

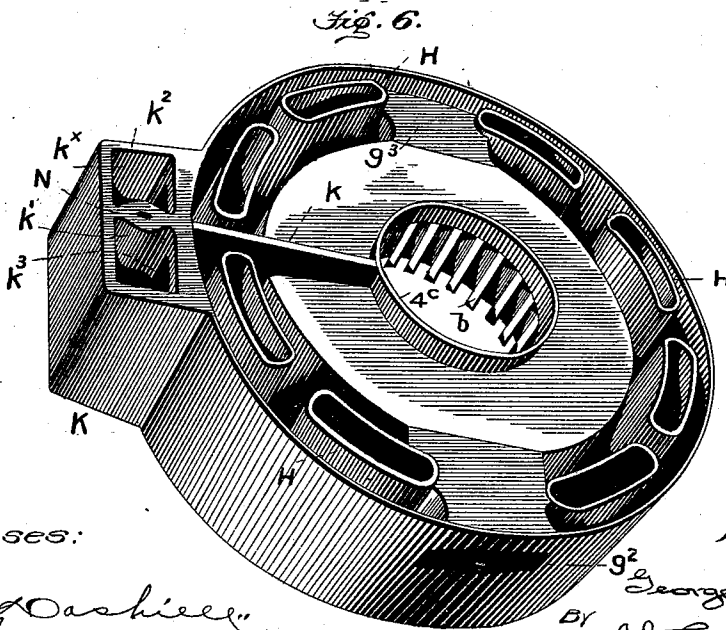
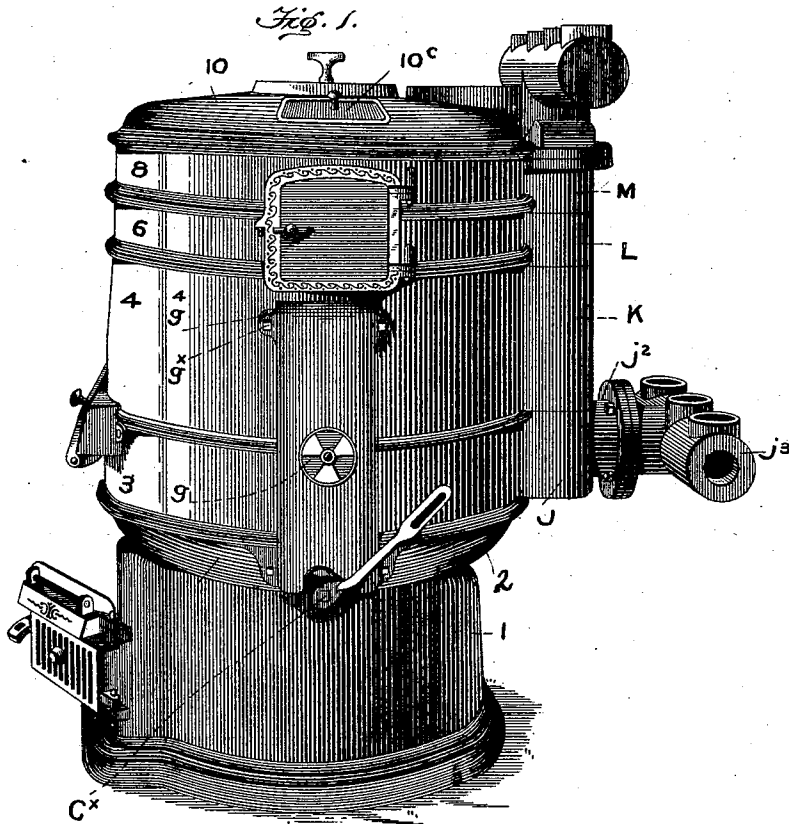
(No Model.)

3 Sheets—Sheet 1.

G. A. WATSON.  
SECTIONAL BOILER.

No. 521,746.

Patented June 19, 1894.



Witnesses:

*Wm. O. Ashlee*  
*W. H. Reid*

Inventor:

*g<sup>2</sup> George A. Watson*  
BY *J. H. Caplinger*  
*Att'y.*

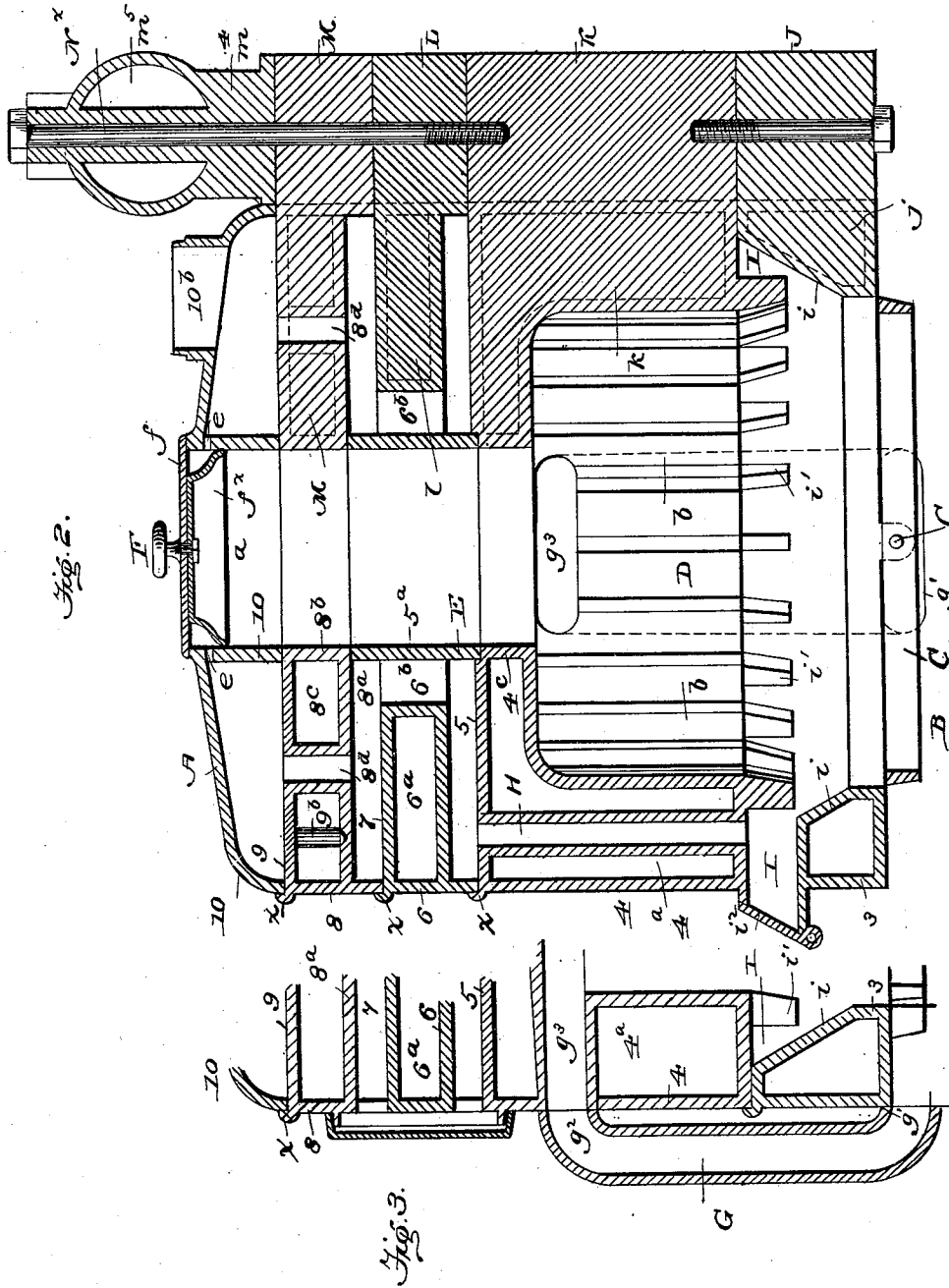
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3 Sheets—Sheet 2.

# G. A. WATSON. SECTIONAL BOILER.

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WITNESSES:  
*W. H. Laid*  
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INVENTOR:  
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(No Model.)

3 Sheets—Sheet 3.

G. A. WATSON.  
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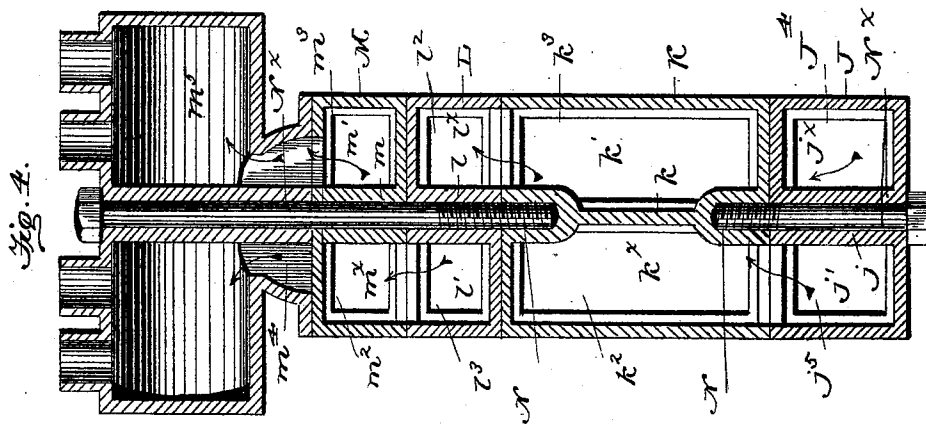
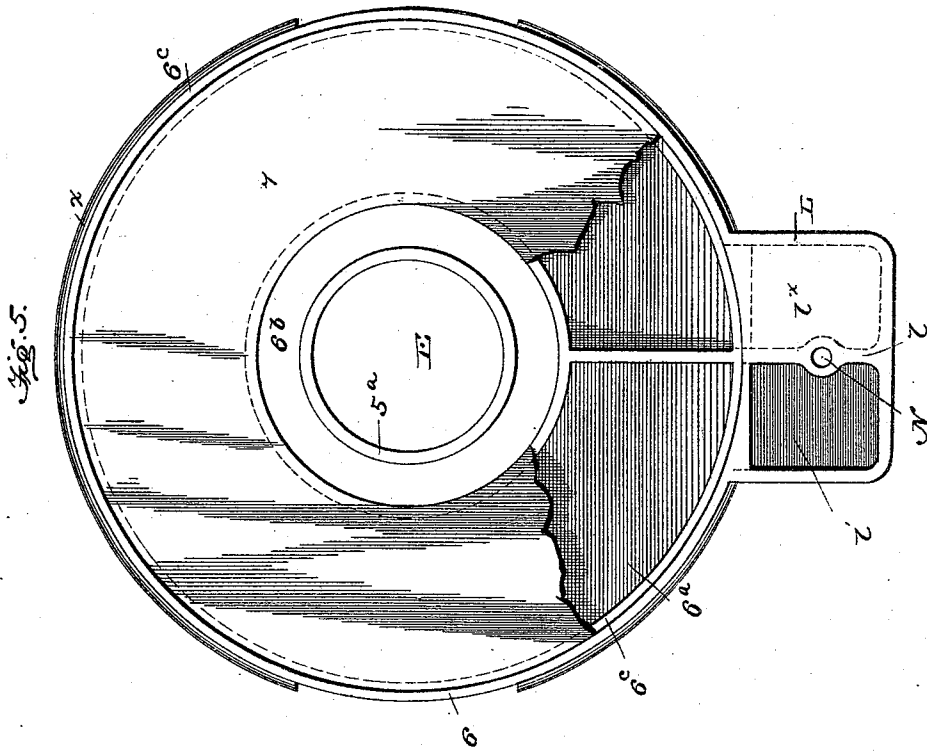


Fig. 4.

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# UNITED STATES PATENT OFFICE.

GEORGE A. WATSON, OF TORONTO, CANADA, ASSIGNOR TO WILLIAM HENRY LAIRD, OF NEW YORK, N. Y.

## SECTIONAL BOILER.

SPECIFICATION forming part of Letters Patent No. 521,746, dated June 19, 1894.

Application filed August 29, 1893. Serial No. 484,292. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE A. WATSON, a subject of the Queen of Great Britain, and a resident of Toronto, in the county of York, Province of Ontario, Canada, have invented certain Improvements in Sectional Boilers, of which the following is a specification.

This invention relates to certain improvements in that class of heating furnaces of which the furnace illustrated and claimed in my Patent No. 503,817, dated August 22, 1893, is a type, and the object of my invention is to provide certain improvements in the construction of such furnaces whereby certain advantages of economy and improved results are attained, all as will be hereinafter fully described.

The novel features of my invention will be carefully defined in the claims.

In order that my invention may be the better understood I have illustrated in the accompanying drawings a furnace provided with my improvements, in which drawings—

Figure 1 is a perspective view of the furnace complete and Fig. 2 is a vertical axial section of the same. Fig. 3 is a vertical axial section of the furnace taken in a plane at substantially right angles to Fig. 2. Fig. 4 is a vertical section taken in the plane at right angles to Fig. 2, and passing through the bolts or rods  $N^x$ . Figs. 5 and 6 are detail views drawn to an enlarged scale and illustrating certain details of construction to be referred to more particularly hereinafter.

In the views A represents the shell or casing of the furnace and B the ash-pit of the same which is provided with the usual ash-door.

C indicates the grate pivotally hung at the base of the fire-pot and adapted to be rocked in its bearings by means of a shaker which may be applied over the squared projecting end  $c^x$  of one of its trunnions.

E is the fuel-magazine provided with a cover F, said magazine opening at its lower end into the fire-pot D, and G, G, are air-tubes or flues leading from the ash-pit below the grate to the upper part of the fire-pot D.

H, H, are draft flues leading from the lower end of the fire-pot D above the grate to the outlet to the chimney.

The fire being kindled in the fire-pot at or near the level of the grate C is fed with fuel descending from the magazine in the usual manner, and with air partly from the ash-pit directly through the grate and partly from the ash-pit by way of tubes G, to the upper part of the combustion chamber or fire-pot and thence in a down-draft to the point of combustion. In this manner the fuel in the fire-pot is more completely consumed and the carbon and hydrogen of the fuel are caused to combine with the oxygen of the air to produce the gaseous products of combustion which pass away through flues H whereby the production of soot, &c., is almost wholly avoided.

So far as described my furnace herein illustrated presents no particular novelty over the construction set forth and claimed in the above-mentioned patent except in the particulars I will now relate: As seen in the sectional view, Fig. 3, the air-tubes G which in the previous construction were arranged within the shell in the space between the same and the wall of the fire-pot, are carried through the shell A exterior to the same and are provided with dampers  $g, g$ , (see Fig. 1) whereby the down draft may be regulated at will. This construction affords important advantages over that of the above-mentioned patent since by its employment the operator is enabled to regulate the draft to a nicety, and further in that the cost of construction is considerably lessened by providing the air tubes in the nature of separate castings with open ends the lower of which communicates with the ash-pit B through an opening  $g'$  in the wall thereof and the upper end of which communicates through an opening  $g^2$  in shell A with an interior horizontal tube  $g^3$  extending across the space between the fire-pot and the shell as seen. These castings forming the air tubes are provided with perforated lugs  $g^4$  at each end, through the perforations of which pass bolts  $g^x$  whereby the tubes are secured in place.

A second feature of the invention not set forth in the above-mentioned patent is the construction and arrangement of the draft flues H, for conveying the products of combustion away from the lower portion of the

fire-pot. In the said patent a construction is shown in which there is but one of these flues in the nature of a large annular space next the shell and completely surrounding the fire-pot, the upper end of which space is in communication with the chimney and the lower end of which communicates through a series of short horizontal flues or openings with the lower end of the fire-pot, said flues or openings passing directly through the wall of the fire-pot. By this construction, the manufacture of the furnace is made quite expensive and in order to overcome this disadvantage I arrange the grate C at a slight distance below the lower end of the fire-pot D whereby an annular gas-space I is formed surrounding the lower end thereof with which space communicate the lower ends of the flues H, arranged in an annular series as seen. In order to prevent the accumulation of ashes and cinders in this gas space I, whereby the draft might be interfered with, the said space is provided with a downwardly and inwardly sloping bottom *i*, whereby no lodgment is afforded thereof, and in order to further avoid this danger the lower edge of the fire-pot wall is provided with depending fingers *i'*, whereby this space is to a certain extent closed off from the fire-pot. In order to admit of access to this gas-space for observing the condition of the fire, cleaning, &c., I have provided the sight-door *i''* at the front of the furnace.

In order to guard against the formation of clinkers, &c., on the walls of the fire-pot D and to render any clinkers which may form in the fire-pot easy of removal, I have provided the interior walls thereof with a series of vertical projecting ribs *b*. These ribs serve to hold the fuel slightly away from the walls of the fire-pot whereby the liability of clinkers forming thereon is prevented.

My invention further contemplates certain improvements in the construction of the furnace in a series of separate and independent rings or sections adapted to be set one upon the other together with means for securing such rings or sections together, the object of this construction being to reduce the cost of the furnace as much as possible and to render it easy of assemblage and this construction I will now describe.

1 is the base ring or section having a flat bottom as shown and constituting the ash-pit of the furnace. On this base ring is mounted the section 2 having the form of the frustum of an inverted cone and provided at opposite sides with openings *g'*, over which fit the lower ends of the air-tubes G. On the top of this section 2 is mounted the ring or section 3 having the bearings *c* of the grate C as seen, said bearings depending below the upper edge of the section 2 and being arranged in such a position that the trunnion *c''* of the grate projects through an opening in one of the air tubes G.

Mounted on the top of section 3 is the in-

termediate section 4 in which is formed the fire-pot D, having the fingers *i'* as clearly seen, said fire-pot being of a diameter considerably less than that of the section 4 whereby an annular space *4<sup>a</sup>* is left between the fire-pot and the walls of the section 4, which space contains the draft flues H, as seen in Fig. 6, which is a perspective view of the section 4 with its top broken out for purposes of illustration. At its center this section 4 has formed in it the tubular projection *4<sup>c</sup>* forming the lower end of the fuel-magazine and said section is closed at its top by the cover or diaphragm 5, having openings for the upper ends of the flues H, as clearly seen in the sectional views. The upper edge of the tube *4<sup>c</sup>* is grooved about its inner surface to provide a seat for the lower end of a thimble *5<sup>a</sup>* forming the next higher section of the magazine E.

On the top of the section 4 is arranged the section 6 having an annular chamber *6<sup>a</sup>* projecting interiorly at a slight elevation above the cover 5 of section 4. The central perforation *6<sup>b</sup>* of this annular chamber *6<sup>a</sup>* is of a size greater than and surrounds the thimble *5<sup>a</sup>* of the fuel magazine, whereby a free annular space or flue is left about the same for the upward passage of the products of combustion from the draft flues H.

Mounted on the section 6 is the ring or section 8 having a form very similar to that of the section 4. This section 8 has also an annular chamber *8<sup>a</sup>* projecting interiorly at a slight elevation from the cover plate 7 of section 6 whereby a free passage is left therebetween, but the central opening of said annular chamber *8<sup>a</sup>* is of smaller diameter than the chamber *6<sup>a</sup>*, and the inner wall *8<sup>b</sup>* of said chamber rests on the upper edges of the thimble *5<sup>a</sup>* and forms the next higher section of the fuel magazine. The chamber *8<sup>a</sup>* of this section corresponds to the chamber *4<sup>a</sup>* of section 4 and within it are arranged an annular series of short draft flues *8<sup>d</sup>*.

Mounted on the section 8 is the crown or cover section 10 having a central depending tube *10<sup>a</sup>* forming the mouth of the fuel magazine and resting on the wall *8<sup>b</sup>* of section 8, and *10<sup>b</sup>* is the outlet from said cover section to the chimney. Said cover is also provided with oppositely arranged cleaning doors *10<sup>c</sup>* as seen in Fig. 1. Thus it will be seen that the products of combustion passing off from the fire-pot D take an upward course through the flues H, thence into the chamber formed between diaphragm 5 and the section 6, thence through the central perforation *6<sup>b</sup>* of section 6 into the chamber between cover 7 of section 6 and the section 8, thence through flues *8<sup>d</sup>* into the upper section 10 and thence to the chimney. The object of this employment of a series of sections is partly as stated, to cheapen the cost of construction of the furnace and partly to utilize to the greatest degree the waste heat from the products of combustion passing through the up-

per part of the furnace by providing a series of water chambers therein whereby hot water or steam may be employed for heating purposes, and at the same time the walls of the several flues and chambers be prevented from being burned out.

I will now proceed to describe the course taken by the water circulating through the furnace.

10 Mounted on the rear side of the section 3 which is hollow being of a triangular form in cross section, is a water chamber J having a central diaphragm  $j$  dividing it into two compartments  $j^x$  and  $j'$ . One of these compartments  $j^x$  has a closed top and is provided with a nipple  $j^2$  to which is connected the feed pipe  $j^3$  as seen in Fig. 1. The diaphragm  $j$  extends completely across the hollow of the section 3 and each of the compartments  $j^x, j'$  is provided with a port,  $j^4, j^5$ , respectively, communicating with said hollow on opposite sides of diaphragm  $j$ . Thus it will be seen that the water from the feed inlet enters the section 3 which surrounds the gas space I of the furnace and is exposed to a very intense heat, by way of the port  $j^4$  passes completely around the same and escapes by the outlet port  $j^5$  on the other side of diaphragm  $j$  into compartment  $j'$ , whence it passes through an opening in the top of said compartment upward into a second water chamber K, formed on the rear side of the intermediate section 4 and aligned with chamber J. Chamber K is likewise divided into two compartments  $k^x, k'$ , by partition  $k$ , which is continued completely across the space  $4^a$  as seen in Fig. 6, into one of which compartments  $k^x$  the water from chamber J enters. Thence the water escapes through port  $k^2$  into space  $4^a$ , passes completely around said space and escapes through port  $k^3$  on the opposite side of partition  $k$  into compartment  $k'$ , which like compartment  $j'$  has an open top through which the water passes into the next higher water chamber L formed on the rear side of section 6 as seen in Fig. 5. This chamber L is provided with a partition  $l$  dividing it into two compartments  $l^x, l'$ , having ports  $l^2, l^3$  respectively which communicate with the hollow of section 6 on opposite sides of partition  $l$ , which extends completely across said hollow. The water enters the compartment  $l^x$  through the opening in the base thereof circulates around section 6 and passes out through the port  $l^3$  into compartment  $l'$ , whence it passes through an opening in the top thereof into the next higher water chamber M formed on the rear side of section 8. This chamber M is in every particular similar to the chambers previously described and the water flows through the port  $m^2$  into chamber  $8^a$  circulates around the section 8 to the opposite side of partition  $m$  and passes through port  $m^3$  into chamber  $m'$ , whence it passes through an outlet pipe  $m^4$  to the header  $m^5$ , as seen in Fig. 1.

In order to secure the several sections to-

gether, I have provided in the partitions or diaphragms of the water chambers, openings N, as seen in Figs. 5 and 6, into and through which pass bolts or rods  $N^x$  whereby when the sections are properly assembled they may be secured rigidly together by means of nuts or the like. In order to dispense with the employment of other bolts for securing the sections together, I have provided the respective sections with overlapping circumferential flanges or lips  $x$ , the purpose of which is to prevent the sections from turning upon bolts  $N^x$  and becoming displaced when once secured together.

In order to permit the escape of any gas which may collect in the fuel magazine into the outlet to the chimney instead of into the room, I have provided in the upper part of the walls of said magazine a series of small perforations  $e$  and have provided the cover F' with a tight fitting cap plate  $f$  adapted to rest on the upper edge of said magazine and with a depending partition  $f^x$  adapted to fit snugly into the said magazine slightly below the openings  $e$  whereby any gases which may collect above partition  $f^x$  will pass through the openings  $e$  and escape to the chimney.

I do not wish to limit myself to the precise construction and arrangement of the several parts as herein set forth as it is evident many changes may be made therein without material departure from the principles of my invention. For instance the sections 6 and 8 might be dispensed with or an additional number of such sections might be employed making more or fewer water chambers, or bolts might be employed at various points about the circumference of the sections for holding the same together in lieu of the flanges  $x$ . Or instead of employing two bolts  $N^x$  running through the water chambers, the opening N might be extended entirely through all of said chambers and but one bolt employed.

Having thus described my invention, I claim—

1. In a sectional boiler, the fire-pot section having double walls whereby a fire-pot and a surrounding water space are formed therein, said fire-pot having a contracted upper portion forming the mouth of the fuel magazine, a partition extending across said annular water-space from the outer to the inner wall and to the mouth of the fuel magazine and inlet and outlet ports arranged on opposite sides of said partition, substantially as described.

2. The combination, in a furnace, of a fire-pot section having double walls whereby an annular water space is formed therein, a grate below the same whereby an annular gas-space is formed between said grate and fire-pot section, a series of gas flues extending through said water space and connecting at their lower ends with the said gas space, and a series of air flues extending horizontally across said water-space and connecting at their in-

ner ends with the interior of the fire-pot above said gas space, substantially as described.

3. The combination in a furnace, of a casing, a grate arranged therein, a hollow fire-pot section having its lower portion arranged above said grate whereby an annular gas-space is formed between said grate and fire-pot section, said fire-pot section being provided with a series of fingers depending into the combustion chamber whereby the gas-space is partially separated therefrom, and a series of draft-flues extending through the hollow of the fire-pot section and connecting at their lower ends with the said gas space, substantially as set forth.

4. The combination in a furnace, of a grate, a fire-pot section arranged above said grate and having double walls whereby a central fire-pot and a surrounding water space are formed therein, a series of gas-flues extending vertically through said water-space, and a series of air flues extending horizontally through said water-space, and connecting at their inner ends with the interior of the fire-

pot section above the lower ends of the gas-flues substantially as set forth.

5. In a boiler-furnace the combination of the grate, the fire-pot section above the same having an annular water chamber surrounding the fire-pot, upwardly leading gas-flues or tubes passing through the water-chamber, and the draft tubes external to the fire-pot section and communicating with the upper part of the fire-pot, so that the currents of air pass upwardly outside of the walls of the furnace, inwardly into the upper part of the fire-pot, downwardly through the same, and then upwardly through the internal gas flues of the fire pot section, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

GEO. A. WATSON.

Witnesses:

ANNIE TODD,  
HARRY CRESSWELL.