C. Fletcher,

Steam-Boiler Water-Heater.

No. 13,031. Patented June 12, 1855.

Fig. 1.

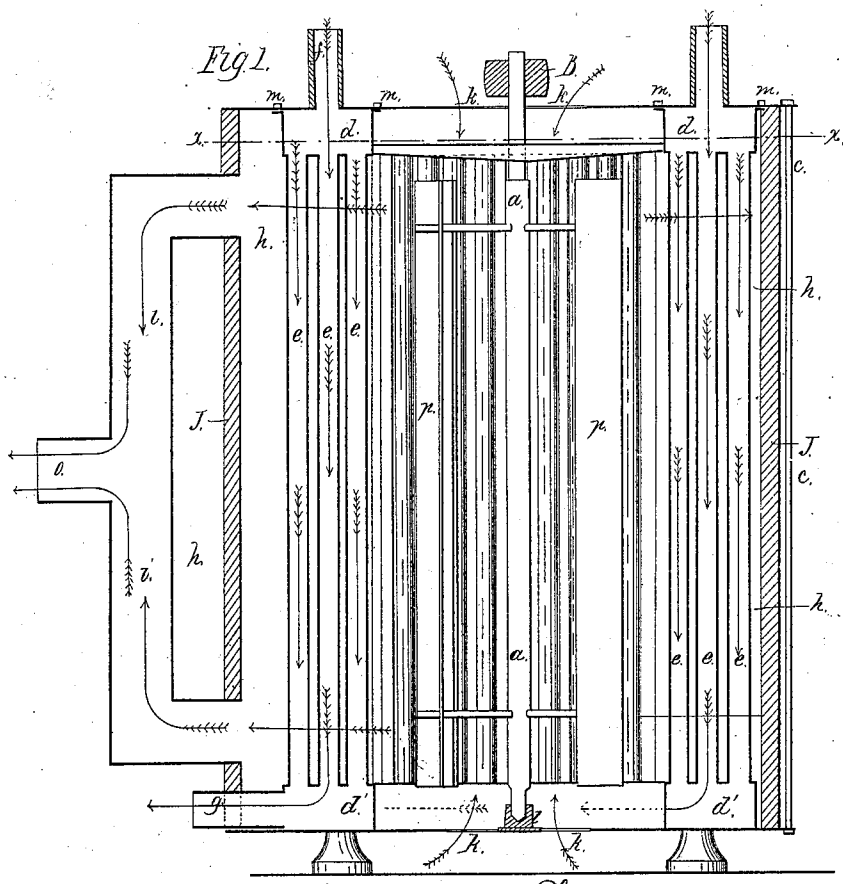
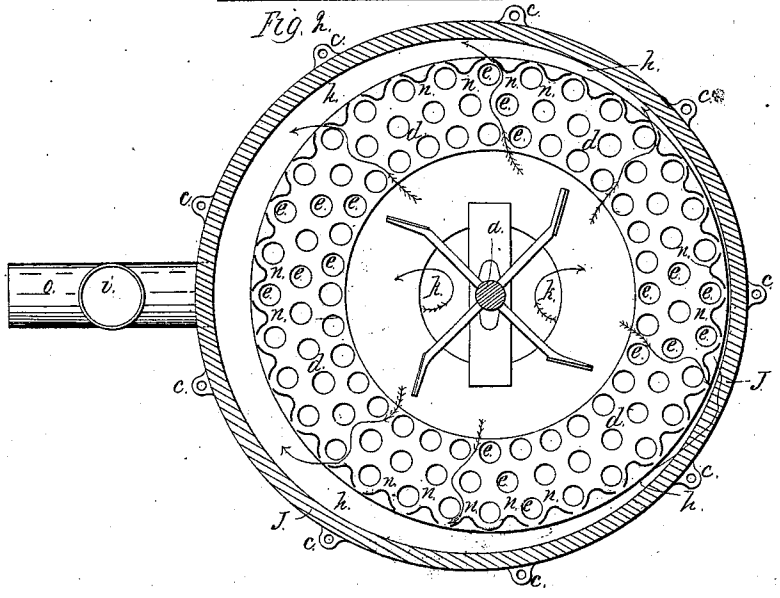


Fig. 2.



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UNITED STATES PATENT OFFICE.

CALVIN FLETCHER, OF CINCINNATI, OHIO.

SUPPLYING FURNACES WITH HOT AIR.

Specification of Letters Patent No. 13,031, dated June 12, 1855.

To all whom it may concern:

Be it known that I, CALVIN FLETCHER, of Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and useful Improvement in Supplying Furnaces with Hot Air and in Consuming the Smoke, Thereby Effecting an Important Saving of Fuel; and I do hereby declare that the following is a full, clear, and exact description of my invention, reference being had to the annexed drawings, forming part of this specification, in which—

Figure 1, is a vertical section, through the axis or center of my apparatus by which I accomplish the objects of my invention. Fig. 2, is a transverse section of my apparatus through *x*—*x*, Fig. 1.

My invention consists in supplying furnaces whether for steam engines, or for other purposes with hot air—the furnace being so closed, as to exclude any other air than that which is previously heated by my apparatus; whereby I effect a great saving of fuel and also the consumption of the smoke. Also in the heating of air by forcing its circulation among and in contact with a series of tubes, or their equivalent, through which the escape steam is compelled to pass. Also in the mode of condensing the escape steam from the engine by means of my apparatus, for the purpose of resupplying the boiler with the water resulting therefrom, or for aiding the formation of a vacuum in connection with the usual condenser and air pump.

My improvement as applied to steam engines, is susceptible of application, either to high, or low pressure engines; any apparatus being alike distinct and separate both from the engine and furnace, not forming part of either; yet being connected with the engine by the conduit for the escape steam, and with the furnace by that of the heated air.

To enable others skilled in the art, to use my invention, and construct and use the apparatus invented by me for the practical application thereof, I will proceed to describe its construction, and operation premising however, that I do not desire to confine myself to the precise construction and arrangement of parts designated in this specification, which may be varied according to circumstances; the principle involved therein, remaining substantially the same nor to the position of the apparatus; (which I describe as vertical) inasmuch as a horizontal or inclined position, would answer equally well.

The dimensions specified are mentioned merely to indicate the relative size of the parts of one of my apparatus in actual and successful operation to a high pressure engine of about ten horsepower.

My apparatus, which is placed in any convenient position to the engine and boiler furnace, consists of a collection of metallic tubes (*e*, *e*, *e*,) Figs. 1, and 2, (say ninety-six in number) of about one inch in diameter, and four feet in length; open at both ends, and arranged in three (or more) consecutive and concentric circles (as shown in Fig. 2,) each circle containing an equal number of tubes, and so arranged that the center of every tube in each circle is immediately opposite the center of the space between the tubes in the next circular series, on a radial line from the common center of the several circles. The tubes composing the first, or inner circle are placed about three eighths of an inch apart.

The ends of every tube are inverted steam tight into two hollow annular steam chambers, *d*, *d*, of about two feet outside diameter, and one foot inner diameter; the width of each annular chamber being about six inches, and its depth four inches. These annular chambers thus connected by the series of tubes, which I place in a vertical position form hollow cylinders, with a central space within the inner circle of tubes (of about one foot diameter) extending from the top of the upper, to the bottom of the lower annular chamber *d'*. In this space is placed a rotary fan *p*, whose axle *a*, is placed in the center of the circular space and runs in a step at the bottom of the machine, and turns through a block at the top.

To the upper extremity of the axle *a*, which projects above the top of my apparatus, is attached the driving pulley B. The wings of the fan *p*, revolve as near the inner circle of tubes, as a safe clearance will permit. Between the tubes of the outer circle, are placed triangular strips of wood *n*, *n*, &c., or other suitable material, (a nonconductor of heat being preferred). These strips are of the same length as the tubes, and placed parallel to them, leaving openings at, or near the middle of each outside tube, about half an inch wide throughout its entire length. The object of these triangu-

lar pieces is to compel the air, which is driven by the fan across the tubes, to more completely in its exit, embrace the tubes of the outer circle.

Wholly outside of the collection of tubes, is an air tight cylindrical casing J, J, made of any suitable nonconducting material, placed around the tubes, but eccentric thereto, and distant therefrom about two inches, at the nearest point, and about six inches at the farthest point. Two tubes *i*, *i*, of about six inches diameter proceed from this casing, one from near the top, and the other near the bottom, at those points in its circumference, where the space between it, and the tubes is the widest. These (six inch) tubes shortly unite in one of larger caliber *o*, and form the pipe of exit for the heated air. Two pipes *f*, *f*, enter the upper annular chamber *d*, through which the escape steam from the engine enters my apparatus. The central space in which the fan rotates, is covered above and below, leaving the usual opening around the axis for the admission of the external air. Pipe *g*, leading from the bottom of the lower annular chamber *d'*, carries off the water produced by the condensation of the steam.

The apparatus is united and held together by rods *c*, *c*, passing through the upper and lower flanges outside of the casing J, J, secured by screw nuts.

Having described the apparatus employed by me, in the practical application of my improvement, I will proceed to describe more fully the mode of its operation.

The escape steam from the engine entering at the top of my apparatus, through the pipes *f*, *f*, fills the upper annular chamber *d*, and descends into the several tubes, connecting with the lower annular chamber *d'*, and thence, whatever steam remains (if any) passes through the pipe *g*, at the bottom. Meanwhile the rotary fan *p*, being set in motion by means of the power from the engine applied to the pulley B, draws in the external air, through the openings, around the axis of the fan, at top and bottom, and drives the air through the interstices between and across the tubes, throughout their whole length, whereby the air is heated by the contained steam, and the resultant water from condensation, drains into the lower annular chamber *d'*, and passing off by pipe *g*, is conducted to the supplying force pump of the engine, (if a high pressure), the uncondensed steam (if any) escaping into the air. With a condensing engine, the pipe *g*, may be connected with the usual condenser and air pump (with or without a regulating valve) which are thus relieved of a great part of their accustomed task to obtain a vacuum.

The air forced by the fan to pass through the interstices between the tubes becomes highly heated, and is driven into the space, outside the tubes, between them, and the outer casing, from the widest part whereof, it finds an exit at pipes *i*, *i*, through which it is driven into the larger pipe *o* and thence into the space, beneath the grates of the furnace. The fire, or furnace chambers of the boiler is closely shut, leaving no opening for the entrance of external air, which is carefully excluded. The pipe *o*, enters the fire chamber ("ash pit") under the grate bars, and the heated air acting on the fire, performs its office of effecting a more perfect combustion of the fuel and of consuming the smoke. A door, or doors in front of the furnace occasionally opened to admit fuel, should fit closely when shut, also the front space below the line of the grates may be provided with an opening to clear out the ashes, but so arranged as to be tightly closed at other times—the tube conveying the heated air occupying only a small part of said space.

I am aware that the heating of air by contact with steam tubes has been done before; but

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

The arrangement hereinbefore described of the fan *a*, steam tubes *e*, *e*, together with the inlet passages for steam and cold air and the discharge of hot air, and water of condensation, in the manner, or its equivalent, and for the purposes hereinbefore set forth.

CALVIN FLETCHER.

Witnesses:

THOS. W. BAKEWELL,

N. MARCHANT.