

UNITED STATES PATENT OFFICE.

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WATER-HEATING FURNACE.

SPECIFICATION forming part of Letters Patent No. 459,243, dated September 8, 1891.

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To all whom it may concern:

Be it known that I, JUDSON W. WARNER, of Oneida, in the county of Madison and State of New York, have invented certain new and useful Improvements in Water-Heating Furnaces; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form part of this specification, in which—

Figure 1 is a perspective view of my improved water-heating furnace. Fig. 2 is a central transverse vertical sectional view thereof. Fig. 3 is an exterior view of the front section, with doors removed; Fig. 4, a similar view of rear section; Fig. 5, a view of the intermediate section; Fig. 6, a detail showing the formation of coal-feed tube.

This invention is an improved water-heating furnace, and its objects are to make a sectional water-heater of simple construction, each section of which can be connected to an independent radiator wherein the several sections when united will form a long tortuous fire-passage, which, however, shall be readily accessible at all points, both the fire and water-circulation shall be in an upward direction, and a large amount of heating-surface shall be produced, no internal bolts be used, and which can be provided with self-feeding coal-reservoirs without destroying the circulation through any section. To these ends the invention consists in the novel construction and combination of parts, as will be hereinafter clearly described and claimed.

Referring to the drawings by letters, A designates the front section, of rectangular form and stood upright on one end. It consists of side legs A' A', united at bottom by a horizontal hollow limb a and at top by a limb a' and by intermediate limbs a² a² and a wide limb a³ just above limb a. Access can be had to the ash-pit through the opening left between limbs a a³, to the fire-chamber through the opening between limbs a² and lowest limb a², and to the fire-flues of the furnace through the openings between limbs a², a², and a'. All said openings are closed by suitable doors, as shown. Section A is hollow throughout, so that its interior forms a series of communicating water chambers or spaces. The inner

face of limb a³ may be recessed, as at a⁴, to receive a lining of fire-brick to protect the same against the fire in the fire-chamber. On the upper inner edges of the several limbs are formed tongues T, hereinafter described.

B designates an intermediate section of the furnace corresponding in exterior contour to a section A and one or more of such sections B may be employed. I have shown four in the drawings, and beingsimilarly constructed generally a description of one will explain all. Each section B is composed of upright side legs B' B', connected at bottom by a limb b and at top by a limb b', and by intermediate limbs b² opposite limbs a² of section A, when the sections are assembled, and also by limbs b³ intermediate limbs b², as shown. Section B is hollow throughout like section A. On the legs B' of section B are formed proper supports for the grate-bars F each section B supporting its own grate-section, and the grate-sections lie opposite the lower edge of limb a³ of section A, the space below the grate-bar forming part of the ash-pit, the space above part of the fire-chamber, and, if desired, the inner faces of legs B' may be recessed, as at B², to receive a fire-brick lining in the fire-chamber. In the upper edges of the limbs of section B are formed grooves G, which are adapted to engage the ribs T of section A or an adjoining section B, and on the opposite edge of each limb of section B is formed a rib or tongue T similar to the ribs on section A. The rear section C is formed with upright legs C' C', connected at bottom by a limb c and at top by a wide limb c' and (opposite the limb a³ of section A) by a wide limb c² and intermediate limb c². The section C is hollow throughout. The opening between limbs c c² allows access to the ash-pit and is closed by a suitable door. The inner face of limb c² may be recessed to accommodate a fire-brick lining, as indicated at C², if desired. The opening between the limbs c² c² is closed by a door, and through it access can be had to the fire-passages for cleaning them. Through the wide limb c' is formed a central passage C⁴, around the outer mouth of which is a flange C⁵, to which may be connected the smoke-pipe. Said passage communicates with the upper end of the fire-passage.

On the inner edges of the limbs of sections C are formed grooves G, adapted to engage the ribs T of the adjoining section B. When the sections are assembled, as shown in Fig. 2, the limbs b^2 b^3 of sections B form a series of horizontal passages above the fire-chamber. The lowest of these passages communicates with the fire-chamber through the opening between limbs c^2 c^3 of the section C, and with the overlying passage just above through an opening between the lowest limbs a^3 of section A, the second passage with the third through an opening in section C, and so on, as indicated. Thus a continuous zig-zag or tortuous upwardly-leading passage is formed from the fire-chamber to the flue or pipe. Each of said passages is readily accessible for cleaning. It will also be observed that each section forms part of the ash-pit, fire-chamber, and several flue-passages, and the sections B also support their own grate-sections, and by increasing or diminishing the number of sections B the capacity of the furnace is increased or diminished. Again, the limbs of section B, with the exception of the lowest, are made with tapered sides, or their sides converge from top to bottom, so that the limbs are almost surrounded by hot air, thus increasing the water-heating surface in the furnace and trapping the heat between the adjoining limbs. The several grate-sections are preferably rocking bars and are connected and operated by links and levers, as indicated, or in any convenient manner. The tongue-and-groove packing-joints T G between the section is more clearly shown in Fig. 6. The tongues and grooves are so made that when the sections are properly set the grooves and tongues interlock, so that the sections cannot move directly away from each other, and in order to separate them the tongued section must be vertically raised until the tongues are free from the grooves, and then it can be moved horizontally away from the other section. By this means the sections are interlocked and set up without the employment of any bolts, and after they are set up the grooves are filled with fire-proof cement, thus closing the spaces between the limbs and making the flue tight, and at the same time additionally binding the sections together. I propose to bind the sections together by external bolts, as indicated in the drawings; but it will be observed that there are no internal bolts, and these interlocking joints allow sufficiently for contraction and expansion of the parts of the sections without injury to the same.

D designates a horizontal supply-pipe, from which the several sections A B C receive water by means of joints d , connecting said pipe with the respective sections at bottom, so that the supply is common. This supply-pipe is connected to the return-pipes y from the radiators in the building, as shown. The water circulates upwardly through the sections, passing first under the ash-pit, thence beside

and over the fire-chamber, and then up over the several fire-passages, and is highly heated when it reaches the top of the sections, through which it passes through independent pipes R to the radiators. I preferably connect each section with one radiator or line of pipe, so that the radiators which are farthest off may receive water from the sections subjected to most heat, which will be a central section, instead of connecting the several sections to a common drum from which all the radiators receive heated water alike. By this arrangement each section constitutes an independent water-heater, and each line of pipe or radiator is in an independent heated-water circuit.

E designates a coal-reservoir at top of the furnace, and it may be made separate from the sections and attached thereon, or may be cast therewith, as indicated, so that each section forms part of the reservoir also, as shown. On top of limb a of section A, I form a box-section E^1 , open on its inner side and having an opening closed by a door e on its outer side. Then on top of each section B, I cast a box-section E^2 , consisting simply of top and sides, and the hollow limb c' of section C closes the rear end of the reservoir.

In order to feed the coal from the reservoir, I have to modify the construction of some of the sections B somewhat. In such case I form the chute preferably in two sections B, as indicated in Figs. 2, 5, and 6, by forming recesses in one side of limbs b^1 b^2 b^3 of opposed sections B, and connect the several limbs at the edges of said recesses by vertical webs or wall B^5 , so that when the two sections are set up a vertical feed-tube e' is formed leading from the reservoir to the fire-chamber without cutting off the circulation of water in the lines of either section. As many of these feed-tubes may be thus produced in the furnace in setting it up as may be desired and as its length may require. Openings may be formed between two or more of the sections just above the fire-level of the coal on the grate so as to admit air above the fire to insure more perfect combustion. By leaving out the reservoir-sections and omitting the coil-reservoir E on top, making up the furnace with the plain inside sections, a surface-burning furnace can be produced, and the coal supplied through the fire-door A without making any trouble or expense in changing patterns, thus doing away with the self-feeding features of the furnace altogether, which in some cases and by some parties may be deemed desirable.

Having described my invention, what I claim as new, and desire to secure by Letters Patent thereon, is—

1. In a water-heating furnace, the combination of hollow front and rear sections A and C, constructed substantially as described, and the hollow intermediate sections B B, constructed substantially as described, so that each forms a part of the ash-pit, fire-chamber,

grate-support, and fire-passage, said front and rear sections being provided with doors opening into the fire-passages, ash-pit, and fire-chamber, substantially as described.

5 2. In a water-heating furnace, the combination of hollow front and rear sections A and C, constructed substantially as described, and hollow intermediate sections B B, constructed substantially as described, so that
10 each forms a part of the ash-pit, fire-chamber, grate-support, and fire-passage, said front and rear sections being provided with doors opening into the fire-passages, ash-pit, and fire-chamber, with the radiator-pipes leading directly and independently from the respective
15 sections and the return supply-pipe, substantially as set forth.

3. In a water-heating furnace, the combination of the front and rear sections A C, constructed substantially as described, with the intermediate sections B, formed with feed-tube passages e' , and a coal-reservoir on top of said section, all constructed and arranged to operate substantially as described.

25 4. The combination of two or more vertical sections united by interlocking horizontal transverse tongue-and-groove packing-joints, constructed and arranged substantially as specified.

30 5. In combination with the independent front and rear sections A C, an intermediate section B, having side legs B' , connected by limbs $b b' b^2 b^3$, all constructed and arranged substantially as specified.

35 6. In a water-heating furnace, the combination of two sections having hollow side legs connected by a series of transverse hollow limbs, said limbs having opposite recesses or depressions in their opposing faces only and
40 connected at the edges of said recesses by vertical webs or walls, whereby a vertical continuous feed-tube is formed between the sections when put together without breaking the water-circulation through the limbs, substantially as specified.

45 7. The combination, in a water-heating furnace, of the water-holding section having horizontal grooves G in one vertical face, substantially as described, with an opposite water-holding section having horizontal tongues T
50 on one vertical face adapted to engage said grooves and lock the sections together, all constructed as and for the purpose specified.

8. The combination of the section A, having a series of grooves G and constructed substantially as described, and the rear section C, having a series of tongues T and constructed substantially as set forth, with the intermediate section B, having a series of
55 tongues T on one side adapted to engage the grooves of section A, and a series of grooves G on the other side adapted to engage the tongues of section C, whereby said sections are interlocked, as and for the purpose specified.
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9. In a water-heating furnace, the combination of sections having hollow side legs connected by a series of transverse hollow limbs, said limbs having recesses or depressions in their opposing faces and connected at the
65 edges of said recesses by vertical webs forming a vertical continuous semi-tube in each section, whereby a feed-tube is formed between the sections when put together, with the front and rear sections A and C, the feed-pipe, and radiator-pipes, all substantially as specified.
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10. The combination of the front and rear sections A and C and the intermediate sections B, formed with feed-tubes e' , all constructed and arranged substantially as specified, with the coal-reservoir on top of said sections, and interlocking tongue-and-groove packing-joints between the sections, as and
75 for the purpose set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

JUDSON W. WARNER.

Witnesses:

CHAS. C. CLARK,
JAMES D. COOK.