Sheet 1. 2 Sheets.

D. M. Melvin

Furnace

No. 75039 Patented Mar. 3. 1868

Fig: 1.

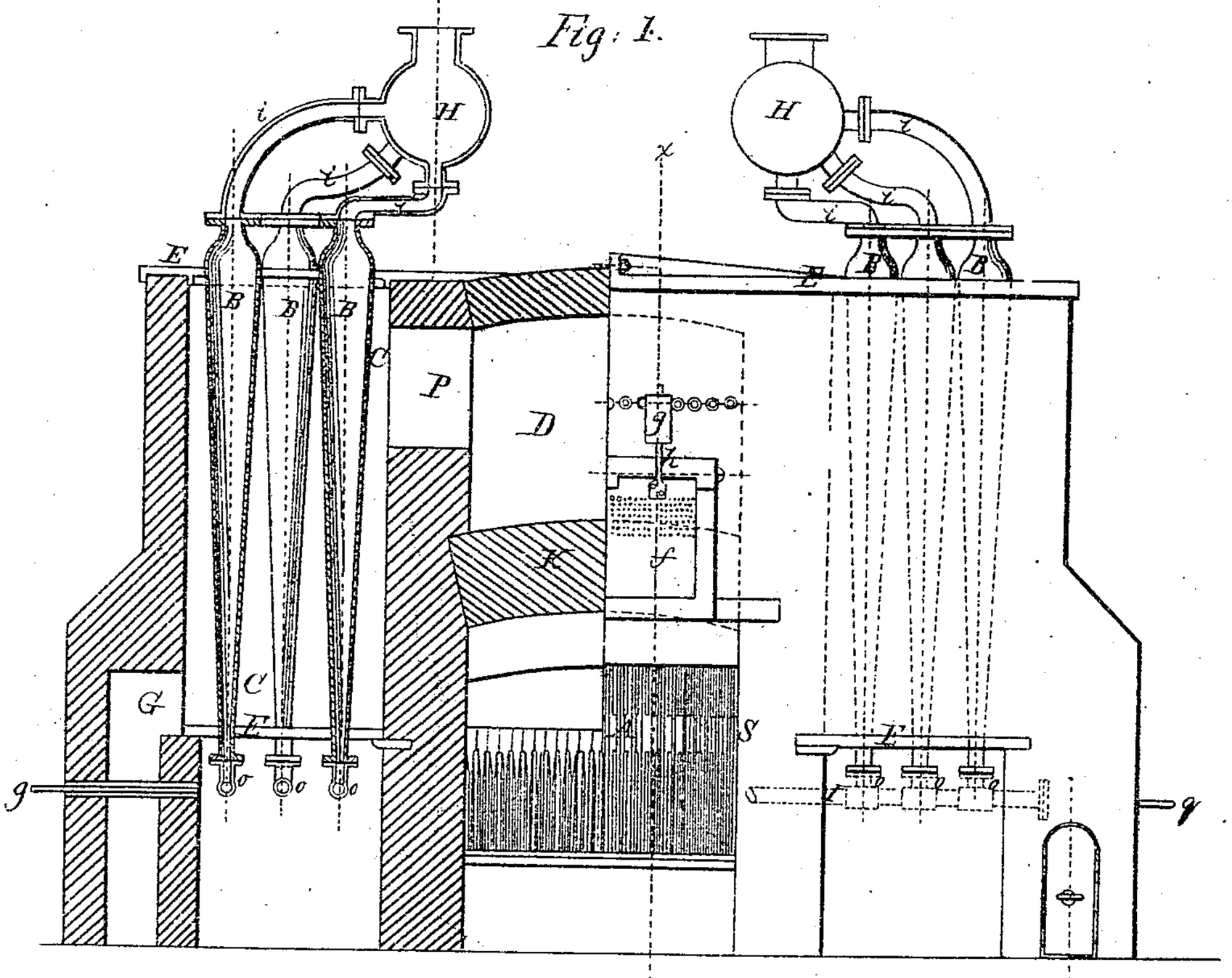
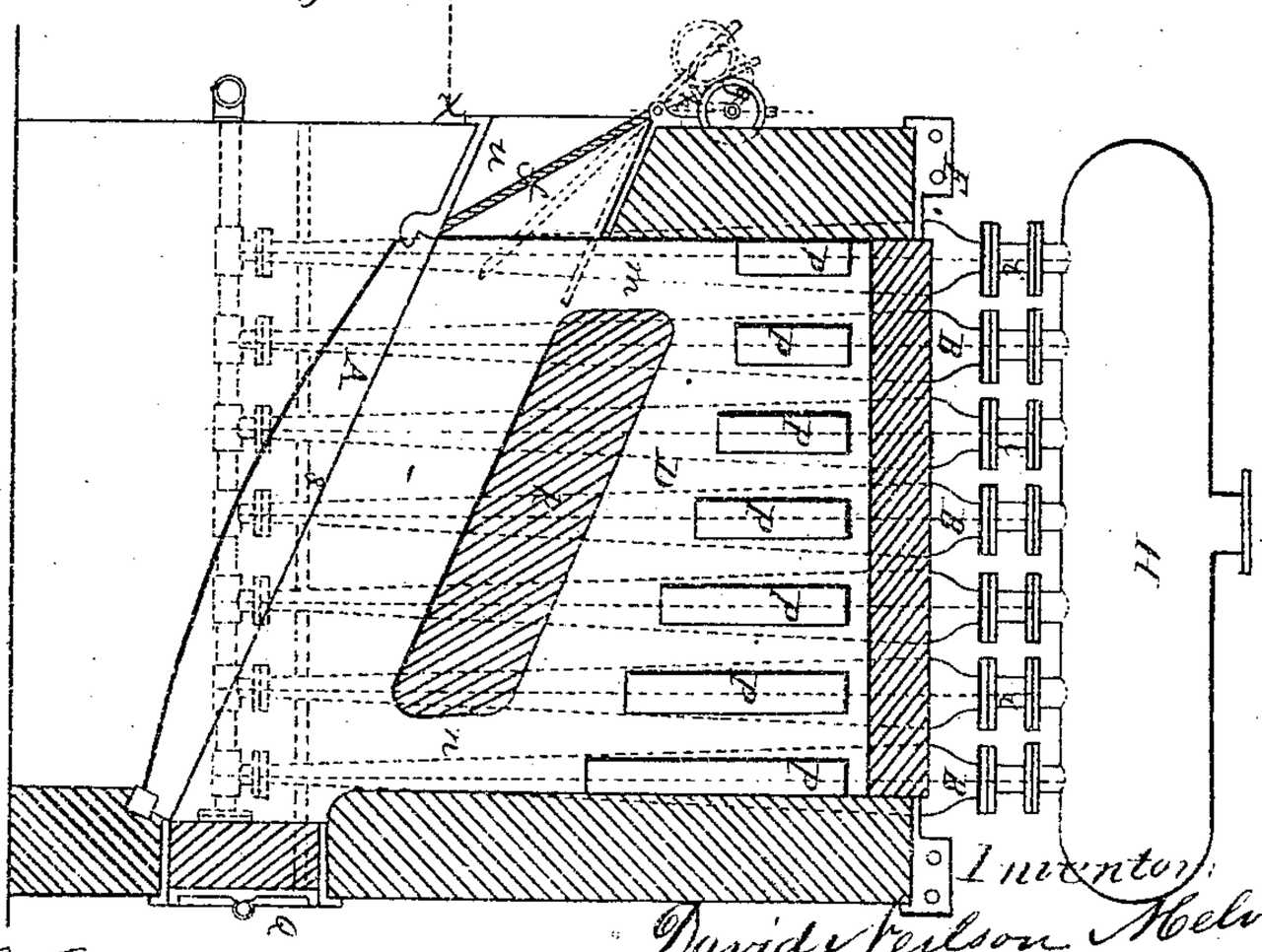


Fig: 2.



Witnesses:
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Edmund Burke

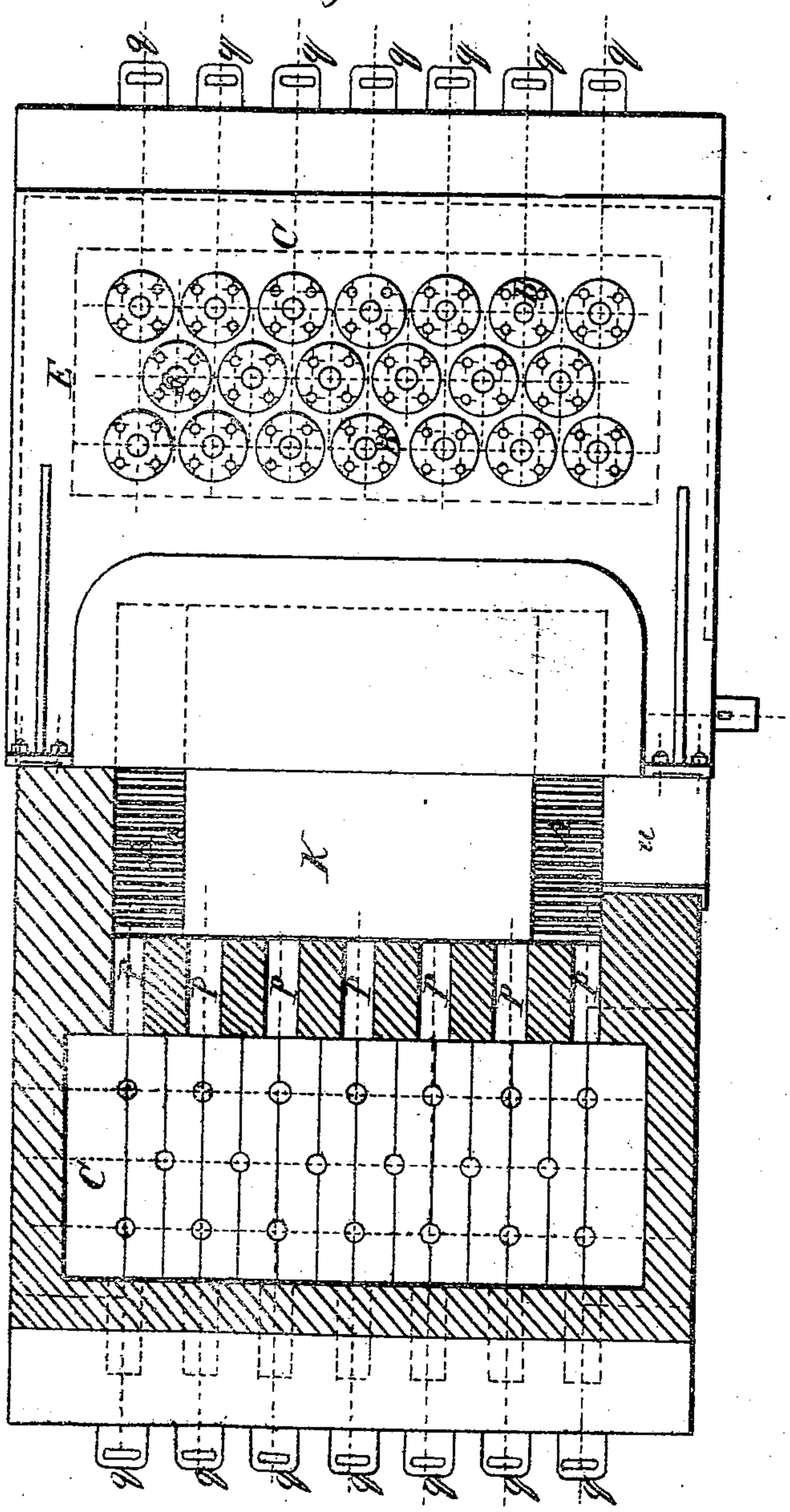
Inventor:
David Neilson Melvin
by L. Fraser & Co. attys.

Sheet 2. 2 Sheets.

D. M. Melvin
Furnace

No. 75039 Patented Mar. 3, 1868

Fig: 3.



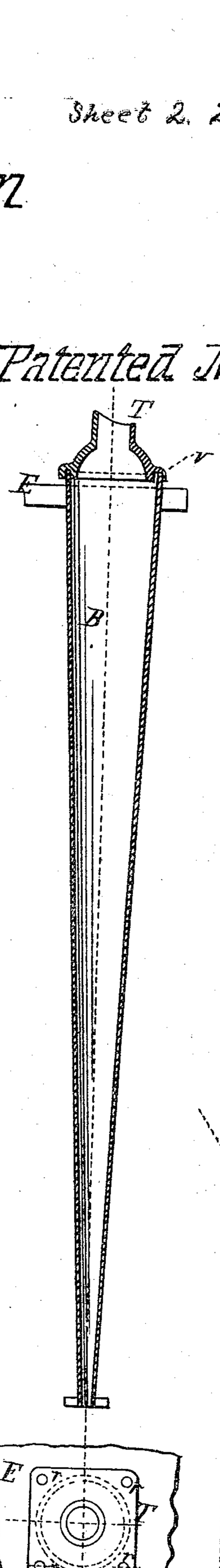


Fig: 4.

Witnesses:

Lyman R. Wilkes

Inventor:
David Peirson Melvin
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UNITED STATES PATENT OFFICE.

DAVID NEILSON MELVIN, OF BUFFALO, NEW YORK.

IMPROVEMENT IN FURNACES FOR GENERATING STEAM.

Specification forming part of Letters Patent No. **75,039,** dated March 3, 1868.

To all whom it may concern:

Be it known that I, DAVID NEILSON MELVIN, of the city of Buffalo, in the county of Erie and State of New York, (formerly of Birmingham, England,) have invented certain new and useful Improvements in Steam-Generators; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a front elevation, partially in section, of my improved generator. Fig. 2 is a central vertical transverse section in plane of line *x x*, Fig. 1; Fig. 3, a plan, partially in horizontal section. Fig. 4 is a section and plan of one of the boiler-tubes, showing the manner of constructing the same when made of wrought-iron.

Like letters of reference designate corresponding parts in all the figures.

My invention relates to an improved method of constructing the boiler and furnace of steam-generators, whereby they become more portable, less dangerous from explosions, and more economical.

It consists in constructing the boiler of one or more (preferably several) inverted conical water tubes or vessels, arranged vertically, or nearly so, each separate and independent of the others, and forming a boiler complete in itself; also, in the manner of sustaining the said conical tubes.

It further consists in the combination of a furnace provided with an inclined fire-grate with a bridge arranged at the center over the fuel, leaving a communication at each end into the combustion-chamber above, for a purpose hereinafter described; also, in the arrangement of a series of dampers with the other parts of the furnace, for equalizing the draft and heat among the different tubes; and in the peculiar manner of hanging the door of the furnace, in connection with a weighted lever, by which it is counterbalanced and made self-operating and self-sustaining, all as hereinafter fully set forth.

In the drawings, (which represent a steam-generator of twenty-horse power,) the furnace is shown arranged at the center, with its inclined fire-grate A extending transversely across the apparatus, and an aggregation of tapering tubes, B B, arranged on each side of the furnace, within two flues or heating-chambers, C C, which communicate with the combustion-chamber D by means of short flues or apertures *p p*, of varying sizes, as shown in Fig. 2. The bars of the fire-grate tip or incline backward at an angle, (preferably of about twenty-five degrees from a horizontal,) and are provided at the center with shoulders, so as to fill up the spaces between them, forming a dead-plate, *s*, the length of which may be varied and its position altered according to the quality of the fuel employed, or other circumstances. Extending across the center of the furnace, over the fuel, I construct an arch or bridge, K, preferably of the inclination of the grate, forming a partial diaphragm, and leaving spaces at each end (shown at *m n*, Fig. 2) for the passage of the draft into the combustion-chamber D above, whence it escapes through the apertures *p p* on each side into the flues or heating-chambers C C. In these chambers are arranged the inverted conical tubes B, preferably of about the degree of taper shown, but which may vary in size, in the drawings two being represented for each horse-power.

One of the objects of using a number of tubes being to diminish the danger in case of an explosion, on account of their reduced size and the separation of each tube from the others, it is evident that we approximate the minimum of danger in proportion as we diminish their size. The tubes are sustained in position by means of the metallic plates E E, forming the top and bottom of the chambers C, which are provided with taper holes corresponding to the taper of the tubes which are hung therein, as clearly shown in Fig. 1. The ends of these tubes project beyond these plates above and below, their upper ends being connected by pipes *i i* to the steam domes or receivers H H above, as represented, while their lower and smaller ends may be fed with water, by means of branch pipes *o o*, from a common feed-pipe, I, as shown. The products of combustion escape at the bottom of the chambers C through flues G, Fig. 1, at each end of the generator, which communicate with the smoke-stack. These flues are pro-

vided with a series of dampers, *q q*, for regulating the draft, in a manner presently to be explained.

The door *f* of the furnace is perforated, and hinged at the top, where it is provided with an arm or lever, *h*, rigidly attached to it, extending upward, (when the door is in a closed position,) and having at its end a weight, *g*, which is preferably made adjustable thereon, so as to form a counterpoise for the door when closed, and to make it self-operating and self-sustaining, as follows: The door resting in the inclined position shown leaves an angular space, *u*, on the outside, formed by it and the bottom of the passage. The coal is thrown in this space against the bottom of the door, which, being nearly counterbalanced by its weighted arm, readily swings up and open, as shown in dotted lines, Fig. 2, for the passage of the coal, when the slight preponderance of the door causes it to immediately close again. By opening the door the full size of the passage, the weighted arm preponderates, and retains it in that position, as shown in same figure.

Q is a small door at the lower and back end of the furnace, for convenience in cleaning.

The tubes B may be made of cast or wrought iron. When made of the latter, they may be formed as shown in Fig. 4, with a cap, T, cast with an annular groove, *v*, corresponding in size with the end of the tube, in which is fitted a ring of packing, when it is secured to the tube by bolts *r r*, passing through a flange of the cap and the plate E; or the cap may be connected therewith in any other suitable manner.

The operation and advantages of my improvements are as follows: The furnace being filled and fired, the inflammable and combustible gases and vapors are first evolved in the front and upper portion of the furnace, which are, by the bridge K, compelled to pass up the draft-passage *m* near the door, the perforations in which furnish the requisite supply of air to render more perfect their combustion as they escape into the chamber D. The introduction of fresh fuel forces this carbonized coal down the grate, under the bridge, and over the dead-plate till it approaches the lower and back end of the grate, where the combustion of the carbonized coal or coke, which by this time has been deprived of its more volatile and inflammable elements, is completed, the resulting gas from the combustion of the latter being principally carbonic acid, which, being non-combustible and a non-supporter of combustion, passes up the space *n* and through the back apertures *p*, without commingling to any great extent with the combustible gases in front. Were it not for this division of the draft, the carbonic acid resulting from the combustion of the residuary coke would commingle with the other gases, and serve to slacken their combustion. In addition to this, the carbonic acid, as it is produced, escapes freely up the passage *n*, without undergoing the deoxidizing process of being converted into carbonic oxide, as is the case when the coke underlies a stratum of glowing combustible more recently added, through which the carbonic acid must pass, which renders ineffectual large quantities of heat that might otherwise be utilized. The draft at the rear not being so intense as in front, the rear apertures *p*, through which it escapes into the heating-chambers, are made correspondingly larger. The draft among the tubes in the chambers C is regulated and directed to any portion by means of the dampers *q*, which enables it to be equally distributed and easily controlled. These chambers being of uniform size, while the areas occupied by the tubes at the bottom are so much less than at the top, leaves a largely-increased area of flue at the bottom, which produces a partial retardation or retaining of the heated products in the lower portion of the flue, which allows a longer time for the absorption of the heat by the water-tubes.

There are several advantages resulting from the use of the independent taper-formed tubes. It enables the boiler to be formed in parts weighing comparatively but little, so as to be easily handled and transported. There are no joints exposed to the action of the fire, and consequently all leakage from that source is prevented. The inclined sides facilitate the rising and escape of the steam as it is being generated without producing "priming."

The arrangement of the draft-passages *p p* with the tubes and heating-chambers causes the most intense heat from the furnace to first come in contact with the enlarged surface of the tubes at the point where the steam is being evolved from the surface of the water therein, the heat of the draft decreasing to a certain extent, and the latter retarded toward the bottom, where the water in the tubes is coldest.

The construction of the furnace insures the most perfect combustion of the combustible gaseous products before their temperature is lowered by the frigorific effect of the tubes, and without the admixture therewith of the non-combustible gases.

The mode of supporting the tubes on the plates E, while it securely retains them in place, also permits their free expansion and contraction.

What I claim as my invention is—

1. Constructing a steam-boiler of one or more inverted conical water-tubes, B, each separate and independent of the others, substantially as set forth.

2. The mode of sustaining the said tubes B in the metallic plates E E, as herein described, to allow of their expansion and contraction.

3. Constructing furnaces having inclined grates with a bridge or partial diaphragm, K, at the center for dividing the draft, in combination with the combustion-chamber D and side escape-flues *p p*, substantially as and for the purpose set forth.

4. The door *f*, provided with arm *h* and

weight *g*, and hinged so as to be self-operating and self-sustaining, substantially as specified.

5. The arrangement of the tubes B, heating-chambers C, and flues *p p*, whereby the heat through the latter comes first in contact with the enlarged upper surfaces of the tubes, and is thence retarded as it descends, substantially in the manner and for the purpose set forth.

6. The series of dampers *q q* in flue G, in combination with the tubes B, heating-chamber C, apertures *p*, and furnace D, provided with a bridge, K, arranged as described, for regulating and equalizing the draft among the said tubes, as specified.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

DAVID NEILSON MELVIN.

Witnesses:

JAY HYATT,

ALBERT HAIGHT.