

May 30, 1939.

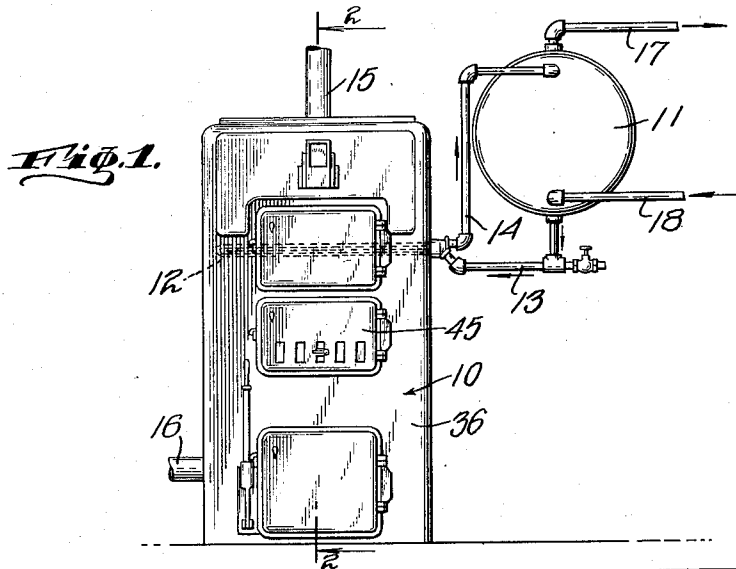
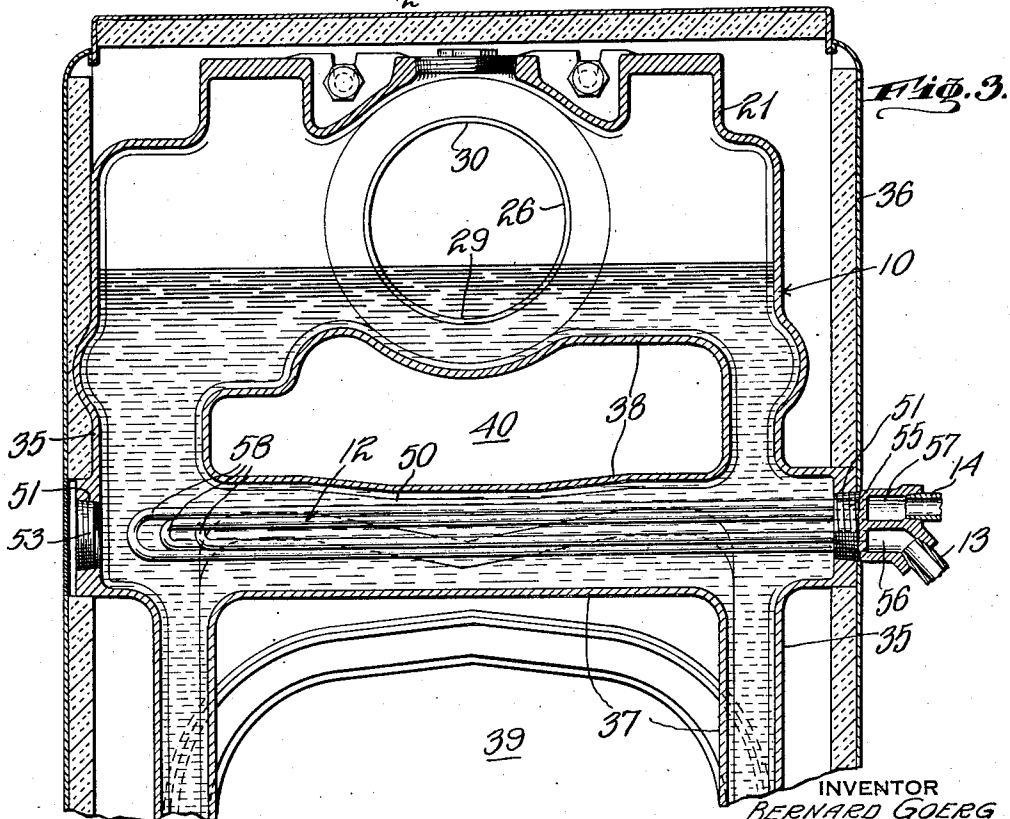
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2,160,801

HEATING APPARATUS

Filed Nov. 30, 1937

2 Sheets-Sheet 1



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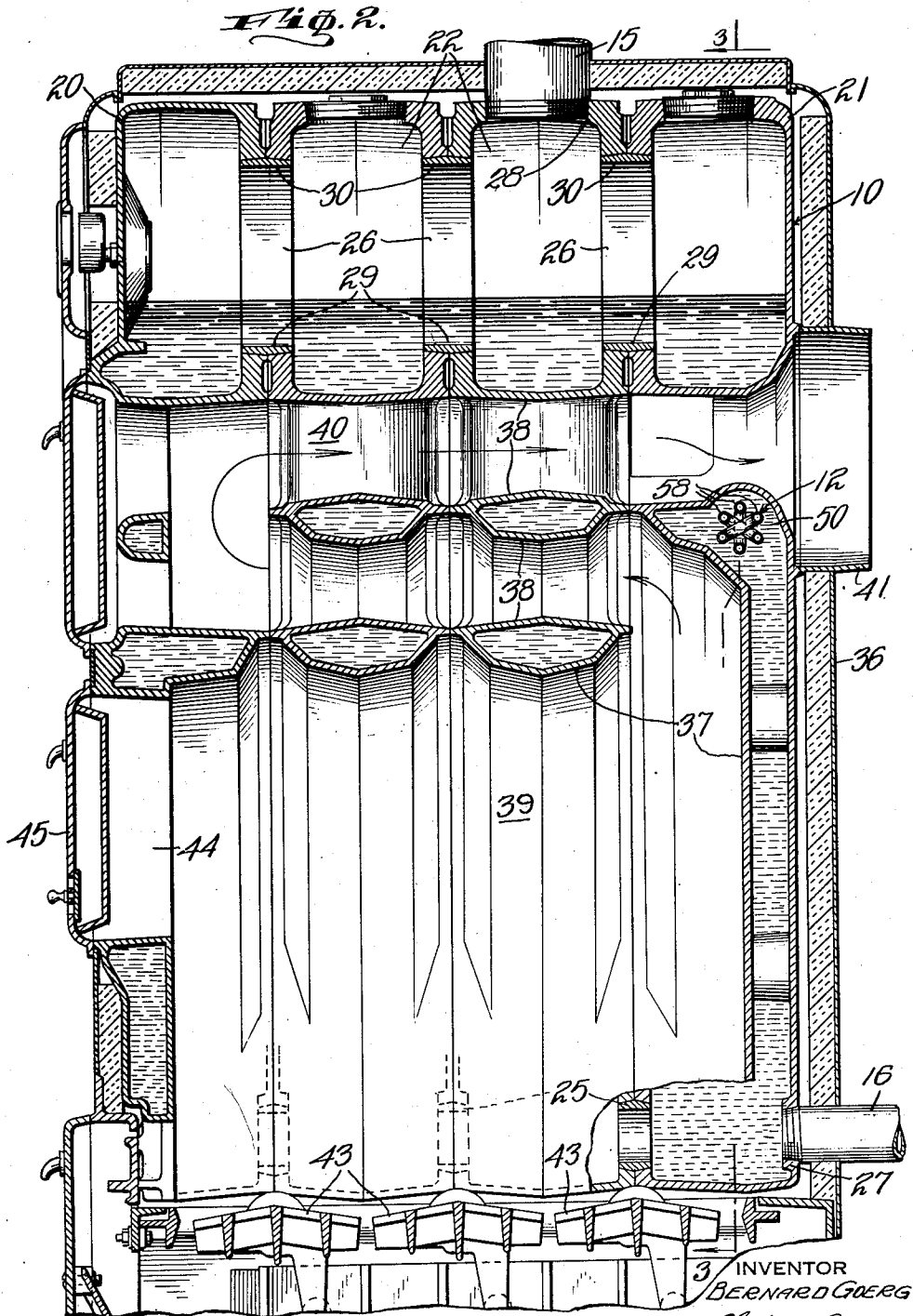
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,160,801

HEATING APPARATUS

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5 Claims. (Cl. 122—225)

My invention relates to heating apparatus, and more particularly to apparatus of this type which functions to supply both heat to occupied building spaces and also hot tap water for the use of the occupants thereof.

The invention consists in the novel construction and combination of parts, to be more fully described hereinafter, and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings, to be taken as a part of this specification, I have fully and clearly illustrated a preferred embodiment of my invention, in which:

Fig. 1 is a front elevation of heating apparatus constructed in accordance with one preferred embodiment of my invention and including a steam boiler of the domestic type combined with a tubular heat exchanger which forms a part of a hot tap water heating system and is connected to a hot water storage tank;

Fig. 2 is an enlarged longitudinal vertical sectional view of the boiler shown in Fig. 1 with the heat exchanger shown as combined therewith, the view being taken on the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary transverse vertical sectional view showing the boiler and heat exchanger, the view being taken on the line 3—3 of Fig. 2.

Referring now in detail to the construction illustrated, it will be observed that I have shown in Fig. 1 a steam boiler indicated by the reference character 10, a hot water storage tank indicated at 11, a tubular heat exchanger 12 arranged transversely of the boiler and within the water space thereof, and hot water circulating pipes 13 and 14 connecting the heat exchanger 12 with the storage tank 11.

The boiler 10 is shown as being of the type which is adapted to supply steam for heating the room spaces of buildings. 15 indicates the steam supply pipe which is adapted to be connected to the usual radiators located in the rooms of the building (not shown), and 16 indicates the return pipe for condensate from such radiators. The storage tank 11 is of conventional construction and is adapted to be connected by a pipe 17 to the usual hot water taps in the room spaces for use by the occupants thereof. The reference character 18 indicates the cold water supply pipe, which may be connected to any suitable source of water under pressure, for example, the city main.

The boiler 10 shown in the drawings is of the vertical cast iron sectional type and comprises a hollow front section 20, a hollow rear section 21,

and hollow intermediate sections 22. The sections 20, 21, and 22 are arranged vertically and in side-by-side parallel relation and the interior spaces thereof are connected at their lower ends and at each side thereof by aligned nipple connections 25. In Fig. 2 of the drawings, I have only shown the nipple connections 25 which are at the left-hand side of the boiler, as viewed in Fig. 1; but it will be readily appreciated that connections of this type are also provided at the right-hand lower side of the boiler. The interior spaces of the sections 20, 21, and 22 are also connected at the top of the boiler by relatively large aligned nipple connections 26. The connection for the condensate return pipe 16 is indicated at 27 and for the steam supply pipe 15 at 28.

As is well known, the hollow interior of the sections 20, 21, and 22 form the water and steam space for the boiler. The portion of the interior spaces of the several sections normally occupied by boiler water is indicated in Figs. 2 and 3. From an examination of these views, it will be observed that the normal water level is indicated as being above the lower edges 29 of the relatively large nipple connections 26 and below the upper edges 30 of these nipple connections. The purpose of this construction is to provide free communication between both the water spaces and the steam spaces of the several sections at the top of the boiler, as well as free communication between the water spaces of the sections at the bottom of the boiler.

The sections 20, 21, and 22 include outer side walls 35 which form the outer side walls of the boiler. The boiler 10 is entirely enclosed by the usual sheet metal jacket indicated at 36. The sections 20, 21, and 22 are also provided with inner wall portions 37 and 38, the wall portions 37 defining a combustion chamber 39, and the inner wall portions 38 defining a reverse flow passage 40 for combustion gases. The path of the combustion gases is indicated by the arrows in Fig. 2. The end of the passage 40 remote from the combustion chamber 39 is connected to a suitable smoke pipe 41 which serves to conduct the combustion gases to the usual chimney (not shown). Arranged across the lower part of the combustion chamber 39 are suitable grates 43 which serve to support fuel undergoing combustion in the chamber 39, the fuel being fed into the furnace through a suitable opening 44, extending through the front section 20 and adapted to be closed by the usual door 45.

The rear section 21 is so formed as to provide an elongated and enlarged water space portion

50 which extends transversely across said section from one outer side wall 35 to the opposite outer side wall 35. The portion 50 of the water space is advantageously arranged in the upper part of the rear section 21 so that the boiler water therein will be at a relatively high temperature. I have shown the portion 50 as being defined in part by that portion of the inner walls 38 of the rear section 21 which define the bottom of the rearwardly extending part of the passage 40 for combustion gases. The opposite outer side walls 35 of the section 21 which define the ends of the portion 50 are provided with tapped openings 51, 51.

15 In accordance with the present invention, I have combined with the boiler 10, a hot tap water heating system which includes the storage tank 11, the circulating pipes 13 and 14, and the tubular heat exchanger 12 previously referred to. 20 The tubular heat exchanger 12 is shown as being advantageously arranged lengthwise of the elongated and enlarged water space portion 50 of the rear section of the boiler. The tubular heat exchanger 12 is so constructed that it may be readily inserted in the portion 50 through either one of the tapped openings 51. Two openings 51 are provided so as to provide flexibility in installation requirements for the boiler and the hot tap water heating system. For example, should it be 30 desired or be necessary to locate one side of the boiler adjacent a cellar wall, the opening 51 at the side of the boiler away from the cellar wall may be used for the heat exchanger, the opening 51 not in use being closed by a suitable plug 53.

35 The tubular heat exchanger 12 is here shown as comprising a plug portion 55 which threadably engages the side of a selected one of the openings 51 and which is provided with a pair of water passages 56 and 57 respectively, which extend longitudinally through the plug, as shown. The heat exchanger 12 also comprises a plurality of open-ended U-shaped tubes 58, each of which is fixed at its opposite ends to the plug 55 in such a 45 manner that its open ends communicate respectively with the inner ends of the passages 56 and 57. The tubes 58 are of different lengths so that they may be compactly nested, as indicated in Fig. 2. It will be noted that the nest of tubes 58 extends entirely across the space 50 and their exterior surfaces contact the hot boiler water within the portion 50. As the tubes are fixed at their ends to the plug 55, the tubes and plug form a rigid unit which may be inserted and removed through either of the openings 51; and, 55 when the unit is in place within the boiler, the tubes are supported in their proper position by the plug 55. The outer ends of the water passages 56 and 57 are connected respectively to the ends of the hot water circulating pipes 13 and 14, previously described.

60 In operation, the heat of combustion from the fuel supported by the grate 43 is transmitted through the inner wall portions 37 and 38 of the sections 20, 21, and 22 to the water within the hollow interior of said sections. As the boiler water is thus heated to steaming temperature, steam bubbles are formed which travel upwardly through the water spaces of the section and collect in the upper part, or steam space, of each section. As the steam spaces of the several sections are in communication with one another, due to the large nipples 26, the steam will flow readily from the several sections to the steam 75 supply pipe 15 and to the room spaces. The heat

from the boiler water within the enlarged water space portion 50 of the rear section 21 will also be transmitted through the walls of the tubes 58 to the tap water within the interior thereof. As the tap water within the tubes 58 absorbs heat and is raised in temperature, it will flow through the passage 57 and circulating pipe 14 to the storage tank 11; and such water will be replaced by relatively cold water flowing to the tubes from the bottom of the storage tank and through the circulating pipe 13 and passage 56.

From the above, it will be apparent that I have provided a novel combination of structural features which provide a simple, inexpensive, and efficient means for heating the room spaces of buildings and for heating hot tap water. The boiler 10, and tubular heat exchanger 12 are so constructed, that the heat exchanger may be readily inserted lengthwise through either side wall of the boiler. The heat exchanger occupies a space in only one of the sections of the boiler. This space extends entirely across the rear section and is located in the upper part of the boiler where the boiler water is relatively hot. On account of the length and cross-sectional area of the space occupied by the heat exchanger, the latter may be provided with a relatively large area of heat absorbing surface.

Heretofore, it has been thought necessary in vertical sectional boilers, in order to provide a hot water heat exchanger of relatively large area, for the heat exchanger to extend through several or all of the sections. This construction was relatively expensive on account of the required special nipple connections between sections to receive the heat exchanger. This construction was thought necessary because in the conventional prior art steam boiler, there was not sufficient circulation of boiler water between sections to prevent undue cooling of the water in one section where the heat exchanger located entirely within the one section. Furthermore, there is not sufficient heat in the water of one section to heat the tap water in a tubular heat exchanger of relatively large heat absorbing area. Were the heat exchanger located in only one section of the prior art boilers, such boilers would be impractical for heating hot tap water during the summer time, as the insufficient circulation between sections would prevent the other sections from losing their heat and the other sections would therefore steam.

The above relatively expensive construction of the prior art is overcome by my invention. As I provide the nipple connections between sections at the bottom of the boiler and the extra large nipple connections between the water spaces of the several sections at the top of the boiler, which latter nipple connections extend partially below the water line, communication is had at all times between the water spaces of the several sections both at the top of the boiler and at the bottom of the boiler. This construction assures thermosiphonic circulation of water between sections at all times and particularly between the section containing the tubular heat exchanger and the others; and this circulation will result in maintaining an even boiler water temperature in all sections, and will thereby supply adequate amounts of heat to the heat exchanger, although it is located in only one of the sections.

What I claim and desire to secure by Letters Patent of the United States is:—

1. In heating apparatus, the combination of a steam boiler comprising front, back, and inter-

mediate hollow cast metal sections arranged transversely of the boiler and in side-by-side relation; the sections having outer side walls providing the boiler side walls and inner wall portions defining a combustion chamber and a passage for combustion gases; the passage for combustion gases including a portion extending rearwardly through the upper part of the back section and at points below the normal water line therein; means for communicatively connecting the interior of the sections at the bottom and at the top of the boiler and below the normal water line to provide for thermo-syphonic circulation of water between sections; the back section being provided with an elongated and enlarged water space portion extending across the section from one of the outer side walls and defined in part by the inner wall portion thereof which defines the bottom of said rearwardly extending portion of the passage for combustion gases; said one outer wall having an opening therethrough providing communication with one end of said elongated water space portion; and a hot water supply system including a pair of circulating pipes located exteriorly of the boiler, and a tubular heat exchanger arranged lengthwise within said elongated water space portion and having inlet and outlet water connections extending through said opening and connected respectively to said circulating pipes.

2. A boiler comprising a front end, a back end, and intermediate hollow cast metal sections arranged in vertical side-by-side relation; the sections comprising walls defining interior water spaces and the walls including outer side walls forming the boiler side walls and inner wall portions defining a combustion chamber and a flue gas passage; said flue gas passage including a portion in the upper part of the boiler and extending lengthwise between the front and rear of the boiler; nipple means communicatively connecting the water spaces of adjacent sections at the bottom and at the top of the boiler; the nipple means providing the connection at the top of the boiler being arranged below the top of the sections and being so constructed and located that at least the bottom portions thereof are disposed below the normal water line when the boiler is operated as a steam boiler, whereby gravity circulation is had between sections when the boiler is operated as a steam boiler as well as when it is operated as a hot water boiler; the inner wall portions of one of said end sections and including the part thereof defining the bottom of said portion of the flue gas passage, being so constructed as to provide an enlarged and elongated water space portion extending across said one end section from one of the outer side walls thereof and in open communication with the remaining water space thereof; said one outer side wall having an opening therethrough providing communication with the end of said elongated water space portion; and a unitary elongated tubular heat-exchanger arranged lengthwise of said elongated space and removable through said opening and including inlet and outlet water connections extending through said opening and secured to said one outer wall.

3. A boiler formed of hollow cast metal sections arranged in vertical side-by-side relation; the sections comprising walls defining interior water spaces and the walls including outer side walls forming the boiler side walls and inner wall portions defining a combustion chamber and a flue gas passage; nipple means communicatively

connecting the water spaces of adjacent sections at their bottom and at their top; the nipple means providing the connection at the top of the boiler being arranged below the top of the sections and being so constructed and located that at least the bottom portions thereof are disposed below the normal water line when the boiler is operated as a steam boiler, whereby gravity circulation is had between sections when the boiler is operated as a steam boiler as well as when it is operated as a hot water boiler; one of said sections being so constructed that the inner wall portions thereof define a relatively large interior water space in open communication with the remaining water space thereof and extending lengthwise across the section from one outer side wall thereof to the opposite outer side wall; each of said outer side walls having an opening therethrough providing direct communication with the adjacent end of said elongated space; a unitary elongated tubular heat-exchanger of a size to permit its insertion and removal through either of said openings and being arranged lengthwise within said elongated space and including inlet and outlet water connections extending through one of said openings; and a removable plug for closing the other of said openings.

4. A boiler formed of hollow cast metal sections arranged in vertical side-by-side relation; each section comprising walls defining therebetween a water space and said walls including outer side walls forming the side walls of the boiler and inner wall portions defining a combustion chamber and a flue gas passage; nipple means communicatively connecting the water spaces of adjacent sections at their bottom and at their top; the nipple means providing the connection at the top of the boiler being arranged below the top of the sections and being so constructed and located that at least the bottom portions thereof are disposed below the normal water line when the boiler is operated as a steam boiler, whereby gravity circulation is had between sections when the boiler is operated as a steam boiler as well as when it is operated as a hot water boiler; the defining walls of one of said sections being so constructed as to provide an elongated and enlarged interior water space therein extending away from one of the outer side walls thereof and across the boiler and being in open communication with the remaining water space of said one section; said one outer side wall having an opening therethrough providing communication with the adjacent end of said elongated space; and a unitary elongated tubular heat-exchanger of a size to permit its insertion and removal through said opening and being arranged lengthwise within said elongated space and including inlet and outlet water connections extending through said opening and secured to said one wall.

5. A boiler comprising front, rear, and intermediate cast metal sections assembled in vertical side-by-side relation; the sections including outer wall portions providing the outer boiler walls and inner wall portions providing a combustion chamber and a flue gas passage extending through the upper parts of said sections; the inner and outer wall portions being spaced to provide hollow interior spaces containing the boiler water; bottom nipples connecting directly the lower parts of the water spaces of adjacent sections; a series of aligned relatively large top nipples arranged below the top of the sections and connecting directly the upper parts of adjacent sections and being so located that the

lower parts thereof are disposed below the normal water line between sections when the boiler is operating as a steam boiler, whereby gravity circulation of water is had between sections under all conditions of operation; said rear section being formed with a relatively large water space portion defined by the outer wall portions thereof which provide the boiler rear wall and oppositely disposed portions of the boiler side wall, and by a part of the inner wall portions thereof defining

the flue gas passage; said rear section being provided with an opening through one of its outer side wall portions communicating directly with one end of said large water space portion; and a domestic hot water heater of the tubular type arranged within said large water space portion and insertible and removable as a unit through said opening and including inlet and outlet water connections extending through said opening.

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