4 Sheets—Sheet 1.

T. F. ROWLAND.

APPARATUS FOR CIRCULATION OF FLUIDS FOR HEATING PURPOSES.

No. 192,938. Patented July 10, 1877.

Fig. 1

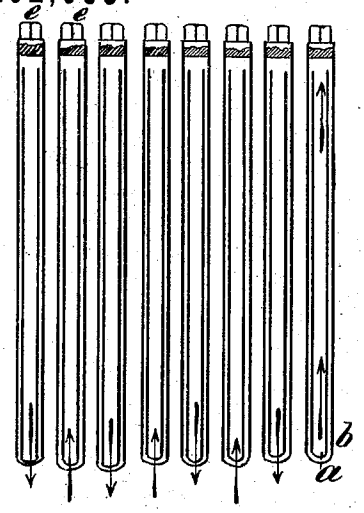


Fig. 2

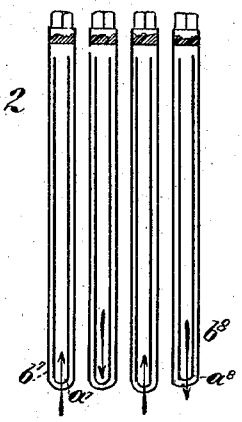


Fig. 3

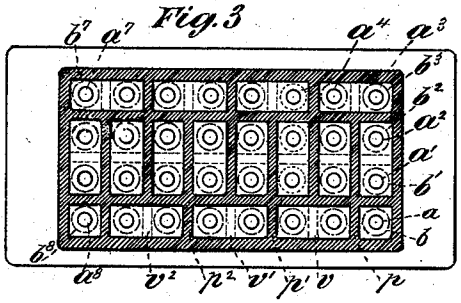


Fig. 4

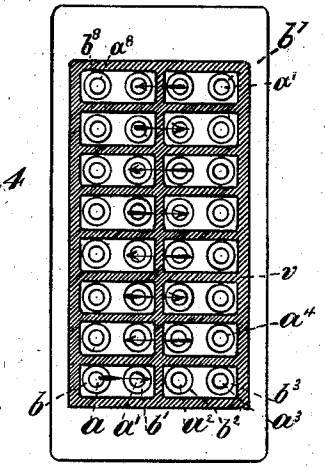


Fig. 1

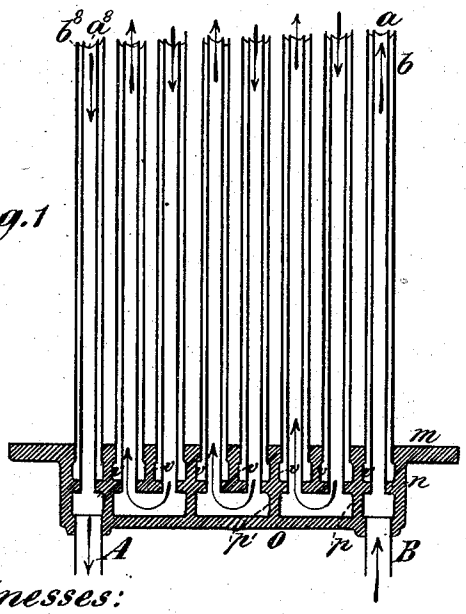
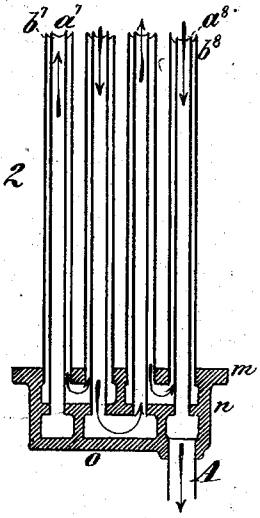


Fig. 2



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Fig. 5

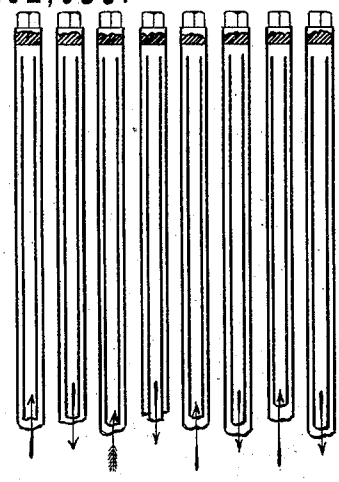


Fig. 6

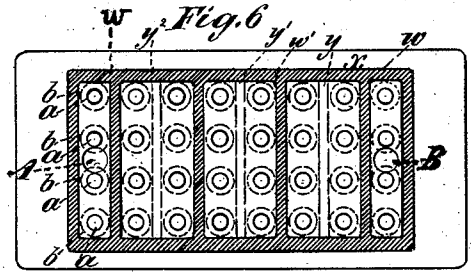


Fig. 5

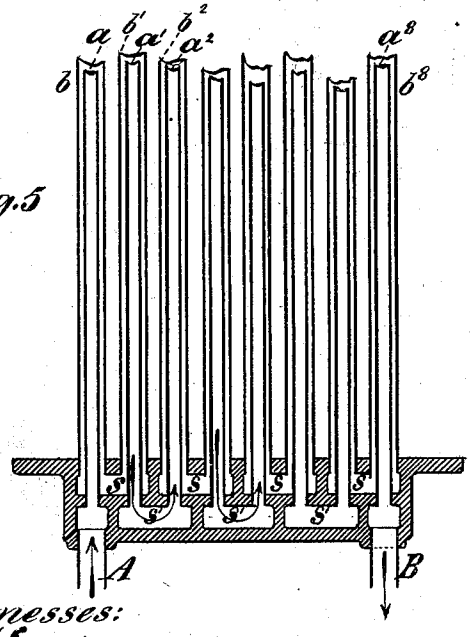
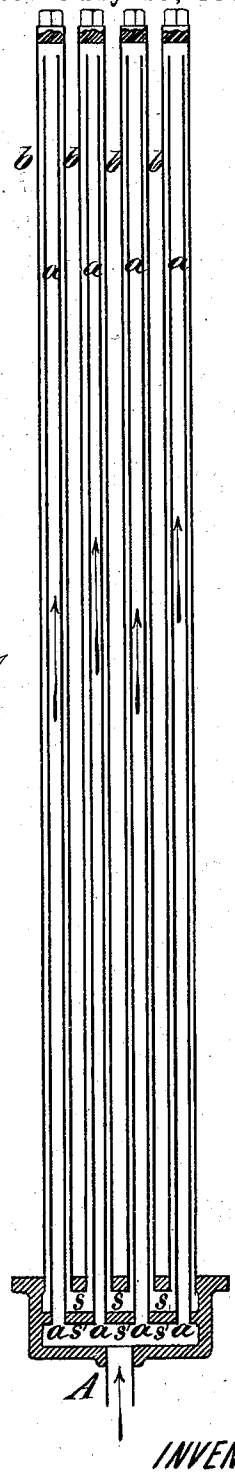


Fig. 7



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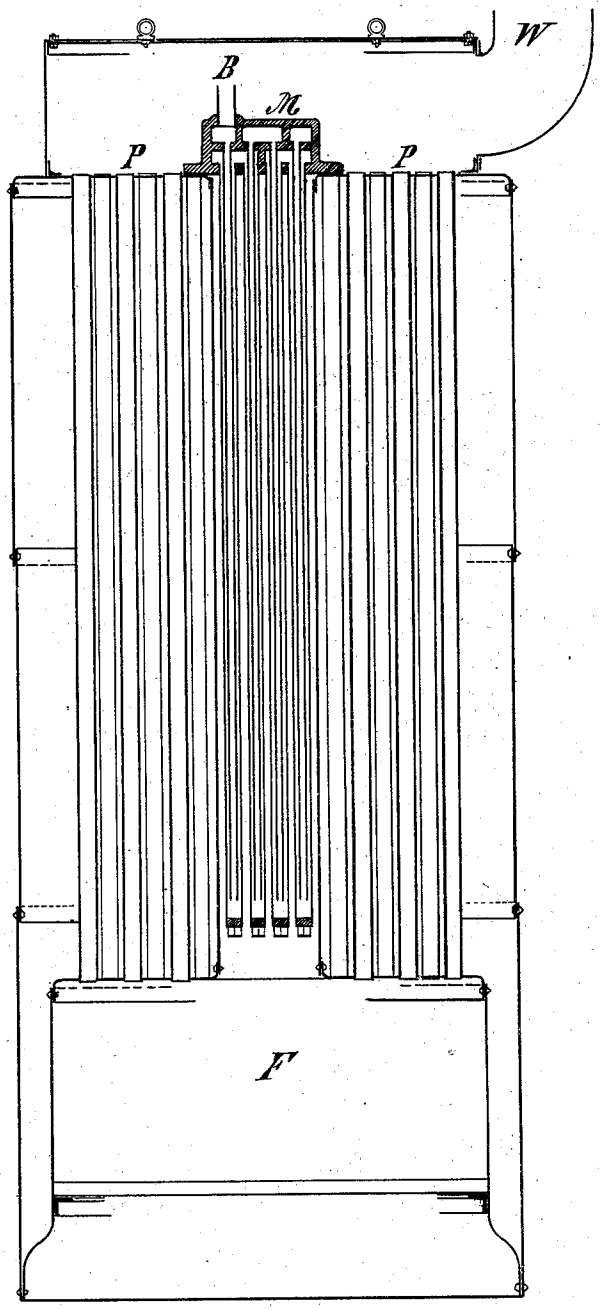
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Fig. 8



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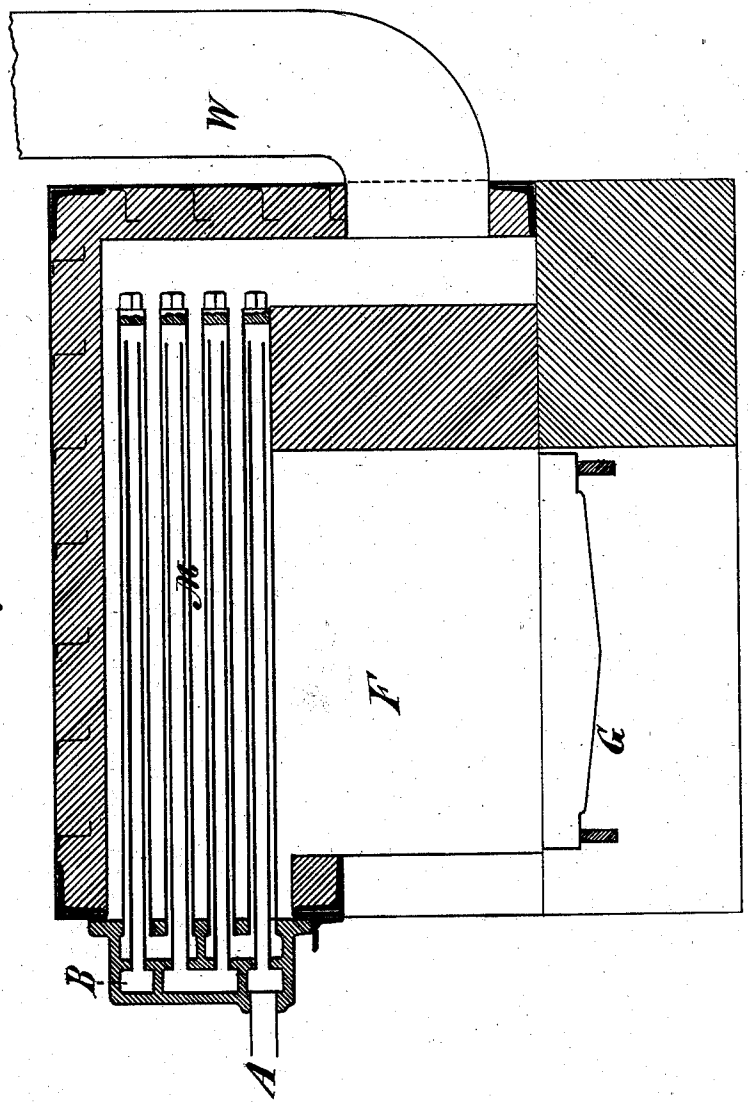


Fig. 9

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UNITED STATES PATENT OFFICE.

THOMAS F. ROWLAND, OF NEW YORK, N. Y.

IMPROVEMENT IN APPARATUS FOR CIRCULATION OF FLUIDS FOR HEATING PURPOSES.

Specification forming part of Letters Patent No. **192,938**, dated July 10, 1877; application filed June 5, 1877.

To all whom it may concern:

Be it known that I, THOMAS F. ROWLAND, of the city of New York, State of New York, have invented a new and useful Improvement in Circulating Apparatus, of which the following is a specification:

It is very important in heating buildings and other similar operations to obtain a thorough circulation of the fluid which is used, whether it be steam or water, through the radiating apparatus, and also a thorough contact with the radiating surface.

Many attempts have been before now made to accomplish these results, but the only one one which has practically been successful in causing the heating medium to traverse the entire circulating apparatus is that in which a continuous coil of pipe is used. This is an expensive apparatus, and one very difficult to repair after it gets out of order, which frequently happens with this class of apparatus, owing to the bursting of the pipes. It is desirable, therefore, to make an apparatus in which one tube can be readily substituted for another without disturbing the rest of the contrivance.

My apparatus consists of a combination of double concentric pipes or tubes, so arranged that the circulating medium passes in succession through the inner and outer pipes, whereby a complete circulation through all the parts of the apparatus is obtained.

In my drawing, Figure 1 represents a lateral vertical cross-section of my apparatus. Fig. 2 represents a vertical cross-section, made in a line at right angles to the section in Fig. 1 through the tube A. Figs. 3 and 4 are horizontal cross-sections through the tube-separating partitions.

In this apparatus the steam passes through each of the inner and outer tubes in succession, and at a different period of its circulation.

Figs. 5 and 6 represent similar sections, through an apparatus in which the circulating medium passes simultaneously through a set of four tubes, and then through the next set of four.

The base of my apparatus, as shown in Figs. 1, 2, 3, and 4, consists, primarily, of three horizontal partitions, which I shall letter *m*, *n*, and *o*, *m* being the top partition, and *o* the bottom partition. These partitions are continuous, excepting where the tubes are inserted.

There are also two sets of vertical partitions, represented in section at Figs. 3 and 4. *p*, *p'*, &c., Fig. 3, represent the vertical partitions between the horizontal partitions *n* and *o*.

The partitions *v*, Fig. 4, represent the upper set of partitions extending vertically between the horizontal partitions *m* and *n*, and are shown in dotted lines in Fig. 3.

It must always be borne in mind that there is a horizontal partition, *n*, between and separating the partitions *p*, Fig. 3, and the partitions *v*, Fig. 4.

The inner tubes in my apparatus are all set or screwed into the middle partition *n*, while the outer surrounding tubes, which make an annular space between themselves and the inner tubes, are screwed into the upper partition *m*.

The steam, entering at the tube B, Fig. 1, as represented by the arrows, is prevented by the partition *p* from escaping laterally between the partitions *n* and *o*, and, therefore, passes up the inner tube *a*, the upper end of which is open. It then turns and descends through the annular space between *a* and *b*, and passes into the space between *m* and *n*. It is then guided by the partitions *v* to the open end of the outer tube, marked b^1, in Fig. 4. It passes upward through this, and then downward through the inner tube, marked a^1, in the same figure. It passes from this center tube into the space between the partitions *n* and *o*, Fig. 3, and is guided by the partitions *p* to the open end of the inner tube, marked a^2, Fig. 3; thence to the outer tube, marked b^2; thence by the partitions to the outer tube b^3; then downward through the open end of a^3 into the lower space, so to the inner tube a^4, and so on till it finally reaches the tubes b^8 and a^8, and in its passage it has evidently crossed this arrangement of the apparatus eight times.

The upper ends of the outer tubes *b* are closed by screw-plugs *e*. It is now obvious that the steam, in passing from B to A, must pass in succession through each inner tube and between each inner tube and each outer

tube in the entire series, as is shown by the arrows.

It is now plain that the reason that the circulating medium passes thus in succession through the inner and outer tubes is that these inner tubes and outer tubes are, by the partitions, arranged in pairs, each pair of inner or outer tubes being separated from the next by a dividing-partition.

It is evident, also, that the upper and lower partitions are alternate, and it is likewise plain that a medium circulating through this apparatus is brought into contact with the entire radiating or absorbing surface, owing to the fact that it is obliged to traverse the annular space between the inner and the outer tubes.

Figs. 5, 6, and 7 represent a similar contrivance, in which the steam enters four tubes simultaneously. The steam entering by the tube A passes first through the inner tubes *a a a a*, Fig. 7, and is prevented by the partition *w*, Fig. 6, from escaping laterally; then it passes downward through the outer tubes *b b b b* into the space marked *s*, Fig. 5, where it is confined by the partition *y;* then through the next four outer tubes, marked b^1, Fig. 5; then through the inner tubes a^1 into the space *s'*, where it is confined by the partitions *w;* then through the inner tubes a^2; then through the outer tubes b^2, till finally it escapes through the inner tubes a^3 of the pipe B.

It is obvious that this contrivance is useful for other purposes besides as a heat-radiator, and I have found it very valuable both as a superheater and boiler.

Fig. 8 represents a general view of my apparatus used as a superheater, in which F represents the fire-box; P, the tubes of a tubular boiler; M, my apparatus, used as a superheater; and W the uptake.

The steam after it has been made in the boiler passes through my superheater M, and escapes by the pipe B, and in its passage through this arrangement is, of course, thoroughly dried and superheated.

Fig. 9 shows my apparatus used as a boiler. This contrivance will make steam very readily, and contains but a small quantity of water, and is therefore very useful for yacht-boilers and similar contrivances. F represents the fire-box; M, my apparatus generally; G, grate-bars, and W the uptake. Water is forced in at the tube A, and escapes as steam from one of the upper tubes at B. Only so much water is forced into the boiler as it is desired to convert into steam. This boiler is laid horizontal to prevent accumulation in the ends of the tubes.

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

1. The combination of a series of inner and outer tubes and partitions, substantially as described, whereby a circulating medium is forced to traverse in succession the inner and the outer tubes, as distinguished from an apparatus in which the circulating medium traverses, first, all the inner tubes, and then all the outer tubes.

2. The combination of a series of double tubes with the horizontal partitions *m*, *n*, and *o*, and the vertical partitions *v*, substantially as described.

3. The combination of the double tubes with the horizontal partitions *m*, *n*, and *o*, and the vertical partitions *p* and *v*, substantially as described.

4. The combination of two or more double tubes with a series of dividing-partitions, substantially as described, whereby the circulating fluid passes first through two inner tubes, then through an outer tube, and then through an inner tube, or vice versa.

5. The combination of a compound series of double tubes with a set of dividing-partitions arranged in the same base, substantially as described, whereby the circulating medium in its passage through the apparatus is forced to traverse first a set of outer tubes, then a set of inner tubes, or vice versa, as distinguished from a circulating apparatus in which the circulating medium traverses first all the inner and then all the outer tubes, or vice versa.

6. A steam boiler or superheater consisting of a series of concentric inner and outer tubes and partitions, substantially as described, whereby the circulating medium is forced to traverse in succession each inner and each outer tube, as distinguished from an apparatus in which the circulating medium traverses first all the inner and then all the outer tubes.

7. A steam boiler or superheater, consisting of a series of sets of concentric inner and outer tubes and dividing-partitions, substantially as described, whereby the circulating medium is forced to traverse in succession each set of inner and each set of outer tubes, as distinguished from an apparatus in which the circulating medium traverses first all the inner and then all the outer tubes.

THOS. F. ROWLAND.

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