L. R. CORNELL.

Steam Superheaters for Evaporating Salt and for other Purposes.

No. 142,440. Patented September 2, 1873.

Fig. 1.

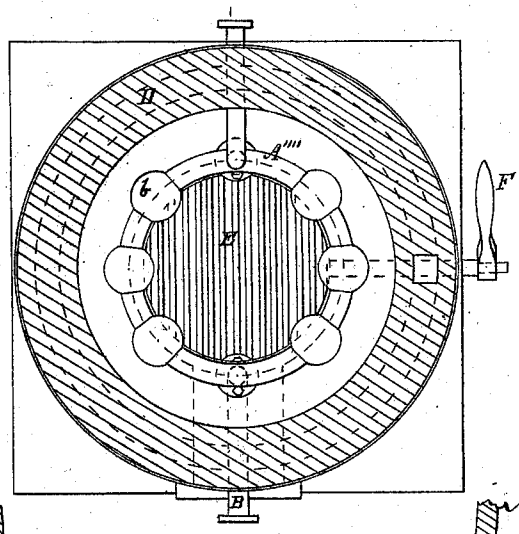


Fig. 2.

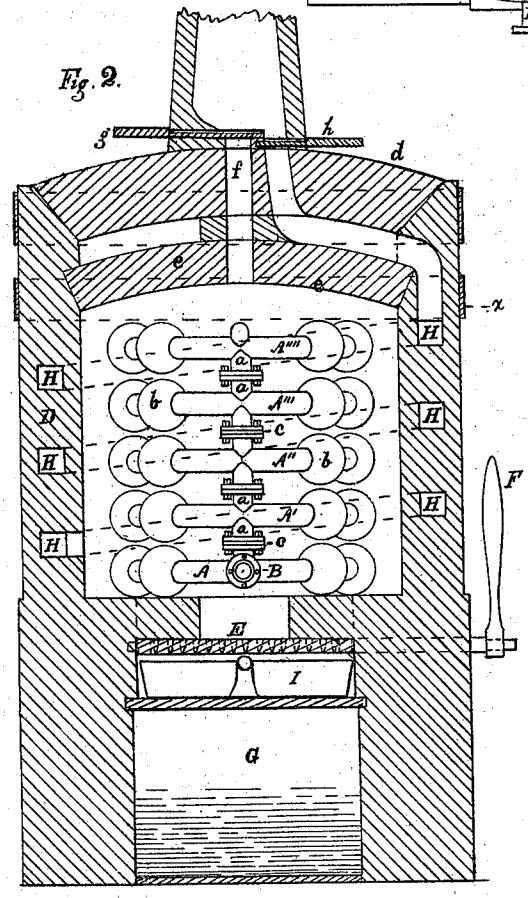
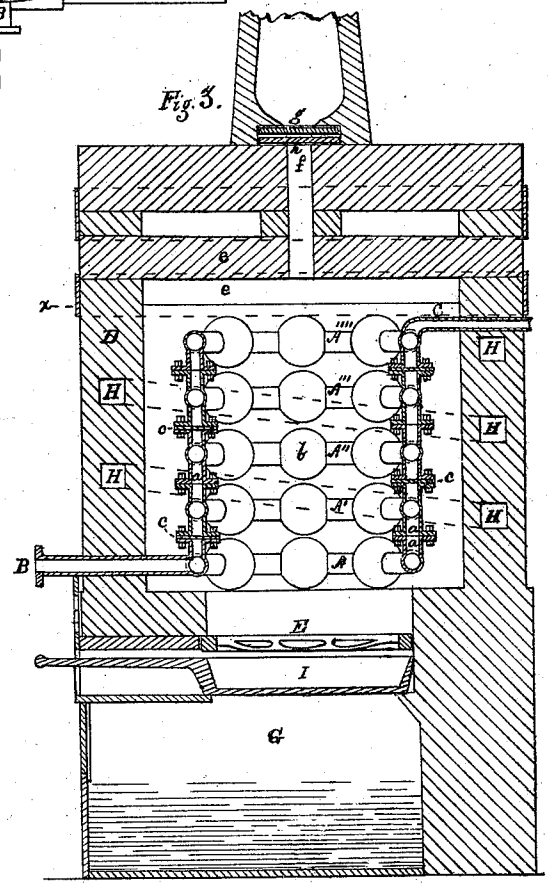


Fig. 3.



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LEFFERT R. CORNELL, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN STEAM-SUPERHEATERS FOR EVAPORATING SALT, AND FOR OTHER PURPOSES.

Specification forming part of Letters Patent No. **142,440**, dated September 2, 1873; application filed July 10, 1872.

To all whom it may concern:

Be it known that I, LEFFERT R. CORNELL, of Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Superheaters, of which the following is a specification:

One of the principal objects of this invention is to furnish a superheater in which the heat shall be so applied as to give the highest degree of heat to that portion of the steam which has passed nearly through it, and a lower degree of heat to that portion of the steam which shall have just entered the superheater. Another object is to secure a more perfect economization of the heat applied than has heretofore been realized. Another object is to produce a more economical construction of a superheater of given capacity than any now in use. This invention consists, in part, in the construction of the portion which is to contain the steam when superheated of a series of rings, or their equivalent, placed one above another, having a series of bulbs on same, for a purpose hereinafter set forth, and arranged and connected in the manner hereinafter described, by which the steam is made to traverse each ring before it is admitted to the one above it. Said invention also consists, in part, in the combination of a series of rings so constructed and connected with a reverberatory furnace, as hereinafter more fully set forth. Said invention also consists, in part, in the construction of the said reverberatory furnace with a spiral flue extending from the lower part thereof to the upper part thereof, or to the chimney, and built into the wall thereof, as hereinafter more fully set forth; and, also, in the combination of the reverberatory furnace, having a flue leading from the bottom thereof, with a series of rings, or their equivalent, having the peculiar features hereinbefore mentioned.

Figure 1 is a horizontal section of my superheater taken through the line *x x*, Figs. 2 and 3. Fig. 2 is a vertical section of the furnace taken from side to side, and a front view of the series of rings hereinbefore mentioned. Fig. 3 is a vertical section of my apparatus taken from front to back.

A A′ A″ A‴ A⁗ are hollow cast-iron rings, which form the portion of my apparatus in which the steam is contained to be superheated. These rings are connected to each other by short vertical sections *a a* cast in the same piece with each section, as shown. These rings have also enlargements or bulbs *b b* therein, partly for the purpose of leaving space for the expansion of the steam, and partly for the purpose of furnishing additional heating-surfaces. The connection between the rings A A′ A″ A‴ A⁗, which would otherwise be open, is closed or cut off alternately on the front and back sides of the coil by plates or disks *c c* interposed between the ends of the sections *a a*, or one of the sections on each disk may be cast closed; or any other mode of closing up this connection that may be preferable may be adopted. Steam is admitted into the ring A through the induction-pipe B; and the opening through the sections *a a* in front, between the ring A and the ring A′, being closed, the steam necessarily passes around through the right and left hand portions of the ring A to the back side thereof, where, the connection through the sections *a a* being open from the ring A to the ring A′, the steam rises at that point into the ring A′, and, the connection between it and the ring A″ at that point being closed, the steam necessarily passes forward through the right and left hand portions of the ring to the front, where, the connection through the sections *a a* to the ring A″ being open, the steam rises into the ring A″, and, the connection through the sections *a a* between the rings A″ and A‴ being closed in front, the steam passes around through the right and left hand portions of the ring A″, and thence in the same manner through rings A‴ and A⁗ to the eduction-pipe C, through which it is taken to the point where it is to be used. Steam is thus made to pass over the entire internal surface of each ring before it passes to the ring above. D is a round reverberatory furnace, the surfaces of the steam-current being repeatedly broken by the bulbs *b b*, and the whole body of said current being brought into direct contact with the hot metal, arched over at the top in the form of a dome, *d;* and it may also have an internal arch, *e*, with dead-air space between the two, which

construction I recommend as being adapted to more perfectly retain the heat. This furnace D is provided with a grate, E, which may be tilted by the lever F; and said furnace is also provided with a well or ash-pit, G, which may be kept filled with water for the purpose of extinguishing the fire by dumping the latter therein should it be desirable. This furnace D is so constructed as to leave a small space between it and the series of rings above described, and is further provided with a flue or chimney, *f*, extending through and out of the top thereof; and the draft through this chimney or opening is controlled by a damper, *g*, which should be left open when starting the fire, but may be closed when the fire is well ignited. H is a flue, which is built into the wall of the furnace D, and carried spirally around it, as shown in Fig. 3, to the top thereof, where it enters the chimney. This flue has also a damper, *h*, to control the draft, as it will often be found that the draft through this flue, if fully open, will be too great for the purposes required, even when the damper *g* is entirely closed. Both the dampers *g* and *h* should be made of fire-clay, and the reverberatory furnace should be made of, or lined with, fire-brick. I is an ash-pan under the grate, which ash-pan may be drawn out for the removal of the ashes or dumping of the grate, or for other purposes, by means of a handle, *i*. *j* is an opening into the well or ash-pit G, to facilitate its being conveniently filled with water, and also to facilitate the removal of the débris of the fire after it is dumped.

It will be obvious, from a consideration of the construction herein described, that the heat will be much greater in the upper part of the furnace, and will be especially ardent upon the upper ring A‴, which receives the direct radiation from the crown as well as the sides of the furnace, and that the steam, being made to pass into and through the lower ring first, and then rising into and passing through the next one above it, and so on in the same manner through the series, is first introduced into the ring, which is subjected to the least heat of all, and gradually, as it becomes heated, subjected to higher heat till it is discharged from the superheater.

The design of the bulbs is to more thoroughly break up the surfaces of the steam in its passage through the superheater, and the invention is valuable in proportion to the extent to which this is accomplished; hence it is obvious that, the steam being thoroughly broken up by the series of bulbs on the rings, they are an essential part of the invention, as by this means the whole body of the steam is brought into direct contact with the hot metal, which is the best means for obtaining a rapid gain of heat.

It will also be obvious that a great saving of the heat, which would otherwise be lost by passing into the chimney, will be effected by taking off the products of combustion in the lower part of the furnace, and conducting them through the spiral flue built into the wall, as above described, as less heat will be drawn into the flue at the bottom of the furnace than should be carried off from a flue passing directly upward from the upper part of the furnace through the crown; and, besides, the heat which does pass off with the products of combustion into the spiral flue is part of it imparted to the brick, and helps to prevent the heat being lost by radiation from the inside of the furnace.

It is also obvious that the double crown of the furnace helps to prevent radiation upward from the inside of the furnace.

It is obvious that the form of the rings may be slightly varied without changing the essential character of the invention, or materially interfering with the operation of the apparatus—as, for example, the rings A A′ A″ A‴ A⁗, instead of being curved in the exact form of a circle, may be curved in the form of an ellipse, and connected in the manner described, the furnace being made in a corresponding form; or the flue H may be varied from an exact spiral form and still answer the same purpose, substantially in the same way.

This superheater is of especial value in open evaporation or evaporation under pressure. In the manufacture of salt, for instance, where open evaporation is employed, it may be used with most economical results. By its use a saving of two-thirds may be effected. In other words, the tools, fuel, and strength and temperature of brine being the same in both cases, by using the superheated steam from this superheater, five thousand pounds of salt may be obtained against three thousand obtained by the use of natural steam.

In all cases of open evaporation a proportionate gain will be made, and in cases where it is used under pressure—for instance, in the boiling of rags in the manufacture of paper—a great gain will be effected. Blue rags, requiring ordinarily fourteen hours to reduce to pulp, have been reduced, by the aid of this superheater, to pulp in six hours' time.

It would be difficult to specify all the purposes to which this superheater can be applied, because, with proper constructions adapted to it, it might be applied for almost all purposes of boiling, distilling, or heating where steam is used, and with great gain in the application.

I claim as my invention—

1. A series of rings, A A′ A″ A‴, or any number thereof, placed one above another, provided with bulbs, for the purpose specified, and communicating with each other by connections inside the furnace, substantially as shown and described.

2. The elements of the first claim, constructed and arranged as therein specified, in combination with a reverberatory furnace.

3. The series of rings A A′ A″ A‴, or any number thereof, communicating by direct connections, on opposite sides inside the furnace, and provided with the bulbs *b*, substantially as specified.

4. The reverberatory furnace D, having a spiral, or substantially spiral, flue, H, built into the wall thereof, substantially as hereinbefore set forth.

5. The combination of the series of rings A A′ A″ A‴ A⁗, or any number thereof, connected as hereinbefore described, with a reverbatory furnace having a draft-flue leading from the lower part thereof, substantially as hereinbefore set forth.

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