

(No Model.)

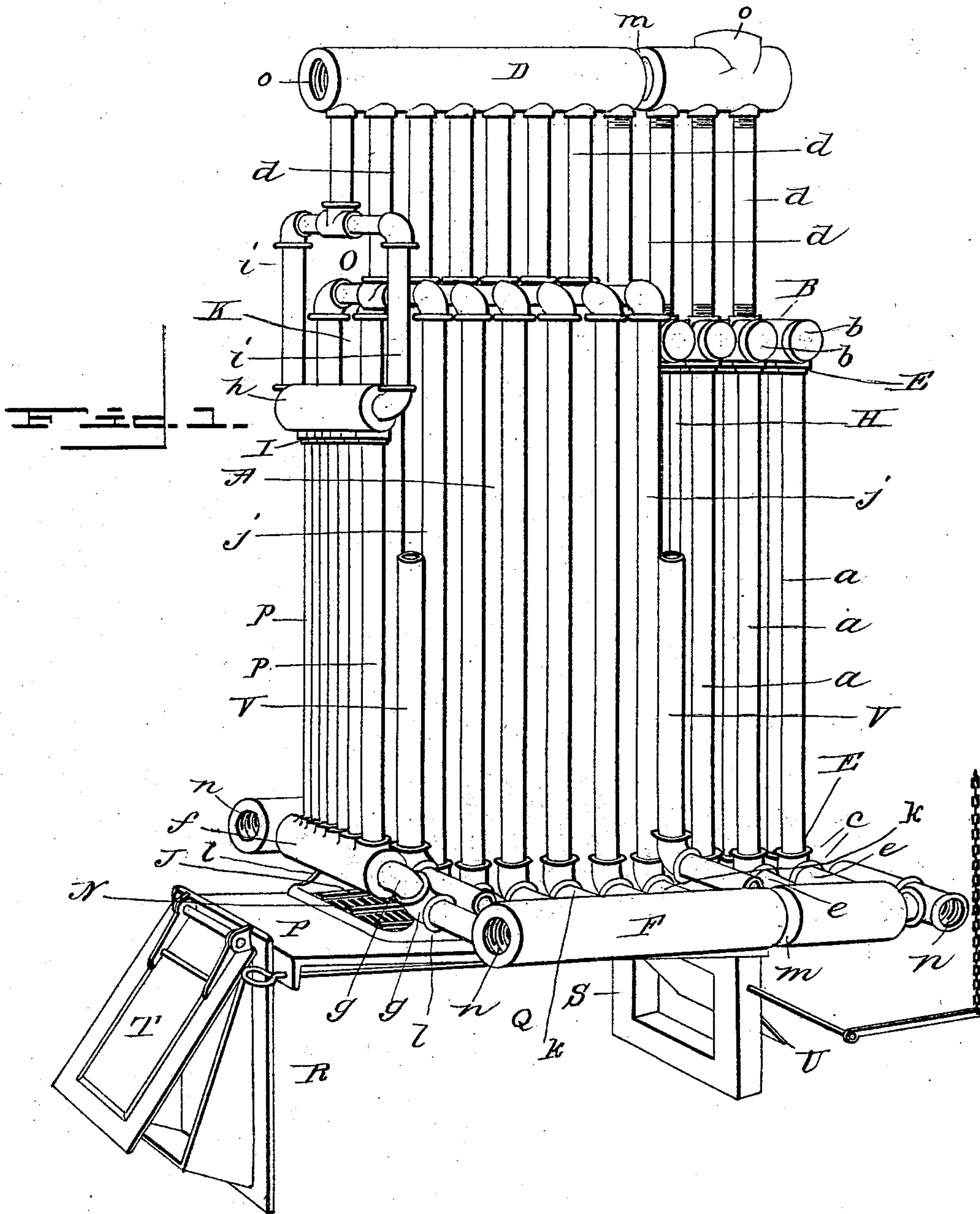
4 Sheets—Sheet 1.

C. PHELPS.

HOT WATER HEATER OR STEAM GENERATOR.

No. 514,026.

Patented Feb. 6, 1394.



WITNESSES:

W. H. Humphrey
Mo. R. Neely

INVENTOR

Chas. Phelps

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Thos. D. Hitchcock
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(No Model.)

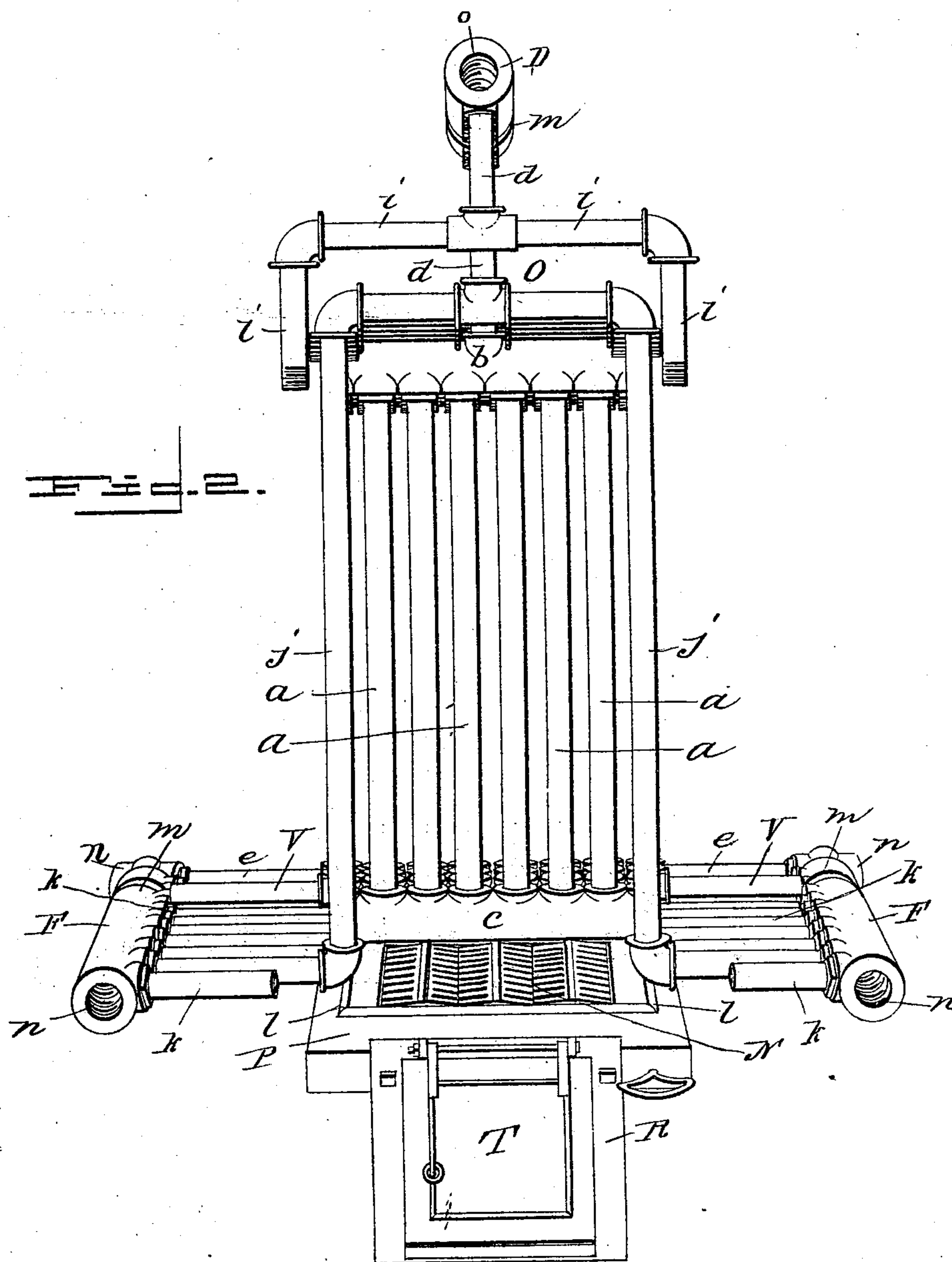
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(No Model.)

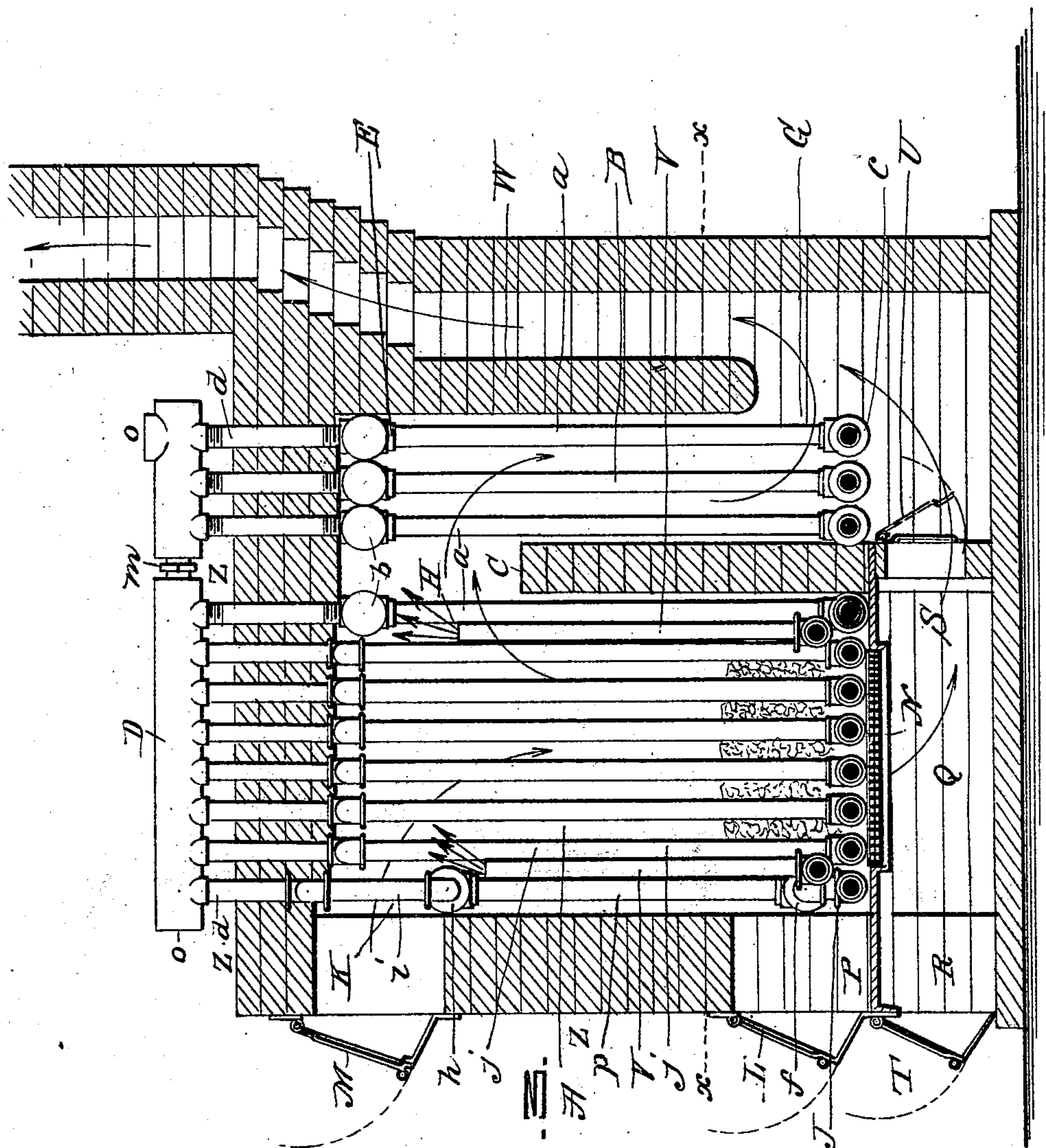
4 Sheets—Sheet 3.

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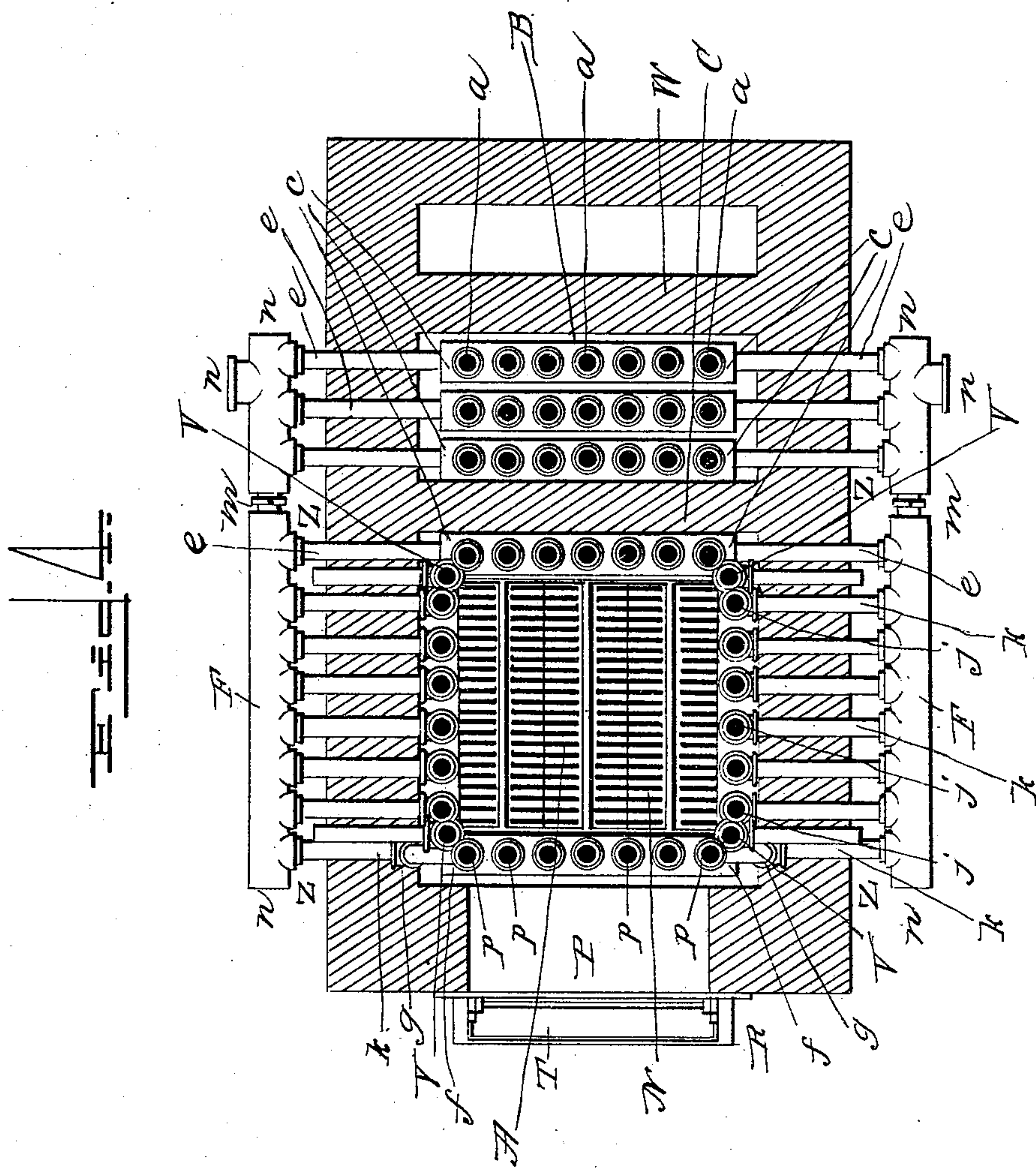
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WITNESSES:

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INVENTOR

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UNITED STATES PATENT OFFICE.

CHARLES PHELPS, OF OSKALOOSA, IOWA.

HOT-WATER HEATER OR STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 514,026, dated February 6, 1894.

Application filed February 23, 1893. Serial No. 463,313. (No model.)

To all whom it may concern:

Be it known that I, CHARLES PHELPS, a citizen of the United States, residing at Oskaloosa, in the county of Mahaska and State of Iowa, have invented a certain new and useful Hot-Water Heater or Steam-Generator; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention is that of a hot water heater or steam generator and its object is to heat water or generate steam for heating or other purposes by providing an extensive heating surface of numerous ramifications whereby a large volume of water in numerous small streams is subjected directly to the influence of the heat generated by combustion.

My invention is illustrated in the accompanying drawings forming a part hereof, wherein—

Figure 1 is a perspective view of my invention uninclosed by its casing. Fig. 2 is a front view with the front section detached. Fig. 3 is a vertical section with one side of the casing removed showing the arrangement of the interior and the relation of the heating chambers to each other and to the chimney. Fig. 4 is a cross section on the line *x, x*, of Fig. 3. Similar letters refer to similar parts throughout the several views.

I attain the objects of my invention as follows: I arrange the heating surfaces of my invention in two chambers,—a fire-box, A, and a down draft chamber, B, separated from each other by the bridge-wall, C, the two said chambers intercommunicating at the top over the said bridge wall. The down draft chamber is formed by the said wall, C, the chimney wall, W, and the casing, Z, of the heater (Figs. 3 and 4), and communicates with the chimney at G. In this down draft chamber, I provide rectangular sections, E, of tubular water pipes, placed vertically and parallel to the shorter horizontal axis of the heater and arranged to allow spaces between them, each section consisting of a series of parallel vertical tubular water pipes, *a*, set with interstitial spaces, the said pipes connecting, top and bottom, with a horizontal cylindrical heading, *b, c*, of a somewhat larger diameter than that of the said vertical pipes, on its convex surface in the direction of its longer axis. Both the said upper and lower cylindrical

headings are connected by union connections, the upper, *b*, on its upper surface midway of its longer axis, to a vertical pipe, *d*, connecting with the horizontal distributing cylinder or steam drum, D, and the lower, *c*, at each end to a horizontal pipe, *e*, extending outward and connecting with the horizontal lateral feed cylinder, F. The size of each section and the number of sections used, as well as the size and number of vertical pipes therein may vary according to the heating capacity desired in the heater. To subject all portions of the said sections to the heat of the gaseous products of combustion and for the longest possible time with inappreciable loss of temperature in their passage to the chimney, I provide communication at or near the bottom of the chimney whereby the heated products of combustion must pass over the top of the bridge-wall, C, and down from the top to the bottom of the down draft chamber, B, along the entire length of the above described sections.

The sides and top of the fire-box or heating chamber, A, are formed of water pipes whereby the heating surface is multiplied and but a very small portion of each pipe fails to be in immediate contact with the burning fuel or the intensely heated products of combustion. The back side consists of a section, H, of tubular water pipes of similar construction to the above-described sections in the down draft chamber, set in similar position, having similar connections with the distributing cylinder, D, and the feed cylinder, F, and separated from the down draft chamber by the bridge-wall, C. The front side is a section, I, of tubular water pipes in general like the back, H, but modified to allow a space, J, below for stirring the fire and removing clinkers and to allow an opening, K, for the introduction of fuel with no loss in the fuel capacity of the fire-box and with the least loss in the amount of fire surface in the heater. The former object I attain by raising a suitable distance above the surface of the floor of the fire-box, the lower heading, *f*, of the said section, by means of double elbows, *g, g*, and setting in the casing a door, L, opposite to the space thus provided for; the latter object is attained by making the said section, I, somewhat shorter than the said back section, H, and by connecting to each end of the upper heading, *h*, a tubular frame, *i*, provided with union

connections and inclosing space sufficient for the introduction of fuel into the fire-box through a door, M, set in the casing opposite thereto. The right and left sides and the top of the said fire-box are formed of sections, O, of tubular water pipes, set at right angles to the longer horizontal axis of the heater and parallel to each other, each section consisting of a vertical water pipe, *j*, on each side of the fire-box, extending from the bottom of the said fire-box to the top thereof where they are adapted to form the roof of the fire-box either by being bent at right angles inward or fitted with elbows, and midway from each side on their upper surfaces are united, by union connections, or standard pipe threads to the vertical pipes, *d*, connecting with the distributing cylinder, D, said vertical pipes, *j*, at bottom adapted to connect with the feed or water supply cylinder, F, by being bent at right angles outward and extended to unite with said cylinder, or united by elbows to the pipes, *k*, extending horizontally outward and connected by union connections to the feed or supply cylinder, F, on its convex surface contiguous to the casing of the heater and along its longer axis. In this way I provide each section with its own inflow and outflow pipe whereby a large volume of water is conducted directly to, and distributed over, an extensive fire-surface and is passed directly away from that surface into the distributing cylinder with no loss of temperature, and also provide for the ready and easy disconnection of any part of the heater for purposes of repair or transportation. The floor of the fire-box or chamber is formed of a grate, N, of any well known construction, but preferably rectangular, of the same size as the cross dimension of the said fire-box and rocking in sections by any well known device, the said grate being set in the plate, P, provided at the edge of the grate opening with a slightly raised rim, *l*, supporting the sections of water pipes, said plate raised above the ground sufficiently high to form a spacious ash-pit, Q, by means of the standards, R and S, front and back, R provided with a door, T, to feed air for combustion and to allow the removal of ashes, and S provided with a check-damper, U, opening upward and into the chimney whereby the ash-pit is connected with the chimney for the purpose of checking and regulating the fire, as set forth in my application for Letters Patent to be granted on this device filed January 21, 1893, Serial No. 459,142.

In each of the four corners of the fire-chamber, A, I have illustrated a hot air supply pipe, V, one arm of which is adapted to extend parallel to and in contact with the fire-surfaces of tubes, *j*, from at or near the grate, N, to a point a short distance above the top of the fuel, the other arm of which is adapted to extend at right angles outward into the air outside. This device, as well as that just mentioned above, I make no application for Letters Patent to be granted on in this applica-

tion, as I have made it the subject of a distinct application filed on January 21, 1893, Serial No. 459,143. These devices are here introduced to show their adaptation to this form of a steam or hot water heater.

The distributing cylinder, D, and water supply cylinders F, F, I construct of a considerably larger diameter than that of the tubes and headings forming the fire surfaces inside the casing so that a large volume of water may be freely supplied to the extensive heating surface and may be freely withdrawn therefrom for distribution. I provide a joint for disconnection at *m*, by either a union connection or by a right and left hand thread whereby the said cylinders may be readily disconnected between the fire-box and down draft chamber for the purpose of repairs or convenience in handling.

To provide against the rusting or eating out of the water supply cylinders, F, F, from the dampness and contact with the ashes, I place them at or about the height of the grate from the ground and connect them in the direction of their longer axis on their convex surface contiguous to the casing of the heater, to the several heating sections within. Both the said cylinders are placed outside the casing surrounding the heating chambers and with their longer axes at right angles to the planes of the heating sections within whereby the said sections may severally be connected therewith by direct communicating pipes, *d*, *e*, and *k*. By this arrangement I, also, prevent the ashes from accumulating between the vertical pipes *j*, and impairing the fire surface.

The bridge-wall, C, may be of any material which will deflect the heat and gaseous products of combustion to the top of the heater but I preferably use fire-brick.

To prevent all possible loss of heat from radiation and conduction to the outside, I inclose the heating chambers in a casing, Z, of brick set up closely against the water pipes on all sides and on the top, with apertures adapted to allow the egress of the pipes, *d*, *e*, *k*, connecting the heating sections, top and bottom, with the distributing cylinder, D, and the water supply cylinders, F, F, whereby the fuel, clinker, and ash-pit doors are the only metallic surfaces from which the heat can radiate.

In operation, water is fed to the horizontal lateral feed or supply cylinders, F, F, at *n*, in any desired manner whence it passes freely and directly to each heating section within the casing by means of the pipes, *e*, *k*, where it is subjected to a large heating surface of numerous ramifications afforded by the combination of water pipes forming the sides and top of the fire-box, A, and arranged in the down draft chamber, B, and where a large volume of water is subjected directly to the intense heat of the burning fuel and of the heated products of combustion, the pipes either immediately impinging upon the bed of burning fuel or

enveloped and bathed in the gaseous products of combustion as they rise from the fire and pass by reason of the natural draft across the top of the bridge-wall, C, from top to bottom of the down draft chamber, B, and into the chimney at G, whereby, in consequence, an energetic circulation of highly heated water is established. The large volume of water thus highly heated is freely and directly gathered from the heating sections inside the casing of the heater by the series of vertical pipes, *d*, into the horizontal distributing cylinder, D, whence, in any desired manner at which it may be carried through the building and back to the water supply cylinders, F, F. Combustion is hastened or retarded by the operation in combination with the natural draft of the chimney of the ash-pit door, T, and the check damper, U, the operation of this said check damper being fully and minutely described in my application for Letters Patent thereon, filed January 21, 1893, Serial No. 459,142.

To keep the surface of the heating sections unimpaired and the chimney unclogged from deposits of soot during active combustion, I provide the device of hot air supply pipes, V, the operation of which is fully and minutely described in my application for Letters Patent thereon, filed January 21, 1893, Serial No. 459,143.

In case the heater is to be used for the generation of steam, the horizontal water supply cylinders, F, F, and the distributing cylinder, D, are to be made much larger in diameter and the water is returned from D to F, F, by pipes outside the casing of the heater whereby the water is kept in constant and rapid circulation.

In the drawings illustrating my invention, I have shown the preferred mode of its construction, but I do not wish to limit myself to the exact number or size of the pipes here shown nor to the size of the several sections or the number of pipes therein, for it will be readily seen that these elements will vary according to the amount of heat or steam sought to be generated; but

What I do claim as my invention or discovery, and desire to secure by Letters Patent, is—

1. The combination, with a heating surface arranged in sections to form the sides and top of a furnace and a group of heating sections placed in a down draft chamber located back of the said furnace and communicating therewith at the top over a bridge-wall of fire-brick separating it therefrom, each heating section in the down draft chamber and the back section of the furnace consisting of a series of vertical tubular water pipes placed in the same plane parallel to each other with spaces between, connecting at the top with a horizontal cylindrical heading having blind ends and adapted on its upper surface midway of its length to be connected with an outflow pipe, and at the bottom with a horizontal cy-

lindrical heading adapted at each end to be connected with an inflow pipe, the front section of the furnace consisting of a series of vertical tubular water pipes placed in the same plane parallel to each other with spaces between, connecting, top and bottom, with horizontal cylindrical headings united at each end to outflow and inflow pipes respectively adapted to allow a fuel-supply space just above the upper heading and a space between the lower heading and the grate-frame, each heating section between the front and back sections of the furnace consisting of vertical tubular water pipes arranged in two opposite each other and horizontally extended at the top inward, the said sections collectively adapted to form the lateral walls and top of the furnace, each section connected at bottom on each side to a horizontal inflow pipe and at top midway between the sides of the said furnace to a vertical outflow pipe, of two lateral horizontal water-supply cylinders, of much larger diameter than that of the pipes forming the heating sections, capable of disconnection at a point opposite to the before-described bridge-wall, exterior to the casing surrounding the heating chambers, on or about on a level with the bottom of the heating sections and having direct communication with the bottom of the said sections through the aforesaid inflow pipes joined by union connections, a horizontal distributing cylinder or steam drum capable of disconnection at a point opposite to the before-described bridge-wall, exterior to the casing surrounding the heating chambers and above the same, having direct communication with the top of the heating sections through the aforesaid outflow pipes joined by union connections, a casing of non-conducting substance, and a chimney, substantially as described.

2. The combination, with a heating surface arranged in sections to form the sides and top of a rectangular furnace and a group of heating sections placed in a down draft chamber located back of the said furnace and communicating therewith at the top over a bridge-wall of fire-brick separating it therefrom, each section in the down draft chamber and the back section of the furnace consisting of a series of vertical tubular water pipes, *a*, parallel to each other and in the same plane, connected at top to a horizontal cylindrical heading, *b*, having blind ends, adapted midway of its length on its upper surface to be united to an outflow pipe, *d*, and at bottom to a horizontal cylindrical heading, *c*, adapted at each end to be connected to a horizontal inflow pipe, *e*, the front section of the said furnace consisting of vertical tubular water pipes, *p*, connected at the bottom to a horizontal cylindrical heading, *f*, adapted at each end to be united to an inflow pipe provided with double elbows, *g, g*, to afford the space, J, between the said heading, *f*, and the grate-frame, P, and at the top to a horizontal cylindrical head-

ing, *h*, adapted at each end to unite with the frame, *i*, of tubular water pipes inclosing the fuel-supply opening, *K*, said frame on its upper transverse tubing adapted to connect with a vertical outflow pipe, *d*, the sides and top of the said furnace formed of a series of sections, *O*, consisting each of two vertical tubular water pipes, *j*, one on each side of the said furnace, extending from the surface of the grate, *N*, to the top of the said furnace where they are formed to cross horizontally from side to center at which point they are connected by means of a union connection to the vertical outflow pipe, *d*, the said sections, *O*, adapted at the bottom on each side to connect with horizontal inflow pipes, *k*, the water pipes composing the several heating sections in the two chambers placed to allow spaces between the said pipes, and the several sections in the two chambers placed transversely to the longer horizontal axis of the heater parallel to each other and with spaces between, of two lateral horizontal water-supply cylinders, *F*, *F*, one upon each side of and exterior to the casing, *Z*, surrounding the heating chambers, capable of disconnection at a point, *m*, opposite to the bridge-wall, *C*, on or about on a level with the bottom of the heating sections and having communication therewith through the aforesaid horizontal inflow pipes, *e*, *k*, joined by union connections, a horizontal distributing cylinder, or steam drum, *D*, capable of disconnection at a point, *m*, opposite to the bridge-wall, *C*, exterior to the casing, *Z*, surrounding the heating chambers and above the same, having communication with the top of the said heating sections through the aforesaid vertical outflow pipes, *d*, joined by union connections, a casing of nonconducting material, *Z*, having but three metallic surfaces therein, the fuel, clinker, and ash-pit doors, *M*, *L*, *T*, and a chimney, as and for the purposes substantially as described.

3. The combination, with a rectangular furnace having its two sides and roof formed of heating sections consisting each of two vertical tubular water pipes one upon each side of the said furnace extending from the surface of the grate-floor to the top of the said furnace where they are formed to cross horizontally to the center of the same and to be there connected by means of union connections to vertical outflow pipes, the said sections placed in a series transversely to the longer horizontal axis of the heater parallel to each other with spaces between, and connected at bottom on each side to a series of horizontal inflow pipes, the said furnace having its front formed of a heating section consisting of a series of parallel vertical tubular water pipes arranged with interstitial spaces in the same plane connected at the top to a horizontal cylindrical heading adapted at each end to unite with a rectangular frame of tubular water pipes inclosing a fuel-feeding space and connecting, midway on its upper edge, by a union connection to a vertical outflow pipe, and at

the bottom to a horizontal cylindrical heading adapted at each end to unite to an inflow pipe by double elbows providing a space between the lower heading and the grate-frame, the said furnace having its back formed of a section consisting of a series of parallel vertical tubular water pipes arranged with interstitial spaces in the same plane, connected at the top to a horizontal cylindrical heading having blind ends and adapted to connect on its upper surface, midway of its length, to a vertical outflow pipe, and at the bottom to a horizontal cylindrical heading adapted at each end to unite with an inflow pipe, of a down draft chamber just back of the furnace communicating therewith at the top and over a bridge-wall of fire-brick separating the two chambers and communicating with the chimney at the bottom and back, having a group of heating sections placed therein parallel to each other and transverse to the longer horizontal axis of the heater and with spaces between the several sections, each section consisting of a series of parallel vertical tubular water pipes arranged with interstitial spaces in the same plane connected at the top to a horizontal cylindrical heading having blind ends and adapted, midway of its length, on its upper surface to unite with a vertical outflow pipe, and at the bottom to a horizontal cylindrical heading adapted at each end to unite with a horizontal inflow pipe, two lateral horizontal water-supply cylinders parallel to the longer horizontal axis of the heater, capable of disconnection at a point opposite to the bridge-wall separating the two heating chambers, exterior to the casings surrounding the heating chambers, one upon each side thereof, on or about on a level with the bottom of the heating sections and having communication therewith through the aforesaid horizontal inflow pipes joined by union connections and forming a series of parallel pipes corresponding in number and position to the said heating sections, a horizontal distributing cylinder or steam drum parallel to the longer horizontal axis of the heater, capable of disconnection at a point opposite to the bridge-wall separating the two heating chambers, exterior to and above the casing surrounding the heating chambers and having communication with the top of the several heating sections through the aforesaid vertical outflow pipes joined by union connections and forming a series of parallel pipes corresponding in number and position to the said heating sections, a casing of nonconducting material having but three metallic surfaces therein, viz., a fuel, a clinker, and an ash-pit door, and a chimney, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

CHAS. PHELPS.

Witnesses:

J. L. NELSON,
S. J. STEWART.