

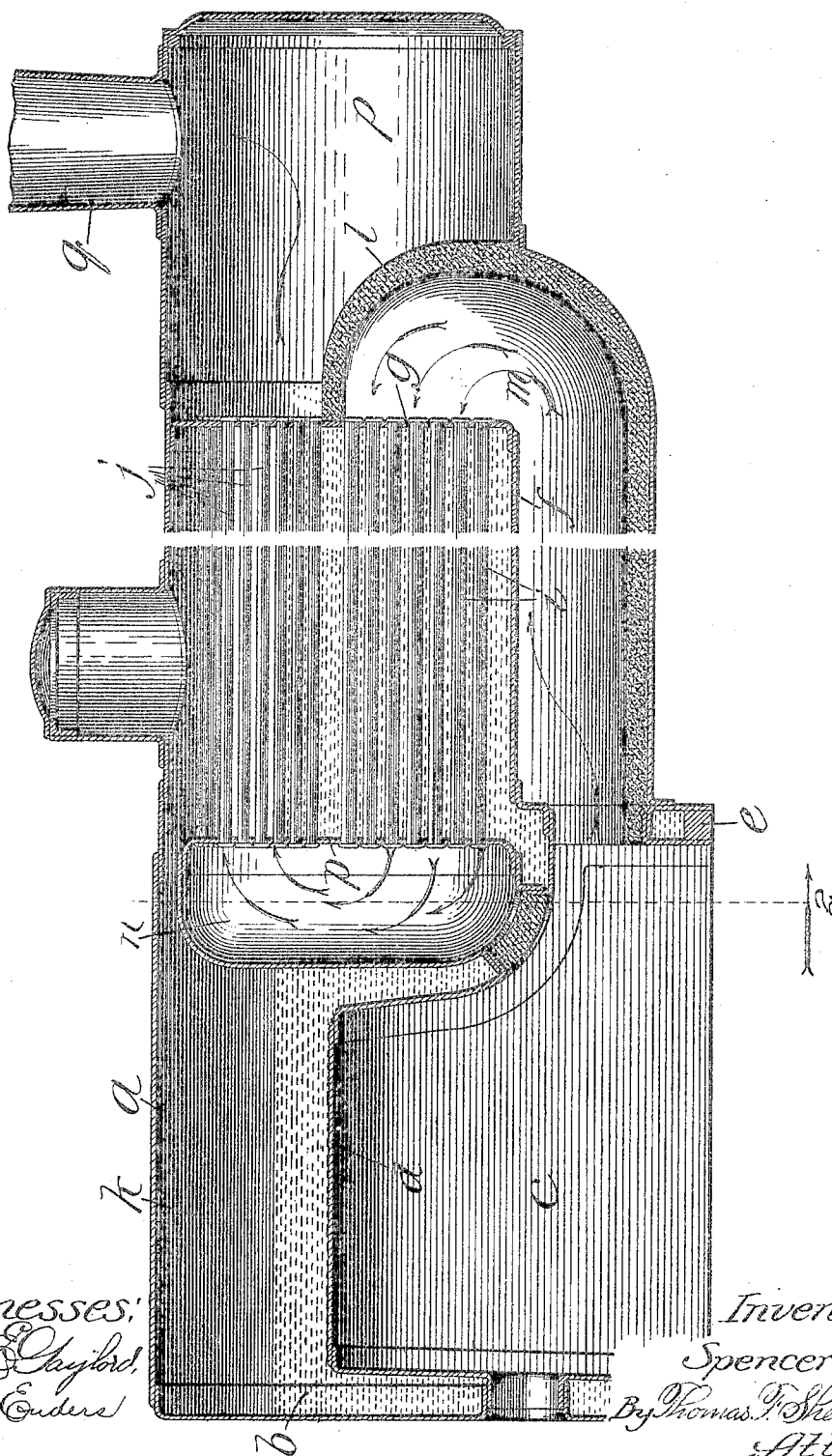
No. 797,601.

PATENTED AUG. 22, 1905.

S. OTIS.
BOILER.

APPLICATION FILED FEB. 8, 1904.

2 SHEETS--SHEET 1.



Witnesses:
Ed. E. Clifford,
John Enders

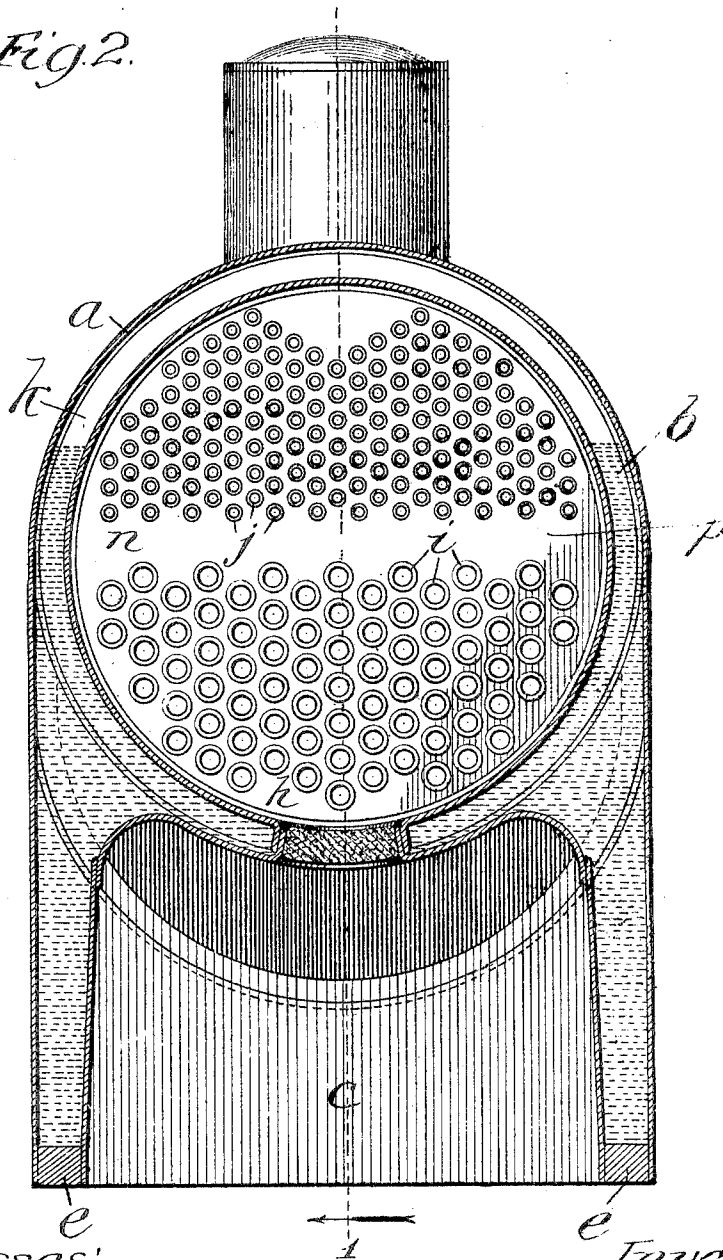
Inventor:
Spencer Otis,
By Thomas F. Sheridan,
Att'y.

S. OTIS.
BOILER.

APPLICATION FILED FEB. 8, 1904.

2 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
Edw. Gaylord.
John Enders

Inventor:
Spencer Otis.
By Thomas P. Sheridan
Attorney

UNITED STATES PATENT OFFICE.

SPENCER OTIS, OF CHICAGO, ILLINOIS, ASSIGNOR TO NATIONAL PATENT HOLDING COMPANY, OF RAPID CITY, SOUTH DAKOTA, A CORPORATION OF SOUTH DAKOTA.

BOILER.

No. 797,601.

Specification of Letters Patent.

Patented Aug. 22, 1905.

Application filed February 8, 1904. Serial No. 192,633.

To all whom it may concern:

Be it known that I, SPENCER OTIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Boilers, of which the following is a specification.

My invention relates to that class of boilers known as "locomotive-boilers," and particularly to that class known as "internally-fired" boilers, and to the construction and arrangement thereof, all of which will more fully hereinafter appear.

The principal object of the invention is to provide a simple, economical, and efficient internally-fired boiler with means for running the heated gases backward and forward through the boiler, so as to obtain the greatest efficiency and economy in the production of steam.

Other and further objects of the invention will appear from an examination of the drawings and the following description and claims.

The invention consists principally in an internally-fired boiler in which there are combined a plurality of fire-tubes extending through the steam and water space thereof, a duct for carrying the heated gases and products of combustion to the forward end of the tubes, a chamber at the rear end of said tubes by which they are separated from the steam and water space and fire-box, so that the products of combustion and heated gases are compelled to go backward and forward through such boiler before they escape.

The invention consists, further and finally, in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a longitudinal sectional elevation taken through one type of locomotive-boiler and showing it as it appears when constructed in accordance with these improvements, and Fig. 2 an enlarged cross-sectional elevation taken on line 2 of Fig. 1 looking in the direction of the arrow.

In illustrating and describing these improvements I have only illustrated and will here describe that which I consider to be new, taken in connection with so much as is old as will properly disclose the invention to others and enable those skilled in the art to practice the same, leaving out of consideration other

and well-known elements, which if set forth herein would only tend to confusion, prolixity, and ambiguity.

In constructing an internally-fired boiler in accordance with these improvements I make, preferably, an incasing shell *a* of the desired size, shape, and strength to hold the parts in operative condition to resist the pressures and strains to which the tubes of the boiler are subjected. In this incasing shell, which provides the water-chamber *b*, is located a fire-box *c*, having a crown-sheet *d* at the upper part. This fire-box is located in the water-space of the boiler and considerably below the upper portion of the shell entirely back of the flues or fire-tubes hereinafter described, so that the crown-sheet and fire-box walls provide a large heating-surface and form lower and inner walls for that portion of the water-chamber of the boiler which is back of the fire-tubes. This part of the boiler is substantially U-shaped in cross-section, and at the lower end portion is the usual mud-ring *e*. Located forward of this fire-box is a cylindrical boiler-shell portion *f*, which is provided with flue-sheets *g* and *h* and through which two sets of fire or boiler tubes are passed—a lower set *i* of relatively large diameter and an upper set *j* of relatively smaller diameter. The set of tubes of large diameter is passed longitudinally through the water-space of the boiler from one flue-sheet to the other, while the upper set is passed through the water and steam space of the boiler longitudinal thereof substantially above the level of the crown-sheet of the fire-box, but entirely in front of such crown-sheet, so that the portion of the water and steam chamber *k* which is over the fire-box is heated by the crown-sheet and fire-box walls and the portion of such chamber forward of the fire-box is heated by the tubes and the walls of the combustion-chamber thereunder formed by wall *f* and tube-sheet *g*. These two sets of fire-tubes are separated from each other at the forward end by means of a partition *l*, which also forms a part of the inclosing wall of the duct or channel *m*. This duct or channel is connected with the forward end of the fire-box or fuel-chamber and forms a combustion-chamber which extends from the front lower end of the fire-box beneath the entire portion of the boiler containing the flues and not heated directly by the fire-box, so that all the heated

gases and products of combustion must first pass therethrough entirely from the rear end to the forward end of the large set of fire-tubes. Located at what I prefer to term the "rear end" of both sets of fire-tubes and entirely within the water and steam chamber of the boiler is an inclosed chamber *n*, that connects with both of such sets of tubes and separates their open ends from the steam and water chamber of the boiler, as well as from the fire-box. Located at the forward end of the boiler and adjacent to the openings of the smaller fire-tubes is a smoke-box *p*, which is provided with an opening or stack *q*, through which the smoke must first pass before being exhausted into the open air.

From the foregoing description of construction and operation it will be seen that the heated gases and products of combustion first pass from the fire-box through the duct or combustion-chamber *m* beneath the boiler and tubes entirely from the rear ends to the forward ends of the fire-tubes of relatively large diameter, thence backwardly through such large fire-tubes into what might be termed a "supplementary combustion-chamber," thence through the fire-tubes of relatively small diameter into the smoke-box *p*, and thence out through the exhaust-stack.

The principal advantage resulting from the use of an internally-fired boiler constructed in accordance with the above-described improvements is that the greatest efficiency is obtained from the development of the heated gases and products of combustion in that such heated products after leaving the fire-box must first contact the lower part of the boiler-shell, as at *f*, where they part with a modicum of their heat, thence pass backwardly through the large tubes, which does not materially affect the combustion of the unspent gases, and into the combustion-chamber, and thence out through the small tubes, and in each of these chambers and fire-tubes the heated products are in constant contact with the walls, so that the water is heated efficiently and the steam in the upper part thereof superheated, all of which provides for great economy in the generation of steam.

I claim—

1. In a locomotive-boiler, the combination of a shell forming a water and steam containing chamber, tubes mounted in such chamber, a fire-box provided with a crown-sheet mounted back of the rear end of such tubes

and forming a heating-surface for the rear portion of the water and steam containing chamber, a combustion-chamber communicating with the fire-box extending therefrom beneath and outside of the water and steam containing chamber to the front end of the tubes and communicating therewith, and means for forming an outlet from the rear ends of such tubes to the exterior of the water and steam containing chamber.

2. In a locomotive-boiler, the combination of a boiler-shell forming a water and steam containing chamber, a plurality of sets of tubes mounted in such chamber, a fire-box having a crown-sheet mounted back of the rear end of such tubes and having side wall portions inside of the water and steam containing chamber and provided with a combustion-chamber communicating with such fire-box and extending therefrom beneath and outside of the water and steam containing chamber from the rear end of the tubes to and communicating with the forward ends of one set thereof, an end wall for such combustion-chamber forming a partition between the front ends of such sets of tubes, and supplementary inner chamber-walls inside of the water and steam containing chamber inclosing and forming a connection between the rear ends of all of such tubes.

3. In a locomotive-boiler, the combination of a shell forming a water and steam containing chamber, a set of tubes mounted in such chamber, a fire-box provided with a crown-sheet mounted back of the rear end of such tubes and forming a heating-surface for the rear portion of the water and steam containing chamber, a combustion-chamber communicating with the fire-box extending therefrom beneath such tubes throughout their entire length to and communicating with the front ends thereof and provided with a wall inclosing the front ends of such tubes, a set of tubes arranged in the water and steam containing chamber having outlet-openings at their front ends outside of the water-containing chamber and combustion-chamber, and a supplementary chamber inside of the water and steam containing chamber provided with walls forming a connection between the rear ends of both such sets of tubes.

SPENCER OTIS.

Witnesses:

ANNIE C. COURTENAY,
ANNA L. SAVOIE.