H. PURDY.

STEAM BOILER.

No. 181,867. Patented Sept. 5, 1876.

Fig 1.

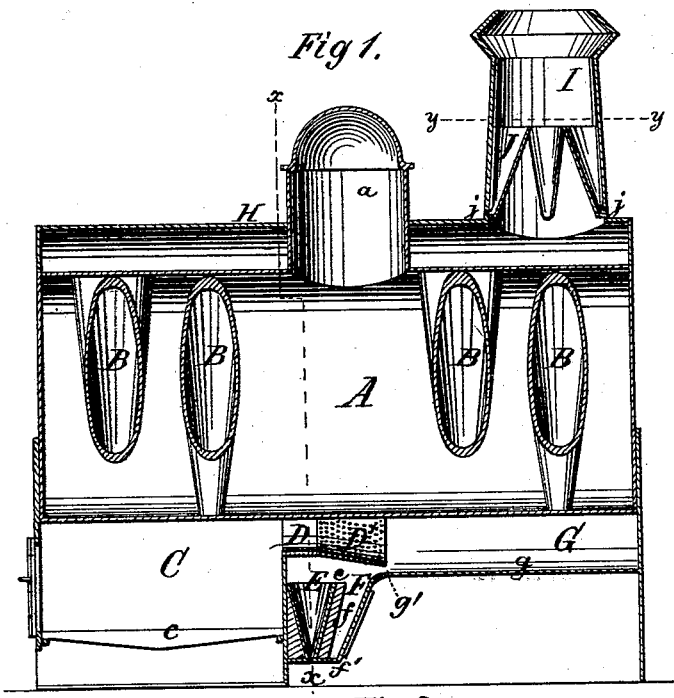


Fig 2.

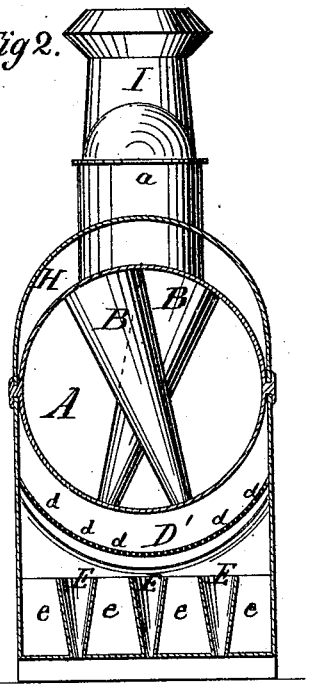


Fig 3.

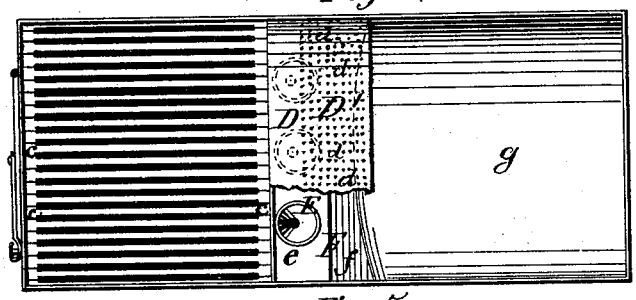


Fig 4.

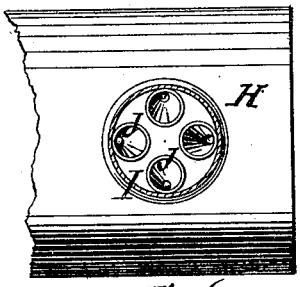
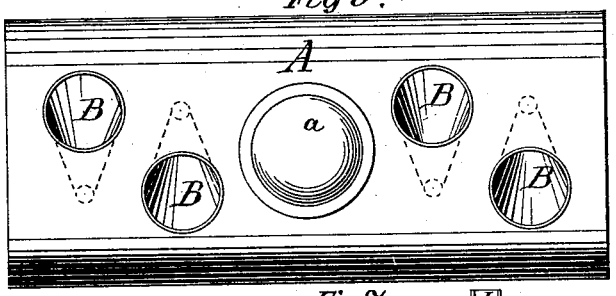


Fig 5.

Fig 6.



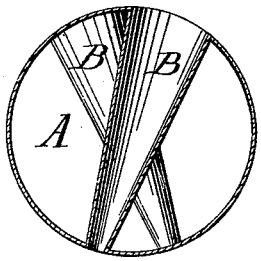
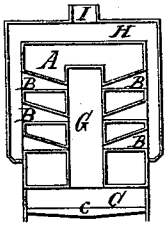


Fig 7.



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UNITED STATES PATENT OFFICE.

HIRAM PURDY, OF BURLINGTON, IOWA.

IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. **181,867**, dated September 5, 1876; application filed June 5, 1876.

To all whom it may concern:

Be it known that I, HIRAM PURDY, of Burlington, in the county of Des Moines, and State of Iowa, have invented new and useful Improvements in Boilers, which improvements are fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section of my improved boiler. Fig. 2 is a vertical cross-section in the line *x x* of Fig. 1. Fig. 3 is a top view of the fire-box and flue, with the boiler removed. Fig. 4 is a horizontal section of the smoke-stack or chimney in the line *y y* of Fig. 1. Fig. 5 is a top view of the boiler, with the steam-dome detached from the fire-box and flues. Fig. 6 is a vertical section of the boiler, through one of the draft-tubes thereof, and Fig. 7 shows a portion of the invention applied to an upright boiler.

The nature of my invention consists in certain constructions, combinations, and arrangements of parts, as hereinafter described and specifically claimed, whereby an improved plan for heating water in steam-boilers and steam-generators is provided, and with which a greater amount of heat from a given amount of fuel is utilized, and a more perfect combustion effected, by reason of the draft and supply of air being freer and more powerful than with other known plans.

The object of my invention is to make a very cheap boiler, of very simple construction, which, with a given amount of fuel, utilizes more heat, and thereby creates more steam or hot water in less time and space than is practicable with a boiler of different construction from mine.

To enable others skilled in the art to understand my invention, I will proceed to describe it.

In the accompanying drawings, A represents a cylindrical boiler, with a steam-dome, *a*. The said boiler is provided with conical flues B, fastened into the shell of the boiler in an inclined direction and with their small ends down, so as to produce a flaring draft-passage through the boiler, as seen in Fig. 6. The said conical flues may be vertical or inclined, or part inclined and part vertical, but always with the wide opening turned up; and they may also be arranged in single or double rows.

In practice, I prefer that one side of each of the cones may be vertical while the other side is oblique thereto, as I believe that form will produce the best results.

Below the boiler A is the furnace, consisting of the fire-box C and smoke or gas flue G, grate-bars *c*, and the fire-back or bridge-wall D, with air-supplying tubes or flues E, a cinder and ash pit or chamber, F, and air-distributer, D′, formed with a back slope, and provided with numerous air-holes, *d*, for the air supplied from below through the tubes or flues E to pass through and mingle with the flame and smoke. The said flues E are inverted hollow frustums of cones, like those in the boiler, and are fastened to the back wall of the fire-box C and the raised bottom *f′* of a chamber, F, behind the fire-box, the said bottom being high enough above the ground to allow a free and plentiful supply of fresh air to the tubes E. The said tubes E are, by preference, formed within the fire-back, as shown at *e*, and the unoccupied part of the chamber F in rear of the tubes E serves as a pit, *f*, for receiving flying ashes and cinders.

The rear end of the air-distributer D′ is so shaped and set in relief from the bottom *g* of the smoke-flue that it extends over said bottom and forms with the same an opening, *g′*, concentric with the bottom *g* of the flue or gas chamber G, through which such part of the fresh air supplied by the flues E as does not pass through the holes *d* enters the said smoke-flue or gas-chamber. By this construction fresh air is introduced into this flue or chamber at the most advantageous point—viz., at the rear end of the distributer, and at the same time that air is passing through the distributer—and thus the burning gases, in their expanded condition, expose their unconsumed and combustible portions at a high degree of heat to the inflowing air, and a quick and perfect combustion is effected. The hot air rises toward the boiler and enters the tubes B, wherein it

gives off its heat to the metal and the surrounding water and steam. The descent of the colder air by its increased weight, and the crowding up of the heated air from the fire-chamber and smoke and flame flue G, in connection with the upwardly and gradually-increasing area of the said flues, produces a spiral motion of the rising gases similar to those of a cyclone, whereby the hotter parts of the gases are repeatedly thrown against the sides of the flues and deprived of their surplus of heat until they leave the flues with about the same degree of heat as that of the water or steam within the boiler. I use a semi-cylindrical cover, H, over the boiler, by which the continuation of the smoke-chamber is formed, and from which the smoke is drawn off by the stack or chimney I. To accelerate the draft in the chimney I insert a number of conical tubes, J, near its base, fastening them to the inside of the chimney with their small ends down, and in communication with side openings *j'* in the stack, which introduce fresh air into the lower parts of the said tubes, which fresh air, for similar reasons as stated above, rises in the said tubes with a cyclonic motion, and thus, while readily and thoroughly mixed with the rising smoke and gases for promoting combustion of flying sparks, gives additional velocity to the rising smoke and dead gases, and thereby increases the draft to the fire-box. The motion of the fresh air entering the tubes E is the same as that in the tubes B and J, and it serves to supply quickly, and in a small space, a very large quantity of oxygen to every part of area between the slope or distributer D′ and the boiler A, and thereby produce a more perfect combustion at this point than is practicable with cylindrical or conical tubes not inverted. The flames and hot gases rising from the grate *c* and the fuel thereon partly enter the tubes B directly above the grate, but the greater part passes between the bridge D and over the rear slope or distributer D′, and in doing so becomes expanded and mixed with the fresh air rising through the holes *d* in the slope or distributer, whereby the greater part of the unconsumed combustible matters carried along by the force of the draft are caused to become consumed.

The combustion above the slope or distributer is continued and completed by the further supply of fresh air from between the rear end of the slope or distributer and the front end of the bottom of the smoke-flue or gas-chamber G, and such matters—as flying ashes and cinders—as are separated from the burning gases drop down through the holes *d* of the slope or distributer into the pit *f*, from whence they are to be removed by a door.

The further course and operation of the hot gases will be fully understood from the description of them before given, and it only remains to be said that by this improved manner of constructing and heating a boiler the course of the gases is the most direct, avoiding a great number of unnecessary bends, corners, lengthy contractions, which latter especially favor deposits of non-conducting ashes and cinders where direct exposure to heat is required, as is the case with boilers having long narrow tubes, for instance. To this great advantage must be added the other, namely, that the heating-surfaces, according to their peculiar construction, are more effective, and the heat communicated to the water or steam within the boiler is considerably greater than that in other boilers of the same capacity and with the same consumption of fuel.

I propose to apply my inverted conical flues to upright boilers, as shown in Fig. 7, and steam-generators used for heating buildings, in which latter application the steam will circulate through a steam-jacket supplied with transverse conical flues, through which flues air to be heated will circulate, and when heated be passed to apartments through pipes.

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

1. A boiler having inverted conical flues placed vertically, or nearly so, to its axis, across it, substantially as and for the purpose set forth.

2. The fire-bridge of a boiler-furnace, constructed with inverted conical air-supplying tubes E, placed vertically, substantially as described.

3. The combination, with a fire-box and smoke-flue, or gas-chamber, of a fire-bridge having a perforated rear slope or distributer, D′, and a fresh-air-supply passage, *g'*, formed by the plate D and shell *g*, substantially as and for the purpose set forth.

4. In a boiler-furnace, the bridge D, the slope or distributer D′, the chamber F, the pit *f*, and the conical tubes E, placed vertically, substantially as and for the purpose set forth.

5. In a boiler-furnace, the combination of the slope or distributer D′, the bottom *g* of the flue or chamber G, and conical air-supply tubes E, constructed and arranged to admit fresh air into the smoke-flue or gas-chamber below the slope or distributer, substantially as set forth.

6. A boiler stack or chimney, provided with inverted conical tubes J and side openings *j*, constructed and operating substantially as set forth.

7. The combination, with a steam-boiler having the inverted conical flues B, and the cover H, having a stack or chimney, I, with the inverted conical flues J, substantially as and for the purpose set forth.

8. The combination of the fire-box C, the fire-bridge D, having the inverted conical air-

tubes E placed vertically, the boiler having the inverted conical flues B, and the stack or chimney I, having the inverted conical flues J, substantially as described.

9. The combination of the fire-box C and bridge-wall D with its smoke flue or chambers G H and stack or chimney I, and the boiler having flues B, vertically, or nearly so, to its axis, across it, substantially as described.

Witness my hand in the matter of my application for patent for improvement in boilers this 26th of May, A. D. 1876.

HIRAM PURDY.

Witnesses:
JAMES MARTIN, Jr.,
M. H. N. KENDIG.