Aug. 20, 1935. S. K. SMITH ET AL 2,012,144

BOILER

Filed Oct. 20, 1933 2 Sheets-Sheet 1

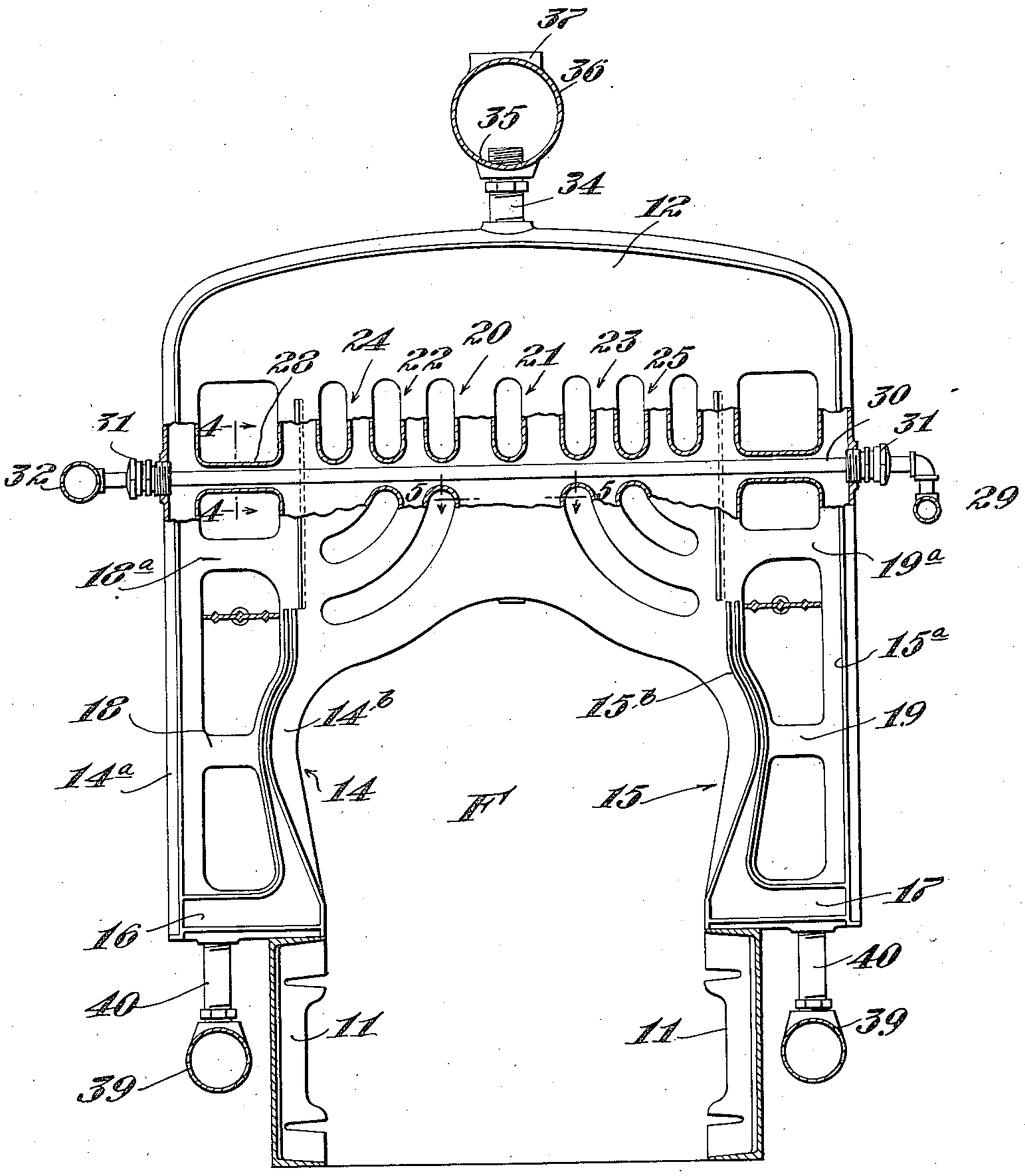


Fig. 1

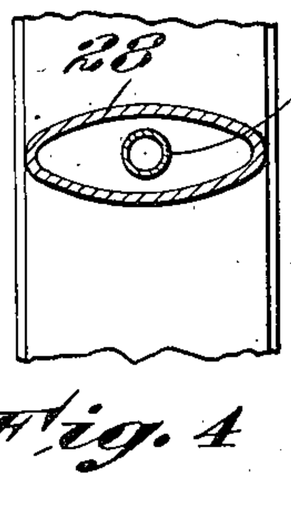


Fig. 4

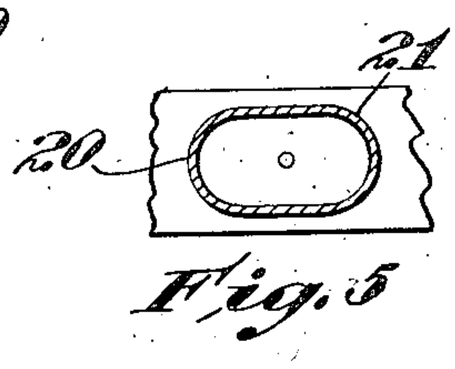


Fig. 5

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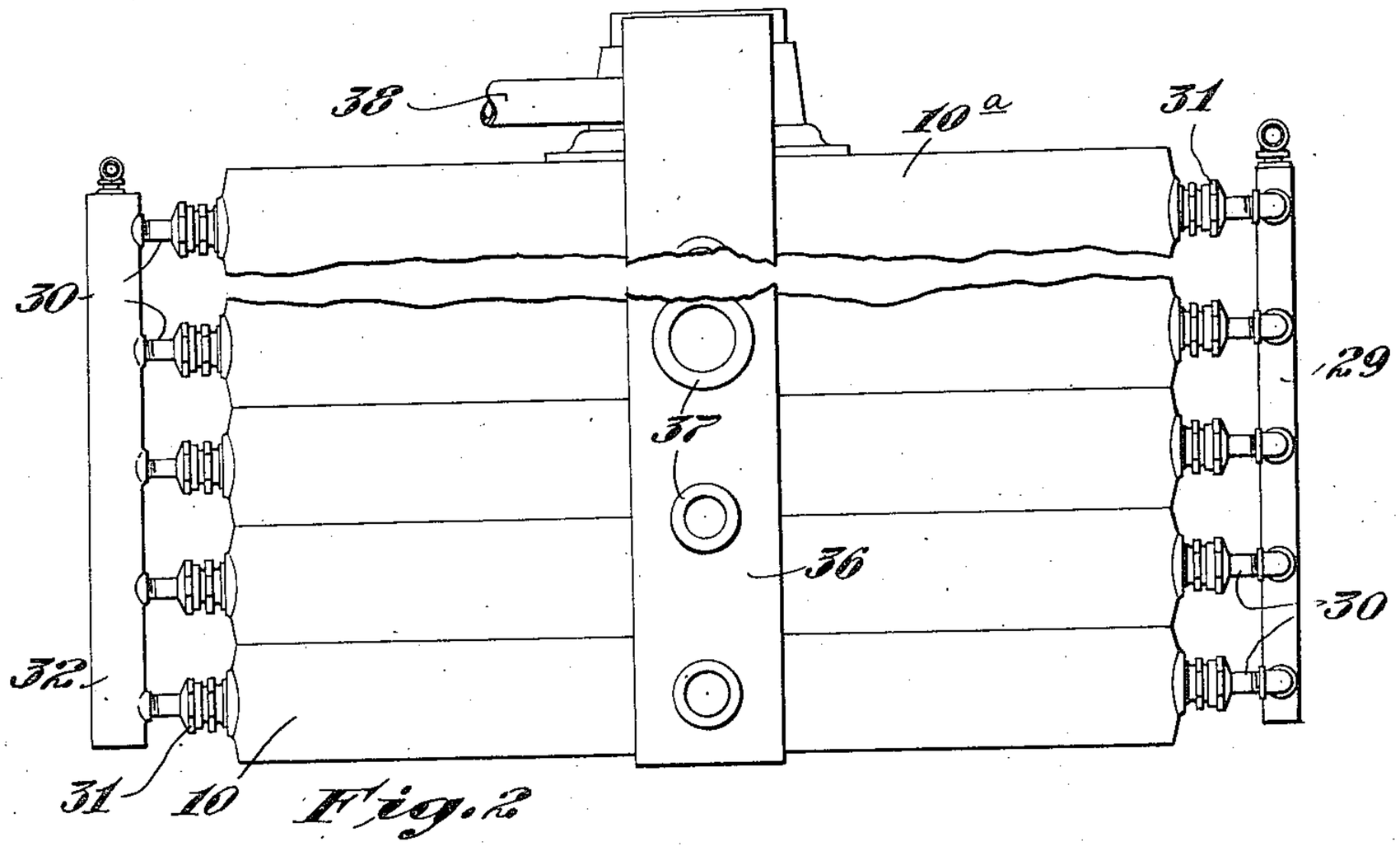


Fig. 2

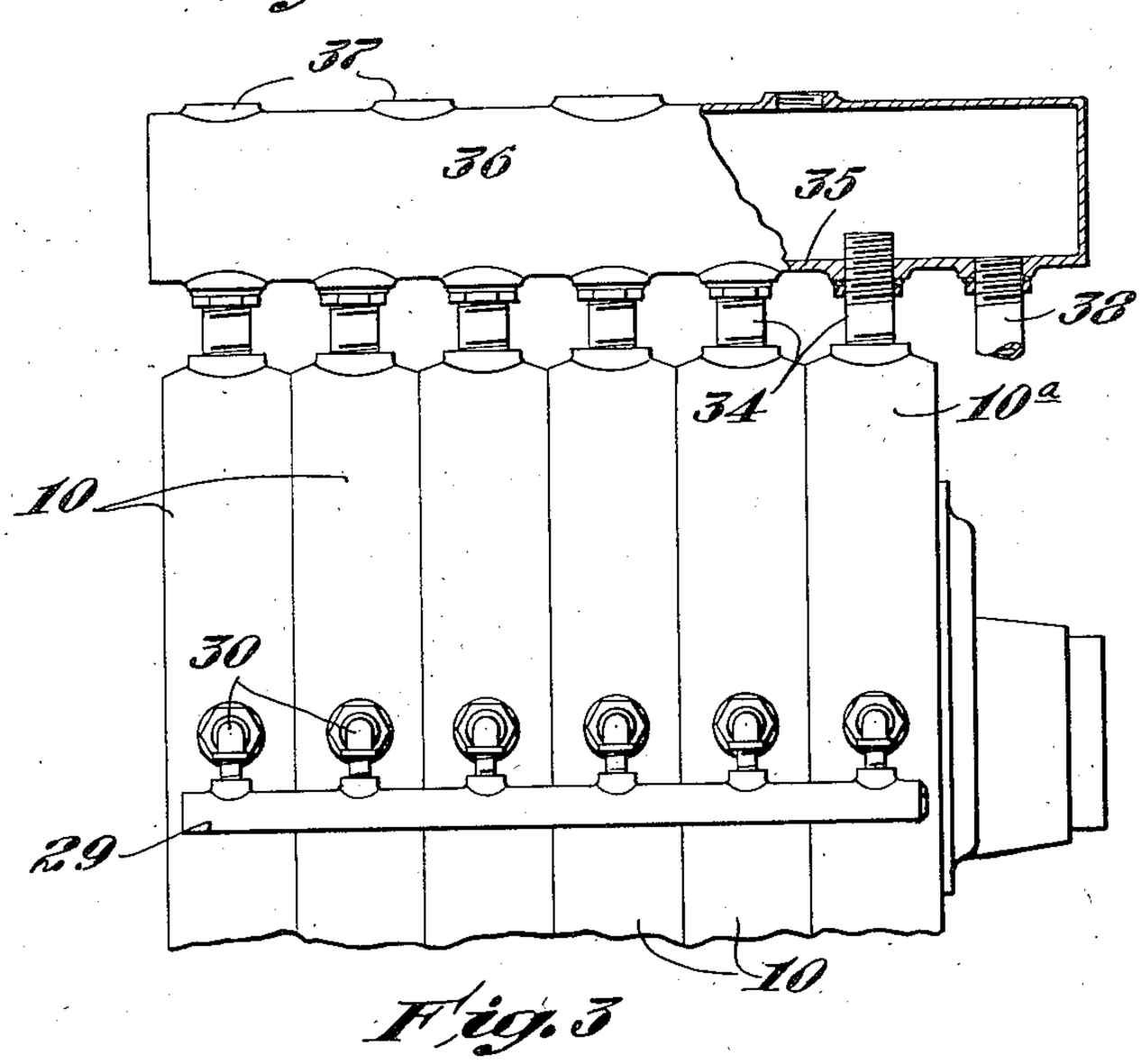


Fig. 3

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# UNITED STATES PATENT OFFICE

2,012,144

## BOILER

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Application October 20, 1933, Serial No. 694,422

3 Claims. (Cl. 122—225)

This invention relates to an improvement in sectional boilers such, for example, as boilers of the Mills types which comprise sections each having vertically extending water tubes in their upper part.

In every type of boiler some difficulty has been experienced due to the fact that some of the waterways are directly over the hot part of the fire and when the boiler is driven at a high capacity there is a tendency to eject water violently up through these waterways in a sort of geyser effect into the upper portion of the boiler. The water thus ejected sometimes is carried into the transmission lines and distributed throughout the system, and/or accumulates in slugs which interfere with the proper transmission and distribution of steam.

A further difficulty experienced with this type of boiler when used for indirectly heating a hot water supply is due to the fact that the header or heating drum through which the supply pipes extend, is attached to one side of the boiler only, and as the heat supplied to the heating drum is furnished solely or principally by the tubes at that side, they become relatively cool in comparison with the tubes on the opposite side of the boiler. When the fire is controlled automatically in accordance with the temperature of either the hot water supply or the heater, the tubes at one side of the boiler are cooled off relatively to those in the opposite side and the latter are often exposed to excessive heat and produce steam at a time when it is not desired as, for example, when the boiler is used in the summertime merely for heating the water supply. Hence the efficiency of the unit and the desired uniformity of operation is appreciably impaired and the cost of heating the hot water supply is greatly increased.

The principal object of the invention is to provide a sectional boiler which is of economical construction, and reliable and efficient in operation, and which overcomes the aforementioned objectionable features and deficiencies inherent in the prior types. Further objects relate to the construction and mode of operation of our improved boiler and will be apparent from a consideration of the following description and accompanying drawings which exemplify one embodiment of the invention chosen for the purpose of illustration.

In the drawings:

Fig. 1 is a front elevation, with parts broken away and shown in section, of our improved boiler;

Fig. 2 is a top plan view thereof;

Fig. 3 is a fragmentary side elevation with parts broken away and shown in section;

Fig. 4 is an enlarged section on the line 4—4 of Fig. 1; and

Fig. 5 is an enlarged section on the line 5—5 of Fig. 1.

Referring to Figs. 1 to 3, the boiler shown therein comprises a series of aligned sections 10 secured in fixed position by any suitable means and mounted on a pair of brackets 11 which may also provide a support for the grate (not shown), if a grate is to be used. Each of the sections 10 (except the rear section 10a) is of similar construction comprising an outer water tube which is substantially U-shaped, having a central horizontally extending portion 12 which defines the top of the section and provides the steam liberating chamber, and a pair of integral depending tubular portions or water legs designated generally by the numerals 14 and 15. As shown in Fig. 1 the water legs 14 and 15 define the side walls of the boiler and are spaced apart a sufficient distance to provide a space F for the firebox.

In this particular embodiment the water legs 14 and 15 comprise a pair of spaced tubes 14a, 14b and 15a, 15b, each pair being connected at their lower ends by tubes 16 and 17, respectively, and intermediate their ends by tubes 18, 18a and 19, 19a. Intermediate the horizontal portion 12 and the lower ends of the water legs 14 and 15 are a plurality of spaced, vertically extending inner water tubes 20, 21, 22, etc., integrally united at their upper ends with the horizontal portion 12. The lower ends of each of the inner tubes are laterally deflected and, as shown in Fig. 1, respectively communicate with the adjacent tubes 14b and 15b of the water legs.

In accordance with the present invention the intermediate portions of the central inner tubes 20 and 21 are integrally united, or otherwise joined or "coalesced", to provide a single central conduit of enlarged cross section, as shown in Fig. 5, and intermediate their ends the inner water tubes are interconnected with the water legs of the outer tubes by a series of horizontally aligned tubular parts 28 which provide a transverse water way preferably extending from one side of the boiler to the other, as shown in Fig. 1. Preferably, the constituent parts of each section are integrally united and form a unitary casting as shown in Figs. 1, 4, and 5, although it is to be understood that the invention is not limited to this feature as it is obvious that the constituent

parts may be constructed as individual units and assembled by brazing, welding or in any other suitable manner.

The transverse waterway and coalesced portions of the central tubes **20** and **21** provide a free and unobstructed communication between each of the inner water tubes and the different parts of the outer water tube and thus cooperate to provide for a more active and efficient circulation which is effective to increase the overload capacity of the boiler and furthermore to break up any "water slugs" which may form in the lower parts of any of the tubes, due to rapid evolution of steam when the boiler is driven at high capacity. Hence, any tendency to force the water in the vertical parts of the inner water tubes upwardly in the form of jets is effectively overcome and consequently the delivery of water into the system is avoided. Although the coalesced portions of the central tubes reduce to some extent the heating surface of the inner water tubes, this reduction is compensated for by the increased heating surface provided by the tubular parts **28**.

The transverse waterway is further utilized to provide an efficient means for heating a hot water supply and to this end the hot water supply main is preferably connected with an inlet manifold **29** which is provided with a plurality of branch conduits or pipes **30**. The pipes **30** extend longitudinally through the transverse waterways of the respective sections, as shown in Figs. 1 and 4, and each pipe may be firmly held in fixed position by any suitable means such as packing unions **31** which engage threaded apertures in the outer walls of the water legs **14** and **15**. When the boiler is used in the summertime for supplying hot water, each section is provided with a pipe **30** extending through its transverse waterway so that undesirable steaming in any section is prevented. The discharge ends of the pipes **30** are preferably connected with an outlet manifold **32** which may discharge into a supply tank (not shown) or may be directly connected with the hot water supply lines leading to the various parts of the system, thus providing an instantaneous hot water service. The size of the manifold **32** preferably is proportioned to the number and size of the pipes **30** so that it will be large enough to serve as a small reservoir which equalizes the flow through the pipes **30** when hot water is being drawn, thus preventing hot water from being drawn from the sections nearer the service outlet and steaming in the sections more remote therefrom.

The transverse water ways and pipes **30** are preferably disposed at a level which is below the level of the water in each of the sections so as to provide for proper circulation of the water within the boiler tubes and a more efficient heat transfer when the boiler is used solely for heating the domestic water supply. With this construction the necessity of providing the usual header or heating drums at one side of the boiler is dispensed with and consequently excessive heating of the water at one side of the boiler section is prevented. The heat absorbed by the pipes **30** is furnished by all the vertical tubes of each section, rather than those at one side only, and hence the temperature of the water in the different parts of each section is substantially equalized. This arrangement is particularly advantageous when the boiler is used merely for supplying hot water, as for example in the summer time, since the temperature of the water may be kept below its boiling point and yet be high enough to furnish sufficient heat to insure an ample supply of hot water.

The top walls of the sections are provided with steam supply nipples **34** which are threaded into the inlet ports provided in the base **35** of an overhead supply drum **36**, the top of the drum being furnished with the usual discharge ports **37** with which the steam mains or risers may be connected. A drain pipe **38** connects the rear end of the supply drum with one or both of the return drums **39**, both of which are connected to the lower ends of the water legs **14** and **15** by nipples **40**.

The upper ends of the nipples **34** project a substantial distance above the floor of the supply drum **36** so that any condensate in the risers and drum collects on the floor of the drum, below the tops of the nipples, and is continually discharged through the drain pipe **38**, the upper end of which terminates at or below the floor of the drum. Thus, the tendency of the inrushing steam to carry moisture or condensate accumulating in the supply drum into the delivery mains is largely eliminated, and the efficient operation of the boiler is consequently enhanced.

While we have shown and described one desirable embodiment of our invention, it is to be understood that the present disclosure is for the purpose of illustration only, and that various changes in shape, arrangement, and proportion of parts, as well as the substitution of equivalent elements for those herein shown and described, may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

We claim:

1. A water tube boiler comprising at least one section having a plurality of spaced, vertically extending inner and outer water tubes communicating at their upper ends with a common conduit and having their lower end portions communicating with each other, a series of horizontally disposed tubes connected to said inner and outer tubes intermediate their ends and defining a transverse water way which provides a free and unobstructed communication between each of said inner and outer water tubes, and means for heating a hot water supply comprising a water supply conduit associated with said transverse water way so as to receive heat from water circulating therethrough.

2. In a sectional boiler of the class described, the combination with a section comprising an outer tube having a horizontally extending central portion providing the top of the section and vertically depending portions spaced apart so as to straddle the fire-box of the boiler, a plurality of spaced, vertically extending inner tubes disposed intermediate the lower ends of said vertically depending portions and below said horizontally extending portion of said outer tube, the upper and lower ends of said inner tubes having connections respectively with said horizontal portion and said depending portions of said outer tube, and transversely extending tubes connecting each of the inner and outer tubes and providing a transverse water way, of a hot water supply conduit extending through the outer walls of said outer tube and through said water way.

3. In a sectional boiler of the class described, the combination with a section comprising an outer tube having a horizontally extending central portion providing the top of the section and vertically depending portions spaced apart so

as to straddle the fire-box of the boiler, a plurality of spaced, vertically extending inner tubes disposed intermediate the lower ends of said vertically depending portions and below said horizontally extending portion of said outer tube, said inner tubes including a pair of central tubes having adjoining intercommunicating portions intermediate their ends, the upper and lower ends of said inner tubes having connections respectively with said horizontal portion and said depending portions of said outer tube, and horizontally extending tubes connecting each of the inner and outer tubes and providing a transverse water way which intersects said adjoining portions of the central tubes, of a hot water supply conduit extending throughout said transverse water way.

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