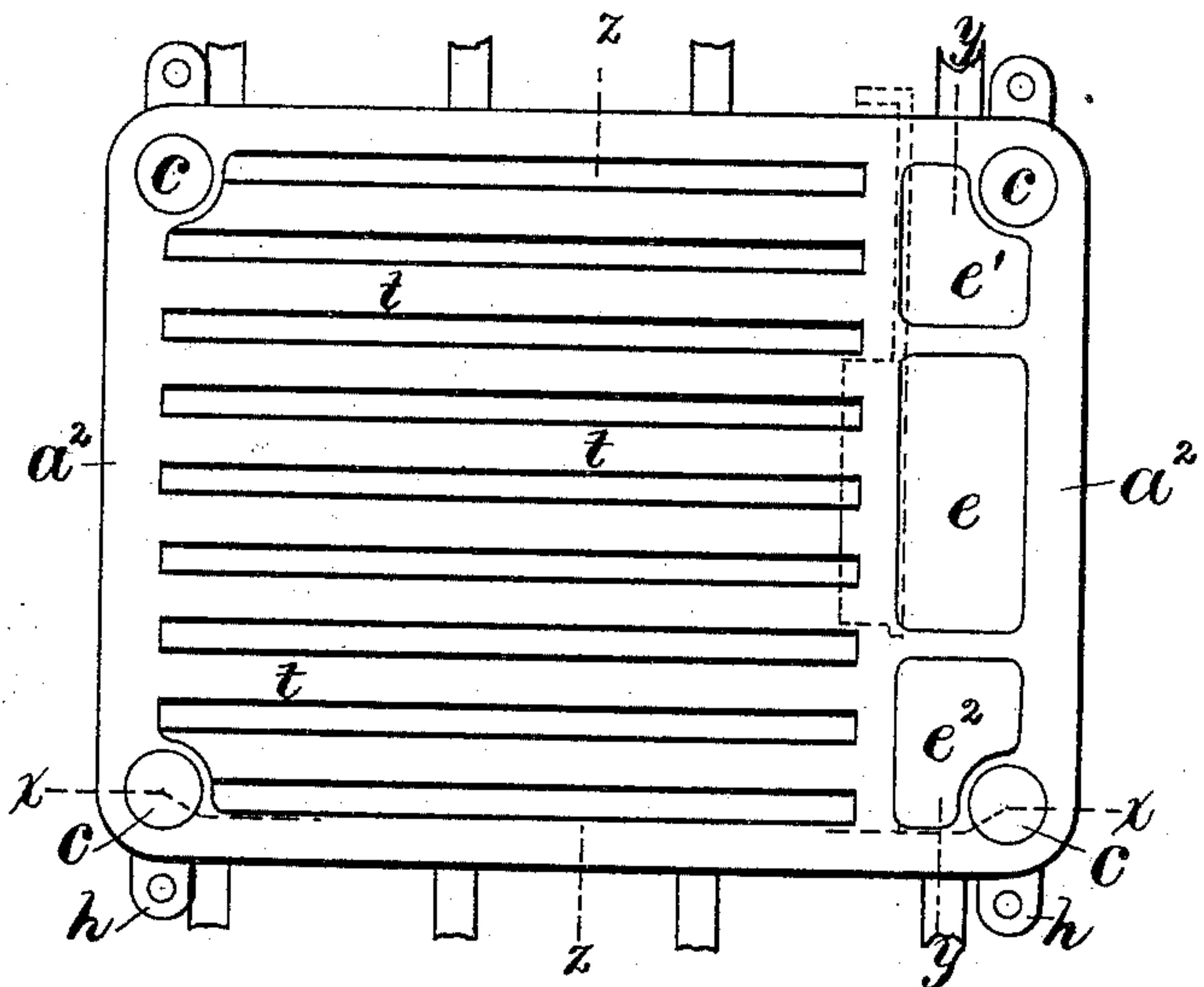
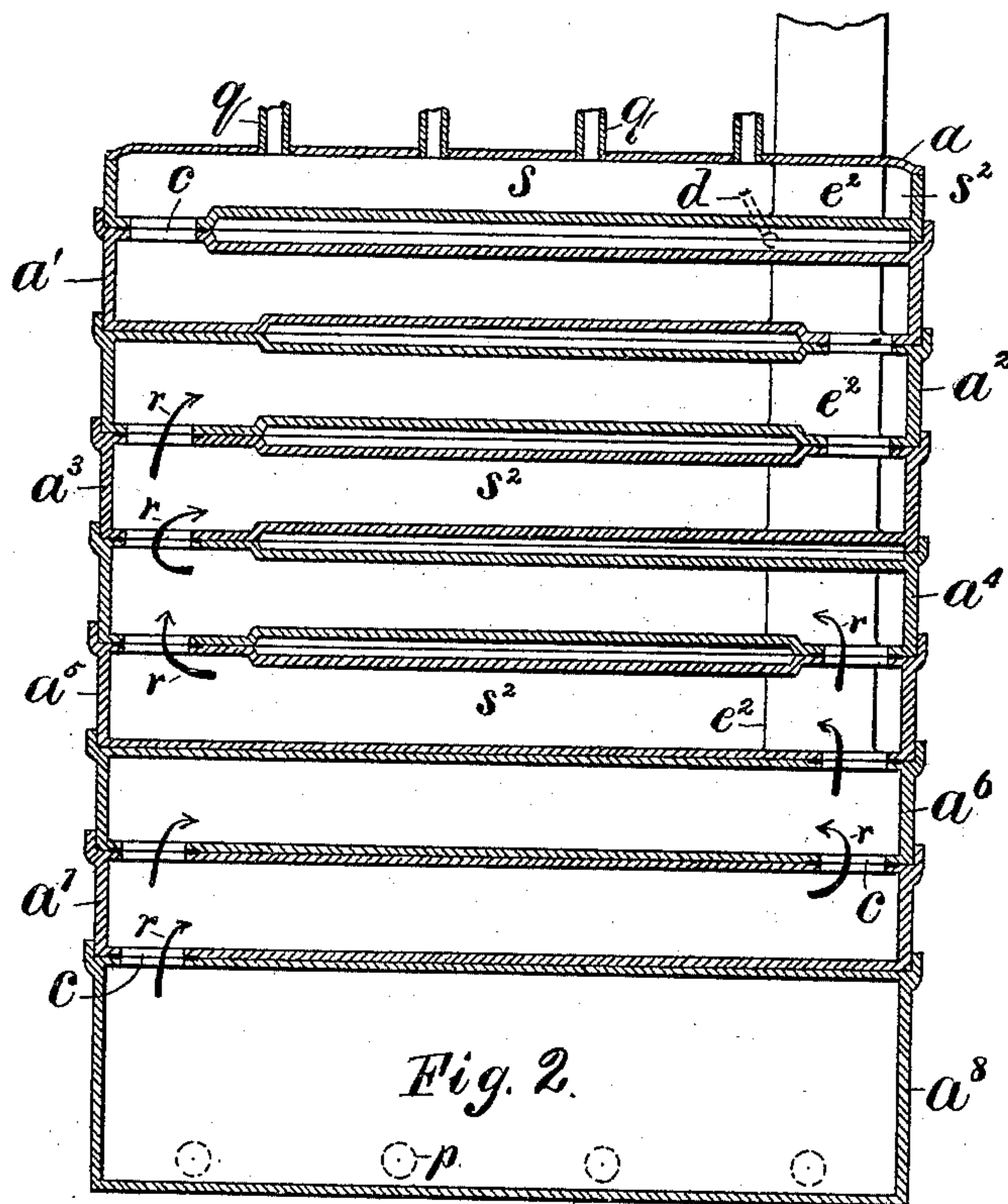


G. C. BLACKMORE.  
WATER HEATER.

No. 409,314.

Patented Aug. 20, 1889.



Attest:  
L. Lee.  
F. C. Fisher.

Fig. 1.

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George C. Blackmore, per  
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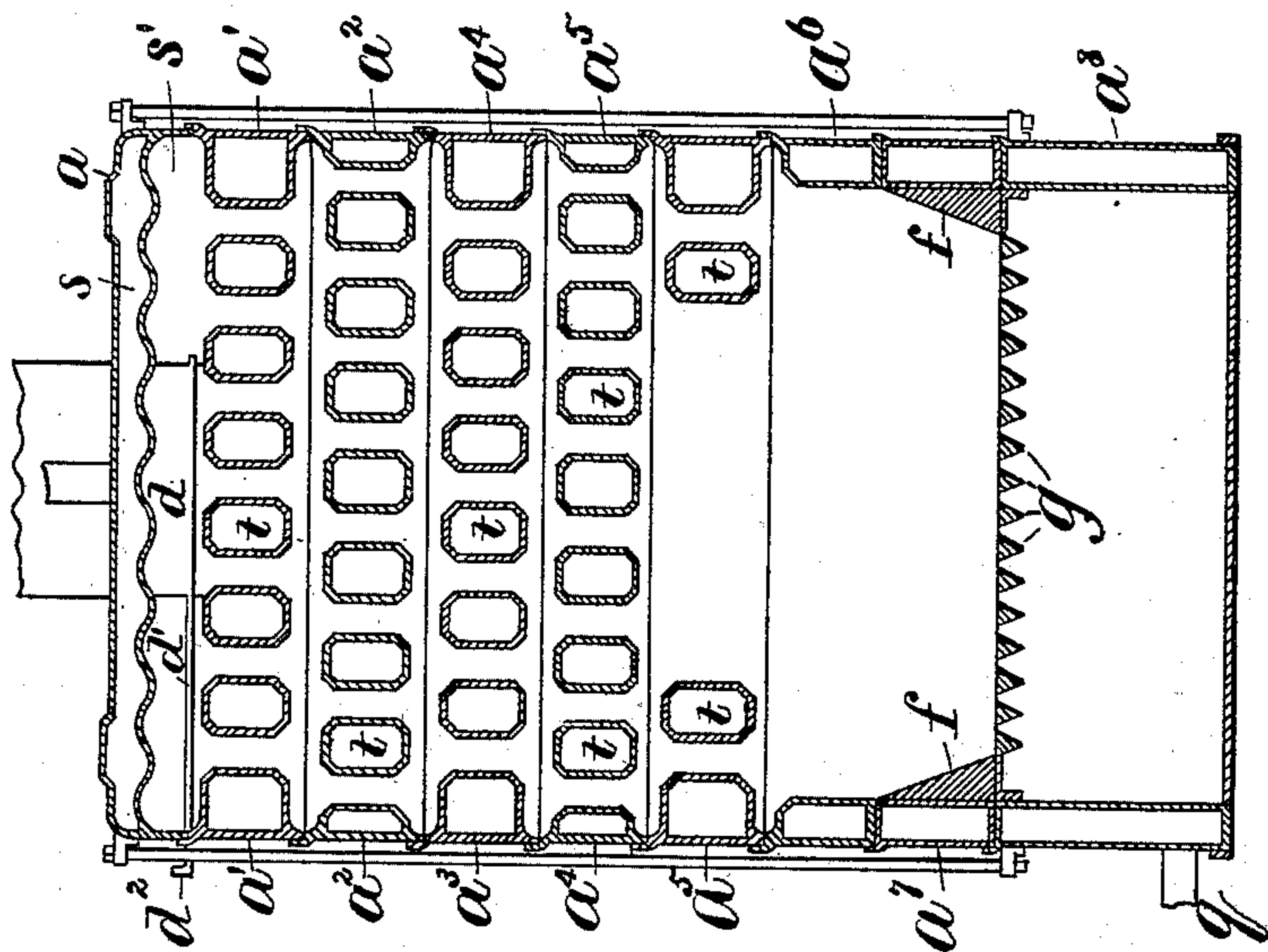


Fig. 4.

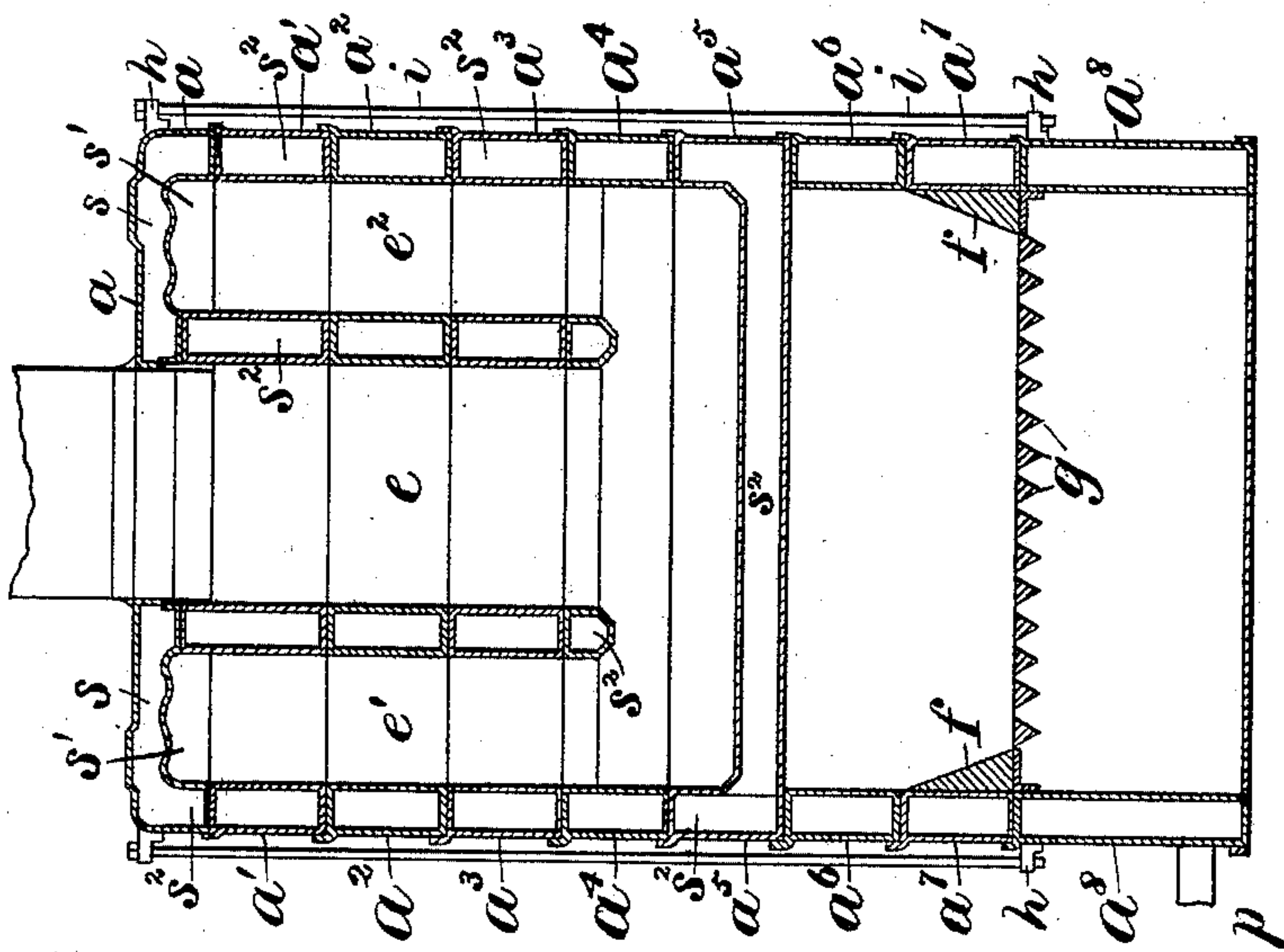


Fig. 3.

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# UNITED STATES PATENT OFFICE.

GEORGE C. BLACKMORE, OF NEWARK, NEW JERSEY.

## WATER-HEATER.

SPECIFICATION forming part of Letters Patent No. 409,314, dated August 20, 1889.

Application filed March 21, 1889. Serial No. 304,181. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE C. BLACKMORE, a subject of the Queen of Great Britain, residing at Newark, Essex County, New Jersey, have invented certain new and useful Improvements in Hot-Water Heaters for Radiators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is to furnish an efficient and at the same time portable hot-water heater for radiators; and it consists in the construction herein shown and described.

The class of heater for which my invention is designed is that comprising a series of parallel sections built up to form a structure of the proper form and dimensions, each of the sections containing water and fire spaces arranged in a suitable manner.

In the annexed drawings, Figure 1 is a plan of a heater constructed in accordance with my invention with the three upper sections removed, but showing the position of the damper in dotted lines. Fig. 2 is a vertical section on line  $xx$  in Fig. 1 of the entire heater. Figs. 3 and 4 are similar sections upon lines  $yy$  and  $zz$  in Fig. 1.

Each of the sections  $a$ ,  $a'$ ,  $a^2$ ,  $a^3$ ,  $a^4$ , &c., is provided with water-spaces arranged in such manner that the fire-space is entirely inclosed thereby, thus avoiding any unnecessary loss of heat by radiation from surfaces in direct contact with the fire and heated gases from the furnace. The top section  $a$  is provided with a water-space  $s$ , covering its whole upper portion with the exception of an aperture near one end for the main flue; and its lower portion consists in a fire-space  $s'$ , where the heated gases and smoke collect after passing upward from the fire-pot through the water-tubes, to be carried away by the flues.

The sections  $a'$ ,  $a^2$ ,  $a^3$ , and  $a^4$  are each provided with water-tubes  $t$ , occupying their interior portions, and with a water-space at  $s^2$ , one end having the central main flue  $e$  and the return-flues  $e'$  and  $e^2$  passing through the same. The section  $a^5$  contains water-tubes only at the sides, leaving an extra space in the center immediately above the center of the fire-pot, where the heat is the greatest, and a transverse passage is formed in the sections

$a^4$  and  $a^5$  to connect the return-flues  $e'$  and  $e^2$  with the main flue  $e$ .

The sections  $a^6$ ,  $a^7$  and  $a^8$ , inclosing the fire-pot and ash-pit, consist merely in hollow rectangular shells having water-jackets, as shown in Figs. 2 and 3, the section  $a^7$  being lined with fire-brick  $f$ , of triangular cross-section, to prevent the direct contact of the burning fuel with the surface of the metal separating the same from the water, and containing the grate  $g$ .

As indicated in the drawings, each section is provided with inlet and outlet apertures  $c$ , arranged in such a way that the water, in its passage from the bottom to the top of the heater, circulates in opposite directions in each alternate pair of sections, as shown by the arrows  $r$ , entering each section at one end and issuing therefrom at the opposite end. In order to attain this result each section, except the ones at the top and bottom of the heater, is formed with apertures at one end on one (either upper or lower) side and at both ends on the other side, and the sections so constructed are arranged as follows: The section  $a^7$  is provided with inlet-apertures at the left-hand end only of the lower side and with outlet-apertures at both ends of the upper side. The section  $a^6$  has inlet-apertures at both ends of its lower side to correspond with the outlet-apertures of the section  $a^7$  and adapted to receive the water therefrom, but has its outlet-apertures at the right-hand end of the upper side only. The inlet and outlet apertures in the remaining sections are arranged in a manner similar to those of the sections already described, each section being formed with apertures at both ends on one side and at only one end on the other side, the alternate sections having the apertures at opposite ends on the sides containing apertures at one end only and the sections intermediate thereto having apertures on their upper and lower sides corresponding with those in the sides adjacent thereto of the sections directly above and below the same. The upper and lower sections  $a$  and  $a^8$ , respectively, would necessarily be provided with apertures corresponding with those in the section in immediate contact therewith, the apertures being omitted on the side opposite. In order to form water-



tight joints between the sections, I apply suitable washers *w*, preferably of india-rubber or leather, between their surfaces around the adjacent inlet and outlet apertures, and clamp  
5 the sections rigidly together by means of tie-bolts *h*, inserted through perforated lugs *i* at the corners of the upper and lower sections, in the usual manner.

My object in dividing the volume of water,  
10 so as to convey it in the same direction in two adjacent sections, is to allow it to flow slowly in order to diminish the friction produced in its circulation, and I find that in this class of heater it is not practicable to form the sections  
15 of sufficient capacity and at the same time to retain a desirable form for the same, to attain this end in a single section. By my arrangement I also secure the advantage of a larger heating-surface, which is afforded by  
20 the adjacent sides of the sections, than there would be were the same formed integral and without the partition formed by the adjacent sides.

*d* is a damper adapted to open and close an  
25 opening between the fire-space *s'* and the main flue, and is operated by a rod *d'* projecting through the side of the heater, provided at its outer end with a handle *d''* for turning the same. The damper is interposed  
30 at such point to effect the direct passage of the smoke and gases from the fire-pot to the chimney, when desired.

It will be noticed that each of the flues is inclosed within the water-space, and that none  
35 of the heat contained by the smoke and gases after passing through the body of the heater and among the water-tubes is permitted to be absorbed by any surface in contact with the external air, and thereby lost by radiation,  
40 until they have passed through the return-flues and have reached the level of the top of the heater in the main flue, when almost the whole amount of heat carried thereby from the furnace has been absorbed by the heating-  
45 surface within the structure.

Heretofore a heater has been devised having each of its flues inclosed by the water-space; but such construction contained only a single return-flue. My construction has the  
50 advantage of an increased heating-surface exposed to the only partially-cooled gases collected at the top of the heater by the addition of a second return-flue, and of such an arrangement as to adapt each flue to be entirely  
55 inclosed by the water-space without avoiding compactness in the structure.

It is evident that by extending the water-leg to the base of the furnace I prevent any

appreciable loss by radiation from the ash-pit, and also effectively distribute the cold  
60 water which enters the water-leg and mix it with that already partially heated, thus avoiding the subjection of the same immediately on its entrance to the hottest portion of the heating-surface, directly over the furnace,  
65 thereby rendering the heater liable to damage by too great a contrast in the temperatures at any point.

From the above description it will be seen that a heater constructed in accordance with  
70 my invention needs no settings in order to put it into operation, as the same is complete in itself, and the construction for the heater shown herein thus renders the same portable and adapted to be moved by merely discon-  
75 necting the supply and distributing pipes *p* and *q*, respectively.

Having thus set forth my invention, what I claim herein, and desire to secure by Letters  
80 Patent, is—

1. A hot-water heater provided with a fire-space at the top, two return-flues leading downwardly therefrom, a main flue interposed between and connected at the bottom with  
85 such return-flues and leading to the chimney, the said flues being inclosed within the water-space of the heater, and an opening between the said fire-space and the main flue, having a damper operated from without the heater to open and close the same, as and for the  
90 purpose set forth.

2. A hot-water heater comprising a series of parallel sections having inlet and outlet apertures and arranged vertically, each section being provided on one side with aper-  
95 tures at both ends and on the other side with apertures at one end only, the alternate sections having the apertures at opposite ends on the side containing apertures at one end only, and the sections intermediate thereto  
100 having apertures on their upper and lower sides corresponding in position and number with those in the sides adjacent thereto of the sections directly above and below the same, the top and bottom sections having apertures  
105 only on the sides in contact with the adjacent sections, and provided, respectively, with supply and distributing pipes, as and for the purpose set forth.

In testimony whereof I have hereunto set  
110 my hand in the presence of two subscribing witnesses.

GEORGE C. BLACKMORE.

Witnesses:

H. J. MILLER,  
F. C. FISCHER.