G. W. BROC.

DEVICES FOR HEATING AND FEEDING AIR TO FURNACES.

No. 181,767. Patented Sept. 5, 1876.

Fig: 1

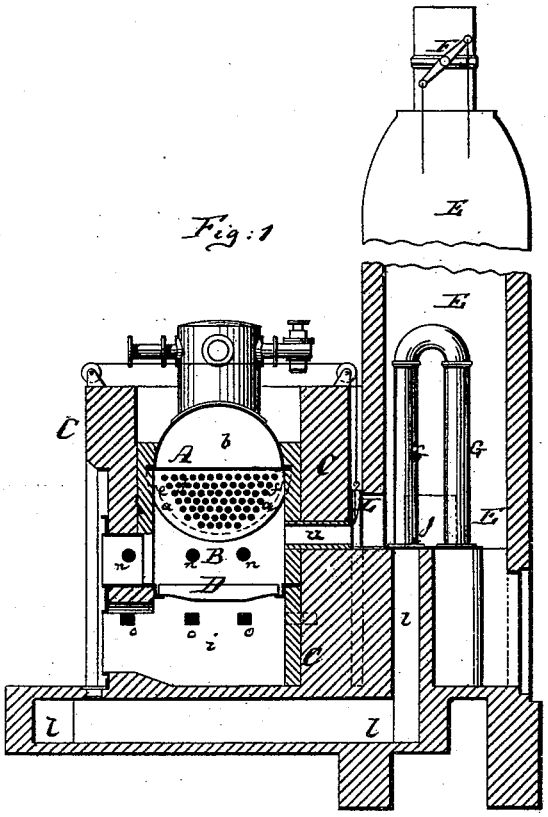


Fig: 5

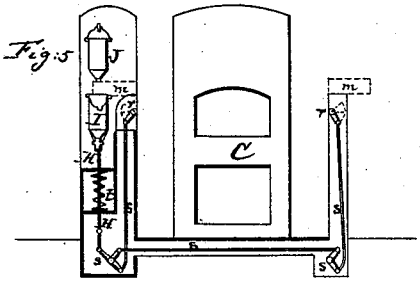


Fig: 2.

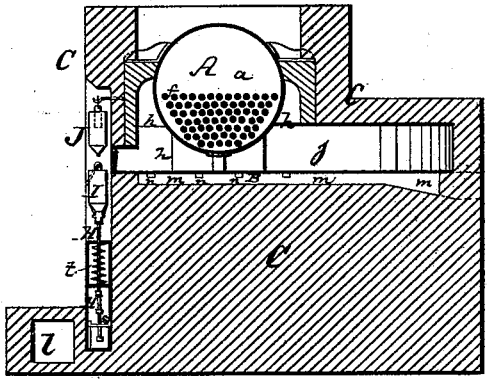


Fig: 3

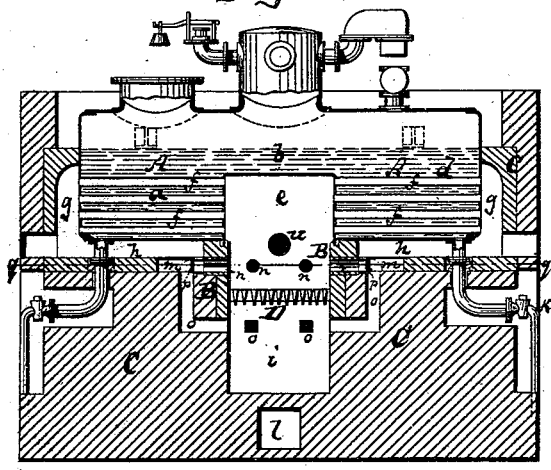
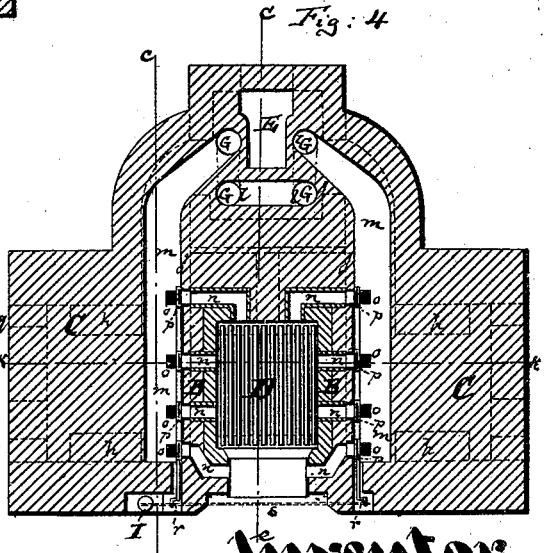


Fig: 4



Witnesses:

A. Moraga.

Ernest C. Weeks.

Inventor

G. W. Broc

by his attorney

A. v. Briesen

UNITED STATES PATENT OFFICE.

G. WILHELM BROC, OF HAMBURG, BAVARIA.

IMPROVEMENT IN DEVICES FOR HEATING AND FEEDING AIR TO FURNACES.

Specification forming part of Letters Patent No. **181,767**, dated September 5, 1876; application filed March 14, 1876.

To all whom it may concern:

Be it known that I, G. WILHELM BROC, of Hamburg, Palatinate Bavaria, Empire of Germany, have invented a new and Improved Steam-Boiler, of which the following is a specification:

Figure 1 is a vertical transverse section of the improved steam-boiler, taken on the plane of the line *c c*, Fig. 4. Fig. 2 is a vertical transverse section of the same, taken on the plane of the line *c k*, Fig. 4. Fig. 3 is a vertical longitudinal section of the same, taken on the plane of the line *k k*, Fig. 4. Fig. 4 is a horizontal section of the same, taken on the plane of the line *q q*, Fig. 3. Fig. 5 is a detail front view, partly in section, of the automatic draft-regulating appliance of my improved steam-boiler.

Similar letters of reference indicate corresponding parts in all the figures.

This invention relates to a new construction of steam-boiler, and has for its object to avoid the use of long horizontal tubes; to augment the heating-surface, avoid loss of heat, and effect an almost total consumption of combustible fuel; to reduce the height of the chimney, and regulate, automatically, the admission of air to the fire-chamber.

My invention consists in the novel combination of parts relating to the boiler and draft-regulator, hereinafter more fully described.

In the accompanying drawing, the letter A represents the boiler proper, made of boiler-iron, of cylindrical or nearly cylindrical form, of suitable length and diameter. This boiler is made in three rigidly-united sections, *a*, *b*, and *d*. The end sections *a* and *d* are alike, or nearly so, in size and form; but the middle section, which unites the ends, comprises but about the upper half of the cylinder in cross-section, as indicated in Figs. 1 and 3, to form the upper part of the fire-chamber *e*. The end pieces *a* and *d* are, of course, closed against the fire-chamber *e*, but are provided with tubes *f f*, which extend from their inner to their outer heads, as clearly shown in Fig. 3. That portion of the boiler which is above the plane of the bottom of the middle section *b* is not provided with flues, but constitutes one continuous water or steam chamber.

It will be perceived that, by thus constructing the boiler with the recess *e* in the middle, I shorten the tubes *f f*, and materially divide the products of combustion into two branches—the one passing from the chamber *e* through the tubes of the end *a*, the other from the chamber *e* through the tubes of the end *d*. In this manner the heating-surface of the boiler is much better utilized than it can be in boilers which have continuous tubing, and the heating-surface is, moreover, actually increased by the formation of the central recess *e* within the boiler.

The boiler A is supported on two transverse fire-walls, B B, directly below the inner ends of its end pieces *a* and *d*, the masonry C extending otherwise around the sides and ends of, and beneath, the boiler, but so as to leave the smoke-passages *g* and *h*, which are shown. The grate D is applied in the masonry, beneath the chamber *e*, and below it is the ash-pit *i*. The passages *h h* lead by horizontal channels *j j*, which are indicated in Figs. 1 and 2, and by dotted lines in Fig. 4, into the chimney E. This chimney is comparatively short, and may have a suitable regulating-damper, F, at or near its upper end.

The air which is to be fed to the flame enters the lower part of the brick foundation through a passage, *l*, whence it ascends into and descends again in U-shaped tubes G G, that are placed into the chimney E. In these tubes G the air is heated by the escaping products of combustion, and from said tubes it escapes into transverse horizontal passages *m m*, (clearly shown in Fig. 4,) which extend through the masonry at both sides of the fire-chamber, and at a level above the grate. Branches *n n* extend from these passages *m m* into the fire-chamber over the grate. Other branches *o o* extend from the passages *m m* into the ash-pit below the grate, as shown in Fig. 3. There are as many branches *o* as there are branches *n*, the end of every branch *o* being contiguous to the inner end of a branch, *n*, at its junction with the passage *m*. A damper or valve, *p*, is placed into the passage *m*, to close the mouth of the branch *n* whenever said valve is in a vertical position, as in Fig. 4; but when the valve is let down into a horizontal position, it opens the channel *n*, but closes over the channel *o* contiguous thereto. There

is, of course, a valve, *p*, for every pair of channels *n o*. The various valves *p p* in each passage *m* are connected with a rod, *r*, by which they are simultaneously raised or lowered. Two rods, *r*, are used, one in each passage *m*. The front ends of the two rods *r* are provided with cranks, which connect by a system of rods and bell-cranks, *s s*, (shown in Fig. 5,) or by equivalent devices, with a vertical slide, H. This slide is raised by a spring, *t*, and when thus raised serves to hold the several valves *p p* over the channels *o o*, closing the same. The slide H carries a funnel-shaped detachable vessel, I, over which a similar vessel, J, filled with sand or equivalent substance, is suspended. The vessels I and J are of equal construction, and should each have a valve to close its lower opening.

Upon starting the fire in the boiler it is desirable to feed the air over the grate, and the valves *p p* are therefore closed over the channels *o*, leaving the channels *n* open. The valve in the upper vessel J is then opened, and the contents of this vessel flow into the vessel I, gradually weighting the same and counteracting the spring *t*, and the valves *p p* are thereby gradually raised until, when the vessel I is filled, the channels *n* are closed and the channels *o* opened. By adjusting the valve in the chamber J, the time occupied for raising the valves *p p* can be regulated at pleasure.

When fresh fuel is to be added, or a new fire is to be started, the empty vessel J is placed upon the slide H, and the full vessel I suspended above it, so that the operation can be repeated, as above stated.

For the first direct draft a flue, *u*, extends from the fire-chamber directly into the chimney, as shown in Fig. 1. This flue is afterward closed by a damper, L.

I claim as my invention—

1. The combination of the boiler A, which has the two cylindrical ends *a d* and the intermediate fire-chamber, with the smoke-passages *g g h h*, transverse channels *j j*, and chimney, substantially as herein shown and described.

2. The combination, in a steam-boiler, of the air-passage *l* with the air-heating tubes G, chimney E, air-distributing passages *m m*, and channels *n o*, substantially as specified.

3. The combination of the valve *p* with the channels *n o* and passage *m*, to operate substantially as specified.

4. The air-supply-regulating apparatus, consisting of the vessels I J and slide H, combined with the valve *p* and channels *m*, *n*, and *o* of a steam-boiler, to operate substantially as herein shown and described.

The foregoing description of my invention signed by me this 12th day of February, 1876.

G. W. BROC.

Witnesses:

C. LIEBER,

F. BRECHBIEHL.