Nov. 11, 1952 A. J. DONOHUE 2,617,392

TANKLESS WATER HEATER

Filed Jan. 8, 1952 2 SHEETS—SHEET 1

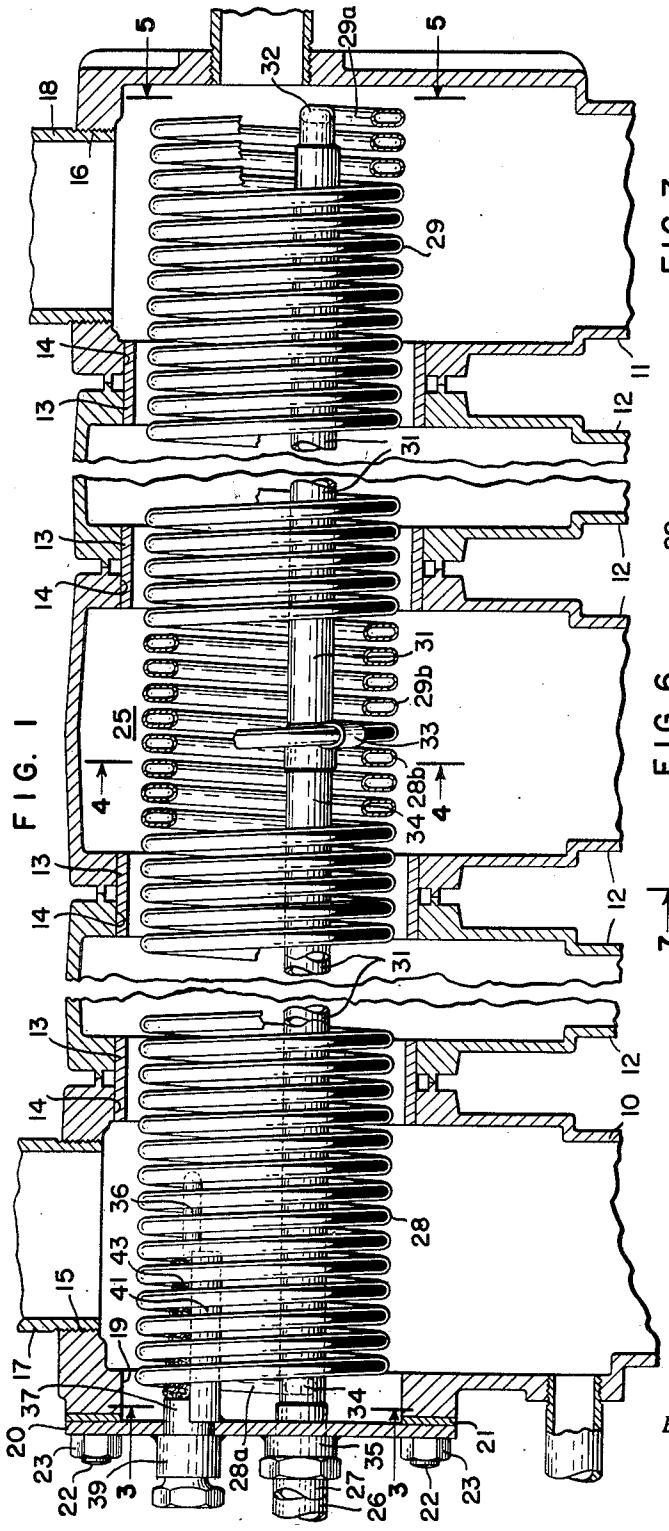


FIG. 1

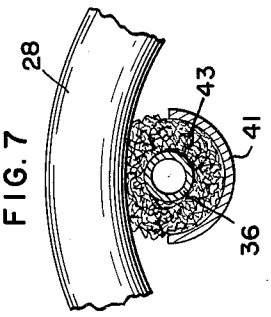


FIG. 7

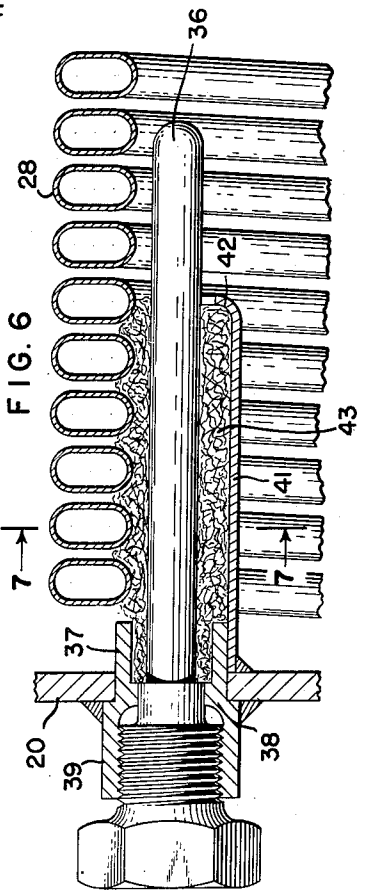


FIG. 6

INVENTOR.
A. J. DONOHUE

BY
B. T. Wolcott Jr.
ATTORNEY.

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FIG. 2

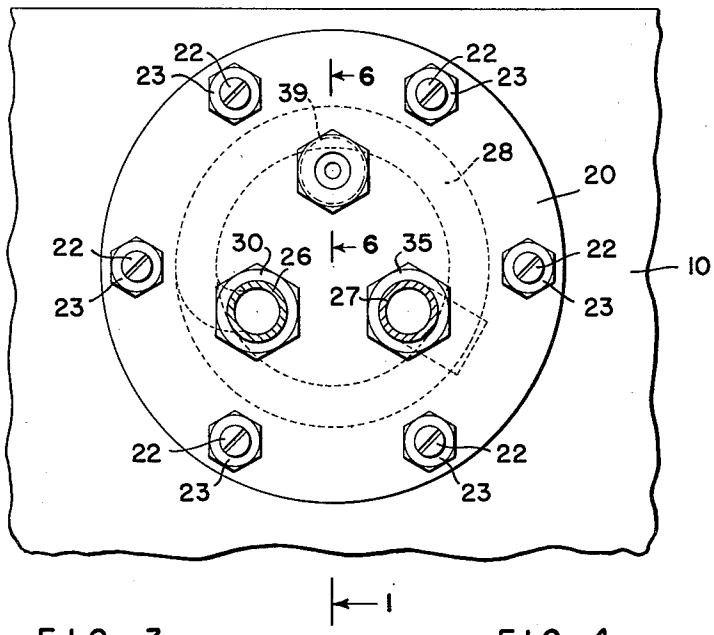


FIG. 3

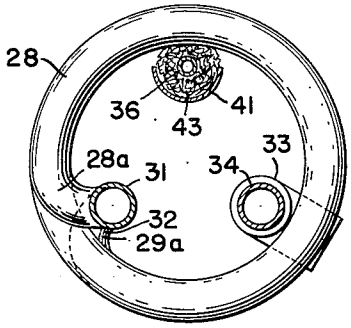


FIG. 4

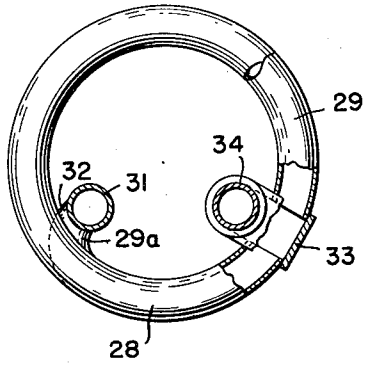
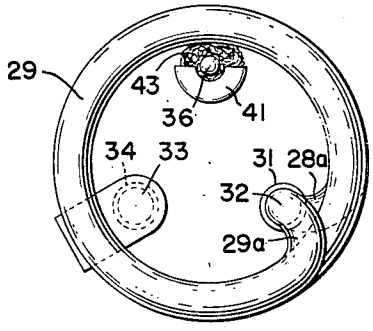


FIG. 5



INVENTOR.
A. J. DONOHUE

BY

ATTORNEY.

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TANKLESS WATER HEATER

Anthony J. Donohue, Merion, Pa.

Application January 8, 1952, Serial No. 265,387

7 Claims. (Cl. 122—32)

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This invention relates to tankless water heaters adapted for installation in domestic heating boilers of the sectional type and which are utilized to supply heat and domestic hot water.

It has heretofore been customary to provide tankless water heaters of the multiple flow type as built-in units only in large heating boilers, and particularly steel boilers, because of the comparatively large space necessary for the installation of the heaters heretofore available.

Steel boilers of larger size are generally designed to provide an unobstructed space either at the top of the boiler or immediately below the water line, or both, thereby facilitating the installation of conventional built in multiple flow trombone type heaters which are usually constructed of ⅝" or larger tubing, connected in a series of parallel loops to a flow and return header bolted to the boiler.

Large cast iron sectional boilers have at best only a limited space available for the installation of built-in-tankless heaters and this type of boiler has been at a competitive disadvantage with steel boilers when a large volume of domestic hot water was required.

It has heretofore been customary to provide on large cast iron boilers, an external tankless heater which requires expensive piping for proper connection. Such built-in heaters as have been provided for large sizes of cast iron boilers usually consist of single pass heaters installed in one section of the boiler. With such heaters, the capacity is necessarily limited as the heat output depends on relatively slow inter-sectional circulation in the boiler of the boiler water. This arrangement has not proven satisfactory except for limited heater capacities, and large capacity hot water flows of the order of 8 to 10 gallons per minute have not been available commercially in cast iron sectional boilers but were only obtainable with heaters in steel boilers.

In the heaters heretofore employed it is essential that the heat input to the boiler be maintained in order to maintain the temperature of the water drawn for consumption at the desired level and to maintain the boiler water at the desired temperature for heating. The common method heretofore of accomplishing the first objective is to provide adequate water capacity in the boiler. Such capacity is not ordinarily available in present designs of cast iron boilers. With limited capacities it is necessary to turn on the burner quickly after the start of the withdrawal of the dometsic hot water. Various devices have been employed to provide a quick turn-on and

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thereby overcome the inherent lag of the boiler water temperature responsive element and subsequent override of boiler water temperature due to residual heat.

The most effective control to achieve quick turn-on heretofore available has been by the use of two water temperature responsive elements, one of which is installed in the domestic water line near the water heater and the other of which is installed in a suitable location in the boiler.

In my prior application for Letters Patent for Coil for Tankless Heaters, filed June 21, 1950, Serial No. 169,452, there is shown a tankless heater suitable for installation in the top boiler nipple ports of a cast iron boiler with a limited number of sections, and while such coil eliminated the shortcomings occasioned by slow intersectional boiler circulation, the heat capacity was still restricted by the allowable pressure drop limitations across a single pass, series wound heater. Furthermore, the heat absorbing ability of a single pass heater extending through the nipple ports of a relatively large number of boiler sections is progressively reduced as increasingly hot water flowing through the coil enters successive boiler sections which all have the same temperature of boiler water.

In accordance with the present invention, an improved heating coil is provided, sutiable for use in sectional cast iron boilers and adapted for use in boilers of various sizes and capacities.

In accordance with the present invention, also, an improved tankless heater is provided for insertion through one of the nipple openings of a cast iron boiler and in which a divided or multiple flow of the water to be heated is achieved.

In accordance with the present invention, also, an improved domestic water heater coil of the submerged type is provided which is particularly suitable for use in sectional cast iron boilers and in which the pressure drop through the heater is kept within permissive limits while maintaining favorable heat transfer characteristics, this being effected regardless of the number of boiler sections used.

In accordance with the present invention, also, an improved domestic water heating coil of the submerged type is provided which may be readily accommodated to the size of the boiler and which is particularly useful in sectional boilers having five, seven or nine sections.

In accordance with the present invention, also, an improved control element is provided which is particularly useful in connection with the heaters of the type herein disclosed.

In accordance with the present invention, also, an improved control element is provided mounted in close proximity to the heater coil and at the inlet portion thereof.

Other objects and advantageous features of the invention will be apparent from the specification and claims.

The nature and characteristic features of the invention will be more readily understood from the following description, taken in connection with the accompanying drawings forming part hereof, in which:

Figure 1 is a fragmentary sectional view of the upper portion of a sectional boiler, taken from front to rear and approximately on the line 1—1 of Fig. 2, and showing the heating coil in operating position therein;

Fig. 2 is a fragmentary front elevational view of a portion of the boiler shown in Fig. 1, and illustrating the mode of attachment of the coil head;

Fig. 3 is a transverse sectional view taken approximately on the line 3—3 of Fig. 1;

Fig. 4 is a transverse sectional view taken approximately on the line 4—4 of Fig. 1;

Fig. 5 is a transverse sectional view taken approximately on the line 5—5 of Fig. 1;

Fig. 6 is a horizontal sectional view taken approximately on the line 6—6 of Fig. 2; and

Fig. 7 is a vertical sectional view taken approximately on the line 7—7 of Fig. 6.

It should, of course, be understood that the description and drawings herein are illustrative merely, and that various modifications and changes may be made in the structure disclosed without departing from the spirit of the invention.

Like numerals refer to like parts throughout the several views.

Referring now more particularly to the drawings, the upper ends of a plurality of sections of a cast iron sectional boiler are shown, with a front section at 10, a rear section at 11 and one or more intermediate sections 12 interposed therebetween to provide the desired heating capacity of the boiler. The sections 10, 11 and 12 are connected at their upper portions, in the conventional manner, by nipples 13 pressed or otherwise placed in position in alined nipple openings 14 at the time of assembly of the sections 10, 11 and 12.

The end sections 10 and 11 may be provided with the customary tapped opening 15 and 16 for the respective connection of pipes 17 and 18, which may serve for the delivery of hot water for use in the heating system in the usual manner.

The end section 10, in accordance with the present invention, is provided with an opening 19, in alinement with the nipple openings 14 of the other sections and is preferably of the same internal diameter.

A coil mounting plate 20 is provided, having a sealing gasket 21 secured in fluidtight engagement therewith and with the end face of the section 10 by studs 22 and nuts 23, to cover and seal the opening 19.

The coil mounting plate 20 is adapted to support the domestic water heating coil shown generally at 25 and provide for the connection of a cold water supply pipe 26 and a domestic hot water delivery pipe 27.

The domestic water heating coil assembly 25 is preferably made of a plurality of axially alined helical coils, such as the coils 28 and 29, each with a plurality of turns or convolutions, and wound either right handed or left handed as desired.

As illustrated, two coil sections 28 and 29 are shown, although a greater number could be used, if desired. The total number of turns in the coils is determined by the space available between the coil mounting plate 20 and the inner wall of the rear section 11.

The coil mounting plate 20 is provided with a through fitting or connection 30 of any desired type, permanently secured thereto in fluidtight relation in any preferred manner. Secured in the inner end of the fitting 30, a rearwardly extending supply pipe 31 is provided, parallel to the longitudinal axis of the coil assembly 25, connected by a fitting 32 to the inlet end 29a of the coil section 29, and having the inlet end 28a of the coil section 28 connected thereto.

At the inner or meeting and delivery ends 28b and 29b of the coil sections 28 and 29, a take-off fitting 33 is provided which is connected by a pipe 34 which extends parallel to the longitudinal axis of the coil assembly 25, and to a through fitting or connection 35 of any desired type permanently secured in the mounting plate 20 in fluidtight relation in any desired manner.

The fittings 30 and 35 are adapted to have the cold water supply pipe 26 and hot water delivery pipe 27 for the domestic hot water respectively connected thereto.

While the coil sections 28 and 29 can be made of any preferred shape of tubing, it is preferred to form the same from copper tubing with an initial outside diameter of the order of 5/8 inch, which is preferably flattened to permit of including a larger number of convolutions in a particular linear distance without unduly increasing the pressure drop across the coil sections 28 and 29.

In order to insure an adequate supply of heat for the coil sections 28 and 29, it is usually necessary that additional heat be supplied quickly by the burner to the boiler water in the boiler sections 10, 11 and 12 to replace that extracted by the coil sections 28 and 29.

For this purpose, a temperature responsive bulb 36 is provided, carried by the coil mounting plate 20 and placed very close to, but not quite touching the interior of the convolutions of the coil section 28.

In production it is difficult to maintain a temperature responsive bulb in the proper spaced relation to the coil, and if the temperature responsive bulb is held in engagement with the coil, it may be sprung out of adjustment upon movement, and upon expansion and contraction.

The temperature responsive bulb 36 is preferably supported in a cartridge 37 having a connecting portion 38 extending through and permanently secured to the mounting plate 20 in any desired manner. The outer portion 39 thereof is preferably internally threaded for the reception of a complementally threaded portion 40 of the temperature responsive bulb 36.

Extending inwardly from the connecting portion 38, a semi-cylindrical section 41 is provided having an upwardly extending ledge 42 at the inner or free end thereof. The semi-cylindrical section 41 has loosely disposed therein a heat conducting packing 43 of corrosion resistant wool, such as copper or other metallic wool, or glass wool, which engages the temperature responsive bulb 36 and the walls of the coil section 28 at the inlet end thereof, so that temperature changes are directly effective through the packing 43 between the coil section 28 and the temperature

responsive bulb 36 at a plurality of locations. It is preferred that about one-third of the length of the temperature responsive bulb 36 extend beyond the ledge 42 into the freely circulating boiler water in the boiler section 10.

The temperature responsive bulb 36 is effective upon the entrance of cold water into the coil section 28 and, upon completion of the withdrawal of water through the coil assembly 25, the effect of the inlet water is eliminated, thereby permitting the temperature of the boiler water only to effect the temperature responsive bulb 36. In this manner the necessity for two control elements is eliminated, while providing quick turn-on of the burner.

The coil assembly 25 comprising the alined coil sections 28 and 29, mounted on the coil mounting plate 20, is inserted through the opening 19 and the inner end advanced respectively through the connecting nipples 13 until the plate 20 is in a position to be clamped and held by the nuts 23. The temperature responsive bulb 36 in its cartridge 37 is simultaneously inserted.

It will be noted, that the supply pipe 31 and the take-off pipe 34 aid in supporting the coil sections 28 and 29 during and after insertion.

The coil assembly 25 is normally submerged when the boiler sections 10, 11 and 12 are filled and the boiler is operating.

When there is a demand for domestic hot water, this water is withdrawn through the pipe 27, the coil sections 28 and 29 being respectively supplied with cold or unheated water through the inlet connection 30 and through the pipe 31 to both coil sections.

It will be noted that the pipe 31 permits of a preheating effect of the water supplied to the coil section 29.

As soon as cool or unheated water enters the coil section 28, the lower temperature of this water creates a temporary cold space in the boiler water, contiguous to the coil section 28. The lowered temperature of this cold space is effective through the packing 43 and at the bulb 36, which within a short interval of time, of the order of about 15 to 25 seconds, is effective at the burner control for supplying heat to the boiler water.

The water in the coil sections 28 and 29 extracts heat from the water in the boiler sections 10, 11 and 12 in a rapid and effective manner for heating the domestic hot water.

Upon the termination of the demand for domestic hot water, the temperature of the water in the inlet porion 28*a* of the coil section 28 is raised, by the circulation of the boiler water, to a point where the bulb 36 is effective to indicate that no further heat is required for the domestic hot water.

It will be noted that the bulb 36, and particularly the free and extending section thereof is, at all times, responsive to the boiler water, so that it is effective to indicate the demand for heat by the boiler water from whatever cause, and the satisfaction of the demand for heat by the boiler water.

I claim:

1. In domestic hot water heating apparatus for a sectional boiler with axially alined horizontal connecting members between the water spaces of the boiler sections and an end opening in an end boiler section alined with said connecting members, the combination comprising a vertical mounting plate for mounting at said end opening, an indirectly heated water heater connected to said plate for insertion through said end opening and said connecting members comprising a plurality of horizontally axially alined helical coils each having a plurality of turns, a cold water inlet connection through said plate, a supply pipe disposed within said coils and connected to said inlet connection and to each of said coils at one end thereof, a hot water delivery connection through said plate, and a delivery pipe disposed within said coils and connected to said delivery connection and to said coils at the other ends thereof.

2. In domestic hot water heating apparatus for a sectional boiler with axially alined horizontal connecting members between the water spaces of the boiler sections and an end opening in an end boiler section alined with said connecting members, the combination comprising a mounting plate for closing said end opening, an indirectly heated water heater connected to said plate for insertion through said end opening and said connecting members comprising a plurality of horizontally axially alined helical coils each having a plurality of turns, a cold water inlet connection through said plate, a supply pipe disposed within said coils and connected to said inlet connection and to each of said coils at opposite ends thereof, a hot water delivery connection through said plate, and a delivery pipe disposed within said coils connected to said delivery connection and to contiguous ends of said coils.

3. In domestic hot water heating apparatus for a sectional boiler with axially alined horizontal connecting members between the boiler sections and an end opening in an end boiler section alined with said connecting members, the combination comprising a mounting plate for closing said end opening, an indirectly heated water heater connected to said plate for insertion through said end opening and said connecting members comprising a plurality of horizontally axially alined helical coils each having a plurality of turns, a cold water inlet connection through said plate, a supply pipe connected to said inlet connection and to said coils at opposite ends thereof and interiorly axially disposed with respect to said coils, a hot water delivery connection through said plate, and a delivery pipe connected to said delivery connection and to contiguous ends of said coils and interiorly axially disposed with respect to said coils.

4. In domestic hot water heating apparatus for a sectional boiler with axially alined horizontal connecting members between the boiler sections and an end opening in an end boiler section alined with said connecting members, the combination comprising a mounting plate for closing said end opening, an indirectly heated water heater connected to said plate for insertion through said end opening and said connecting members comprising a plurality of axially alined helical coils each having a plurality of turns, a cold water inlet connection through said plate, a supply pipe connected to said inlet connection and to said coils at opposite ends thereof in supporting relation and interiorly axially disposed with respect to said coils, a hot water delivery connection through said plate, and a pipe connected to said delivery connection and to contiguous ends of said coils in supporting relation and interiorly axially disposed with respect to said coils.

5. In domestic hot water heating apparatus for a sectional boiler with axially alined connecting members between the boiler sections and an end opening in an end boiler section alined with said connecting members the combination comprising

a mounting plate for mounting at said end opening, a plurality of helical coils, supply and delivery connections for said coils extending through said plate, a temperature responsive member carried by said plate and having a temperature responsive bulb extending in spaced relation to the convolutions of one of said coils, and a packing of heat transmitting material engaging said bulb and said convolutions.

6. In domestic hot water heating apparatus for a sectional boiler with axially alined connecting members between the boiler sections and an end opening in an end boiler section alined with said connecting members the combination comprising a mounting plate for closing said end opening, a plurality of axially alined helical coils, supply and delivery connections for said coils through said plate, a temperature responsive member carried by said plate and having a temperature responsive bulb extending in spaced relation to the convolutions of one of said coils, a packing of heat transmitting material engaging said bulb and said convoltions, and a sleeve for holding said packing in position.

7. In domestic hot water heating apparatus for

a sectional boiler with axially alined connecting members between the boiler sections and an end opening in an end boiler section alined with said connecting members, the combination comprising a mounting plate for closing said end opening, a plurality of axially alined helical coils, supply and delivery connections for said coils through said plate, a temperature responsive member carried by said plate and having a temperature responsive bulb extending axially in spaced relation to the convolutions of one of said coils, a packing of heat transmitting material engaging said bulb and said convolutions, and a sleeve for holding said packing in position.

ANTHONY J. DONOHUE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
947,308	Rich	Jan. 25, 1910
1,288,055	Langsenkamp	Dec. 17, 1918
1,631,911	Brahm	June 7, 1927