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WATER HEATERS

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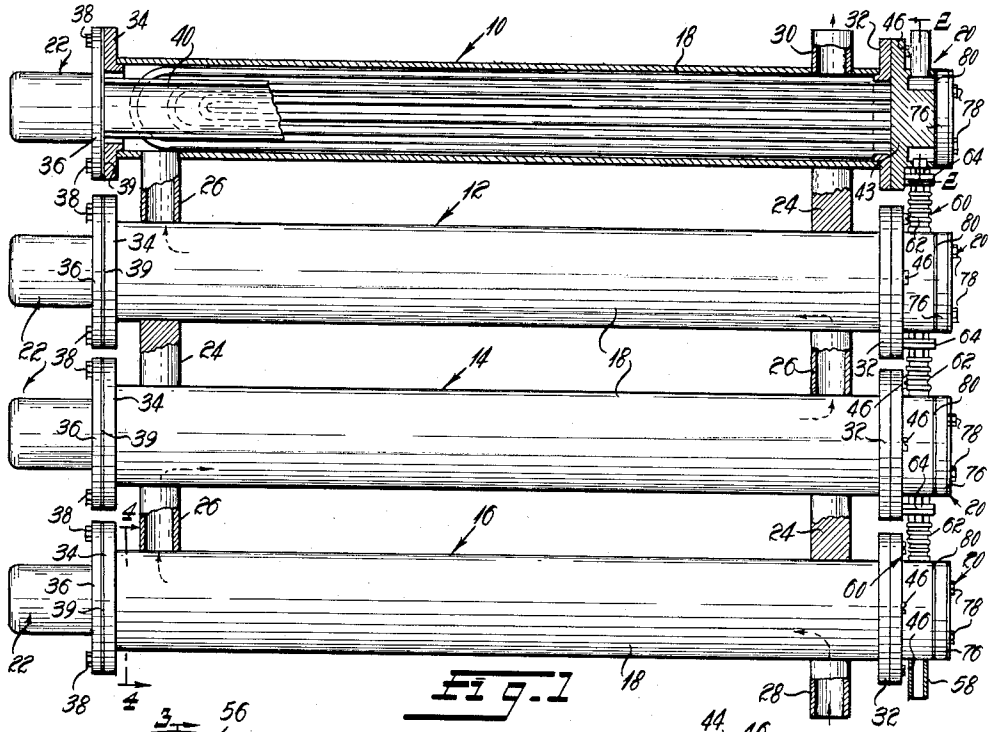


Fig. 1

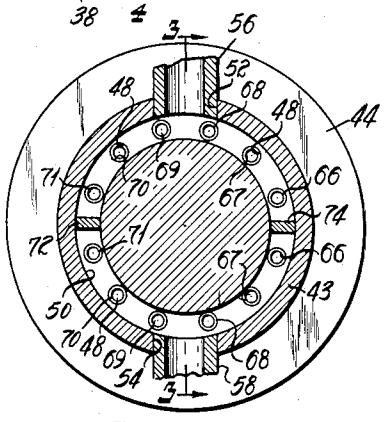


Fig. 2

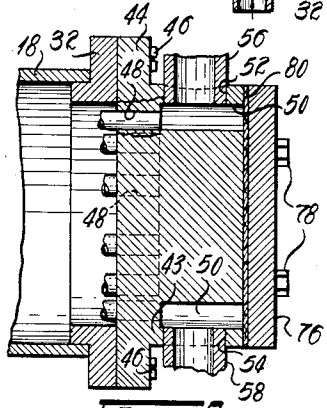


Fig. 3

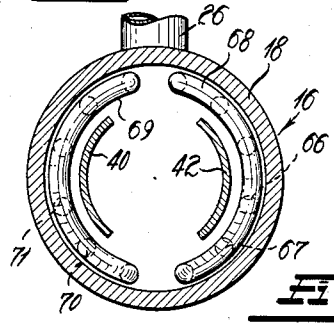


Fig. 4

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WATER HEATERS

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This invention relates to water heaters and more particularly to improved multi-stage water heaters which furnish hot water for heating purposes as well as domestic hot water.

While attempts have been made in the past to provide hot water heaters of this general type and their advantages have long been recognized, none of the prior attempts has achieved any appreciable degree of success and separate heaters for water for heating and domestic purposes are presently in widespread use.

It is believed that the failure of the prior combined units to win commercial acceptance is due to the inability of the prior units to maintain a high degree of efficiency for both types of heating services and the failure of the prior devices to achieve the degree of flexibility of operation and control necessary to permit the efficient satisfaction of the widely varying demands imposed by the two types of service.

It is accordingly the principal purpose and object of the present invention to provide improved combined hot water heaters which supply hot water for heating and domestic purposes with a degree of efficiency and flexibility not heretofore obtainable.

It is also an object to provide improved electrically operated multi-stage combined hot water heating units which supply water for both major purposes quickly and economically.

It is a further object of the present invention to provide improved combined hot water heaters which may be used efficiently and conveniently to supply hot water instantaneously or used with a separate storage tank if required by the service demands.

It is an additional object of the present invention to provide completely automatic electrical hot water systems which function without change for summer or winter requirements.

It is a further object of the present invention to provide novel combined hot water heaters in which the amount of water required to be heated is substantially below that required in units of comparable capacity.

It is also an object of the present invention to provide novel packaged combined hot water heaters which are entirely self-contained and which may be readily adapted to existing homes and which may be installed in new homes with a minimum initial cost and reduced operating cost.

It is a more specific object of the present invention to provide improved combined hot water heaters which comprise a number of similar major components which may be easily and quickly removed for inspection, cleaning and repair.

Additional objects and advantages will become apparent as the description proceeds in connection with the accompanying drawings in which:

FIGURE 1 is a side elevation of a combined hot water heater constructed in accordance with the present invention with parts broken away to show interior details;

FIGURE 2 is an enlarged fragmentary transverse section taken along line 2—2 of FIGURE 1;

FIGURE 3 is a vertical section taken along line 3—3 of FIGURE 2; and

FIGURE 4 is an enlarged fragmentary transverse section taken along line 4—4 of FIGURE 1.

Referring now more particularly to the drawings, the combined hot water heater of the present invention comprises a plurality of substantially identical stages indicated generally at 10, 12, 14 and 16, each of which is effective to supply hot water for domestic heating and for general heating purposes. While in the form shown in the drawings, four such stages are employed, the number of stages can be readily varied to provide the desired overall capacity, since the total capacity of the unit is a direct function of the number of stages employed.

The principal structural element in each of the stages is a cylindrical tube or casing member 18 to one end of which is detachably secured a domestic hot water heating coil assembly indicated generally at 20 and to the opposite end of which is detachably secured an electric heater assembly indicated generally at 22. The adjacent tube or casing members 18 are supported in vertically aligned spaced relation by cylindrical support members 24 and 26 which are welded or brazed at their opposite ends to the casing members 18. Members 24 are solid and provide only a support function while the members 26 are hollow and provide a path for the circulation of water between the adjacent stages. The members 24 and 26 are alternated so the water within each of the stages must flow the entire length of that stage before passing to the next adjacent stage. The inlet for water to be heated for general heating purposes is effected through a fitting 28 brazed or otherwise suitably secured to the righthand end of the lower surface of the lowermost stage 16, while the outlet is provided through a fitting 30 welded or otherwise secured to the upper righthand surface of the uppermost stage 10. The fittings 28 and 30 are suitably threaded for connection to the main piping system not shown.

Suitably secured by brazing or welding to the opposite ends of each of the tube members 18 are attaching flanges 32 and 34. The copper clad electric immersion heating units 22 are provided with flanges 36 which are detachably secured to the permanently installed mounting flanges 34 by a plurality of cap screws 38 threaded into tapped holes in the mounting flanges after installation of the usual gasket 39. The electric heating units 22 which are of conventional construction, are preferably provided with opposed heater elements 40 and 42 which are of semi-circular configuration and extend substantially the entire length of the respective stages in which they are installed. However other types of commercial immersion heaters may be used.

The water tube assembly 20 comprises a main adaptor member 43 having a flange 44 detachably secured by a plurality of cap screws 46 to the flange member 32. The adaptor member is provided with a series of through openings 48 which extend from the inner surface of the flange member 44 into an annular recess 50. Diametrically opposed upper and lower openings 52 and 54 connect the recess 50 with the exterior of the device. The opening 52 in the assembly 20 associated with the upper stage 10 leads into the interior of an outlet fitting 56 connected to the domestic hot water system not shown. The opening 54 in the assembly 20 associated with the lowermost stage 16 leads into a fitting 58 which is adapted to be connected to a water supply source. The openings 52 and 54 of the assemblies 20 associated with the intermediate stages 12 and 14 are connected to the opposite ends of flexible connector assemblies 60 which are provided with a flexible section 62 and a detachable connector 64.

The ends of U-shaped tubes 66, 67, 68, 69, 70 and 71 are silver soldered or otherwise secured in the openings 48. As best shown in FIGURE 4, the ends of the tubes at the U-bend are of arcuate shape to leave the central portion of the casing unobstructed from end to end to accommodate the electric heaters 40 and 42. It will be

noted that each of the tube assemblies has a lower pass below the center of the tube member 18 and an upper pass above the center of this tube. Horizontal baffles 72 and 74 are permanently installed in the recess 50 to block flow from the lower portion of the recess to the upper portion of the recess except through the tube assemblies 66–71.

Thus, as water enters the lower part of the recess either from the intermediate flexible connectors or from the inlet, it necessarily flows successively through the lower passes of the tubes which extend substantially the full length of the main casing members 18 and through the upper passes of each of the tubes to the portion of the recess 50 above the spacers 72 and 74 and exits from the device through the upper openings 52.

The outer ends of each of the tube adaptors are closed by imperforate cap members 76 detachably secured in place by a plurality of cap screws 78. In accordance with conventional practice gaskets 80 are compressed between the cap members 76 and the adjacent areas of the tube adaptor. Thus the path of the domestic water is entirely separate from the path followed by the water to be supplied for general heating purposes.

Since the heating elements for both systems are entirely electric, it will be appreciated that the system lends itself readily to automatic control. Such control can be effected with thermostats, aquastats and similar equipment which are wholly conventional and thus have been omitted from the drawings for simplicity. In both systems the water exits from the device at its point of highest temperature. Thermostats controlling the operation of the electric heater assemblies 22 will be so arranged that the heaters will be energized whenever the temperature of the main hot water supply or the temperature of the domestic hot water supply falls below a predetermined level. For wintertime operation, the unit will function under the control of two independent thermostats whereas for summertime operation only the domestic hot water thermostat will call for heat and no change need be made in the system to accommodate it either to winter or summer operation.

Removal of any of the heater elements 22 or the tube assemblies 20 can be effected readily to permit inspection, replacement or repair without affecting the remainder of the system.

From the foregoing it will be apparent that the above-stated objects and advantages of the invention have been attained by the provision of a novel combined hot water heater of compact, relatively simple and rugged construction which functions with an efficiency not heretofore obtainable.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A multi-stage electric heater for heating two separate bodies of water comprising a plurality of horizontal stages mounted in parallel spaced relation, each stage comprising a main hollow horizontal casing member having a bottom water inlet adjacent one end and a top water outlet adjacent the opposite end, an electric immersion heater detachably secured to one end of said casing member and extending internally thereof substantially to the opposite end thereof, a coil unit detachably secured to said opposite end of said casing, each coil unit comprising a header assembly, baffles in said header assembly providing upper and lower independent chambers therein sealed from the interior of said casing member, a series of U-shaped coils carried by said header assembly and extending substantially the full length of said casing and having one leg extending below the horizontal centerline of said casing and in communication with said lower chamber and the other leg extending above the horizontal centerline of said casing and in communication with said upper chamber, fluid conduits connecting the upper chamber of one header assembly with the lower chamber of the header assembly of the next adjacent stage, and a plurality of support members extending between the adjacent ends of adjacent stages, alternate ones of said support members being hollow and in communication with the outlet of one stage and the inlet of an adjacent stage.

2. The electric heater according to claim 1 wherein said immersion heaters each comprise a pair of arcuate heating elements formed concentrically with the casing member and wherein the reverse bends in said U-shaped tubes are bent to extend between said elements and said casing.

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