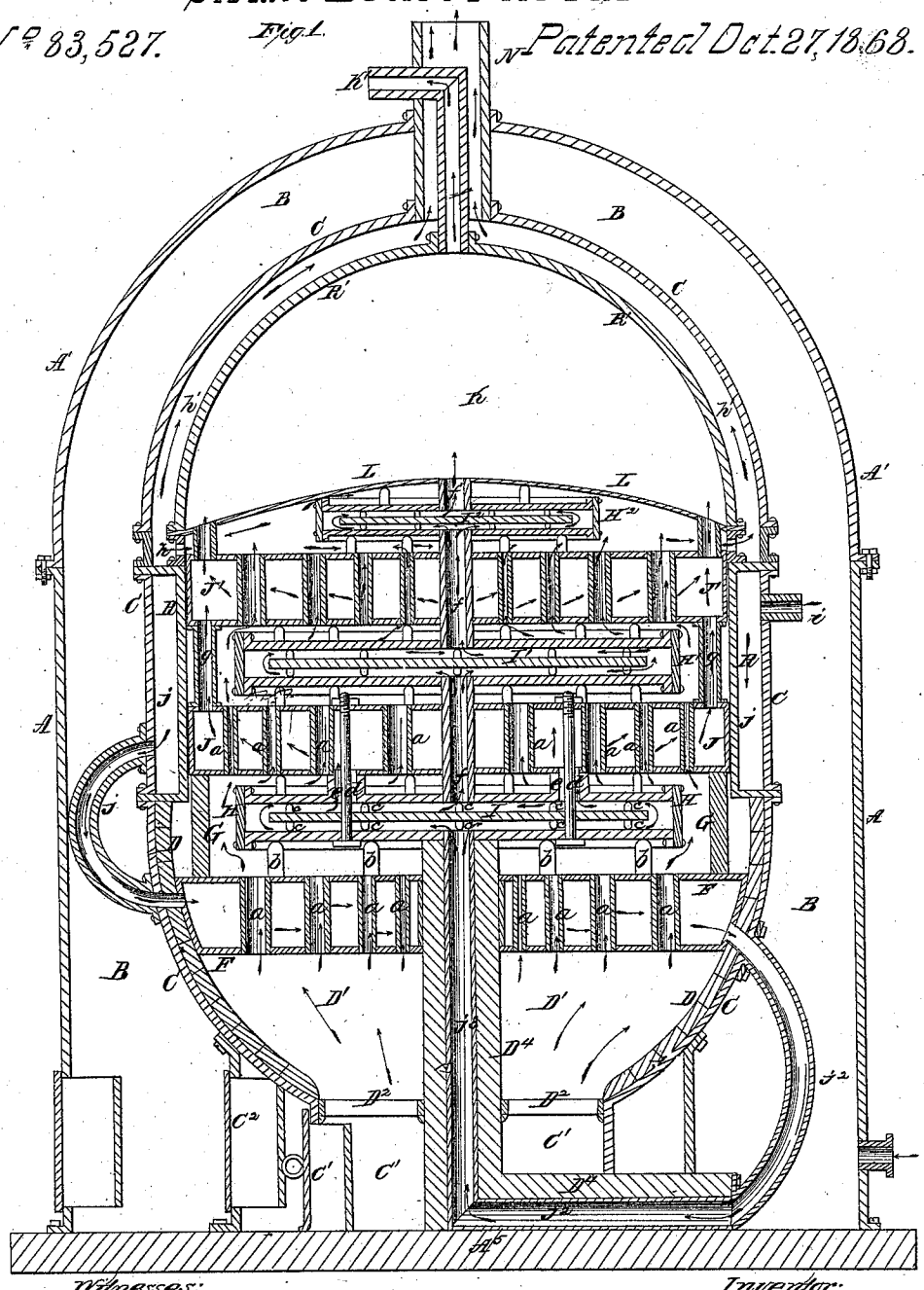
E. P. Mosman, 2 Sheets. Sheet 1.

Steam-Boiler Fire-Tube

No. 83,527. Fig. 1. Patented Oct. 27, 1868.



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2 Sheets-Sheet 2.

E. P. Mosman,

Steam-Boiler Fire-Tube.

No. 83,527. Patented Oct. 27, 1868.

Fig. 1.

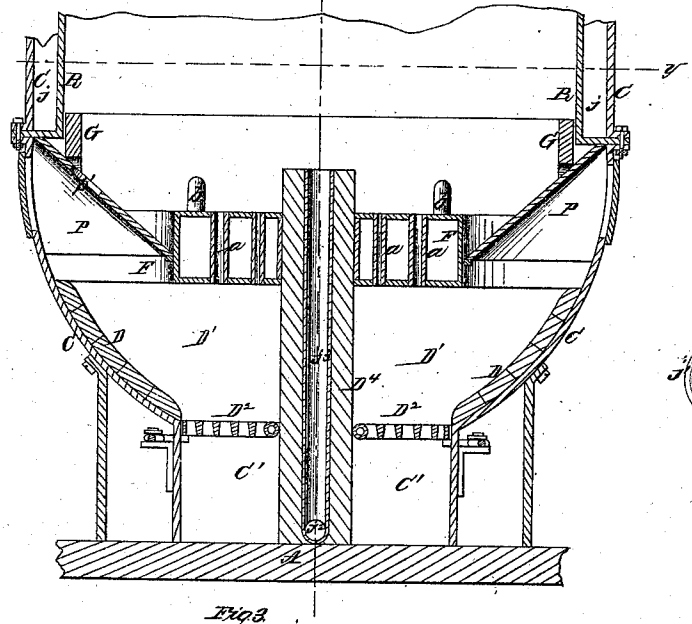


Fig. 3.

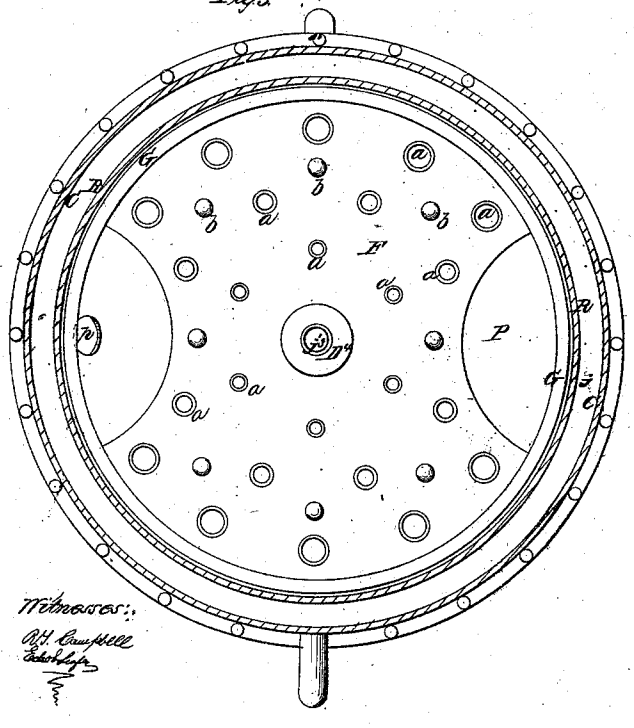


Fig. 5.

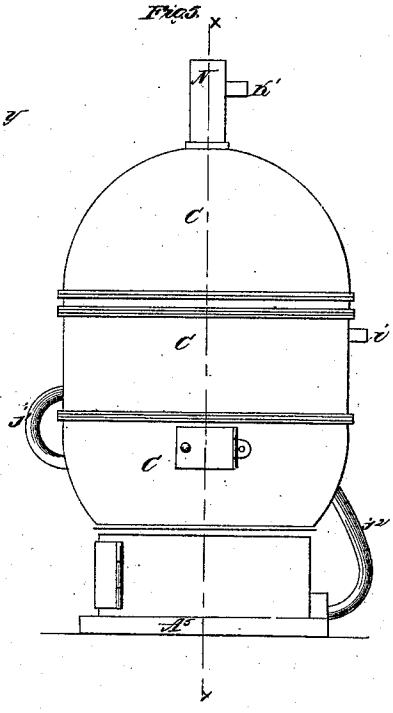
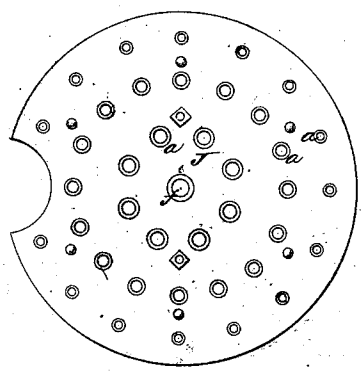


Fig. 4.



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United States Patent Office.

E. P. MOSMAN, DECEASED, (ALBERT S. BOLLES AND SARAH E. MOSMAN, ADMINISTRATORS,) OF NORWICH, CONNECTICUT.

Letters Patent No. 83,527, *dated October* 27, 1868; *antedated October* 24, 1868.

IMPROVEMENT IN STEAM-GENERATORS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, E. P. MOSMAN, of Norwich, in the county of New London, and State of Connecticut, have invented a new and improved Steam-Boiler; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1, sheet 1, is a diametrical section through my improved boiler, enclosed by a jacket or water-case.

Figure 2, sheet 2, is a diametrical section of the lower portion of the boiler, taken in a vertical plane, at right angles to the sectional plane of fig. 1, showing the lower flue-boiler, the fire-chamber, and the feed-openings leading thereto.

Figure 3, sheet 2, is a section, taken through the boiler, in the horizontal plane indicated by red line *y y* in fig. 2.

Figure 4 is a top view of one of the short-flue boilers.

Figure 5 is a front elevation of the boiler without its water-jacket.

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

The leading object of my invention is to secure a thorough diffusion, in thin streams or sheets, of the water or vapor in its circulation, and at the same time effect a rapid evaporation and consequent rapid generation or superheating of steam; and to this end I have devised a new construction of evaporizer, as will be hereinafter described.

Another of the objects of my invention is to obtain a much greater proportion of exposed heating-surface, in a steam-boiler of a given size, than has hitherto been attained in any boiler of the same size with which I am acquainted; at the same time to provide for allowing access to every part of the flue and water-spaces, and to afford freedom for the heated products of combustion to circulate through the flue-spaces on their way to the main escape-flue.

Another object of my invention is to so arrange and combine a number or series of horizontal short sections of a flue-boiler and horizontal evaporizers, within a casing which is wholly or partially surrounded with water, that said boilers and evaporizers form between and around them flue-spaces for the circulation of heated products of combustion; at the same time to have the feed-water heated by waste heat from the flue-shell on its way to said sections of a boiler and said evaporizers, as will be hereinafter explained.

Another object of my invention is to employ, in conjunction with a water-jacket for containing feed-water to be supplied to the boiler, certain conduits, which will lead the water vertically through the centre of the fire-chamber, and through the first or lowermost short-flue boiler to the first or lowermost evaporizer, whereby the water is gradually brought to a boiling-point before it is exposed to the evaporizers, and a circulation of the water and rapid generation of steam effected.

Another object of my invention is to employ, in conjunction with one or more horizontal short-flue sections of a boiler, an evaporizer, which is so constructed that the water shall be caused to flow in thin sheets from its centre to its circumference, or, *vice versa*, from circumference to centre, and thence back again on its way to a higher short-flue boiler or evaporizer, as will be hereinafter explained.

Another object of my invention is to so interrupt or deflect the ascending currents of the heated products rising from the fire-chamber, by means of short-flue sections of a boiler, and by evaporizers, that the inflammable gases shall be arrested long enough to effect, by a mixture of air with them, their total consumption before they reach the point or points of exit from the boiler, as will be hereinafter explained.

To enable others skilled in the art to understand my invention, I will describe its construction and operation.

The body of the boiler may be composed of three or more horizontal sections or parts, properly united together, and so shaped that, when united, the boiler, when taken in vertical section, presents the form of an ellipse.

The lowermost section is mounted upon a suitable base, A^5, and consists of a flaring fire-chamber, D^1, which is enclosed by the outer wall C, lined with fire-brick, D, or other substance, which will protect this wall from direct contact with the fire in said chamber D^1.

At the base of the fire-chamber D^1 is a grate, D^2, which may be made in any suitable manner, so that it will tilt and also oscillate about a central axis or support; and below this grate, D^2, is the contracted ash-pit, C^1, which is surrounded by a jacket, C^2, as shown in figs. 1 and 2, for the purpose of preventing the escape of heat, and also for affording an additional base-support for the superimposed weight.

The fire-chamber D^1 is fed with fuel through chutes or passages P P, which open at points above the fire-chamber, through the upper termination of the flaring wall C, as shown in fig. 2 at *k k*. These chutes, P P, are arranged diametrically opposite each other, and serve to allow the fire to be fed with fuel at a point above the bed of coals therein.

Directly over the fire-chamber D^1 is the first short-flue section, F, which is arranged in a horizontal plane, and constructed with vertical flues, *a a*, through it, which flues increase in diameter as they approach the circumference of this boiler, so that the products of combustion rising from the fire-chamber will pass through the flues nearest the sides of this fire-chamber, where the combustion would be slowest, more rapidly and freely than such products are allowed to pass through the flues nearest the centre of the boiler. By thus arranging the said flues over the fire-chamber, the

surface of the bed of coals will be uniformly incandescent, and consequently the bottom of the boiler F will be uniformly subjected to heat throughout.

On top of this short-flue section, F, studs or posts, *b*, are constructed, which are adapted for supporting an evaporizer, H, and which are made of sufficient height to allow access to a person between the boiler and evaporizer, for inspecting or repairing the same.

The evaporizer consists of two parallel disks, of cast or wrought-metal united together, by means of a band or hoop, so as to form a narrow chamber, within which is centrally arranged a disk, I, of cast or wrought-metal.

The disk I is supported and held in place by means of studs, *c c*, as shown in fig. 1, and it is of less diameter than the case or box H, so as to leave an annular passage around it for the ascent of the water or steam admitted below said plate I, as will be hereinafter described.

Surrounding the evaporizer H is a ring, G, which is sustained upon the top plate of the short-flue-boiler section F, and made of such diameter as will encompass all of the vertical flues *a*, through the said boiler-section, and leave an annular space around the evaporizer for the ascent of the products of combustion rising through the tubes *a a* of the boiler-section F, as indicated by the black arrows in fig. 1.

On the top of the ring G, and resting thereon, is another short-flue-boiler section, J, provided with flues, *a a*, which are arranged in an exact converse order to the arrangement of the flues *a a* of the lowermost boiler-section, F; that is to say, the flue-tubes *a*, of the boiler-section J, are made quite small in diameter nearest the circumference of this shell J, and gradually increase in diameter as they approach the centre thereof, as shown in fig. 1. By thus arranging the largest flues *a* nearest the centre of the shell J, it will be seen that the draught will be greatest at said point, and consequently the products of combustion will be carried over the evaporizer on its way to said flues.

Such an arrangement of flues will equalize the draught, and cause a uniform heat over the evaporizer and beneath the second flue-boiler section.

Above this flue-boiler section J is another evaporizer, H^1, constructed exactly like the first one above mentioned; and above this evaporizer is another short-flue-boiler section, J′, constructed exactly like the boiler-sections F and J; and above this boiler-section J′ is another evaporizer, H^2, which completes the series or nest.

On top of the lowermost section of the boiler, and suitably united to the lower shell C, is an annular water-chamber, *j*, which is formed by the two shells R C. This annular chamber *j* forms a water-jacket around the interior flue-chamber of the boiler, as shown in fig. 1. This water-jacket is supplied with water from a suitable pump through a pipe, *i*, applied near its upper end, and after circulating around space *j*, the water passes off through a pipe, *j*, into the lowermost short-flue-boiler section F. From this boiler the water escapes through a pipe, *j*^{2}, arranged diametrically opposite pipe *j*^{1}, and passes down beneath the grate D^2 to a centrally-arranged vertical pipe, *j*^{3}, which latter rises through the fire-chamber D^1, through the centre of the short-flue-boiler section F, and through the bottom plate of the evaporizer H.

To prevent a rapid destruction of the vertical pipe *j*^{3}, it may be enclosed and protected with fire-brick, D^4, as shown in figs. 1 and 2.

Thus it will be seen that the feed-water forced into the chamber *j* will absorb a large quantity of heat, which is radiated from the shell R, and thus become warmed on its way to the steam-generator or short-flue-boiler section F; and it will also be seen that the water thus warmed will be conducted horizontally over the fire-chamber D^1, through boiler-section F, and thence vertically through said fire-chamber, and through said boiler-section F, whence it enters the first evaporizer H, as above shown.

The evaporizer H communicates with the boiler-section J, arranged directly above it, by means of several short pipes, *e e*, arranged around a central vertical pipe, *f*, which latter forms a communication between said evaporizer H and the evaporizer H^1, as shown in fig. 1.

The boiler-section J communicates with the boiler-section J^1, through pipes *g*, and boiler-section J^1 communicates with the steam-chamber, or steam and water-chamber K, through pipes *g′*, and also through the small evaporizer or superheater H^2 and central pipe *f*^{1}, as clearly shown in fig. 1.

The red arrows in fig. 1 indicate the course of the water and steam from the annular chamber *j*, through the several boilers and evaporizers, to the steam-chamber K.

The third and highest section or part of the boiler consists of the crown-sheet L, which covers the flue-spaces, and forms the base of the steam-chamber K; also a dome, R′, which, with the crown-sheet L, encloses this steam-chamber, and also an outer dome-shaped jacket, C, which forms a flue-space, *h′*, into which the products of combustion escape through openings *h*, and from which such products escape through the chimney N, as indicated by the black arrows in fig. 1.

The openings *h′* may be arranged close together, and extend entirely around the shell through which they are made, so as to have as large an exit as may be required to afford a good draught.

By the arrangement shown in the drawings, some of the water will be subjected alternately to the short-flue-boiler sections, while the rest of it will pass directly from one evaporizer to another.

The heated products of combustion rising to the escape-openings *h* will be alternately brought in contact with the short-flue boilers and evaporizers.

Instead of having short-flue boilers alternating with the evaporizers, as shown, all the short-flue boilers above that which is next the fire-chamber may be left out, and evaporizers substituted in their stead.

Under this arrangement, there may be a direct communication through the centres of the several evaporizers leading from the short-flue boiler to the steam-dome, and each evaporizer may communicate with the succeeding one above it by means of pipes applied at the circumference of the evaporizers, so that while part of the water will circulate readily over the distributing-plates or diaphragms I, to their perimeters, part of the water will rise directly through the several evaporizers.

In carrying out my invention, I shall not confine myself to the precise arrangement shown in the drawings, as the parts may be arranged differently, to adapt them to the requirements of the case.

For boilers wherein saline water is to be used, I shall construct a salt-well beneath the ash-pit, with a suitable self-regulator and blow-off applied to it, and form communications between the short-flue-boiler sections, and evaporizers, and this well, so as to carry off all sediment which may be deposited.

The boiler may be provided with air-pipes leading from points at or near the ash-pit, into the flue-spaces between the evaporizers or short-flue-boiler sections, for the purpose of supplying oxygen in considerable quantities to the gaseous products of combustion, and thus effecting their total combustion.

The furnace may be provided with a water-jacket applied so as to completely envelop it, for the purpose of absorbing heat which would otherwise be carried off, and, if desirable, the entire body of the boiler may be encased in an air or water-jacket, A, as shown by

fig. 1, which jacket or jackets may communicate, in a suitable manner, with the water-space *j*, which is interposed between the fire-chamber and steam-dome.

The feed-pump or feed-water apparatus may be provided with an automatic regulator so constructed that it will supply water to the short-flue-boiler sections and evaporizers in such quantities that the water-level will be maintained at a given height during the operation of the boiler.

By such an arrangement, there will be a constant circulation of water in the boiler, and the supply of water will be commensurate with its conversion into steam.

Under this arrangement, the steam may be more or less superheated by keeping the water-line below one or more of the evaporizers, and thus making the latter serve as superheaters.

Having described my invention,

What I claim as new, and desire to secure by Letters Patent, is—

1. An evaporizer for a steam-boiler, consisting of a case or shell, H, with an enclosed diaphragm, I, arranged within it, substantially as described.

2. The combination of short-flue-boiler sections and evaporizers, constructed, arranged, and communicating with each other, substantially as described.

3. A feed-water-heating chamber, combined with a short-flue-boiler section or sections, substantially as described.

4. The manner, substantially as shown and described, of conducting the water from a chamber, *j*, horizontally over the fire-chamber, and thence vertically through said fire-chamber.

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