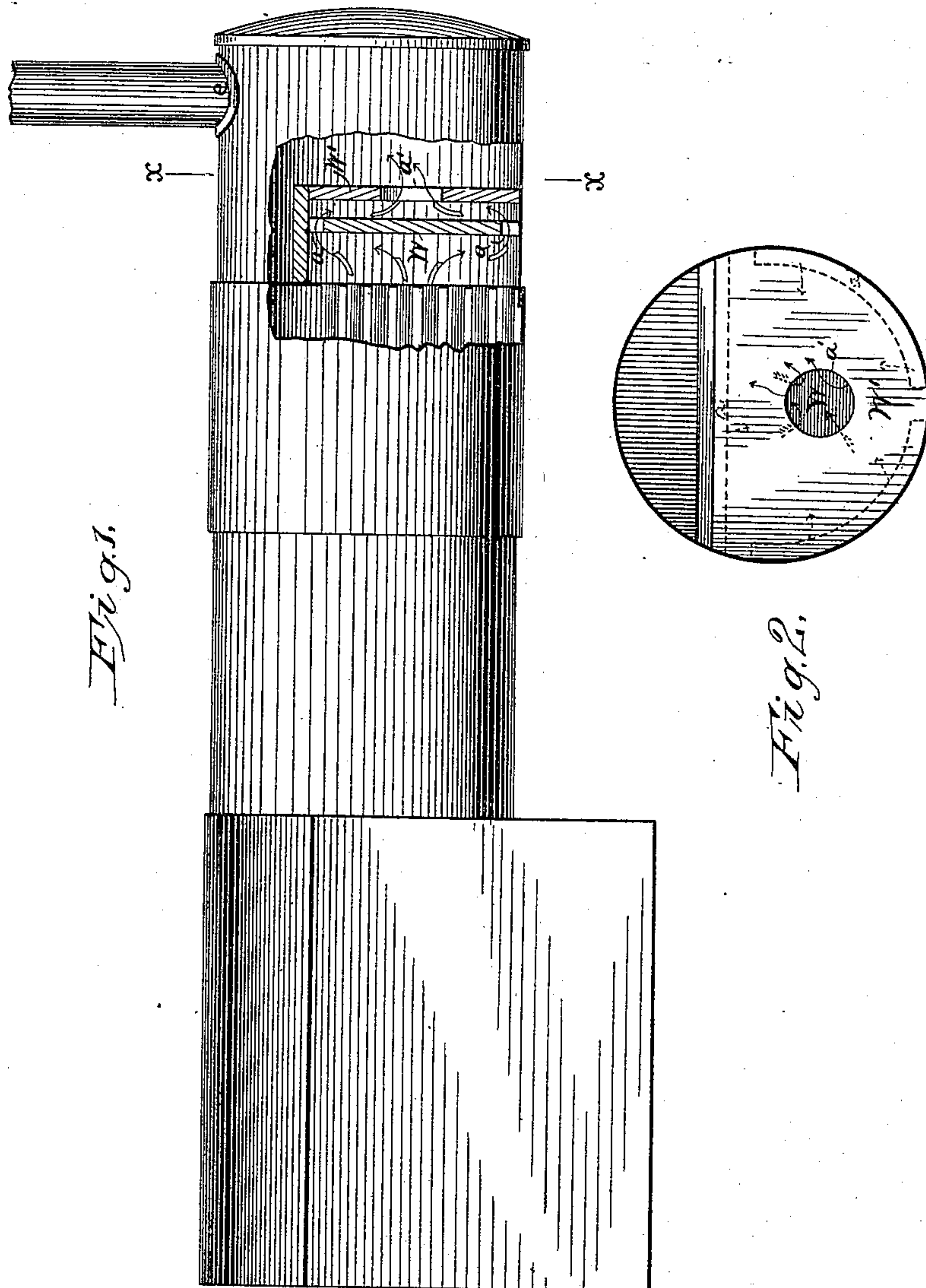


(No Model.)

E. F. EDGAR.
METHOD OF BURNING FUEL IN FURNACES.

No. 450,616.

Patented Apr. 21, 1891.



Witnesses:
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UNITED STATES PATENT OFFICE.

ELLIS F. EDGAR, OF WOODBRIDGE, NEW JERSEY.

METHOD OF BURNING FUEL IN FURNACES.

SPECIFICATION forming part of Letters Patent No. 450,616, dated April 21, 1891.

Application filed September 11, 1890. Serial No. 364,623. (No model.)

To all whom it may concern:

Be it known that I, ELLIS F. EDGAR, a citizen of the United States, and a resident of Woodbridge, in the county of Middlesex and State of New Jersey, have invented a certain new and useful Improved Method of Burning Fuel in Furnaces and Analogous Apparatus, of which the following is a specification.

In my experiments with various methods of heating furnaces and analogous apparatus and with various apparatus therefor I have found, as have others, that while an intense heat might be produced just at the fire-bed with several known appliances, none of them in practical use by any means exhausted the heat units known to be in the fuel consumed, (that is so far as obtainable results were concerned,) and, furthermore, that much of the heat produced was wasted in obtaining the high heat even at the fire-bed, while from that point onward in the course of the draft to the exit the heat diminished in a very rapidly-increasing ratio, though at the same time much heat was absorbed by chimneys and other connections, to the great detriment of economy in the production of the amount needed for the work to be performed by that apparatus. In other words, not so much heat as theoretically possible was developed and a large proportion of that actually developed ran away without doing any work, this being especially so in the furnaces of locomotive-boilers, where great heat is constantly needed to generate the large quantity of steam at high pressure, which the work to be done necessitates, the imperative demand for high speed, consequently high pressure, and great power requiring that with ordinary methods economy be largely disregarded in the adoption of means to the desired end. To remedy these defects in method and apparatus was my purpose. As is manifest, success lay in the direction of causing the complete combustion within the space to be heated of all the fuel, not only in the form initially employed—such as wood, coal, oil, &c.—but also in the form of gases generated from these bases by ordinary methods of combustion. To accomplish this it required that this “secondary fuel,” if I may so term it, should be retained within the apparatus in some manner that opportunity might be given for exhausting it of heat

units. At the same time it was evident that this must be done without impairing the draft of the apparatus, for otherwise the initial fire would sweat and all progress be checked. In this situation I availed myself of the law that the higher the temperature that is given to a gas the greater will be its expansion, and utilized that expansion of each particle acting upon each other particle to produce a compression which operates to hold the secondary fuel somewhat in check and yet not impede the main draft. To create that higher temperature I place a body that may be highly heated right in the line of draft and substantially at the limit of the space within which I desire to create heat, preferably deflecting the line of draft so that it shall pass about this body as far from the center line as possible, and I further protect this body from drafts of cold air, that its temperature may not be constantly or intermittently lowered by contact with said cold air, the passages about the said body being so proportioned that the draft shall not be impaired, it being found that under natural draft this will be accomplished by making the aggregate area of the said passage or passages about equal to the area of the draft-exit, while with a forced draft the said aggregate area may be somewhat diminished. The end attained by the method thus described is eminently satisfactory, heat being generated rapidly and evenly, and the heat units of the fuel being utilized to its entire exhaustion before the resultant burned-out matter passes into the chimney or other draft-conduit.

That the method may be the more readily understood, I exhibit in the accompanying drawings, forming part of this specification, an apparatus in which it may be practiced, upon which apparatus I seek a patent by application, Serial No. 345,482, filed March 27, 1890.

Figure 1 represents in side elevation a boiler with the required modifications, a part of the wall being broken away to more clearly exhibit the parts; and Fig. 2 is a vertical cross-sectional view on line *x x*, Fig. 1.

As will be noticed, I have placed a wall *W*, usually of fire-clay, just beyond the limit of the flues, said flues and the part of the boiler surrounding the fire-box being the space to be heated. Draft-apertures *a* (shown at the

edge of wall W) are provided, which I proportion so as to permit as great a draft as the exit (here *e*) would accommodate were there no wall W. As thus arranged, the apparatus
 5 is susceptible of use by my method; but I prefer to more certainly provide against the cooling of wall W by a second wall W', placed beyond the first and having a draft aperture or apertures *a'* not in line with apertures *a*.
 10 It will be found in use that the gases or secondary fuel held by wall W to some extent and in any event impinging upon it raise its temperature and in turn are themselves heated by it. The increased heat causes
 15 greater expansion, which, acting in all directions, assists the draft through apertures *a*, and yet causes a pressure back through the flues and the fire, so that its effect is sometimes even noticeable in the ash-pit. The
 20 newly-generated secondary fuel is by this pressure or compression seized and held in this extremely high temperature within the space to be heated, its heat units practically exhausted and utilized to do the work desired—*i. e.*, here to generate steam—the
 25 resultant matter finally delivered at the exit being so bereft of heat as to scarcely raise the temperature of the chimney at all, thus proving its exhaustion, while the temperature of the space to be heated will be
 30 found to be even throughout as high in and through the flues as it is in the fire-box itself, which is a result long sought but not heretofore attained. The flues are the spaces where
 35 heat is desired, and by my method it is there found not only at the fire-box end but, throughout the entire length, the pressure caused by the great expansion of the secondary fuel being, according to the known law of gases, even
 40 in all directions, and I have succeeded in causing the heat to be also thus distributed, while beyond wall W, indeed from a line drawn about the boiler in the plane of the inner face of wall W, there is practically no heat. In
 45 some forms of apparatus the wall inclosing the space from fire-bed to plane of inner face of wall W will be evenly at a red heat, while beyond it will not be at all changed in color from the heat. That wall W is protected from
 50 back drafts of cold air by wall W' is plain; but I do not intend to limit myself to that method of protection, as the form of the body whose function is performed by wall W might

be changed without departing from the spirit of my invention, and when changed, or even 55 if not changed, it might be protected by other means than wall W'.

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

1. The method herein described of burning 60 fuel, which consists in interrupting the passage of the gases produced by the initial combustion by inserting a body or wall of refractory material capable of rising to a high temperature in their path at a point substantially 65 at the limit of the space to be heated, but of a size and form that shall not impair the draft and protecting said body from cold air, whereby the gases will be compressed by the expansion thereof and held within said space until 70 exhausted of heat units, which will be evenly and generally distributed throughout the said space, all substantially as set forth.

2. The method herein described of burning 75 fuel, which consists in interrupting the passage of the gases produced by the initial combustion by inserting a body or wall of refractory material capable of rising to a high temperature in their path at a point substantially 80 at the limit of the space to be heated, but of a size and form that shall not impair the draft, leading the draft-currents about said body and protecting it from cold air, substantially as and for the purpose set forth.

3. The method herein described of burning 85 fuel, which consists in interrupting the passage of the gases produced by the initial combustion by inserting a body or wall of refractory material capable of rising to a high temperature in their path at a point substantially 90 at the limit of the space to be heated, but of a size and form that shall not impair the draft, and protecting said body from cold air by placing a second body in said path beyond 95 the first and at a short distance therefrom and leading the draft currents through said second body in other than lines extending straight through or about the first body, substantially as and for the purpose set forth.

Signed at New York, in the county of New 100 York and State of New York, this 10th day of September, A. D. 1890.

E. F. EDGAR.

Witnesses:

SCHUYLER L. MACKIE,
 A. G. N. VERMILYA.