suitable source of heat, so that there is maintained within the coil a supply of heated water which is constantly circulating past the faucet, so that heated water begins to flow from the faucet as soon as it is opened, thus avoiding the necessity of drawing off a volume of cool water preliminary to the heating of the water admitted to the inlet side of the coil.

A further object of the invention is to provide within the device a divided circulation to one part of which cold water is admitted and from another part of which the heated water is withdrawn. This arrangement admits of the circulatory coils being made of relatively small diameter so that the water circulating therethrough may be readily heated, and also provides for the passage of an ample volume of water through the coils within a given time when the draw-off faucet is opened.

A still further object of the invention is to arrange the coils of the two part or branched circulatory system in such a way that both branches may be nested together and arranged symmetrically with respect to the burners, so that both branches of the circulatory coils receive heat uniformly from the burners.

Other objects of the invention are to improve and simplify the construction and arrangement of the parts of the heater and to render the construction exceedingly compact and the operation thereof simple and efficient.

The invention consists in the matter hereinafter set forth and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a central vertical section of a heater embodying my invention. Fig. 2 is a cross section on line 2—2 of Fig. 1. Fig. 3 is a detail vertical section on line 3—3 of Fig. 1. Fig. 4 is a horizontal section on line 4—4 of Fig. 1. Fig. 5 is a side elevation of one of the double helices constituting a section of the circulatory coil. Fig. 6 is a detail illustrating the manner of joining one of the coil sections to a like coil section.

The casing or shell of the heater comprises a cast metal section 10, which is supported on the base 11, an upper jacket section 12 and a cap portion 13. The section 12 of the casing, when made to constitute a water jacket may comprise inner and outer thin

sheet metal walls which incloses an annular water space 15.

Contained within the lower section 10 of the casing is a horizontal burner ring 17 which supports and is in communication with a plurality of upright burner tubes 18, 18 which may be made of any suitable or preferred construction. The burner ring is provided at one side with an inlet nipple 20 which communicates with a gas supply pipe 21 through the medium of a conduit, designated as a whole by 22, which latter is made up of a number of suitably connected pipe sections and valve fittings, as will hereinafter more fully appear, arranged to control the supply of gas to the burners. The pipe 21 and conduit 22 are supported on a bracket 21′ which extends laterally from the lower cast section of the casing.

25 designates a cold water inlet or service pipe. It opens into a cylindric valve casing 26 that may be supported in any suitable manner on the casing of the heater. Said valve casing communicates, as herein shown, with the annular water space 15 of the heater casing through the medium of a pipe 27 which communicates with a port 28 at the lower side of said valve casing. A piston valve 29, is located within the casing 26 between the inlet or service pipe 25 and the port 28 and controls the supply of water to the circulatory system of heater. The piston valve is forced inwardly by the pressure of the water in pipe 25 when the pressure on the other side of the piston valve is reduced by the withdrawal of water from the outlet side of the circulatory system, and when said piston valve passes the port 28 water is free to flow from the service pipe 25 to the circulatory system as will hereinafter appear. A by-pass 31 connects the inner and outer ends of the cylindric valve casing 26 so as to equalize the pressure on the opposite sides of the piston valve to allow the valve to open and close promptly.

The conduit 22 is provided with a main valve designated as a whole by 35, which controls the passage of gas to the main burners, and above said main valve with a pilot valve designated as a whole by 36 which controls the supply of gas to the pilot burner, and is also arranged to cut off gas from both the pilot and main burners. The main valve 35 is provided with a ported partition, the port of which is controlled by a conical valve disk 38 provided with a stem 39 that extends outwardly through a stuffing box 40 of the valve casing. Said valve disk is held to its seat by a spring 41, interposed between the same and a screw-threaded plug 42 on the inner side of the valve casing. The said valve disk is opened against the action of the spring 41 by means of a vertically swinging lever 43 which is operatively connected with and is controlled by the water inlet valve. Said lever 43 is pivoted between its ends to a plug 44 that is screw threaded to the outer side of the pilot valve casing 36. The said lever carries at its lower end a screw threaded adjusting stud 45 having a rounded head which bears against the outer end of the stem 39 of the main burner valve disk 38. At its upper end said lever 43 carries a loosely fitting collar 47 that has screw threaded connection with the outer end of the stem 30 of the piston valve 29. With this arrangement, when the water valve is opened the main burner gas valve is at the same time automatically opened to admit gas to the burners, and when the water valve closes the gas valve is closed by its spring 41.

50 designates a pilot burner located within the casing section 10, below the level of the heads of the main burners 18. The mixing tube 51 of said pilot burner is supplied with gas through a pipe 53 which enters the conduit 22 between the main and pilot burner valves. Said pipe is provided with a throttle valve 54 to limit the flow of gas therethrough. The pilot valve casing is provided with a ported partition, the port of which is controlled by a conical valve disk 56 that is held against its seat by a spring 57 which is interposed between said disk and the screw threaded plug 44 before referred to. The said valve disk 56 is provided with a stem 60 which extends inwardly through a stuffing box at the inner side of the casing.

65 designates a horizontally arranged thermostatic bar located above the pilot burner. It may be made of brass or other expansive material. The said bar is fitted to and is supported at its inner end on a bracket 66 that extends inwardly from the casing section 10. The outer end of said bar extends through an opening in said casing section, and engages at its outer end a vertically swinging lever 68 that is pivoted at its upper end to the adjacent bracket 21′, the bar engaging said lever near its pivoted end. The said lever 68 extends downwardly alongside the casing section 10 and engages near its lower end an inwardly extending lug 70 on a lever 71 arranged outside of and generally parallel with a lever 68. The lever 71 is pivoted at its lower end to an arm or bracket 72 extending laterally from the lower casing section, said lug 70 being located near the pivoted end of the lever 71. The lever 71 carries at its upper end a screw threaded contact stud 74 having at its outer end a rounded head which engages the inner end of the stem 60 of the pilot valve disk 56. The upper end of the lever 71 extends into a slotted portion of the supporting bracket 21′ whereby it is guided in its vertical movement. The pivot bracket 72 of the lever 71 may be likewise slotted to engage and guide the lower end of the lever 68.

The compound system of levers described and the thermostatic member 65 are so arranged and adjusted that when the pilot light is burning and its flame is impinging against the thermostatic member, the pilot burner valve will be held open sufficiently to supply gas to the pilot burner, and also to supply gas through the main valve to the main burners when open. When no water is being drawn from the circulatory heating coil, the main burner valve will be closed and the only gas supplied will be through the pilot gas valve, regulated by the throttle valve 54 in the pipe 53. In the event of accidental extinguishment of the pilot light, the thermostatic member 65 will become cool and will contract to allow the spring 57 to close the pilot burner valve, and thereby avoid the wasteful and dangerous escape of gas at such time. Not only is gas prevented from escaping through the pilot burner, but gas is at such time shut off from the main burner valve in case such valve be opened by the opening of the water valve. In first lighting the pilot burner, the pilot valve may be held open temporarily by pressure applied to the lever 71, and until the thermostat 65 becomes heated sufficiently to hold the pilot valve open.

Referring now to the arrangement of the circulatory coils, in which the water is heated as it passes therethrough and from which the hot water is drawn, the same is made as follows: The said coils are contained within the jacketed section 12 of the heater casing, and as herein shown, comprise a plurality of superposed sections, each consisting of two double helices 80. Each double helix consists of an upper member 81 and a lower member 82 as shown in Fig. 5. The two helical coils of each section are nested together with the turns of their coils alternating. The said superposed helices are connected at their sides by unions 84, as shown more clearly in Fig. 6. The said coils connected as described, are arranged symmetrically within the heater casing about a central vertical tube or pipe 86 that is supported at its lower end on a post or standard 87 rising from the base 11 of the casing, and connected to the pipe by a screw-threaded sleeve or juncture fitting 88. The said pipe 86 is provided with a plurality of superposed sets of radial downwardly and outwardly inclined supporting arms 90 which are attached at their inner ends to collars 91 fixed to said pipe 86 and extend at their outer ends to points near the casing wall. The lower members 82 of the helical coil sections rest on and are supported by the said arms 90, while the upper sections 81 are supported from the lower sections by reason of their integral connection therewith. Each branch of the coil thus arranged is connected at its upper end to a cross pipe 93, which latter is connected by a pipe 94 with the water space 15 of the section 12 of the heater casing. The point of connection of said pipe 94 with the cross pipe 93 constitutes the dividing point of a branched circulatory system, and from this point the water circulates downwardly through the two branches of the coils toward the burners. Said two branches of the coils communicate at their lower ends with pipes 96, 97, said pipes leading from the opposite sides of the coils. The pipe 96 extends radially inwardly and thence upwardly alongside the central coil supporting pipe 86 and terminates at its upper end in a horizontal draw off pipe 99 which leads to a faucet 100. The pipe 97 extends downwardly and thence radially inwardly and thence upwardly alongside the post or standard 87, and its upper end communicates with a radially arranged return bend, consisting of two generally horizontal members 101, 102. The end of said return bend enters the sleeve or fitting 88 that connects the central coil supporting pipe 86 with its supporting standard 87, and communicates through said sleeve or fitting with the pipe 86. The pipe 86 is provided at its upper end with a fitting 103 having a lateral branch 104 that communicates with a draw off pipe 105 that is arranged generally parallel with the draw off pipe 99. Said pipes 105 and 99 have looped connection with the draw off faucet 100.

It will thus be seen that water entering the divided coils from the pipe 94 passes downwardly through the separate coils, and that the water from one of the coils or branches passes upwardly through the pipe 96 and draw off pipe 99 to the faucet 100, while water from the lower end of the other coil or branch passes through the pipe 97, through the members 101, 102 of the return bend, the coil supporting pipe 86 and draw off pipe 105 to the faucet. Thus when water is being drawn from the faucet the flow of water divides at the point of connection of the pipes 94 and 93 and passes through the two branches of the coils to the faucet in parallel with said pipe 94 and faucet 100. With this arrangement I may make the coils of smaller cross section and thereby promote the rapid transmission of heat to the water, while avoiding resistance to the passage of water, such as would occur if water were passed through a pipe of like diameter and of a length equal to the combined lengths of the two branches.

It will be observed by reference to Fig. 3 that the pilot burner head is provided with a central opening, immediately beneath the thermostatic member 65 and with two side openings arranged to direct flame against the members of the loop or return bend.

The provision of the divided or branched

circulatory coils within the heater casing, connected at one side with the service water pipe and at its other side with the draw-off faucet, provides within the heater (when no water is being withdrawn therefrom) a closed loop through which the water may circulate, the branches of the loop being connected in series so that all the water in the loop circulates continuously past the pilot burner and the faucet, and the arrangement of the pilot burner adjacent to the lower part of this loop provides means for maintaining a circulation of water in said loop and for keeping the water which circulates through the loop heated. This arrangement is of great practical advantage inasmuch as the water at the faucet is always heated so that the first water drawn off from the faucet is hot water. While the water is drawn off from the coils cold water enters the coils and said cold water is heated as it passes through the branches of the coils. There is therefore an uninterruption of the flow of hot water from the faucet from the time the faucet is opened to draw the water from the device until the faucet is closed after the withdrawal of all the water required. The arrows in Figs. 1 and 2 of the drawing indicate the course of the water through the coil when water is flowing through the coil and out of the faucet. The circulation of water through the coil, when the faucet is closed, is in the same direction through one branch, but in a reverse direction through the other branch.

A horizontally arranged deflector 108 is shown as supported on the coil supporting pipe 86 a distance above the bottom coils to deflect the flames outwardly over the inclined nest of coils and prevent them passing centrally upwardly through the casing around the said pipe 86.

Means are provided for maintaining a substantially uniform temperature of water drawn from the device while the faucet is open for that purpose. Said means embraces a thermostatic member that is exposed to the heat of the outflowing hot water, and which is connected with and controls the supply of gas to the main burners. My improved arrangement for effecting this result is made as follows:

110 designates a thermostatic bar, made preferably of zinc, that is contained within the hot water outflow pipe 86. It is seated at its lower end on the upper end of the standard 87 and extends at its upper end through a stuffing box in the fitting 103 at top of said pipe 86. The bar engages at its upper end the underside of a vertically swinging lever 112 which is pivoted at one end to a bracket 113 supported on said fitting 103. The lever 112 bears at its other end against the under side of a second lever 114 which is pivoted at one end to a bracket 115 supported on the fitting 103. Said latter lever extends at its other end outside the casing through an opening in the cap member 13, and it is provided at its outer end with a vertical opening through which extends a rod or link 116. Said link extends downwardly alongside the heater casing and carries at its lower end a valve disk 118, located within a valve casing 119, which constitutes part of the gas supply conduit 22. The said valve disk 118 is an upwardly closing disk and controls a port in a diaphragm or partition 120 in said valve casing. The thermostatic bar 110 is so adjusted with respect to the compounded levers 112, 114 as to close the valve disk 118 against its seat upon the rising of the temperature of the outflowing hot water above a predetermined point, while allowing the valve to remain open to permit gas to be supplied to the main burners up to the prescribed or normal temperature at which the water is intended to be delivered from the heater. A spring 125, interposed between the upper side of the lever 114 and a nut 126 screw-threaded to the upper end of rod 116, provides means for regulating the closing movement of said regulating valve.

The cap piece 13 is provided at its top with an opening 130 for the outlet of the products of combustion, over which a pipe is adapted to be set. In order to prevent cold air from falling downwardly through said opening upon the coils I provide the cap piece at its sides with a plurality of openings 131, and arrange between the outlet opening 130 and said side openings 131 a deflector plate 132 which deflects air falling downwardly through the opening 130 to and through the radial or side openings 131.

The water space 15 is divided by a partition or partitions arranged to direct the water on its way from the pipe 27 to the pipe 94 through restricted passages around the jacketed section 12. As herein shown a spiral passage is thus formed by a spirally arranged partition 135 which extends from the bottom to the top of said water space.

It will be observed that the branch of the coil that is heated by the pilot burner extends below said burner so that the circulation in said branch is forced toward the faucet instead of toward the cold water inlet side of said branch.

It will be understood that the structural details of the heater and its regulating devices may be varied within the spirit and scope of the invention and I do not limit the invention to the details herein shown, except as such details may be made the subject of specific claims.

I claim as my invention:

1. A water heater comprising a casing,

a heating coil therein divided into two branches, means at the upper end of the casing for connecting said branches with a source supplying cold water, main burners and a pilot burner below said coil, the branches of said coil communicating at their lower ends with pipes which are connected in looped arrangement with a draw-off faucet, one branch of said coil being subjected to the constant heat of the flame of the pilot burner, and arranged to direct the circulating water through the branches of the coil and past the faucet when said faucet is closed and to thereby maintain the water heated in the branched coil.

2. In a water heater, a heating coil divided into a plurality of branches through which the water may circulate in series when no water is being withdrawn from the coil, a cold water pipe and a draw-off device with which said branches are connected in parallel, a main burner for heating said coil and a pilot burner arranged to supply constant heat to one of the branches in a manner to maintain a constant circulation of water through the coil when the draw-off device is closed.

3. In a water heater, a heating coil divided into a plurality of branches through which the water may circulate in series when no water is being withdrawn from the coil, a cold water pipe having branched connection with said branches at the top of the coil, a draw-off device having looped connection with said branches, a burner beneath the coil for heating the same and a pilot burner arranged to supply constant heat to one of the branches in a manner to maintain a circulation of water through the coil when the draw-off device is closed.

4. In a water heater, a casing, a heating coil divided into two branches through which the water may circulate in series when no water is being withdrawn from the coil and connected with a source supplying cold water, said branches extending beyond the casing, a faucet having looped connection with said branches beyond the casing, a burner for heating said coil and a pilot burner arranged to supply constant heat to one of said branches in a manner to maintain a circulation of water through the coil when the faucet is closed.

5. A water heater comprising a casing, a heating coil therein comprising a plurality of branches having a common feed pipe, each branch consisting of coils arranged in series, a draw-off faucet having direct looped connection with the branches of said coil, whereby water flows through the branches in parallel when the draw-off faucet is open, main burners for heating said coil, and a pilot burner, one of the branches having a portion which is subject to the constant heat of the pilot burner, whereby a circulation of heated water is maintained through the branches in series when the draw-off faucet is closed.

6. A water heater comprising a casing, a circulatory coil therein divided in two branches, each branch comprising a series of superposed sets of coils with the turns of the coils of the two branches in each set arranged in alternation, said branches being connected at one end of the coil with a source supplying cold water and at the other end thereof with a draw-off device, and burners for heating said coils.

7. In a water heater, a casing, a circulatory coil therein divided into two branches, each branch comprising a series of superposed sections having the form of double helices, the helical sections of the two branches being nested together with the turns of the coiled branches of each section arranged in alternation, said branches being connected at one end of the coil with a source supplying cold water, and at the other end of the coil with a draw-off device, and burners arranged beneath the coil for heating the same.

8. In a water heater, a casing, a water heating coil therein, a cold water feed pipe communicating with the upper end of said coil, the lower end of the coil communicating with an outflow pipe which extends centrally upwardly through said coil and provided with a draw-off device and means for supporting the coil on the upwardly extending outflow pipe.

9. In a water heater, a casing, a water heating coil therein arranged in two branches, each comprising a series of superposed coil sections, a cold water feed pipe communicating with the upper ends of said branches, one of said branches having an outflow pipe which extends upwardly through said coil sections, means for supporting said coil sections on the upwardly extending outflow pipe, the other branch being provided with an outflow pipe and a draw-off faucet having looped connection with said outflow pipes.

10. In a water heater, a casing, a water heating coil therein arranged in two branches, each comprising a series of superposed coil sections, a cold water feed pipe communicating with the upper ends of said branches, one of said branches having an outflow pipe which extends upwardly through said coil sections, means for supporting said coil sections on the upwardly extending outflow pipe, the other branch being provided with an outflow pipe, a draw-off faucet having looped connection with said outflow pipes, and main burners and a pilot burner below said coil, one of said branches having a part which is subject to the constant flame of the pilot burner.

11. In a water heater, a casing, a vertical

pipe located centrally therein, a water heating coil arranged in two branches, each branch comprising a series of superposed coil sections, supports carried by said central pipe upon which said coils are supported, a cold water supply pipe communicating with the upper ends of said branches, the lower end of one branch having an outflow pipe which extends upwardly through the casing and outwardly therefrom for connection with a faucet, and the lower end of the other branch communicating with the lower end of said central pipe, and a draw-off pipe communicating with the upper end of said central pipe and with said faucet.

12. A water heater comprising a casing, a circulatory coil therein divided into branches connected in parallel with a source supplying cold water and with a draw-off device, main burners for the heating coil and a pilot burner, means for supplying gas to said burners, one of the coil branches being subjected to the constant heat of the pilot burner whereby is maintained a circulation of water in the branched coil when the draw-off device is closed, and the pilot burner heated branch extending below the level of said pilot burner.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 12th day of August A. D. 1909.

THEODORE J. RADKE.

Witnesses:
W. L. HALL,
W. GOLDBERGER.