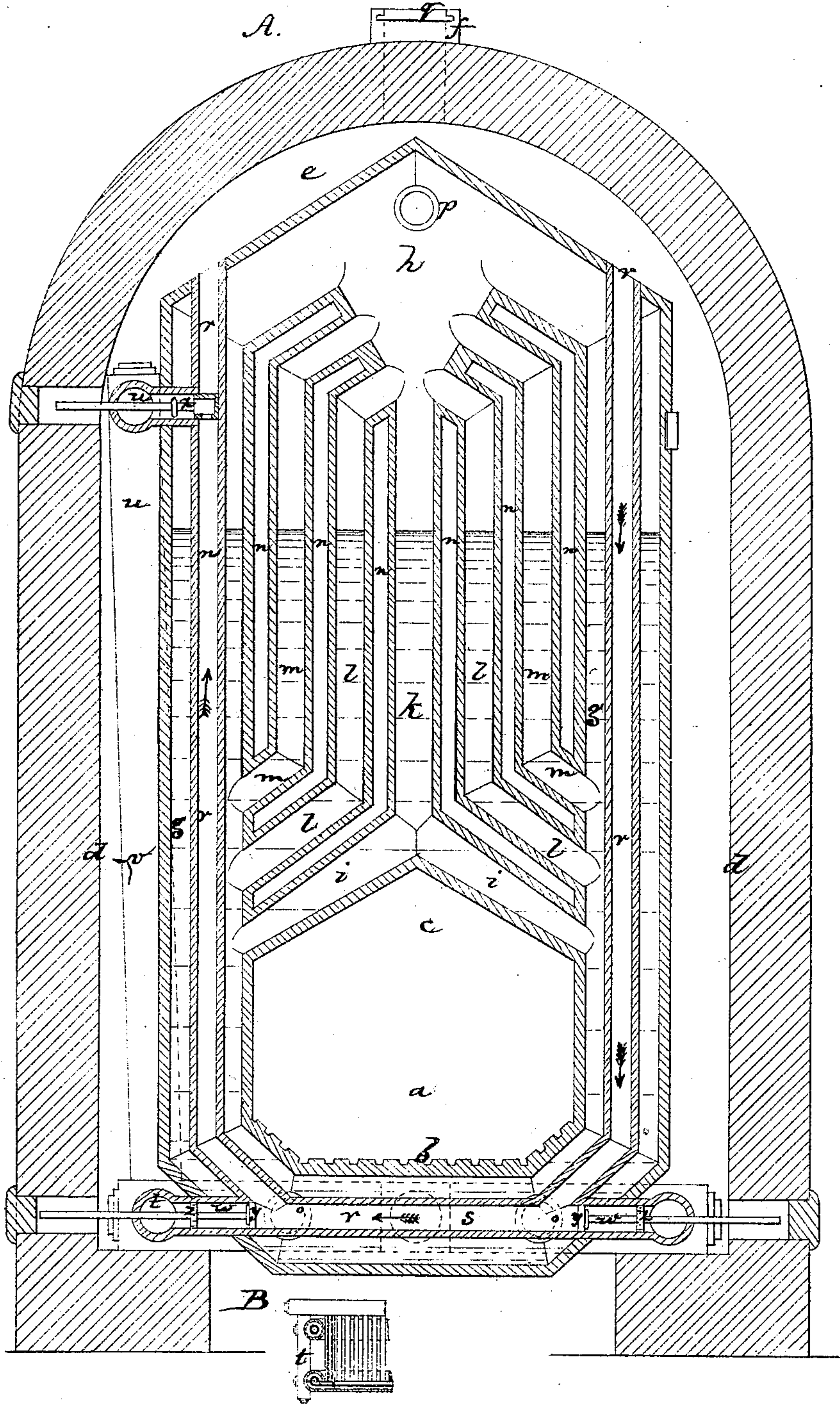


C. & A. Spring,

Tube Boiler.

No. 103,793.

Patented May 31, 1870.



Witnesses
P. B. Ridder
M. W. Nottingham.

C. Spring
A. Spring
by their Attys
Crosby, Holsted & Co

United States Patent Office.

CHARLES SPRING, OF HYDE PARK, AND ANDREW SPRING, OF WESTON,
MASSACHUSETTS.

Letters Patent No. 103,793, dated May 31, 1870.

IMPROVEMENT IN STEAM-GENERATORS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that we, CHARLES SPRING, of Hyde Park, Norfolk county, and ANDREW SPRING, of Weston, Middlesex county, all in the State of Massachusetts, have invented an Improvement in Steam-Generators, &c., and we do hereby declare that the following, taken in connection with the drawing which accompanies and forms part of this specification, is a description of our invention sufficient to enable those skilled in the art to practice it.

This invention has particular reference to a detail of construction of that class of upright steam-generators or boilers, in which a series of vertical water-pipes extend through the hot air or combustion-chamber of the furnace, these pipes branching laterally from main vertical water-chambers at the sides of the boiler, and leading into the common steam-chamber at the top of the boiler.

Our invention consists in extending a vertical flue-pipe through each or either of the main or auxiliary steam and hot-water chambers, such flue or flues leading from the top of the main combustion-chamber or dome, and passing out into the chimney at any suitable point.

The drawings represent one of the sections of a sectional steam-generator embodying our invention.

A shows a vertical section through one set of the pipes.

B is a horizontal section of the same.

a denotes the fire-pot.

b, the grate thereof.

c, the hot-air chamber over the fire-pot, and within the walls, *d*, the heated air, smoke, and other volatile products of combustion filling this chamber and rising into the dome *e*, and then escaping by the main flue *f*.

On each side of the fire-pot, or between each side thereof and the adjacent wall *d*, is a main water-pipe or chamber, *g*, the two pipes extending under the fire-pot and joining, as seen at A, and each extending up to the top of the furnace and into a common steam-chamber, *h*, as also seen at A.

Directly over the fire-pot two water-pipes *i i*, branch from the opposite main pipes *g g*, uniting and leading into a center pipe *k*, which extends up into the steam-chamber *h*.

Above the pipes *i*, other pipes, *l m*, lead from the main pipes *i*, and up between the pipes *g* and *k*, into the steam-chamber or dome *h*, there being any suitable number of the pipes *l m*, in accordance with the width of the furnace, and there being left, between the adjacent surfaces of all of the pipes, a narrow vertical hot-air space, *n*, forming part of the combustion-chamber, each section of the boiler composed of

the water and steam-pipes, and chambers *g, i, k, l, m*, and *h*, being preferably cast integral or in one casting, and the adjacent sections being united by suitable hot water or steam-pipes, or couplings, at *o* and *p*, so that any desirable number of these sections can be associated in range to form one steam-generator, the grate-bars *b* extending from section to section, and the furnace-walls being extended to correspond to the number of sections employed.

Neither the construction and organization of the pipes of each section, nor of the united sections, is of our invention, but it is particularly to such construction and organization that our improvement relates.

It is well known that there is always a great waste of caloric, which escapes into the chimney with the volatile products of combustion. It is the purpose of our invention to utilize the caloric after it reaches the top of the main hot-air chamber, by diverting the currents of smoke, &c., from their passage into the main flue leading it therefrom, by suitable pipes through the main hot-water pipes. To accomplish this, we place in the main flue a damper, *q*, and from the dome or upper part of the combustion-chamber *e*, we lead one or more flue-pipes *r*, carrying such pipe down through one water-chamber *g*, and across to and up through the other, as seen at A, and thence out into the main flue, or we lead a pipe from the dome-chamber *e*, down through each chamber *g*, and from the bottom of such chamber into the flue.

Within the chamber *h*, these flue-pipes are entirely surrounded by steam and water, and, when the damper *q* is closed, the volatile products of combustion can only escape through these flue-pipes, and in their passage their caloric will be imparted to the steam and water surrounding the pipes.

When the fire is started or needs to be quickened, the damper *q* is opened, and the flames, smoke, &c., escape directly into the main flues; but when the fire is well established, the damper is closed, and the products of combustion pass through the flue-pipes *r*, as described.

At the foot of each flue-pipe *r*, (preferably in line with the horizontal part *s* thereof,) the pipes may be provided with suitable hand-holes and plugs, for the purpose of cleaning out the flues from sooty deposits, the water-pipes *g* being provided with suitable hand-holes and plugs opposite thereto.

It will be obvious that either of the hot water and steam-chambers, or each of them, may have a flue-pipe thus passing through it, the said pipes leading one into another, or from the main hot-air chamber and thence or finally into the main flue.

It will also be obvious that these auxiliary flue-

pipes may run from section to section of the boiler, the same as do the water and steam-couplings *o p*, such connections being made by lateral flue-pipes *t u*, extending from section to section, the flues of the last section connecting with the main flue-pipe *v*.

The direction of the flue-currents may be regulated by slide dampers, as seen at *w* and *x*.

Each damper *w* has a close disk, *y*, at its inner end, and an open or perforated disk, *z*, at some distance therefrom. The dampers being arranged as seen in the drawing, the smoke and other products of combustion, entering the top of the right-hand flue, will pass down through the same, across through the bottom flue and up through the left-hand flue, and, through the damper *x*, into the main flue-pipe *v*, as denoted by the arrows. Or, if the damper *x* be opened and the dampers *w* pushed in, the current will pass down both vertical flue-pipes *r*, and out into the main flue through the perforations in the disk *z*.

The inner and outer pipes may be differently disposed from the arrangement shown in the drawing, and the arrangement of inner and outer pipes may be used for changing the temperature of any fluid in one pipe, by passing through the other pipe a fluid of different temperature.

Instead of passing one pipe directly through the other, it may pass down at the side thereof, or a pipe be divided by a longitudinal partition, the hot water or other fluid passing through the chamber formed on one side of the partition, and the hot air or other fluid through the chamber on the opposite side thereof.

We claim—

In combination with the main fluid-holding pipes, the auxiliary pipes *r*, or their equivalents, substantially as described.

Also, connecting two or more series of pipes having such auxiliary flues, by lateral flues *t u*.

Also, in combination with the auxiliary pipes *r*, the hand-holes and plugs for cleaning the flues, substantially as described.

Also, in combination with the auxiliary pipes *r*, the dampers *w x*, for changing the current through the flues, substantially as described.

CHARLES SPRING.
ANDREW SPRING.

Witnesses:

FRANCIS GOULD,
M. W. FROTHINGHAM.