W. F. CUNNINGHAM.

Radiator.

No. 199,799. Patented Jan. 29, 1878.

Fig. 1.

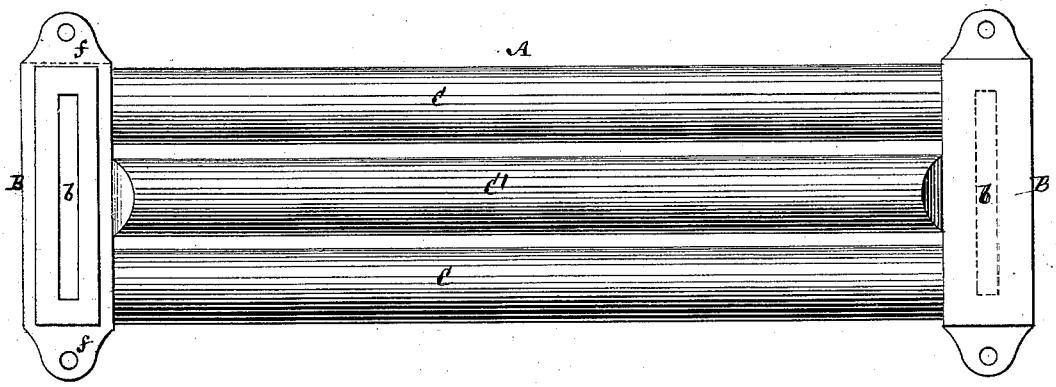


Fig. 2.

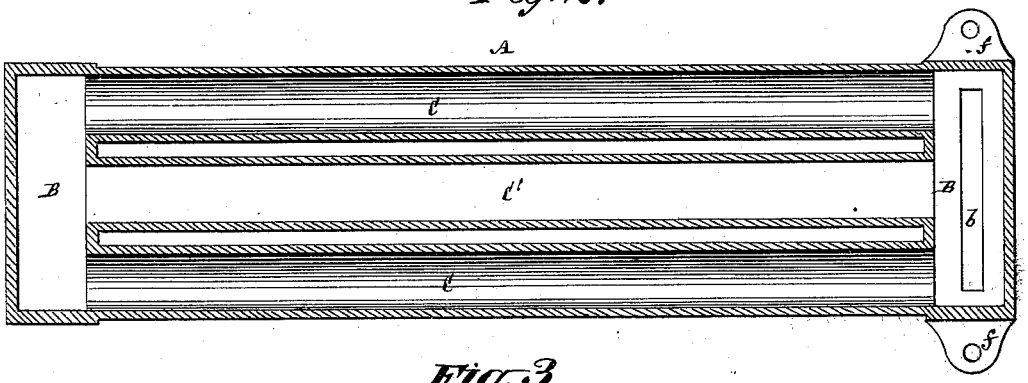


Fig. 3.

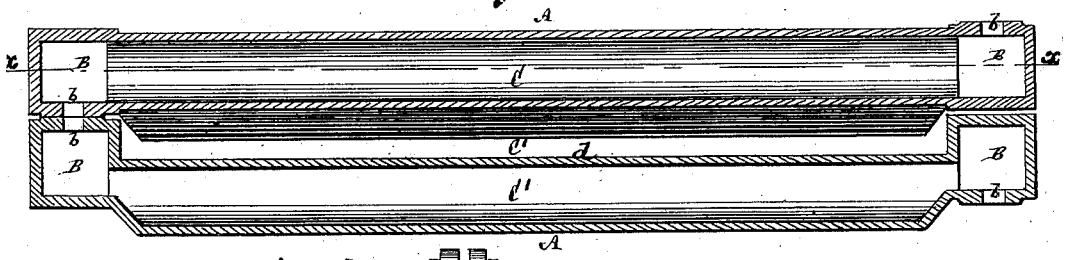
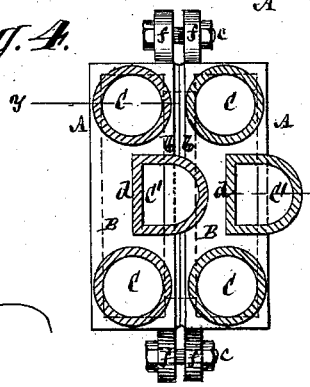


Fig. 4.



Witnesses

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IMPROVEMENT IN RADIATORS.

Specification forming part of Letters Patent No. **199,799**, dated January 29, 1878; application filed December 24, 1877.

To all whom it may concern:

Be it known that I, WILLIAM F. CUNNINGHAM, of the city of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Radiators, of which the following is a description, reference being had to the accompanying drawing, forming part of this specification.

This invention, generally, consists in a steam-radiator of novel construction, whereby the steam is circulated backward and forward successively through a series of sections composed of end boxes or chambers, having reverse communicating side openings or passages at the opposite ends of the sections, and connected by a series of pipes or tubes, each alternate one of which is out of line or plane with the tubes on opposite sides of it in the same section, and each alternate one of which is preferably formed with an offset at its connection with the end boxes or chambers of its section, so that the alternate tubes of each section enter between the tubes of the adjacent section, substantially as hereinafter described, whereby compactness in the structure is combined with an enlarged heating-surface, and an advantageous circulation of the air passing up between the sections and about the tubes is obtained.

Figure 1 represents an outside face or side view of a radiator-section constructed in accordance with my invention; Fig. 2, a longitudinal vertical section thereof on the line *x x;* and Fig. 3, a horizontal section on the irregular line *y y* in Fig. 4, which represents a transverse section of two radiator-sections united with each other.

The radiator is composed of a series of sections, A, arranged in parallel relation with each other, and united at their opposite ends by bolts *c*, passing through flanges or ears *f* on said sections. Each radiator-section is composed, in part, of opposite end boxes or chambers B B, having side ports or passages *b b*, which establish communication between the sections on reverse sides of each section at opposite ends thereof, for the purpose of keeping up a steam-circulation backward and forward through the several sections alternately. Thus the port *b* at one end of each section is on the reverse side of said section to that on which the other port *b* at the opposite end of such section is arranged, and these ports communicate with corresponding ports in the two sections, respectively, lying on either side of said section. The flanges or ears *f* at the ends of either section should be on the sides of the end boxes or chambers B B which have the ports *b b* in them. The two end boxes or chambers B B of each section are connected by any number of tubes, C C′, arranged in relation with each other so that each intermediate tube C′ is out of line or plane with the tubes C immediately above and below or on opposite sides of it in the same section, but all of said tubes serving to pass the steam from one end box B to the opposite end box B of the section. This arrangement of the connecting-tubes between the end boxes operates to give the air to be heated a tortuous and prolonged travel between the sections and about the tubes thereof.

To secure a more perfect effect in this respect, each intermediate tube C′ is made with a flattened side, *d*, and such flattened side arranged to face the rounded side of a similarly-constructed intermediate tube in the adjacent sections whereby the air passing up between the several tubes is caused to impinge on the flattened sides *d* of the intermediate tubes, and deflected by said sides, and caused to impinge on and circulate about the other tubes. Great compactness also is obtained in fitting the sections together, without impairing the circulation of the air between the tubes or reducing the capacity of the latter, but rather giving an extended heating area of the tubes.

Each radiator-section A may readily be detached for repair or renewal when required.

Each alternate tube C′, whether made with flattened sides or otherwise, is formed with an offset at its connection with the end boxes or chambers B B of its section, so that the alternate tubes of each section enter between the tubes of the adjacent section, as shown in Fig. 4, thus materially adding to the compactness of the radiator for a given amount of tubular heating-surface.

I claim—

1. In a radiator-section, the combination, with the end boxes or chambers B B, having communicating ports or passages *b b* on reverse sides of its opposite ends, of tubes C C′, each alternate one being offset laterally beyond one side of the end boxes or chambers, whereby a tube of each section is interposed between two tubes of the adjacent section, substantially as specified.

2. The tubes C C′, arranged so that each alternate one is out of line or plane with the tubes on opposite sides of it in the same radiator-section, and constructed alternately with flattened sides *d*, in combination with the end boxes or chambers B B, having communicating ports or passages *b b* between the sections of the radiator, on reverse sides of each section, at opposite ends thereof, essentially as described.

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Witnesses:

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