Aug. 28, 1962 A. J. DONOHUE 3,051,145

SECTIONAL BOILERS

Original Filed July 20, 1956

3 Sheets-Sheet 1

Fig. 1.

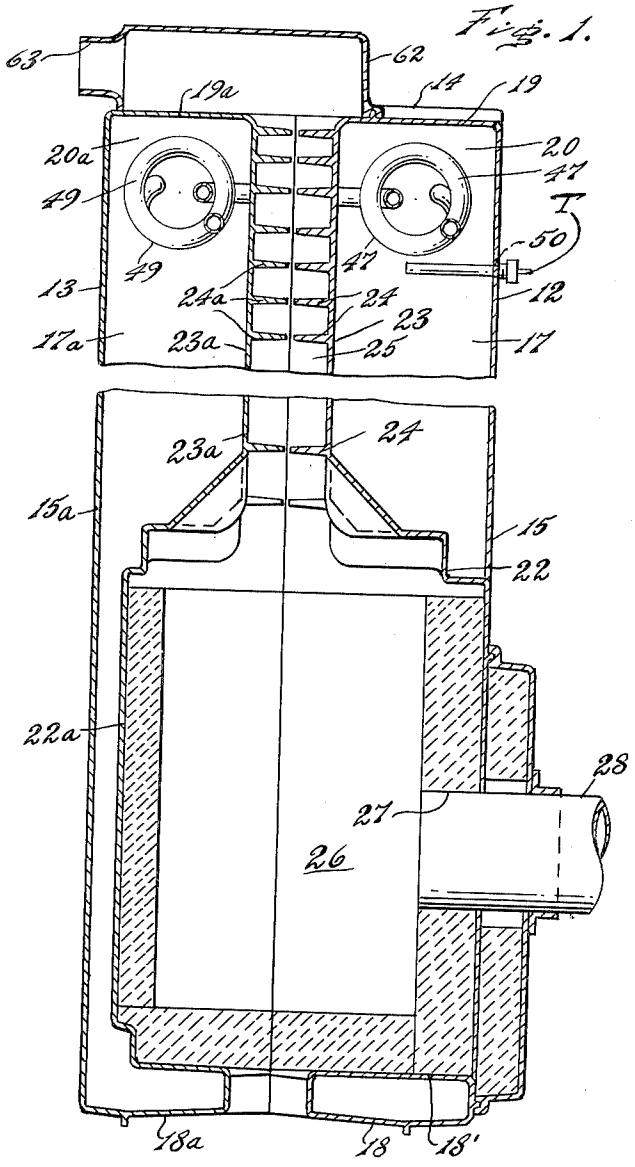
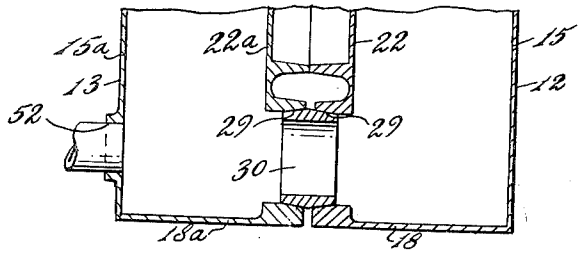


Fig. 5.



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Fig. 2.

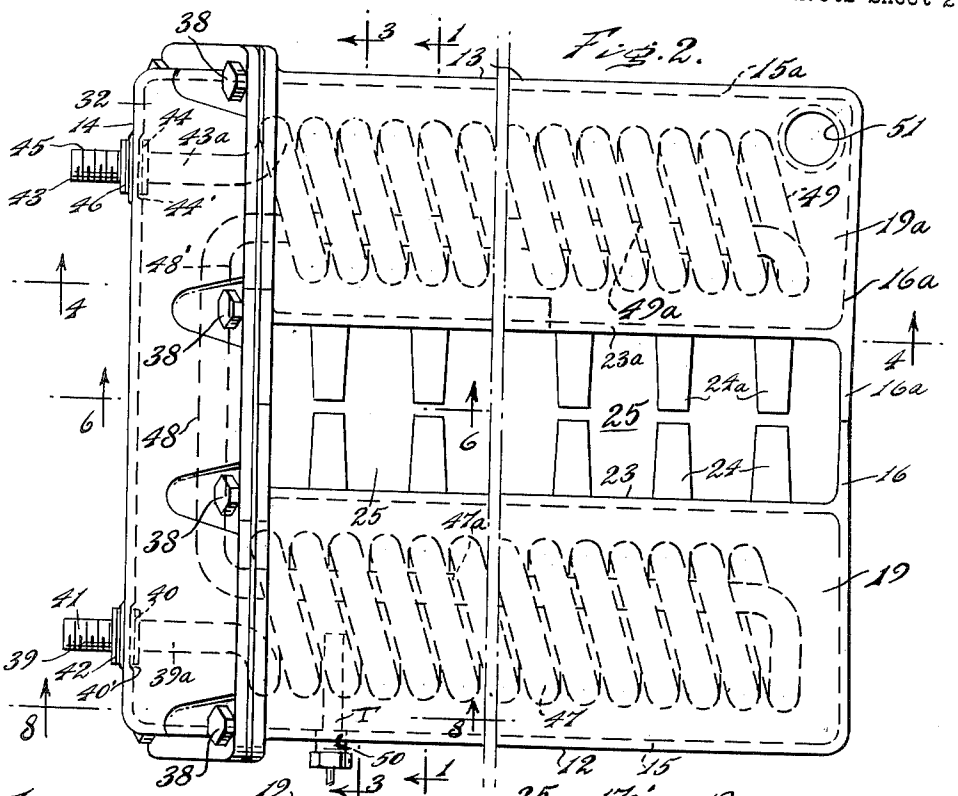


Fig. 3.

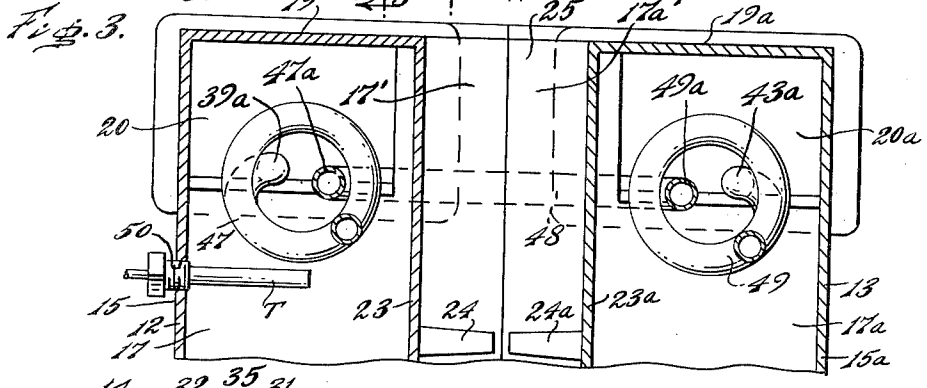
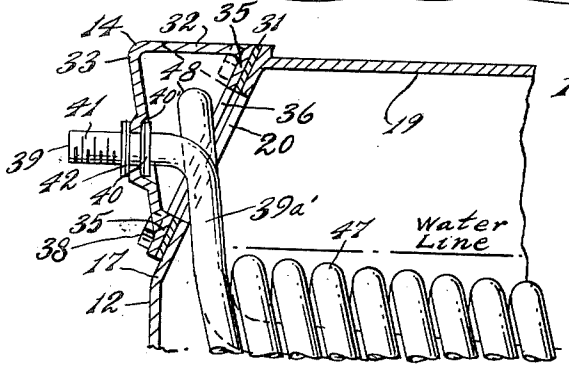


Fig. 8.



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Fig. 4.

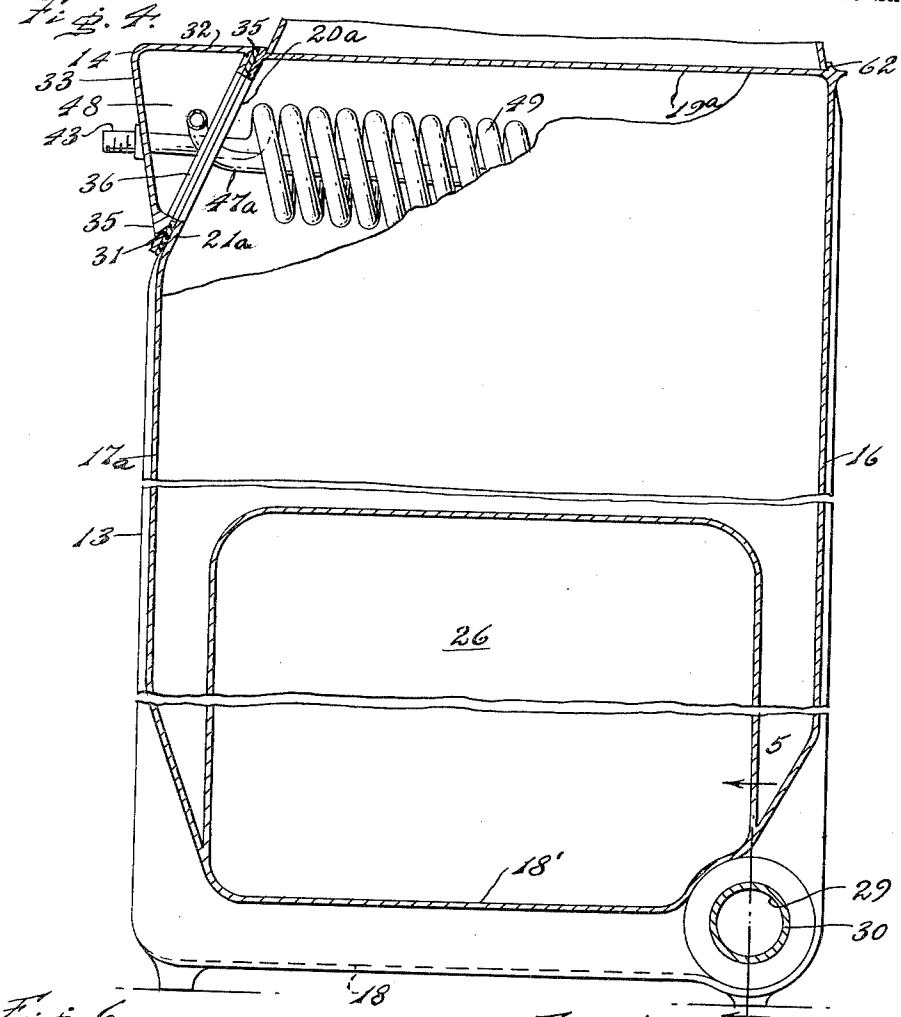


Fig. 6.

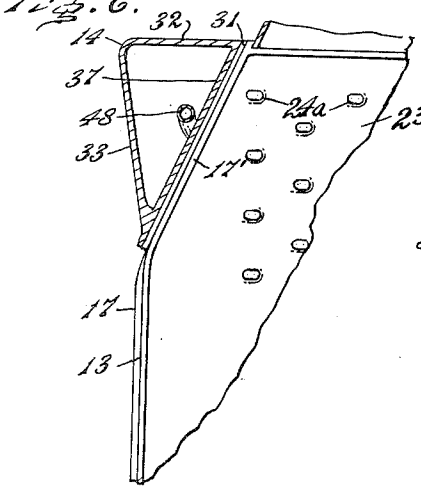
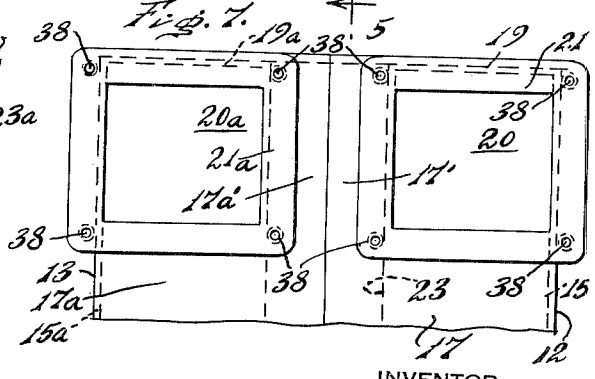


Fig. 7.



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Patented Aug. 28, 1962

3,051,145

SECTIONAL BOILERS

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Continuation of application Ser. No. 599,040, July 20, 1956. This application Apr. 17, 1959, Ser. No. 807,181
2 Claims. (Cl. 122—225)

This invention relates to sectional boilers for steam and hot water heating which are also suitable for supplying hot water for domestic consumption, and more particularly to such boilers capable of preassembly at the place of manufacture.

It has heretofore been the almost universal practice, with cast iron sectional heating boilers, to employ tapered sleeves, commonly referred to as push nipples, for the purpose of connecting the individual sections into an integral unit, and with such push nipples disposed both at the bottom and at the top of the heating sections. Heavy duty reaming machines capable of machining two or three tapered holes in each side of a boiler section simultaneously have been required to insure accuracy. At the same time the center distances or locations of the reamed holes used in such boiler sections must always be interchangeably machined to permit of replacement. Accuracy in manufacture of the push nipples is also required. A cast iron boiler manufacturer is often called upon to supply replacement sections for boilers made 25 years before. The carrying of replacement parts held to close tolerances over such long periods of time is commercially undesirable and is not found in other comparable industries.

Such prior boiler constructions, as heretofore referred to, may be desirable where a heating contractor is called upon to assemble the boiler sections on the job but the cost of doing this work is now relatively high. Steel boilers, which do not require precision machining and which are replaced in their entirety upon failure have an apparent cost advantage which can be, and is, overcome by the construction herein disclosed.

The upper push nipples, as heretofore employed in the upper part of the boiler, and for internal circulation, also take up space which reduces the space available for flues for the gases of combustion.

It is the principal object of the present invention to provide an improved type of boiler construction whereby the boiler sections can be assembled at the factory on an assembly line and without the necessity of precision machining and assembly of a character inherent with constructions requiring accurate center positioning.

It is a further object of the present invention to provide a boiler assembly so constructed and arranged that each individual section can expand freely in any direction under heating stress so that cracked sections due to misaligned and faulty nipple assembly will be eliminated.

It is a further object of the present invention to provide a boiler assembly of the character aforesaid which is particularly suited for the use therewith of submerged coils for heating domestic hot water.

It is a further object of the present invention to provide a boiler assembly which is free from the obstructions at the top thereof attendant upon the use of internal circulation connections.

It is a further object of the present invention to provide a boiler assembly having a head so constructed that it serves as the top connecting means for the boiler sections while simultaneously being capable of serving as a mounting means for the submerged domestic water heating coils.

It is a further object of the present invention to provide an improved boiler assembly having a head construction which serves as the top connecting structure for the boiler sections and which will permit of free circulation of water between the sections.

It is a further object of the present invention to provide a boiler construction having a head connecting a plurality of boiler sections and which head is also capable of serving as a mounting for a plurality of interconnected domestic water heating coils.

It is a further object of the present invention to provide a boiler construction having sections in which a minimum number of positively aligned parts are required so as to reduce the accuracy required in machining.

It is a further object of the present invention to provide a boiler construction having a plurality of boiler sections with a head in engagement therewith and in which the connection between the head and the sections accommodates irregularities in the dimensioning and finishing thereof.

It is a further object of the present invention to provide an improved boiler construction for heating which in one size thereof has only two sections and one vertical flueway but with which a sufficiently high rating can be obtained to furnish adequate domestic hot water, so that the cost of manufacture of the same can be reduced.

It is a further object of the present invention to provide a boiler construction having a plurality of boiler sections with an upper connecting head therebetween, the connecting head containing only a limited amount of boiler water therein, the connecting head also having the inlet and delivery connections of a tankless water heating coil connected therethrough and serving to support the heating coil.

It is a further object of the present invention to provide a boiler construction having the advantageous characteristics as aforesaid while effecting a reduction in both the size and the weight from boilers now available.

Other objects and advantageous features of the invention will be apparent from the description 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 thereof, in which:

FIGURE 1 is a vertical central sectional view of a sectional boiler in accordance with the invention, taken approximately on the line 1—1 of FIG. 2;

FIG. 2 is a top plan view of the sectional boiler shown in FIG. 1 on a larger scale, the collecting hood being removed;

FIG. 3 is a fragmentary sectional view taken approximately on the line 3—3 of FIG. 2;

FIG. 4 is a vertical sectional view taken approximately on the line 4—4 of FIG. 2;

FIG. 5 is a fragmentary sectional view taken approximately on the line 5—5 of FIG. 4;

FIG. 6 is a fragmentary vertical sectional view taken approximately on the line 6—6 of FIG. 2;

FIG. 7 is a fragmentary side elevational view as seen from the left of FIG. 2 with the connecting head removed; and

FIG. 8 is a fragmentary vertical sectional view taken approximately on the line 8—8 of FIG. 2 and showing the arrangement of the domestic water heating coils in a steam boiler made in accordance with the invention.

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

Like numerals refer to like parts throughout the several views.

The sectional boiler in accordance with the present invention includes a plurality of cast iron sections, with a lower interiorly disposed combustion space or chamber, supplied with fuel for combustion therein, and with a vertical flue extending upwardly from said combustion

chamber between adjoining sections for heat exchange and discharge of products of combustion.

The boiler sections are connected and held together at their lower portions, and at the top have inclined plane surfaces for receiving corresponding inclined plane surfaces of a connecting head, a compressible gasket being interposed between the plane surfaces for preventing fluid leakage.

The head has an interior space for circulation between the connected boiler sections, and preferably also serves for the support of submerged domestic water heating coils interconnected through the connecting head space and extending into the boiler sections.

Referring now more particularly to the drawings, a pair of aligned and meeting boiler sections **12** and **13** of a cast iron sectional boiler are shown which may constitute the front boiler section and the rear boiler section. The boiler sections **12** and **13** are connected at the top thereof, as hereinafter explained, by a connecting head **14**.

The front section **12** is provided with a substantially straight vertical front wall **15**, vertical side walls **16** and **17** extending rearwardly therefrom, a horizontal bottom wall **18**, extending rearwardly from the front wall **15** and connected to the side walls **16** and **17**, and a horizontal top wall **19** extending rearwardly from the front wall **15** and between said side walls **16** and **17**. The side wall **17** has an upper inwardly inclined portion **17'** extending to the top wall **19**.

Between the top wall **19** and the side wall **15**, at one side of the boiler section **12**, an inclined face is provided (see FIG. 7) which has an opening **20** therethrough communicating with the water space in the boiler section **12** and which is surrounded by a rim **21**. The face of the rim **21** is ground or otherwise finished to provide a fluid tight joint at this location, as hereinafter explained, but does not require finishing to a close tolerance.

A bottom interior wall **18'** has extending upwardly therefrom an interior wall **22** which is in spaced parallel relation to the front wall **15**, with an upper wall portion **23**, intermediate the side walls **16** and **17**, in a more closely spaced relation to the front wall **11** than the front to back dimensions of the side walls **16** and **17**. The wall portion **23** has a plurality of spaced projections **24** extending therefrom to provide extended heat exchanging surfaces.

The side walls **16** and **17** and upper inwardly inclined portion **17'**, and the wall **23**, provide boundaries of a vertical flue passageway **25** into which the projections **24** extend.

The front section **12** also has interiorly disposed, and below, and in communication with the flue passageway **25**, the front part of a combustion chamber **26**.

The lower part of the flue passageway or the transition portion between the combustion chamber **26** and the flue passageway is preferably constructed as shown in my copending application filed August 13, 1956, Serial No. 603,545, now Patent No. 2,934,046.

A burner opening **27** extending through the front wall **15** and into communication with the combustion chamber **26** can be provided for the insertion of a burner tube **28** for supplying gas or liquid fuel, and air for supporting combustion.

At the lower part of the rear wall **22** (see FIGS. 4 and 5) and preferably contiguous to the side wall **16**, but outside the combustion chamber **26**, a nipple opening **29** is provided, for purposes to be explained.

The rear section **13** is substantially similar in construction to the front section **10**, although of opposite hand, with a vertical rear wall **15***a*, vertical side walls **16***a* and **17***a*, upper inclined side wall portion **17***a'*, disposed in meeting relation to the side walls **16** and **17** and wall portion **17'** in the assembled condition of the sections **12** and **13**, a horizontal bottom wall **18***a*, a top wall **19***a*, an inclined face between the top wall **19***a* and the side wall **17***a* with an opening **20***a* therethrough surrounded by a rim **21***a*. The face of the rim **21***a* preferably is finished in the same manner as the corresponding surface of the rim **21**.

A downwardly extending wall **22***a* is provided in spaced parallel relation to the wall **22** with an upper wall portion **23***a* similar to the wall portion **23**, and with spaced projections **24***a* extending therefrom and in registered relation to the projections **24** in assembled condition of the sections **12** and **13**.

The side walls **16***a* and **17***a* and upwardly inclined portion **17***a'*, and the wall **23***a* provide with the boundaries previously described, the remaining boundaries of the vertical flue passageway **25**.

The rear section **13** also has interiorly disposed therein, and below the flue passageway **25**, the rear part of the combustion chamber **26**. The combustion chamber **26** can be lined with refractory material, if desired, when the boiler is oil fired.

At the lower part of the wall **22***a*, and preferably contiguous to the side wall **16***a*, but outside the combustion chamber **26**, a nipple opening **29** is provided, aligned in assembled condition of the sections **12** and **13** with the opening **29** in the section **12** for the reception of a push nipple **30** for circulation of water between the lower parts of the sections **12** and **13**.

It will be noted that the nipple **30** is provided at the bottom and only at the bottom of the boiler sections **12** and **13**.

The rims **21** and **21***a* have, in engagement therewith, sealing gaskets **31** of rubber, natural or synthetic, or of any desired compressible packing material.

The head **14** is closed at its front and rear ends and has a horizontal top wall portion **32**, and downwardly extending outer side wall portions **33**, with rim portions **35**, complemental to the rim portions **21** and **21***a*, all the rim portions **35** having inclined faces finished in the same manner as the faces of the rims **21** and **21***a*, for engagement with the gaskets **31**, and with openings **36** aligned with the openings **20** and **20***a*. Between the rims **35** a central connecting wall **37** is provided.

The head **14** is adapted to be held in position on the boiler sections **12** and **13**, and with the rim portions **35** in compressing relation to the gaskets **31** to provide fluid tight joints around the openings **20** and **20***a* and the openings **36** between the head **14** and the sections **12** and **13**, by a plurality of studs **38** which extend through the rim portions **35** and into threaded engagement in the rim portions **21** and **21***a*.

The head **14** is preferably utilized as the supporting mounting for an immersion type domestic hot water heating coil or coils of the type referred to as a tankless heater.

For this purpose the wall **33** is provided with an inlet fitting **39** having an interior shoulder **40** engaging a gasket **40'** and an exteriorly disposed threaded portion **41** with a tightening nut **42** thereon, and with a similar outlet fitting **43** having an interior shoulder **44**, engaging a gasket **44'**, an exteriorly disposed threaded portion **45** with a tightening nut **46** thereon. The inlet fitting is connected by a pipe **39***a* to a substantially horizontally disposed domestic water heating coil **47**, which extends into the boiler section **12** through the opening **20** and the aligned opening **36**, with a return connection **47***a* extending from the inner end of the coil **47** to a crossover tube section **48**. The only connection required for the dual coil assembly shown, between the individual coil units, is provided at **48'** in the crossover section **48**. The tube section **48** extends between the sections **12** and **13** within the interior of the head **14** and to a connection **49***a* to the inner end of a water heating coil **49** which extends into the boiler section **13** through the opening **20***a* and one of the openings **36**. The other end of the coil **49** is connected by a pipe **43***a* to the outlet fitting **43**.

Referring now more particularly to FIG. 8, a modified form of heating coil construction is shown carried by the

head 14 and with downward integral extensions, the extension 39a' being shown, for locating the heating coils 47 and 49 below the water line of the boiler where the boiler is used as a steam boiler.

The front wall 15 is preferably provided with a threaded opening 50, near the cold water inlet portion of the coil 47 for the insertion of a water temperature responsive or sensing instrument T. The location of the instrument T is such that it has a quick response to the reduced temperature of a limited portion of boiler water caused by cold water entering the coil 47.

One of the boiler sections, such as the boiler section 13, can be provided with a threaded opening 51 for the connection of a pipe for delivery of hot water or steam to the heating system, and one of the boiler sections such as the boiler section 13 can be provided with a threaded return connection opening 52 aligned with the openings 29 and the push nipple 30 for return of water to the boiler for heating therein.

The structure for discharge of the gases from the flue space 25 is shown as a collecting hood 62 carried on the top wall 19 and with a discharge flange 63 for the attachment of a pipe (not shown) leading to the stack.

The mode of operation will now be explained.

The combustion of the fuel in the combustion chamber 26 is utilized to provide heat for absorption by the surfaces of the sections 12 and 13 surrounding the combustion chamber 26, and upon the passage of the gases of combustion through the flue passageway 25 in contact with the walls surrounding the flue passageway 25 and the projections 24 and 24a extending thereinto. The gases at the top of the flue passageway 25 are collected by the collecting hood 62 for discharge.

Circulation between the boiler sections 12 and 13 is effective through the push nipple 30 at the bottom of these sections and through the interior of the head 14 at the top.

Water delivered to the lower part of the boiler at the return or inlet opening 52 has its temperature increased as it moves upwardly and the hot water or steam for delivery to the house heating system is delivered through the opening 51.

While the boiler is available for supplying heated fluid for the heating system, the coils 47 and 49 are also utilized for heating domestic hot water.

When a demand occurs for domestic hot water, cold water enters at the inlet fitting 39 and upon movement through the coils 47 and 49 to the outlet fitting 43 is heated by the boiler water. The total quantity of boiler water available for heating the domestic hot water, particularly in small boilers is limited so that the burner must be turned on quickly at the start of most draws. However, a time interval or delay is desirable to prevent repeated burner turn on for momentary draws. It has been ascertained that this time interval should not exceed about thirty seconds. For normal draws of several minutes duration the burner should turn on after about thirty seconds to maintain the domestic water temperature. Effective burner turn on is achieved with this lag by inserting the sensitive portion of the instrument T in close proximity to the inlet portion of the coil 47. At this location the chilling effect of the incoming water in the coil 47 is effective on the water at the instrument T which is quickly chilled by the incoming domestic water irrespective of the average temperature of the water in the boiler. This sudden drop in ambient temperature overcomes creep in the boiler water temperature above the control setting plus the differential of control and brings the burner into action within the desired interval.

This application is a continuation of my prior application, Serial No. 599,040, filed July 20, 1956, for Sectional Boilers, now abandoned.

I claim:

1. A sectional boiler comprising a plurality of separate vertical boiler sections each with enclosing walls, said enclosing walls of each of said sections including top wall portions on each of said sections and aligned vertical outer side wall portions on each of said sections, said sections being disposed in facing relation, said sections having therebetween at the lower part thereof a combustion space, a fluid connection at the lower part of said sections connecting said sections for fluid circulation between the lower interior portions thereof, the upper parts of each of said sections having inclined plane terminal face portions extending downwardly from said top wall portions and terminating at corresponding outer side wall portions, said face portions having openings therethrough, flueway bounding connecting walls on each section between the face portions of said sections, and a connecting head in bridging relation to said sections having on one side thereof openings surrounded by plane face portions in juxtaposed abutting relation to said first mentioned plane face portions, said head connecting the interior portions of said sections for fluid circulation between the upper interior portions of said sections, said boiler having a vertical flueway extending upwardly from said combustion space, said flueway being bounded at one end by said connecting walls, said connecting head having a domestic hot water heating member carried thereby, said heating member including inlet and outlet connections extending through a wall portion of said connecting head, and said heating member including a coil extending through said openings and into at least one of said vertical boiler sections.

2. A sectional boiler comprising a plurality of separate vertical boiler sections each with enclosing walls, said enclosing walls of each of said sections including top wall portions on each of said sections and aligned vertical outer side wall portions on each of said sections, said sections being disposed in facing relation, said sections having therebetween at the lower part thereof a combustion space, a fluid connection at the lower part of said sections connecting said sections for fluid circulation between the lower interior portions thereof, the upper parts of each of said sections having inclined plane terminal face portions extending downwardly from said top wall portions and terminating at corresponding outer side wall portions, said face portions having openings therethrough, flueway bounding connecting walls on each section between the face portions of said sections, and a connecting head in bridging relation to said sections having on one side thereof openings surrounded by plane face portions in juxtaposed abutting relation to said first mentioned plane face portions, said head connecting the interior portions of said sections for fluid circulation between the upper interior portions of said sections, said boiler having a vertical flueway extending upwardly from said combustion space, said flueway being bounded at one end by said connecting walls, said connecting head having a domestic hot water heating member carried thereby, said heating member including inlet and outlet connections extending through a wall portion of said connecting head, and said heating member including a plurality of water carrying coils extending through said openings and into said sections, said coils having communicating terminal connections connected respectively with said inlet and outlet connections, and a fluid connection between other terminal ends of said coils disposed within said connecting head.

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