J. E. CROWELL.

BOILER FURNACE AND AIR SUPPLYING APPARATUS.

No. 191,518. Patented June 5, 1877.

FIG. 2.

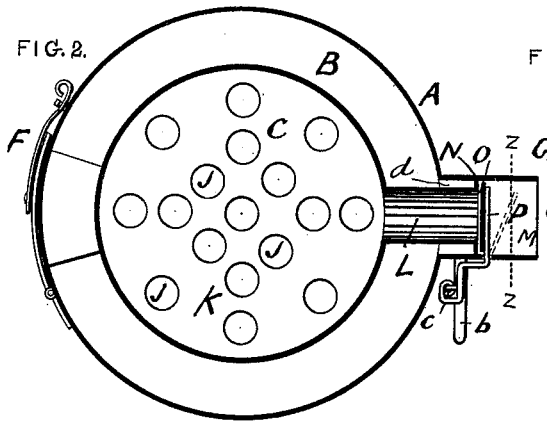


FIG. 3.

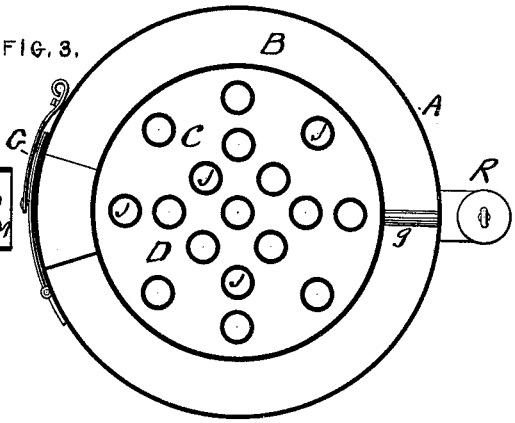


FIG. 5.

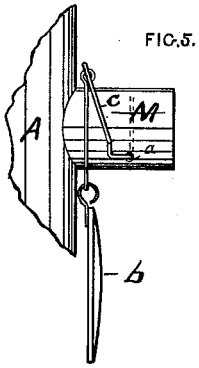


FIG. 1.

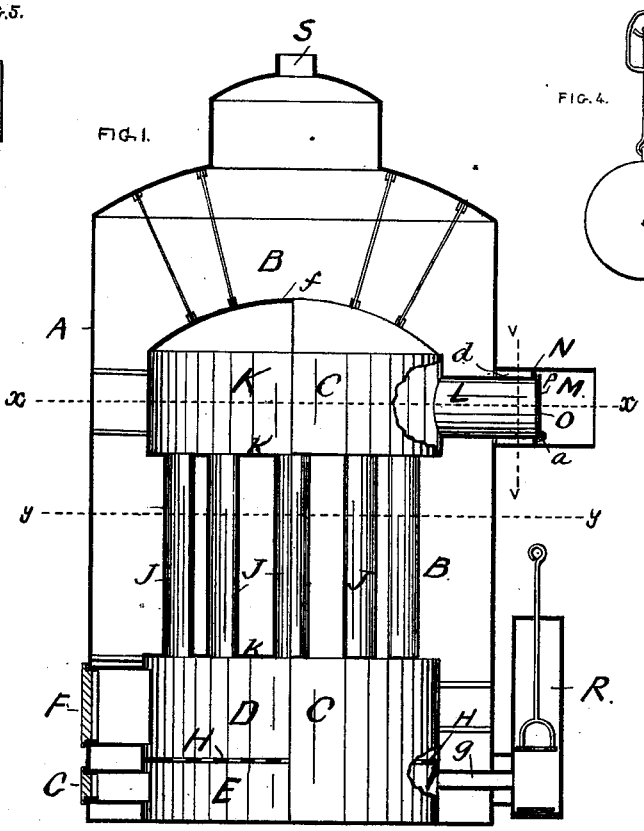
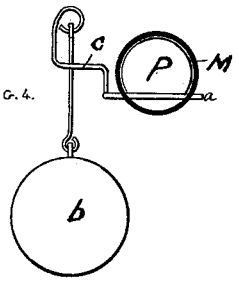


FIG. 4.



WITNESSES.

Edmund M. Brown

Geo. H. Earl.

FIG. 6.

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JAMES E. CROWELL, OF CHELSEA, ASSIGNOR TO ALBERT MERRILL, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN BOILER-FURNACES AND AIR-SUPPLYING APPARATUS.

Specification forming part of Letters Patent No. **191,518**, dated June 5, 1877; application filed November 11, 1876.

To all whom it may concern:

Be it known that I, JAMES E. CROWELL, of of the city of Chelsea, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Boilers, Furnaces, and Air-Supplying Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to steam-boilers and furnaces, and the arrangement of them is that the shell is cylindrical, but may be any other suitable form, and fitted with a fire-box and combustion-chamber, connected with a series of fire or flame tubes concentrically located within the shell, and surrounded with an annular water-space, and with an air-tight ash-pit and furnace-doors; and it consists in introducing into the furnace atmospheric air by means of an air-pump and automatically-arranged damper or valve, whereby the air in the furnace, commingled with the products of combustion, is maintained at any given pressure, and by which an intense heat is produced. A great saving of labor and economy of fuel is the result; all of which will hereinafter more fully appear.

It is well known to practical men that the common method of generating steam is to create in the furance a draft, and this draft passes through the furnace at a rapid rate, not only having a cooling effect, but carries off with it a large portion of non-consumed gases, and also the flame before it has time to impart its heats. Thus a large percentage of fuel is wasted.

By my invention I avoid these losses, and present a larger heating-surface and a more intense heat. By supplying a sufficient quantity of air to the furnace I produce a more perfect combustion and compel the intense heat thus generated to forcibly press or impinge on all parts of the heating-surface of the boiler, by which the flame gives up its heat to the water in contact with boiler-plate to a greater degree than by the ordinary means.

I will now proceed to describe the construction and operation of my improved boiler-furnace, &c.

Referring to the accompanying drawings, Figure 1 represents a vertical sectional elevation, showing the air-pump and regulating-valve in position. Fig. 2 illustrates a horizontal section on the line *x x*, Fig. 1; Fig. 3, a horizontal section on the line *y y* of Fig. 1; Fig. 4, a detail view of the damper-valve inclosed in a cross-section of the smoke-funnel, illustrating also the crank-lever and operating-weight attached. Fig. 5 is a detail elevation of the same attached to a portion of the boiler, and Fig. 6 shows the smoke-flue and its surrounding water-jacket. This figure may also represent the connection of the air-pump to the furnace.

A represents a cylindrical upright round-top boiler, provided with the usual appendages of safety-valves, &c.; B, the crown-sheet of the secondary combustion-chamber. It will be seen it is arched or concave on the inner side and convex on the opposite side.

This crown-sheet should be made of thicker iron than any other portion of the boiler, for the reason that the flame from the fire-box through the flame-tubes strikes it with such force as to cause it to wear sooner than any other portion. The convex shape has also a tendency to prevent any sediment from depositing upon it on the water side, while it performs a reverberatory function on the flame side.

K is the secondary combustion-chamber. It will be seen that this chamber projects into the water-space beyond the tubes, and also connects with the smoke-funnel L. D represents the fire-box, corresponding in diameter to the combustion-chamber K, each of which is provided with tube-sheets *k*, into which is fitted flame-tubes J. This fire-box D is provided with the ordinary grate H; also with doors F and G. Said doors as well as the ash-pit E are made air-tight. Into the ash-pit E leads a pipe, *g*, of sufficient size to admit a sufficient quantity of atmospheric air to support combustion. The outer end of the pipe

g is connected to an air-pump, and the inner end is provided with a check-valve. Said pipe runs through the shells of the boiler. An ordinary air-pump, R, provided with the necessary valves-plunger C *c*, is connected to pipe *g*, as before stated, and is operated by any suitable mechanical means, and is designed to supply the furnace with sufficient air. The pipe L is provided with a valve. P, at its outer end. The valve P is hinged at its bottom, and shuts upward, but may be attached in any other well-known method. The end of the hinge-rod of the valve projects through the sides of the smoke-funnel, and is then bent upward, and then in a horizontal line, and again upward, thus forming a compound crank, *c*, the upper end of which is provided with an eye, to which is attached, by means of a rod, a weight, *b*. This weight *b* is so graduated as to close the valve P so as to resist a given pressure, say from three to five pounds. Telescoped on said pipe L is the end of the uptake or chimney M, and between the inner side of this pipe M and the outer side of pipe L there is a space, N, into which water from the boiler runs, and thus the pipe L is surrounded with water and prevented from burning.

S represents the steam-dome, and *f* near about the water-line. It must be recollected that the crown-sheet B must be continually covered with water. Circulating devices may be readily attached to this boiler. The water-space extends down to the lower part of ash-pit.

Modifications may be made of my improved arrangements without departing from the spirit of my invention.

Operation: The boiler being supplied with water by any ordinary boiler-feeding device, the valve L is opened, also the ash-pit door, both for the purpose of creating a draft through the boiler. The fire is then started, and continues to burn until sufficient steam is raised to work the engine. When this is done the valve P is closed by means of the weight and its mechanism. The ash-pit door C is also closed, and the air-pump R is put in motion, when the blowing operation is commenced. The fuel on the grate immediately becomes brilliant, the heat intense, and combustion perfect. This intense heat is forced through the flame-tubes up against the crown-sheet, where it is given out and taken up by the water, the heat itself being prevented from escaping by the valve P. This process continues until the pressure designed is attained, when the combustion-chamber K becomes a reverberatory-chamber, and reflects back its heat on all parts of the boiler. Thus it will be seen that a complete diffusion of the gases and the better commingling of the air with carbureted and other gases is produced, and thus a more perfect combustion, and therefore a greater economy of fuel, and necessarily in labor. It may be further remarked that by means of equal pressure and temperature on all parts of the boiler unequal expansion and contraction is prevented, which on tube-sheets is very destructive.

When the fire is to be replenished the pump is stopped, and by this means the hot air is prevented from flying out in the face of the attendant.

This invention is particularly applicable to steam-launches and other small vessels where a minimum amount of fuel must produce rapidly a maximum amount of steam.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a boiler having an air-tight fire-box, of the air-pump R, smoke-funnel L, valve P, and damper-pressure regulating device, constructed and arranged substantially as described.

2. The combination, in a steam-boiler, of the fire-box D, secondary combustion-chamber K, each provided with tube-sheets *k*, and communicating flame-tubes J, with the air-pump and pressure-regulating devices, in the manner and for the purpose set forth and described.

3. The combination, with a steam-boiler, of the pump R, pipe *g*, valve P, and pipe L, valve-crank *c*, and weight *b*, all combined and arranged to operate substantially in the manner set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

JAMES E. CROWELL.

Witnesses:

JAMES NICHS. CALLAN,

MARY S. CALLAN.