H. Boardman,

Steam-Boiler Furnace.

No. 6649. Patented Aug. 14, 1849.

Fig. 3.

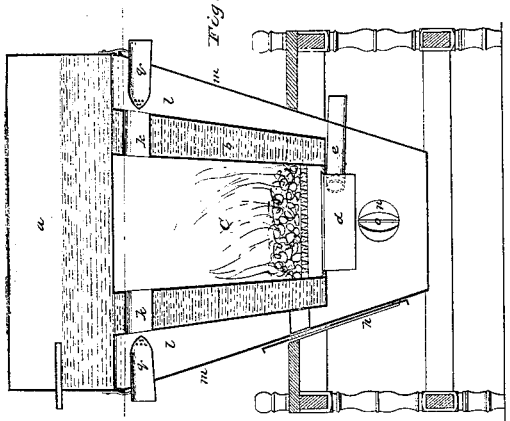
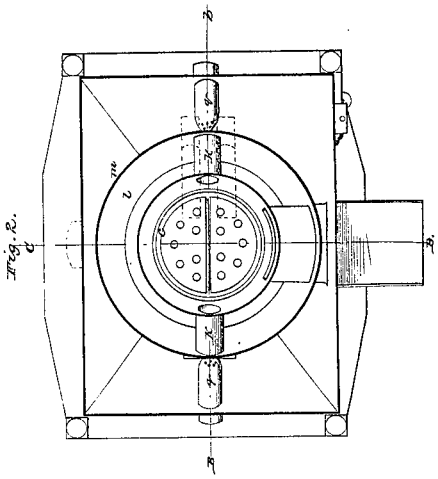


Fig. 2.



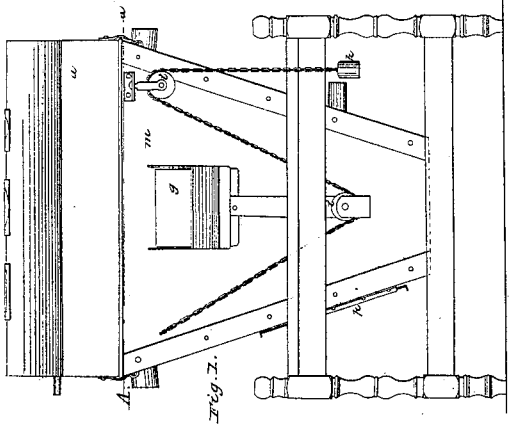
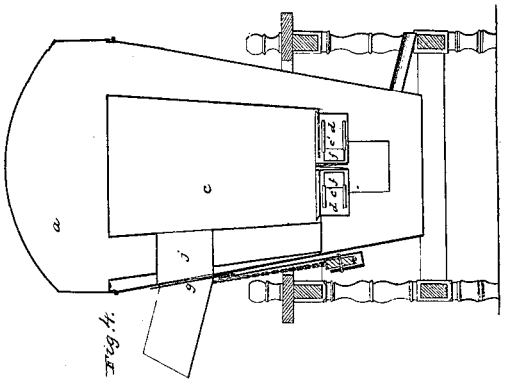


Fig. 1.

Fig. 4.



UNITED STATES PATENT OFFICE.

HORACE BOARDMAN, OF PLATTSBURG, NEW YORK.

ARRANGEMENT OF STEAM-BOILER AND FURNACE THEREOF.

Specification forming part of Letters Patent No. 6,649, dated August 14, 1849; Reissued February 25, 1851, No. 190.

To all whom it may concern:

Be it known that I, HORACE BOARDMAN, of Plattsburg, in the county of Clinton and State of New York, have invented certain new and useful Improvements in Steam Boilers and Furnaces, and that the following is a full, clear, and exact description of the principle or character which distinguishes them from all other things before known and of the manner of making, constructing, and using the same, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is an elevation of the boiler and furnace; Fig. 2, a horizontal section taken at the line (A *a*) of Fig. 1; and Figs. 3 and 4, vertical sections taken at the lines (B *b*) and (C *c*) of Fig. 2.

The same letters indicate like parts in all the figures.

The nature of my invention consists in giving to the fire-box or combustion-chamber of boilers the form of an inverted cone or pyramid, surrounded by a watercase of the same general form (the thickness of the upper part of which is greater than the lower) and communicating at its upper part, by passages through the watercasing, with an inverted-pyramidal chamber, by which the products of the combustion are conveyed downward and discharged below the fire-box; the outer or gas-chamber is of greater area at its top where it communicates with the interior of the fire box, than it is at its bottom where the spent gases are discharged. The combustion of the fuel in the fire box is maintained by a blast introduced in a wind chest beneath the grate and heated by the spent gases; the inflammable gaseous products of the combustion are burned by the introduction of jets of air at the passages through the water casing. The fire box, water-casing, and gas-chamber thus constructed are attached to the flat bottom of the upper part of a boiler which forms the top of the fire box and gas-chamber, and which communicates with the water casing by one or more openings to allow of a free passage of water and steam. This form of fire box and gas-chamber presents an increased amount of fire and flue surface corresponding to the increased volume and temperature of the gases ignited by the jets of air, and by retarding their progressive motion enables the water of the boiler to absorb the heat more completely, while it forms a reservoir for the gases from which the colder portions are first expelled by the action of the ascending currents within the fire box. The upward circulation in the water-case is maintained by the feed alone, which is injected into the lower and colder part of the water-case where it acts to cool the plates in immediate contact with the fire, and to absorb the heat of the spent gases.

In the accompanying drawings, (*a*) represents the body or upper part of a steam boiler, which should be provided with man holes, safety valve, steam pipes, and all the other appendages of a steam boiler, but which are not described or represented, as they make no part of my invention. The bottom of this boiler which is flat is provided with an inverted conical water chamber (*b*) of such capacity as to leave a free circulation for the water from the body of the boiler through every part of it. The space (*c*) within the water chamber constitutes the fire box which is to be provided with a grate for the fuel, in the usual or any appropriate manner, and which is not therefore represented, and with a wind chest (*d*) below the grate. The wind chest is divided into two compartments (*c'*, *c'*) for the convenience of repairs, as this facilitates the removal and replacement of them when required. Each compartment is provided with a twyer or pipe (*e*) connected with any blowing apparatus for supplying a blast of air to the fuel on the grate. The two compartments have each a door (*f*) for the purpose of cleaning out. The fuel is introduced through a door (*g*) in the outer casing, which door is counterpoised by a weight (*h*) on the end of a chain which passes around two pulleys (*i*, *i*), one on the door and the other on the casing. And from this door the fuel passes through a tunnel or feed pipe (*j*) to the inside of the fire chamber.

Near the bottom of the body of the boiler the water chamber is provided with two tubular flues (*k*, *k*) on opposite sides through which the products of the combustion pass to the upper part of the gas chamber (*l*) which surrounds the water chamber, and which is formed by an outer casing (*m*) which extends from the outer edge of the bottom of the body of the boiler, down to

some distance below the bottom of the wind chest, this outer casing being in form an inverted quadrangular pyramid with an exit pipe (*n*), below the wind chest, and thence leading to the chimney, the said exit pipe should be provided with a damper (*o*) for regulating the discharge of the products of the final combustion. The lower part of the outer casing is provided with an aperture closed by a sliding door (*p*) for giving access to the wind chest, and to clean out the ashes and sparks which accumulate in the bottom of the gas chamber. A twyer (*q*) connected with some blowing apparatus is introduced through the casing opposite to each of the passages (*k*) and so as to be centrally in a line with them. The inner end of the twyers are round and pierced with small holes for the purpose of diffusing the blast of air. If desired the inside of the fire chamber may be lined with fire brick or other refractory substance, and the outer casing which surrounds the gas chamber should either be surrounded by masonry or made of some bad conductor of caloric.

When the blowing apparatus is to be operated by the steam generated in the boiler, then either the twyers which supply the blast to the grate should be so constructed as to admit of being disconnected to admit a draft of air to the grate or a separate pipe should be made for that purpose. The combustion in the fire chamber excited by the action of the forced blast introduced in the wind chest below the grate evolves flame and inflammable gases which fill the fire chamber and communicate an intense heat to that part of the bottom of the body of the boiler which forms the top of the fire chamber, and also to the inner side of the surrounding water chamber. The flame and the gaseous products of the combustion are forced out through the tubular flues (*k*, *k*), and as they pass out their outward currents are broken by the blasts of atmospheric air from the twyers or blast pipes (*q*, *q*), which has the effect thoroughly to commingle the atmospheric air and the inflammable gases at a high temperature, and thus to inflame them and consume all or nearly all the combustible matter.

The natural course of the gases produced by the combustion of the fuel on the grate is upward and consequently an accumulation of the hottest portions will take place at the upper part of the fire box and (through the passages *k*, *k*) in the upper part of the gas-chamber; the heat at these portions of the boiler is further increased by the consumption of the inflammable gases effected by the introduction of air through the twyers (*q*). The introduction of air at this part of the boiler not only increases the intensity of the flame but also increases the volume of the gases, thus rendering necessary a corresponding increase in the area of the fire-box and gas-chamber at these points which is obtained by giving them the form herein described; as the gases descend the outer side of the water casing their heat is gradually absorbed and their volume correspondingly diminished, thus requiring a corresponding diminution in the area of the gas chamber, which is effected by giving it the form of a hollow inverted cone or pyramid whose thickness is greatest where its upper end adjoins the lower part of the main boiler.

By this arrangement of boiler and this method of burning the fuel, a more intense heat is given out above than below; hence the water in the lower or colder portions of the water-casing does not circulate with that contained in the upper or hotter parts of the casing and boiler, but is kept moving slowly upward by the action of the feed aolne, which is introduced in the lowest or coldest part of the boiler.

The force of the blast from the wind chest upward through the grate forces the ashes and sparks up to and through the flue tubes (*k*, *k*), and thence they fall by gravitation through the gas chamber and are deposited at the bottom thereof below the exit pipe, where the sparks are extinguished by the carbonic acid gas which is always present in this part of the apparatus when in operation.

The products of the entire combustion as they pass down by pressure toward the exit pipe, after acting on every part of the boiler, finally act on and heat the air which is blown into the wind chest before passing out; and as the gases are retained within this gas chamber under pressure that part of the chamber below the wind chest will always be filled with heated gases to keep up the required temperature of the wind chest.

I do not wish to limit myself to the number of twyers for the introduction of the blast of atmospheric air either to the fuel on the grate or to the gases issuing from the fire chamber into the gas chamber, but there should be one twyer for each passage leading out of the fire chamber. Nor do I wish to limit myself to the special form of the boiler, the fire, water, or gas chambers as these may be varied at pleasure so long as the principle or character of my invention is retained.

What I claim as my invention and desire to secure by Letters Patent is—

1. Giving the combustion-chamber of boiler an inverted conical or pyramidal form, so as to make the area of the upper horizontal section greater than that of the lower, surrounding it with a watercasing and with a gas-chamber also of increased capacity at the top, and attaching the several parts to the flat bottom of a boiler which

forms the top of the combustion and gas-chambers; the water casing and the flat-bottomed vessel being connected with each other and the whole forming one boiler, the several parts of which are arranged substantially in the manner and for the purposes herein set forth.

2. I likewise claim the injection of a jet or jets of air at the flues or passages which connect the combustion-chamber with the gas-chamber, for the purpose of igniting the gases and retarding their progressive motion toward the bottom of the gas-chamber.

H. BOARDMAN.

Witnesses:
A. P. BROWNE,
M. GRANDIN.

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