F HUNGERFORD.
Steam-Boiler.

No. 161,964. Patented April 13, 1875.

Fig. 1.

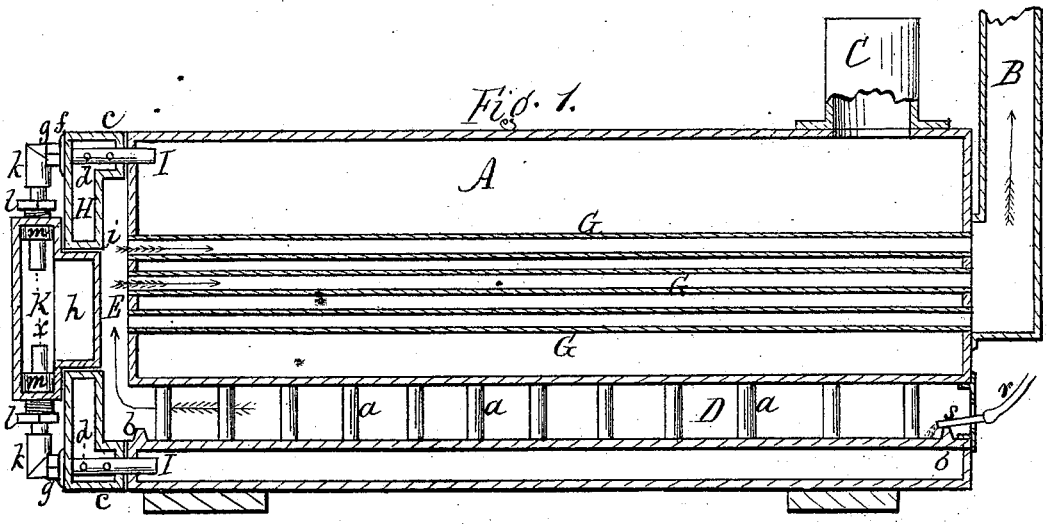


Fig. 2.

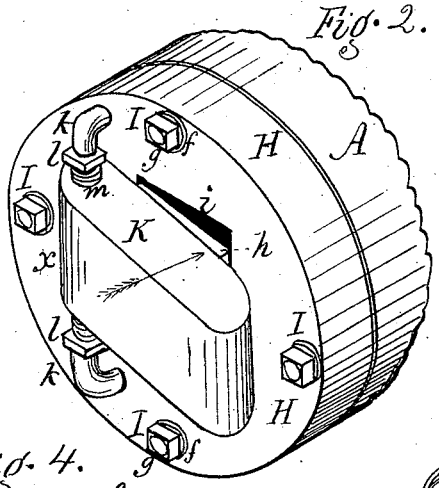


Fig. 3.

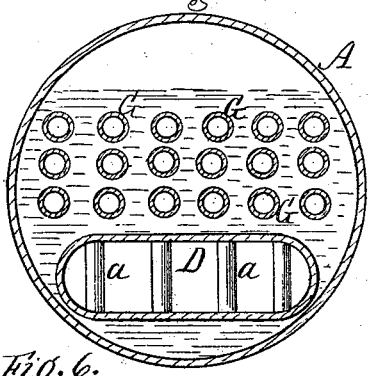


Fig. 4.

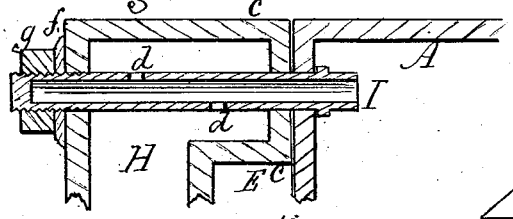


Fig. 5.

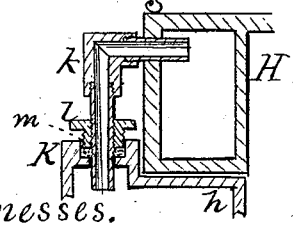


Fig. 6.

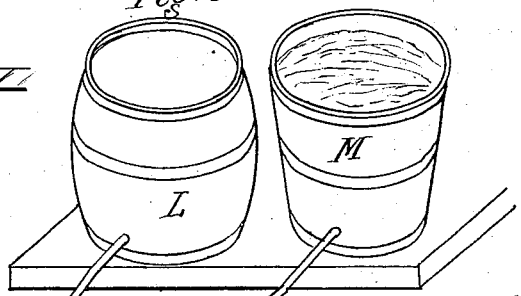
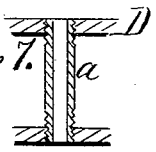
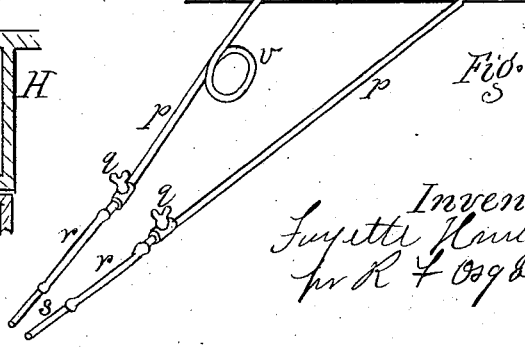


Fig. 7.





Witnesses.
E. R. Scott.
Louis Spahn.

Inventor.
Fayette Hungerford,
per R. F. Osgood, Atty.

UNITED STATES PATENT OFFICE.

FAYETTE HUNGERFORD, OF ROCHESTER, ASSIGNOR TO AMOS CARLTON STEARNS, OF CORNING, NEW YORK.

IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. **161,964**, dated April 13, 1875; application filed July 27, 1874.

To all whom it may concern:

Be it known that I, FAYETTE HUNGERFORD, of the city of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section. Fig. 2 is a perspective view of the rear end of the boiler. Fig. 3 is a vertical cross-section. Figs. 4, 5, 6, and 7 are detail views.

This invention is an improvement on that patented to me September 2, 1873; and consists, more particularly, in the construction and arrangement of the water head and door at the rear end of the boiler, communicating with the interior of the boiler by pipes; also, in certain other improvements to be hereinafter described.

In the drawings, A represents a steam-boiler of any desired form. B is the chimney, and C is the steam-dome. D is the oil-furnace, located in the lower part of the boiler, and surrounded by the water on all sides. It is of oval or elongated form in cross-section, and extends the whole length of the boiler, being joined at the heads to prevent leakage. It is made of boiler-iron, riveted, and has a series of vertical water-tubes, *a a*, which open through the upper and lower plates, and thus allow a free passage of the water above and below. Any desired number of these furnaces may be used in the boiler, one above another. The fire burning in the interior of the furnace comes in contact with these tubes *a a* throughout the whole extent of the furnace, and thus adds much to the heating power. The tubes *a a* are preferably cut with screw-threads at the opposite ends, which screw into the opposite sheets or plates of the furnace, and the projecting ends are then riveted or headed down to make tight joints. The tubes not only serve the purpose of conducting the water, as above described; but they also serve as braces to sustain the furnace and prevent collapse of the same under the great pressure to which it is subjected by the steam, thereby saving the use of extra stays.

In this construction of the furnace, with the series of bracing water-tubes, consists one of the novel features of my invention. The bottom of the furnace, at opposite ends, has ledges *b b*, by which a pan is formed to receive and hold the liquids used for fuel. At the rear end is a flue-space, E, through which the smoke and products of combustion pass to the smoke-flues G G, which lead longitudinally through the boiler to the chimney B. These flues, being covered by water, add greatly to the heating capacity, as the waste heat is thus expended in raising steam. H is a water-head, which is made separate and bolted to the rear end of the boiler. It is made hollow to hold water, and has offsets or projections *c c*, which abut against the boiler, with a suitable packing between, by which means the flue-space E is formed. The water-head is connected with the boiler by four hollow tubes, I I, three of which rest below the water-line, and one opens into the steam-space above the water. The ends of these tubes, which enter the boiler, are left open, and the portion which rests within the water-head H is provided with perforations *d d*. By this means a free communication is made between the boiler and the water-head, and the water and steam can pass in and out freely. The outer ends of the tubes are cut with screw-threads and project through the water-head, and washers *f* and nuts *g* are applied thereon to bolt the water-head fast to the boiler. This arrangement is shown most clearly in Fig. 4, which is a vertical section through one of the tubes.

K is a water-door, turning upon an axis, *x*, at one end, and having an offset or head, *h*, which strikes into and closes a man-hole, *i*, of the water-head, while the body of the water-door itself closes up against the surface of the water-head. The door is made hollow to secure water, which is allowed passage from the water-head by the following means: *k k* are two pipe-elbows, the inner ends of which pass through the outer plate of the water-head, while the outer ends pass through the upper and lower plates of the door, in the line

of the axis. These elbows are tubular and open at the ends, which allow free passage of the water. On each of the elbows, outside the door, rests a nut, *l*, which screws into a socket, *m*, of the door, having packing therein, by which means a stuffing-box is produced that makes a water-tight joint, allowing the door, at the same time, to swing upon its axis. In addition to forming a stuffing-box, this arrangement allows the door to be adjusted higher or lower, to fit accurately in the man-hole, by simply turning the nuts *l l* up or down. The employment of the water-head H enables me to utilize the heat which passes to the rear end of the boiler, and which, by reason of the turn in the flue E at that point, is very intense, and would strike through an ordinary plate and much be lost. In my arrangement this heat is all expended upon a body of water connected directly with the boiler, and none can escape. The water-door accomplishes the same purpose with respect to the man-hole *i*. L is the oil and M the water tank, which stand at a higher level than the furnace. *p p* are pipes leading from these tanks to the furnace. They are provided with cocks *q q*, for gaging and controlling the flow of the liquids, and they also have short lengths of flexible tube *r r*, with nozzles *s s*, by which they can be turned to any position in entering the door of the furnace. A constant flow of oil and water is let on through these pipes, which, in commingling, produce an intense combustion that fills the whole furnace-space. The water has not only the effect of increasing the fire by the decomposition of its gases, but it rebounds and spatters through the whole space, breaking the body of oil into minute particles, which readily ignite. The combustion is, therefore, so perfect that little or no residuum is left, and the furnace rarely needs cleaning out. The oil-pipe has, at some point in its length, a trap, *v*, formed by bending the pipe once or more around, as shown in Fig. 6, the coil standing downward to hold a body of oil therein at all times, and thereby prevent the fire from the furnace creeping back through the pipe and igniting the tank. In some cases it is necessary to set the tank near the furnace, and if the oil should get low in the tank, so as to partially uncover the interior space of the pipe, a clear passage of gas might be left through the pipe, which would convey fire to the tank and lead to explosion. In my apparatus such result cannot occur.

Any liquid suited to this use may be employed in place of the oil—for instance, benzine or naphtha. If desired, also, the boiler may be mounted over an ordinary coal or wood furnace, so that other fuel may be employed when it is desired not to use oil.

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

1. The combination, with the boiler A, of the detachable hollow head H, provided with the hollow door K, having conducting-pipes extending from the same through the hollow head and into the boiler, substantially as and for the object specified.

2. The removable water-head H, provided with the offsets *c c*, abutting against the boiler, whereby the flue-space E is formed between said water-head and the flues G, in combination with the pipes I, for producing the circulation between the water-head and boiler, substantially as and for the purpose described.

3. The combination, with the water-head H, of the water-door K, pipe-elbows *k k*, nuts *l l*, and sockets *m m*, as and for the purpose specified.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

FAYETTE HUNGERFORD.

Witnesses:
R. F. OSGOOD,
E. B. SCOTT.