March 10, 1936. H. W. A. JOHNSON ET AL 2,033,904

HEATER

Filed Sept. 20, 1934

Fig. 1.

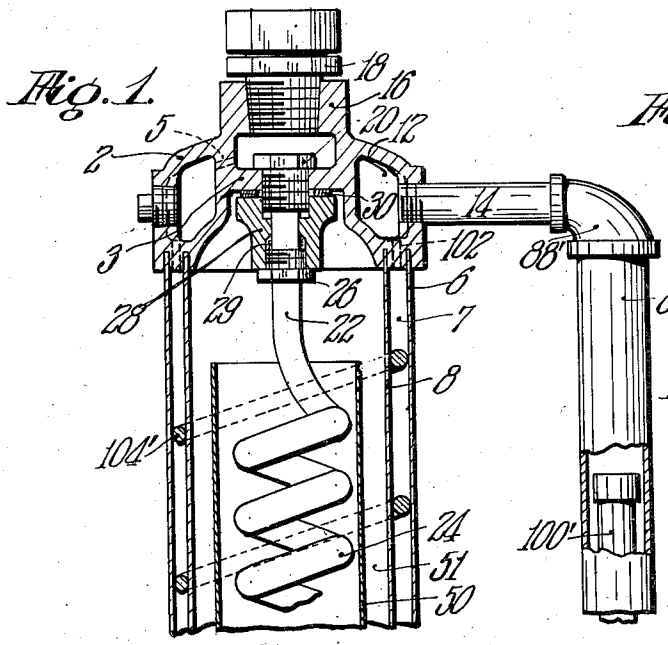


Fig. 2.

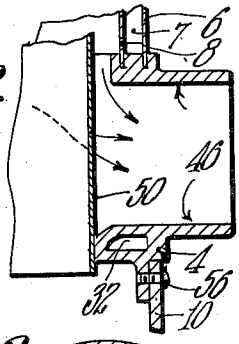


Fig. 3.

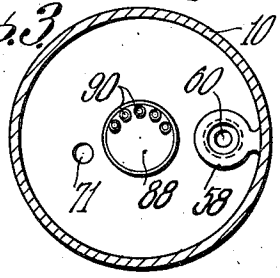


Fig. 4.

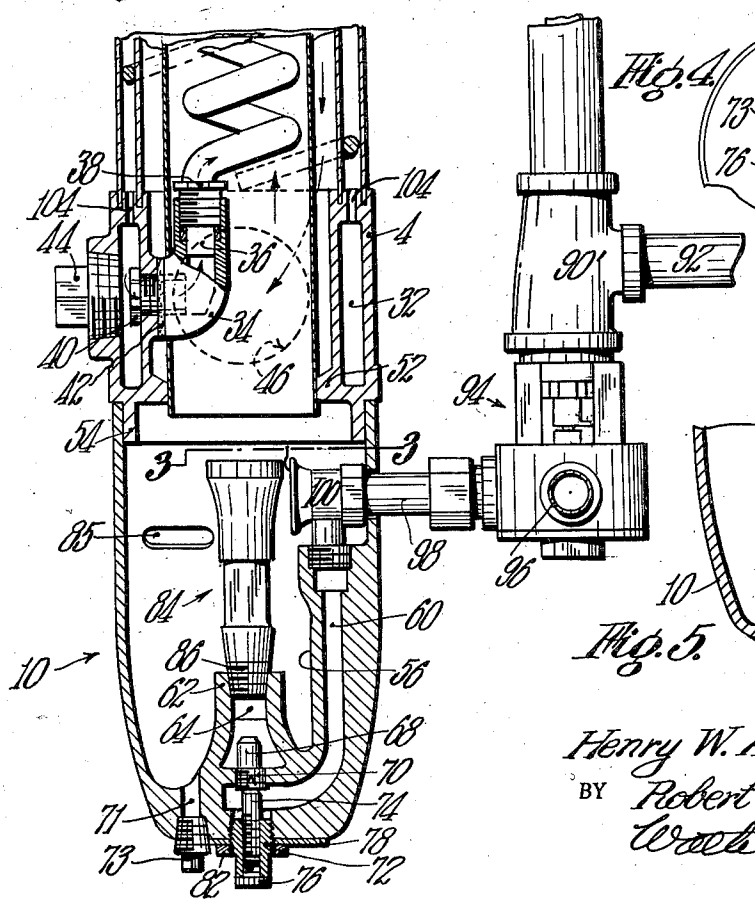
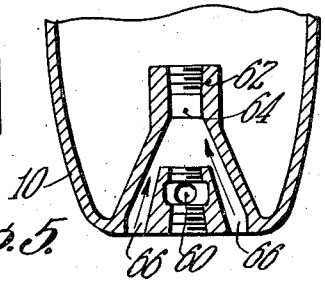


Fig. 5.



INVENTORS

Henry W. A. Johnson

BY Robert H. Moore

Wood, Cross

ATTORNEY.

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UNITED STATES PATENT OFFICE

2,033,904

HEATER

Henry W. A. Johnson, Roslindale, and Robert H. Moore, Lexington, Mass., assignors to J. W. Moore Valve Corporation, Everett, Mass., a corporation of Massachusetts

Application September 20, 1934, Serial No. 744,760

3 Claims. (Cl. 122—169)

This invention relates to improvements in water heating apparatus and is directed more particularly to water heaters of the type commonly known as side arm heaters which are used in connection with domestic hot water systems and the like.

One object of the invention is the provision of a heater of the type referred to which is simple in construction so as to be economical to manufacture and is accomplished by the novel combination and arrangement of related parts as will hereinafter appear.

Another object of the invention is the provision of a heater constructed and arranged in such a way as to operate with the greatest efficiency. A relatively large amount of water is heated with a minimum fuel consumption and this is by reason of the novel combination and arrangement of parts to be hereinafter described.

Numerous and various other novel features and advantages of the invention will be more fully hereinafter referred to in connection with the accompanying description of the present preferred form of the invention reference being had to the accompanying drawing wherein:

Fig. 1 is an elevational sectional view showing a heater structure embodying the novel features of the invention;

Fig. 2 is a partial sectional elevational view showing the flue of the heater and its relation to other parts thereof;

Fig. 3 is a sectional plan view on the line 3—3 of Fig. 1;

Fig. 4 is an inverted plan view of the lower drip cup of the heater; and

Fig. 5 is an elevational view through the drip cup taken in a plane at an angle to that of the section shown in Fig. 1.

Referring to the drawing more in detail the invention will now be fully described.

In a general way the heater comprises an upper cap or header 2 and a lower base 4 disposed at opposite or upper and lower ends of spaced outer and inner tubular shells 6 and 8 and a drip cup 10 located below the base has burner mechanism associated therewith.

The cap 2 is provided with an annular water chamber 12 for receiving cold water through a pipe 14. A hub 16 on the upper end of the cap threadedly receives a coupling 18 to which may be secured in any well-known manner an offtake pipe so that water may circulate from the heater.

The tubular shells 6 and 8 are spaced apart as shown and have their upper ends secured to the cap 2 in any well-known manner as by being secured in suitable grooves by brazing, welding or the like, or of course the jointure between the shells and caps may be made by a pressing operation, screw threads, or by any other well-known means.

A hollow coupling gland 20 is screw-threaded in a web 3 of the cap and receives the upper end 22 of a coil 24. A bushing 28 threadedly receives the lower end of the member 20 and is also hollowed out for receiving the end 22 of the coil while a gland 26 is screwed into the lower end of the bushing to compress packing such as 29. There is a ring of packing 30 between the bushing 28 and web 3. By means of the parts just described, the upper end of the coil is secured to the cap and as will be observed, there is space around the part 20 which is separate from the water chamber.

As a special feature of the invention, the threaded part of member 16 is relatively large so that the tapped opening in the hub 16 is larger in diameter than the diameter of the gland 20. This is to permit insertion of the gland 20 through the opening and facilitates manipulation of the gland 20 for making up the connections between the coil and cap.

The base 4 is secured to the lower end of the shells 6 and 8 after the manner already described in connection with the cap and upper ends of the shells and the base has a chamber 32 therein as shown.

An elbow 34 is provided, to which the lower end 36 of the coil 24 is connected by means of a gland 38 which is threaded in the upper end of the said elbow. A hollow coupling 40 is in threaded engagement with the lower end of the member 34 and a packing 42 is provided so that the member 34 may be secured to the base in a tight manner. Thus the lower end of the coil is detachably connected to the compartment 32 of the base 4.

A plug 44 is screwed into the base which is preferably somewhat larger in diameter than the diameter of member 40. This is so that the member 40 may be inserted through the opening for the plug 44 and facilitates making up the connections for the lower end of the coil as described.

A flue 46 is provided which extends through a side of the base 4 and of course is out of communication with the water chamber 32 of the base, as indicated in Fig. 2.

A combustion tube 50 extends upwardly and is spaced from the inner shell 8 and from the coil 24. Thus there is provided a space between it and

the inner shell 8. The upper end of the tube 50 preferably terminates at a point below the cap or, if desired, it may extend to the cap and be provided with notches or opening therethrough at or adjacent its upper end. The lower end of the tube 50 may be secured to an inwardly extending flange 52 of the base or in any other suitable manner so that the said tube 50 is held against displacement.

The drip cup 10 is arranged so that its upper end slips over a flange 54 which extends downwardly from the base 4 and may be held in place as by screws such as 56 threadedly engaging the flange 54 of the base. A boss 58 is provided on the inner side of the cap 10 which extends therein and is joined to a central hub 62. The boss 58 is hollowed out to have a fuel passageway 60 which extends downwardly and inwardly, as shown.

The said central hub 62 has a chamber 64 therein into which leads from the bottom of the cup one or more air passages such as 66 (see Fig. 5). A hollow nozzle 68 has a part 70 which is screw-threaded in the hub 62 above the fuel passageway 60 and a fitting 72, screwed into the lower side of the cup, has a needle valve 74 in threaded engagement therewith.

A plug screw 76 in the end of the fitting 72 is removable so that the needle valve 74 may be turned in one direction or the other to adjust the needle valve relative to the nozzle or tube 68. In this way the supply of fuel for the burner is controlled. An opening 71 in the lower side of the cup is normally closed by a plug 73 which may be removed for draining the cup.

A damper plate indicated by 78 may be provided which has openings such as 80 therethrough for registering with the air passageways 66 in the lower side of the cup 10 and a nut 80 on the member 72 may be provided for clamping the plate 78 in various positions of adjustment to facilitate adjustment of the air opening or openings extending into space 64.

A burner nozzle indicated by 84 has a screw-threaded portion 86 by means of which it is secured to the hub 62 and its upper end may have a cap 88 which is provided with a multiplicity of openings such as 90 so that a plurality of jets of fuel may be discharged through the nozzle. A plurality of vent openings such as 85 which may be of any form or shape desired are provided through the side wall of the drip cup 10.

A column 86' preferably in the form of a pipe is connected at its upper end by means of a fitting 88' to the pipe 14 associated with the cap 2 while its lower end is connected as by a T 90' or other suitable fitting to a water inlet pipe 92. Below the T 90' there is a fuel-control valve mechanism 94 to which a fuel supply is connected as by a pipe 96. A fuel connection 98 extends from the control mechanism 94 into and through the drip cup and carries on its inner end a fuel shut-off mechanism indicated by 100 which has its lower end in threaded engagement with the boss 56 and in communication with the fuel passageway 60.

The mechanisms 94 and 100 form no part of the present invention and are shown for illustrative purposes only. Any mechanism may be located at 94 which has the ability to control the supply of fuel to the heater according to temperature variations and the mechanism 100 may take various forms but will be arranged to shut off the supply of fuel should the flame at the burner be cut off. A thermostat tube 100' associated with the mechanism 94 extends upwardly within the column 86 for operating the said mechanism 94.

One or more passageways such as 102 are provided in the cap which serve as connections between the water chamber 12 of the cap and the space 7 between the outer and inner shells 6 and 8. One or more bleed holes indicated by 5 may connect the water chamber of the cap with the space therein around the gland 20 while other passageways 104 are provided in the base between the water chamber 32 thereof and the space 7 between the outer and inner shells 6 and 8.

A baffle 104' is provided in the space between the outer and inner shell members 6 and 8 and this is preferably arranged spirally so as to cause water to take a circuitous course downwardly and around through the passageway from the cap to the base.

The apparatus may be connected to hot water systems of various types and used in various ways. For the purpose of describing the operation of the apparatus in a rough way it will be assumed that the water inlet pipe 92 and an outlet or takeoff pipe extending from the upper connection coupling 18 are connected to a hot water storage tank so that the heater is in series with the said storage tank. When so connected, water enters through pipe 92 and circulates upwardly through the column 86 and pipe 14 into the water chamber 12 of the cap or head. Then the water circulates down and around through the passageways 102 and around the water passageway 7 between the outer and inner shells and into the water chamber of the base through openings 104. From the chamber 32 of the base 4 the water circulates through the connections 40 and 30 upwardly through the coil 24 and out through the offtake at the upper side of the cap.

It will be assumed that the pipe 96 is connected to a fuel supply such as the gas supply. In that case gas flows through valve mechanism 94 and inwardly and downwardly through passageway 60 and past needle valve 74 and through nozzle 68 and then upwardly through space 64 and into burner 84. The needle valve is adjusted to regulate the desired amount of gas being supplied the burner. Air enters through the passageways 66 in more or less amount according to the adjustment of the plate 78 which, when used, may be set to provide the correct amount of air for the most efficient combustion. Air may also enter the opening or openings 85.

The products of combustion pass upwardly within the tube 50, then downwardly in the passageway between the said tube 50 and the inner shell 8 and then outwardly through flue 46. The supply of fuel is controlled by the control-valve mechanism operated by the temperature-sensitive thermostat while the cut-off mechanism indicated at 100 will operate to cut off the supply of fuel if the flame is extinguished.

It will be noted that the water takes a circuitous path downwardly and around from the cap to the base and then upwardly while the products of combustion pass upwardly through and around the coil and then downwardly adjacent the inner wall of the outer passageway. In this way, there is the most efficient heat transfer action which results in low-cost operation. Any condensation of atmospheric moisture falls into the drip cup which is relatively deep so that the condensation is vaporized by the heated burner and passes out through the one or more openings such as 84 in the cup.

The means for connecting the lower end of the coil to the outer water compartment not only serves to provide a detachable connection but it is not as susceptible to injury by the flame over the burner as is the case with a coil which is readily attacked by the gases which must be replaced from time to time because it is impaired by the impinging flame and gases.

It will be noted that the apparatus is formed by co-operating separate parts. That is, a cap and base associated as they are with the shells **6** and **8** facilitate economical manufacture and ready assembling and at the same time it is possible to provide a structure which is not only rugged and substantial but which is pleasing in appearance. The cap and base, as well as the shells, may be made from such materials as are best adapted to withstand the service to which the heater is subjected. The means for connecting the coils to the cap and base not only facilitate easy and ready assembling of the parts but makes it possible to easily and readily replace a coil should it be necessary.

Various modifications and changes may be made in the form of the apparatus without departing from the spirit and scope of the invention and therefore it is not desired to be limited by the foregoing description of the preferred form of the invention but, if at all, by the appended claims. What we desire to claim and secure by Letters Patent of the United States is:

1. A water heating apparatus comprising in combination, a cap having co-operating walls forming a water chamber and a water take-off, a base having an outer wall and an inner apertured wall forming a water chamber, separate outer and inner spaced shells having their opposite ends secured to said cap and base forming a water space therebetween, the said base and cap provided with passageways from the water chambers thereof to the water space between the outer and inner shells, a coil extending upwardly within the inner shell, separable connections between the upper end of said coil and water chamber of the cap, separable connections between the lower end of said coil and water chamber of the base, a central combustion tube around said coil and spaced from said inner shell, the first-named connections including hollow separable engageable members receiving the upper end of said coil engaging a wall of the said cap at a side of the water takeoff thereof and the last-named connections including an upwardly extending hollow member receiving the lower end of said coil at the inner side of the inner wall of the base and a hollow member engaging the outer side of said wall and said upwardly extending member, the outer wall of said base provided with an opening adjacent the last-named connection to permit access thereto and the said cap having an opening associated with the offtake thereof adjacent the first-named connections sufficiently large to permit a part of said connections to be withdrawn therethrough.

2. A water heating apparatus comprising in combination, a cap having co-operating walls forming a water chamber and a water take-off, a base having an outer wall and an inner apertured wall forming a water chamber, separate outer and inner spaced shells having their opposite ends secured to said cap and base forming a water space therebetween, the said base and cap provided with passageways from the water chambers thereof to the water space between the outer and inner shells, a coil extending upwardly within the inner shell, separable connections between the upper end of said coil and water take-off of the cap, separable connections between the lower end of said coil and water chamber of the base, a central combustion tube around said coil and spaced from said inner shell, the first-named connections including hollow separable engageable members receiving the upper end of said coil engaging a wall of the said cap at a side of the water take-off thereof and the last-named connections including an upwardly extending hollow member receiving the lower end of said coil at the inner side of the inner wall of the base and a hollow member engaging the outer side of said wall and said upwardly extending member, the outer wall of said base provided with an opening adjacent the last-named connection to permit access thereto.

3. A water heating apparatus comprising in combination, a cap having co-operating walls forming a water chamber and a water take-off, a base having an outer wall and an inner apertured wall forming a water chamber, separate outer and inner spaced shells having their opposite ends secured to said cap and base forming a water space therebetween, a baffle in said water space, the said base and cap provided with passageways from the water chambers thereof to the water space between the outer and inner shells, a coil extending upwardly within the inner shell, separable connections between the upper end of said coil and water take-off of the cap, separable connections between the lower end of said coil and water chamber of the base, a central combustion tube around said coil and spaced from said inner shell, the first-named connections including hollow separable engageable members receiving the upper end of said coil engaging a wall of the said cap at a side of the water take-off thereof and the last-named connections including an upwardly extending hollow member receiving the lower end of said coil at the inner side of the inner wall of the base and a hollow member engaging the outer side of said wall and said upwardly extending member, the outer wall of said base provided with an opening adjacent the last-named connection to permit access thereto.

HENRY W. A. JOHNSON.
ROBERT H. MOORE.