

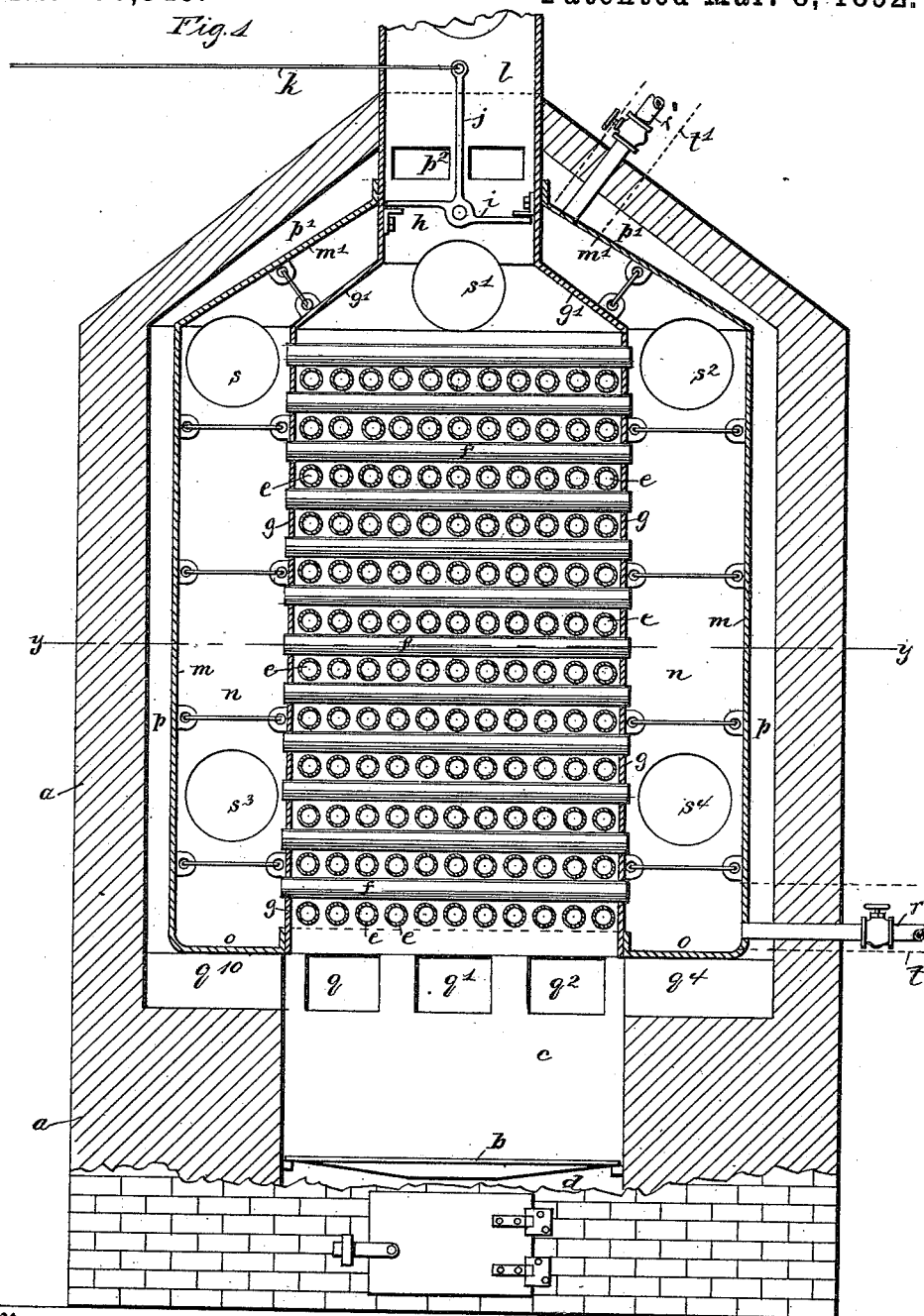
(No Model.)

2 Sheets—Sheet 1

H. BALL, Dec'd.  
C. A. CHASE, Administratrix.  
HEATER.

No. 470,345.

Patented Mar. 8, 1892.



Witnesses  
Fred Kempfer.  
V. T. Wilson.

Inventor  
Hosea Ball  
By his Attorneys  
Gifford & Saw

(No Model.)

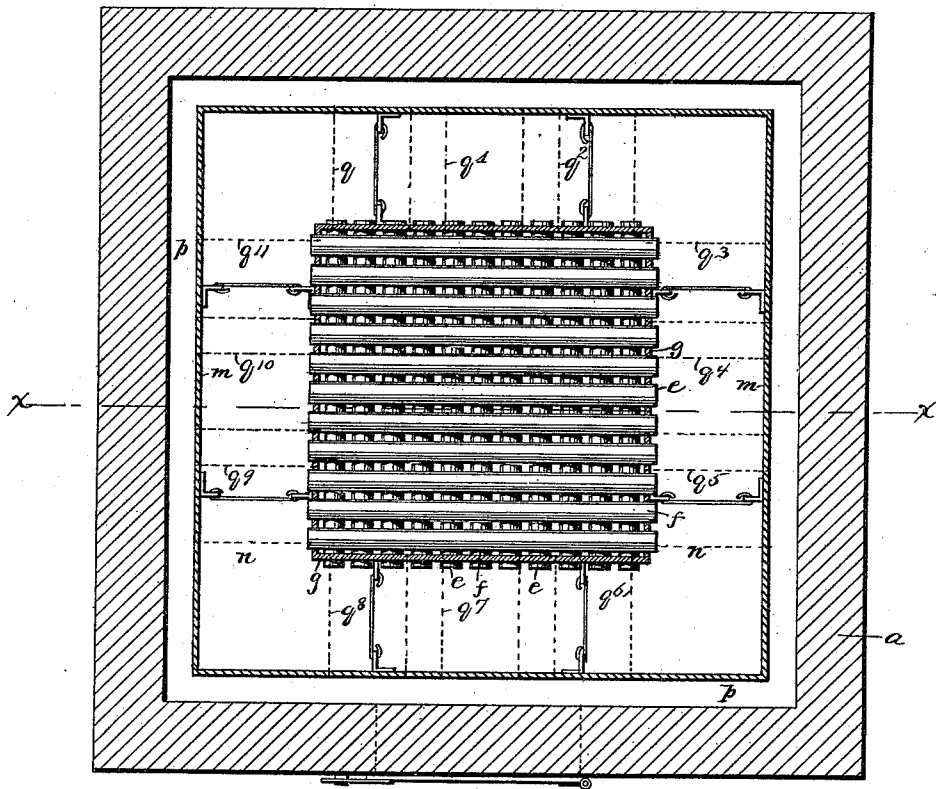
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*Fig. 2.*



Witnesses  
*Fred Kimper*  
*V. T. Wilson*

Inventor  
*Hosea Ball*  
By his Attorneys  
*Gifford & Saw*

# UNITED STATES PATENT OFFICE.

HOSEA BALL, OF NEW YORK, N. Y., ASSIGNOR OF THREE-EIGHTHS TO  
SAMUEL O. ROCKWELL AND JOHN BALMORE, OF SAME PLACE; CORA  
A. CHASE ADMINISTRATRIX OF SAID HOSEA BALL, DECEASED.

## HEATER.

SPECIFICATION forming part of Letters Patent No. 470,345, dated March 8, 1892.

Application filed December 11, 1890. Serial No. 374,313. (No model.)

*To all whom it may concern:*

Be it known that I, HOSEA BALL, of New York city, New York, have invented a new and useful Heater adapted for Producing Steam, Hot Air, or other Heated Fluid, of which the following is a specification.

Figure 1 is a vertical section of the heater, taken through the line  $xx$  of Fig. 2. Fig. 2 is a horizontal section taken through the line  $yy$  of Fig. 1.

$a$  is the brick-work by which the heater is inclosed.

$b$  is the grate, above which is the fire-chamber  $c$  and below which is the ash-chamber  $d$ .

Directly above the fire-chamber  $c$  and covering substantially the same horizontal area is a stack of pipes consisting of alternate layers of pipes  $e$  and  $f$ , superposed one layer above the other, and the lengths of pipe in each layer being substantially at right angles with the lengths of pipe in the adjoining layer. The lengths of pipe in each layer are separated from each other by a sufficient space to give the products of combustion free circulation throughout the whole stack. The space occupied by this stack of pipes is open at the bottom, but is inclosed on all sides by a diaphragm  $g$ , perforated to admit of the passage through it of the ends of the lengths of pipe, and in operation is closed at the top. It thus constitutes a hood which may be of any form, which is crossed by the pipes and is located over the fire. Each length of pipe extends through the diaphragm at each end, forming a tight joint therewith and affording a free passage-way through the pipe from outside the diaphragm at either end. The diaphragm  $g$  may converge at  $g'$ , above the level of the pipes, so as to form a contracted passage  $h$ , closed when required by a damper  $i$ , which damper may be controlled through the lever  $j$  by means of a hand-rod  $k$ . The passage  $h$  of the damper  $i$  when open has free communication with the chimney  $l$ .

$m$  is a vertical inclosure extending all the way round the diaphragm  $g$  at a distance therefrom, so as to leave the inclosed space  $n$  surrounding the stack of pipes and communicating therewith. The form of this inclosure may be varied. The inclosure  $m$  may con-

verge at  $m'$  until it connects with the exterior of the passage-way  $h$ , as shown in Fig. 1. A bottom plate  $o$  at the bottom of the space  $n$  connects the diaphragm  $g$  with the inclosure  $m$ , so as to complete the inclosure of the space  $n$ .

Between the brick-work  $a$  and the inclosure  $m$  on all sides is left a narrow space  $p$ , which connects at its bottom with the fire-chamber by the passages  $q q' q^2$ , &c., extending from all sides of the fire-chamber slightly below the stack of pipes and passing immediately under the bottom plate  $o$ . These passages  $q q'$ , &c., are shown in dotted lines in Fig. 2. The narrow space  $p$  converges at  $p'$  and connects with the chimney  $l$  at  $p^2$  above the passage  $h$ .

If this apparatus be employed for generating steam or hot water the water may be supplied to the space  $n$  through the pipe  $r$  and the steam or hot water may escape through the pipe  $r'$ . If used for heating air, the cold-air pipe  $t$  would be substituted for the water-pipe  $r$  and the hot-air pipe  $t'$  for the hot-water pipe  $r'$ , as indicated in dotted lines in Fig. 1.

The operation of the apparatus is as follows: Suppose water be admitted into the space  $n$  until it is sufficiently full. Then upon starting a fire on the grate  $b$  the damper may be employed or not. If the damper is employed, it is left open at the outlet and the products of combustion will pass directly up through the stack of pipes and the passage  $h$  to the chimney. This condition of things will be allowed to continue until the fire has assumed sufficient headway and the pipes have become sufficiently heated, when the damper is closed, whereupon the necessary connection between the chimney and the fire-chamber for the purposes of combustion will be maintained through the passages  $q q' q^2$ , &c., and the passage  $p p'$ . Therefore when this apparatus is in operation the heat from the fire rises among the pipes, but being unable to escape in that direction a downward pressure is produced, compelling the production of a downdraft to and through the outlets  $q q' q^2$ , &c. The effect of this is that the upper surfaces of the pipes as well as the lower surfaces are submitted to the direct action of the heat. The products of combustion passing

to the chimney through these passages *p* will give their heat largely to the water within the space *n*, passing as they do under it and on all sides of it; but at the same time the stack of  
 5 pipes *e f*, being maintained as it were within a hood directly over the fire-chamber, will be subject to such an intense, diffused, confined, and direct heat on all sides that by the time the products of combustion reach the chimney  
 10 they will have given off so much of their heat to the contents of the pipes and of the space *n* as to produce the highest degree of economy in the use of the apparatus. The downward draft and the course which the heat is com-  
 15 pelled to take within the pipe-chamber produces a radially-different mode of operation from anything accomplishable by a mere upward draft or travel of the heat, for the reason that with a mere upward draft the heat im-  
 20 pinges only against the lower surfaces of the pipes and is not diffused on all sides, as above described.

I do not limit myself to the form or detail of construction. Thus I do not limit myself  
 25 to the presence of the passage *h* or the damper *i*, or the number of passages *q*, or the form of the pipe chamber, or of the inclosure surrounding it, or the form or position of the passages leading from the passages *q* to the  
 30 chimney, since I am aware that in these and other respects the particular form of apparatus which I have shown to illustrate my invention may be varied.

I claim—

35 1. In combination, a chamber closed at the top and on all sides, a series of pipes crossing the same, a draft-opening at the base thereof for creating a downward draft to cause the heated air to return by the space through  
 40 which it ascended, and means for producing heat at the bottom of said chamber, which upon ascending therein will be diffused among said pipes by the downward draft impelled through said draft-opening, substan-  
 45 tially as described.

2. In combination, a chamber closed at the top and on all sides, a space surrounding the same containing the fluid to be heated, a series of pipes connecting with said space and  
 50 extending across said chamber, a draft-open-

ing at the base of said chamber for creating a downward draft to cause the heated air to return by the space through which it ascended, and means for producing heat at the bottom of said chamber, which upon ascend- 55  
 ing therein will be diffused among said pipes by the downward draft impelled through said draft-opening, substantially as described.

3. In combination, a fire-chamber, a hood over the same, a series of pipes traversing 60  
 said hood, and a draft-opening at the base of said hood for creating a downward draft to cause the heated air to return by the space through which it ascended, whereby the heat entering said hood is diffused around said 65  
 pipes and a downdraft is impelled through the draft-opening, substantially as described.

4. In combination, a fire-chamber, a chamber located above the same and terminating at its top with a passage communicating with 70  
 the chimney, a damper adapted to close said passage, a space inclosing said last-named chamber, pipes crossing said last-named cham-  
 ber and communicating at each end with said space, and a passage passing around said 75  
 space from the fire-chamber to the chimney, and openings connecting the fire-chamber with said passage, substantially as described.

5. In combination, a fire-chamber, a stack of pipes located above the same, the inclosure 80  
 surrounding said stack of pipes, a passage leading around said inclosure from the fire-chamber to the chimney, and openings below said inclosure connecting the fire-chamber  
 with said passage, substantially as described. 85

6. In combination, the fire-chamber, the inclosure *g g' o m m'*, adapted to contain a bell-shaped body of fluid, beneath the mouth of which the fire-chamber is located, a passage 90  
*h* at the apex of the bell connecting with the chimney, a damper adapted to close said passage, a passage extending from the fire-chamber around said bell to the chimney at a point  
 above said damper, and openings connecting said fire-chamber with said passage, substan- 95  
 tially as described.

HOSEA BALL.

Witnesses:

JAMES T. LAW,  
 LIVINGSTON GIFFORD.