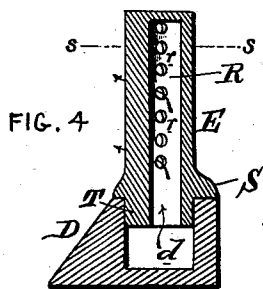
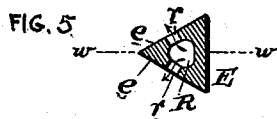
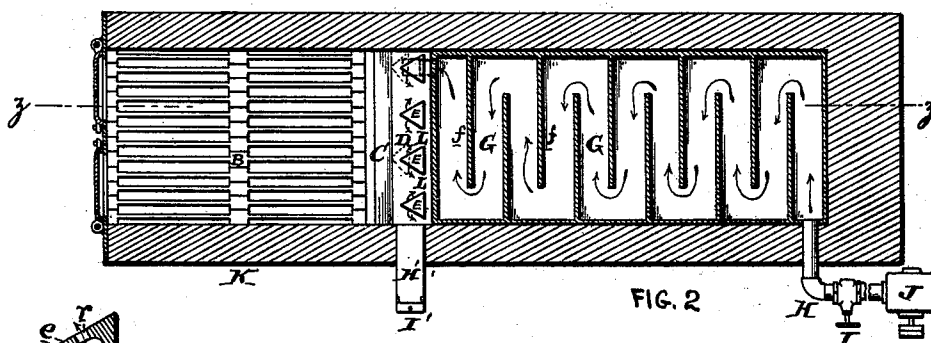
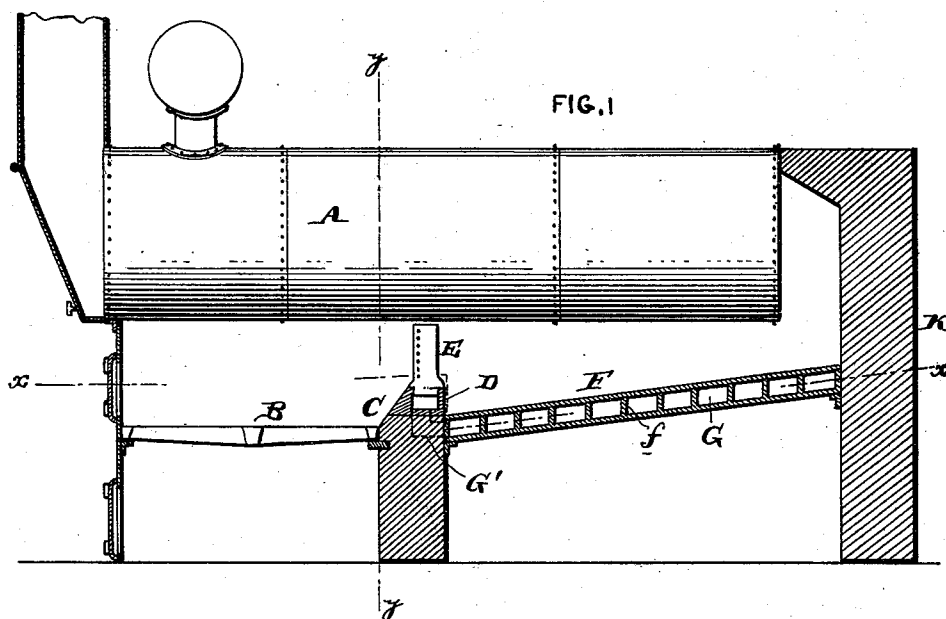


(No Model.)

P. J. GRAU.
FURNACE FOR STEAM BOILERS.

No. 539,941.

Patented May 28, 1895.



WITNESSES:

Henry Denny
Muel Brandel Martin

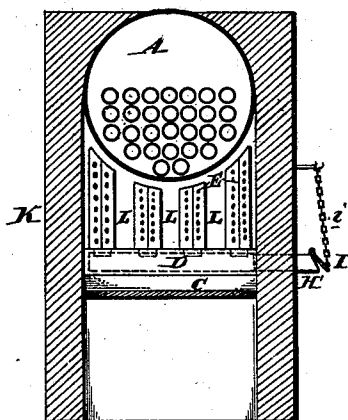


FIG. 3

INVENTOR:
Philip J. Grau
By *[Signature]*

UNITED STATES PATENT OFFICE.

PHILIP J. GRAU, OF TYRONE, PENNSYLVANIA.

FURNACE FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 539,941, dated May 28, 1895.

Application filed March 27, 1894. Serial No. 505,257. (No model.)

To all whom it may concern:

Be it known that I, PHILIP J. GRAU, of Tyrone, county of Blair, State of Pennsylvania, have invented an Improvement in Furnaces for Steam-Boilers, of which the following is a specification.

My invention has reference to furnaces for steam boilers, and consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings which form a part thereof.

The object of my invention is to provide means for admitting highly heated air to the partly consumed gases generated in the furnace, and also to bring the said gases at their time of admixture with the superheated air into contact with highly refractory material heated to incandescence.

In carrying out my invention, I provide the bridge immediately at the rear of the grate bars with a series of upwardly extending columns of refractory material such as fire clay, said columns being preferably triangular in cross section so as to present to the products of combustion obliquely arranged front faces over which said products of combustion are required to pass, and thereby become highly heated. Furthermore, the throat or aperture between the upwardly extending columns is of gradually decreasing width so that the products of combustion in passing between the said columns are required to be more or less condensed and thus brought into more intimate contact with the said columns and with the air which may be admitted through them. I furthermore provide the bridge with a flue or passageway which opens into vertical passageways in the aforesaid columns and from which small apertures lead to the oblique faces, whereby the air may be admitted to and directed toward the products of combustion in their passage over the bridge wall, and thus be brought into intimate contact with the said products of combustion in the presence of the highly heated refractory material. In cases where it is desired to superheat the air before permitting it to escape from the vertical columns, I provide suitable flues or passageways in the rear of the bridge wall over which the products of combustion pass so as to heat the air on its way to the aforesaid bridge

wall. If desired, I may employ a suitable blower or device for forcing the air through the passageways under pressure.

My invention will be more fully understood by reference to the accompanying drawings, in which—

Figure 1 is a sectional elevation through a furnace, showing my improvements applied to steam-boilers, the said section being taken on the line *z z* of Fig. 2. Fig. 2 is a sectional plan view of same on line *x x* of Fig. 1. Fig. 3 is a vertical sectional plan view of same on line *y y* of Fig. 1. Fig. 4 is a vertical section through the upper part of the bridge-wall and column, taken on line *w w* of Fig. 5; and Fig. 5 is a transverse section of the said column on line *s s* of Fig. 4.

A represents a steam boiler and may be of any suitable construction. B represents the grate bars, and C is the bridge wall at the rear of the grate bars. The upper portion or cap of the bridge wall I form of fire brick, preferably molded into a tubular box D with an inclined front wall, having a longitudinal air passage *d* and a series of apertures at the top for receiving the air columns.

E shows a series of air columns preferably triangular in cross section so as to present toward the grate bars two inclined walls *e*. The lower part of these columns is provided with shanks T adapted to fit into the upper part of the box shaped fire brick cap D of the bridge as is clearly shown in Fig. 4. The rear portion of each of the columns may be provided with a foot piece S to act as the strut in supporting the columns E against backward pressure, and thereby make it still more stable in its setting upon the box part D. The columns E are formed of fire brick or other suitable refractory material and are provided with a vertical flue or passageway R opening at the bottom into the passageway *d* of the bridge cap D. The inclined faces *e* of the columns are provided with a series of apertures *r* opening from the passageway R. The height of the columns is preferably such as to fit approximately to the under side of the boiler as is shown clearly in Fig. 3 but would of course be shaped differently with different boilers. The series of vertical columns E (of which there may be any number) form between them throats L gradually lessening in width as they

approach from the front to the rear. The columns E may be staggered if desired as indicated in dotted lines in Fig. 2.

Air may be admitted to the bridge cap D through a hollow floor F which may be provided with a series of baffle plates or walls forming a sinuous passageway G, communicating at one end of the cap D and at the free end in a pipe H provided with a suitable valve I, and if desired communicating with a blower or fan J of any suitable construction. The blower J may be omitted if desired. In this manner the air passing through the floor F becomes superheated and emerges from the apertures *r* of the columns E in a highly superheated condition, it being first heated in the floor F and then superheated to a greater extent in passing through the bridge wall and columns. When the air escapes from the columns it is directed toward the passing products of combustion and is carried backward with said products of combustion and forced into intimate contact therewith while the said products are passing over the highly heated surface of the columns, thus insuring the most thorough commingling and superheating of the entire gases. As these combined gases pass through the throats L they are condensed into the most thorough contact or admixture, and lead from the rear in strong heating flames. Where it is not desired to superheat

the air before passing it through the columns, it may be directly passed into the box cap D by an air flue H' provided with a suitable valve I' which may be controlled by a chain as clearly shown in Figs. 2 and 3. In some cases it is not desired to admit air from the columns E at all as the superheating effect of the said columns of refractory material insures all the requirements where a slower and more uniform temperature is necessary.

What I claim as new, and desire to secure by Letters Patent, is—

In a furnace for steam boilers, the combination of the grate, with a bridge wall having openings in its upper surface, and a series of vertical hollow columns of refractory material fitted into said openings and having inclined faces at the front or forward end provided with air orifices opening through them into the interior and which columns are so arranged as to form a series of parallel vertical passages through which the products of combustion from the grate are required to pass, and an air passage communicating with the interior of the hollow columns.

In testimony of which invention I hereunto set my hand.

PHILIP J. GRAU.

Witnesses:

H. B. CALDERWOOD,
JOHN A. HILLER.