

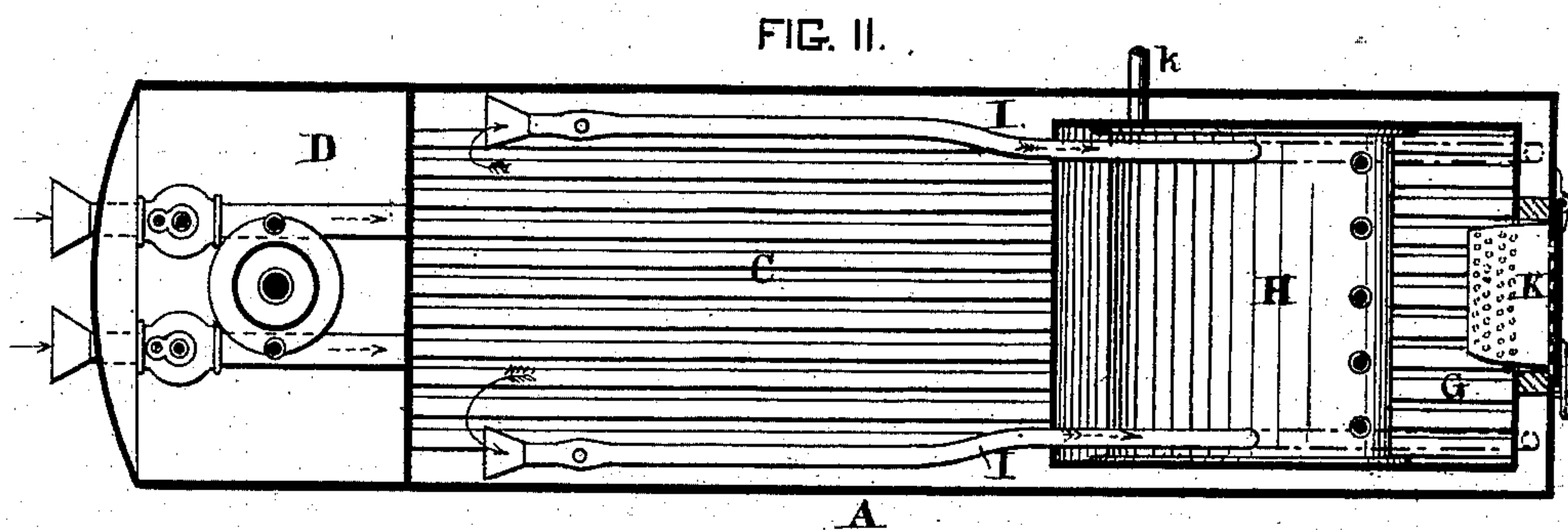
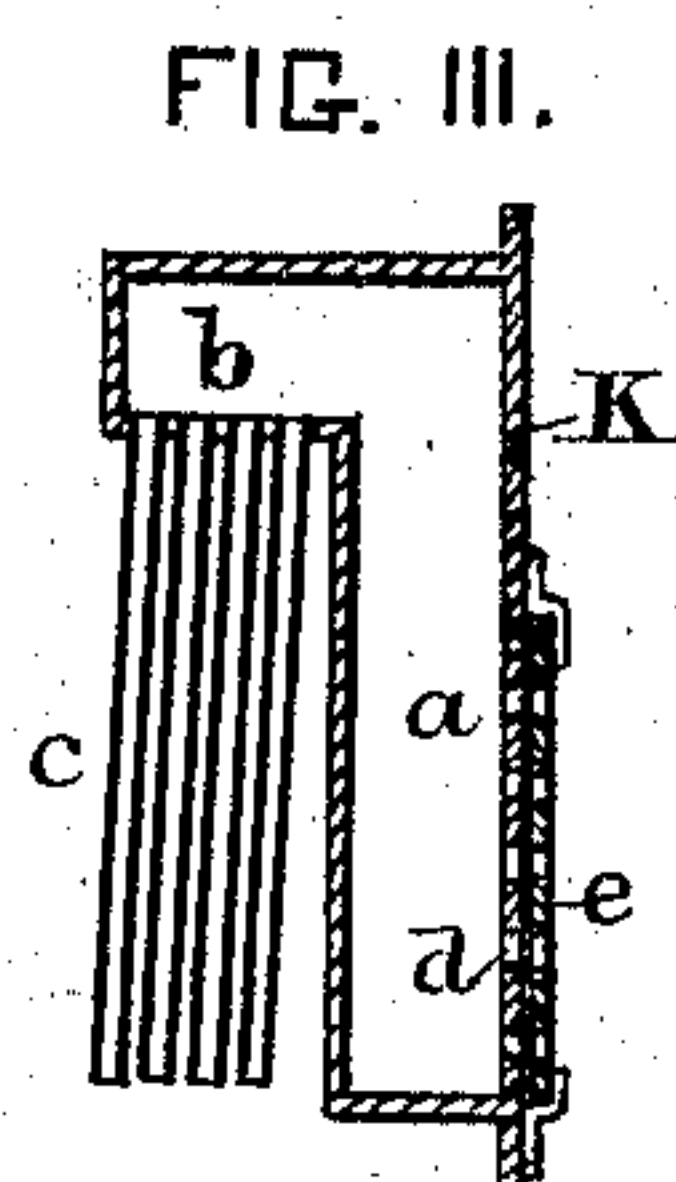
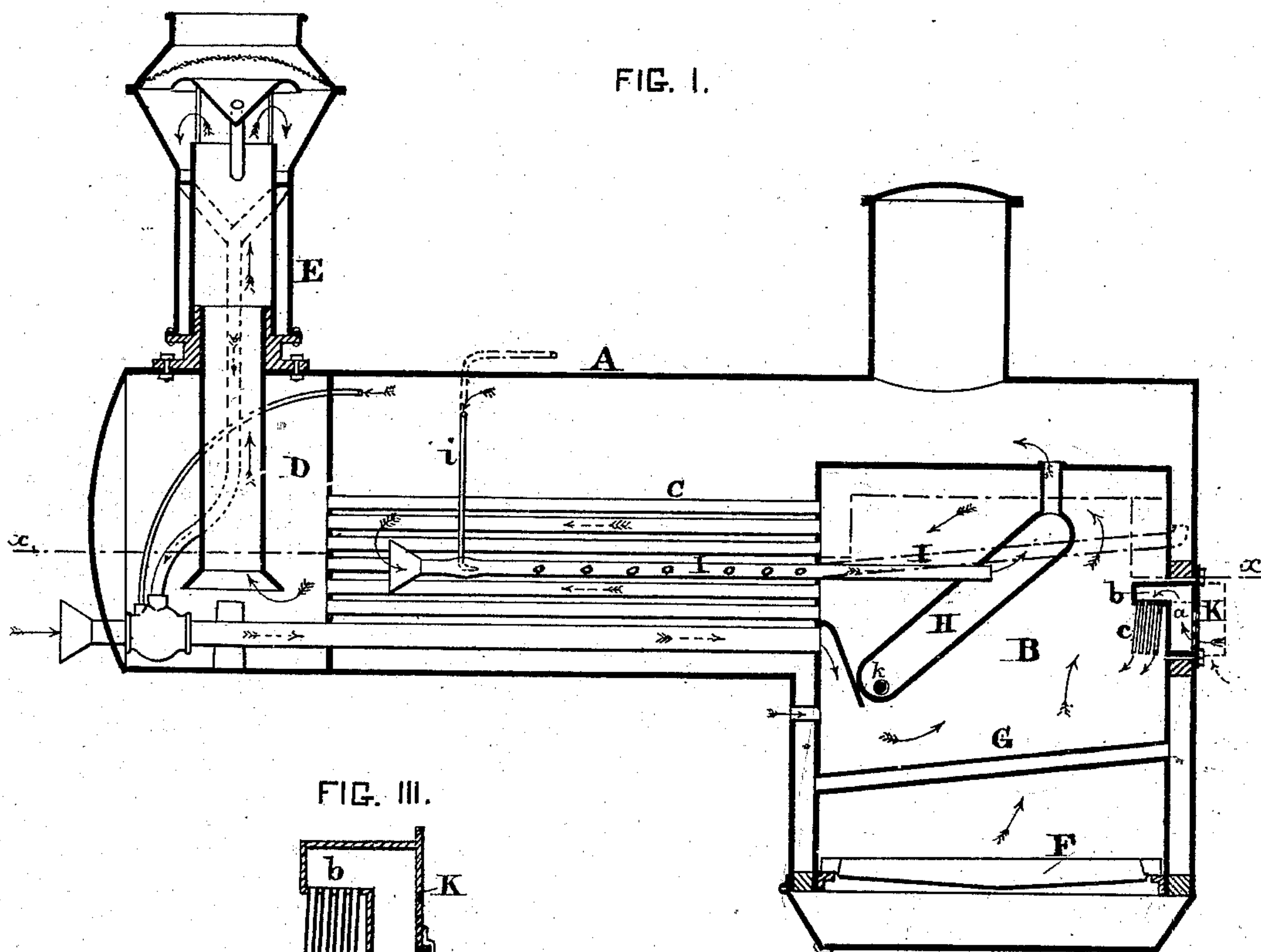
(No Model.)

A. BERNEY.

Heating and Circulating Water in Boilers.

No. 239,308.

Patented March 29, 1881.



WITNESSES:

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HEATING AND CIRCULATING WATER IN BOILERS.

SPECIFICATION forming part of Letters Patent No. 239,308, dated March 29, 1881.

Application filed September 22, 1880 (No model.)

To all whom it may concern:

Be it known that I, ALFRED BERNEY, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Heating and Circulating Water in Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to apparatus for heating and circulating the water in locomotive-boilers, and also in assisting the combustion of the fuel, especially for burning anthracite coal, which, as is well known, has and can be done very imperfectly with the apparatus now in use; and the object is to create a better circulation of water in the boiler, and thereby also increase the evaporative efficiency and heating qualities, and at the same time to burn less fuel and entirely consume the sparks, cinders, and products of combustion, and prevent their escape into the air.

The invention consists, first, in placing a number of tubes, forming hollow grate-bars, a short distance above the common grate-bars, and connecting them with the front and rear water-legs, so that the fine burning coal and cinders can fall upon the lower grate and assist in heating the water circulating through the tubes.

It also consists in placing a water-diaphragm at an angle in the furnace and connecting it at the top with the water-space above the crown-sheet, and about midway of its width, or near its lower end, introducing one or more pipes extending into the water-space of the boiler, and into said pipes a jet of steam, water, or compressed air, to create a circulation of water through the diaphragm and boiler.

It further consists in supplying fresh air through a hollow furnace-door, whose upper end projects into the furnace, and is provided at its lower side with a number of pendent tubes, through which air, being first heated, is

admitted into the fire, all of which will be more fully described hereinafter, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal section of a locomotive-boiler with my improvements attached. Fig. 2 is a horizontal section on line *xx*. Fig. 3 is an enlarged cross-section of the furnace-door.

In the drawings, A is the shell of the boiler, in which the furnace B, tubes C, smoke-arch D, and stack E are of ordinary construction. In the furnace are arranged, a short distance above the ordinary grate-bars F, a series of tubes or hollow grate-bars, G, connecting with the front and rear water-legs of the boiler, so as to create a circulation of water through them. The small coal, cinders, &c., passing through the spaces of the hollow grate-bars, fall upon the lower grate-bars, of ordinary construction, and assist in heating the circulating water through the hollow grate-bars. Above these bars is secured the water-diaphragm H, in an inclined manner, and connected at its open ends with the water-legs to the sides of the boiler, and at its upper end by tubes *h* with the water-space above the crown-sheet. Into the diaphragm H project one or more pipes I, passing through the rear-tube sheet, and extending near to the front-tube sheet, where they are preferably provided with funnel mouths. Near the mouths of these pipes a jet-pipe, *i*, for steam, water, or air is introduced, by which the water is forced rearward and through the water-diaphragm H and tubes *h*, back again into the water-space of the boiler, above the crown-sheet, thereby creating a constant, rapid, and continuous circulation of water. In the lower part of the water-diaphragm is inserted a blow-off pipe, *k*, provided with the usual blow-off valve, so as to clean out any sediment that may accumulate therein, whenever necessary.

To aid in the combustion of the fuel and generation of steam, I provide a furnace-door, K, which consists of a hollow shell or front, *a*, having a branch, *b*, at its upper side, at right angles to the front part. To the branch *b* are secured a number of pendent open-ended tubes, *c*, through which air is introduced into

the fire. In the front of the door are arranged a number of perforations, *d*, over which a sliding plate or damper, *e*, is adjustably attached, and through which the amount of air desired
5 can be regulated. The air, in passing up through the front part, *a*, into the branch *b* and through the tubes *c*, becomes highly heated before it reaches the fire, and assists in the burning of the fuel, and prevents chilling of
10 the fire.

Instead of the perforations and sliding damper the front part may be solid and arranged outside of the boiler-shell, as shown in dotted lines, and air admitted through the
15 bottom, which is then open, and may be provided with a damper.

I have shown my heater and circulator in connection with my spark-arrester and return-flues to the furnace; but it may be used with
20 any other or without any, if desired.

If desired, the water-diaphragm in the furnace may be dispensed with, and the tubes or pipes *I* be continued through the furnace, as shown in dotted lines, and pass into the front
25 water space or leg of the furnace, when the circulation of the water will be created, as in the first instance, and become highly heated in passing through the furnace. The circulation may also be reversed in its course by forcing
30 the water in the tubes *I* in the opposite direction. The circulating-tubes *I* can be perforated along their entire length, more or less, with small holes, to make more perfect circulation.

I do not confine my invention—*i. e.*, pipe *I*—to the particular place shown, but place it or branches from it into any other part of the boiler.

The circulating-tubes can be easily inserted
40 in new or old boilers by drilling one or more holes in the flue-sheets, then inserting a screw-plug in said hole or holes after the tube has been expanded to fit the hole.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, 45 is—

1. In an apparatus for heating and circulating water, the method of creating a circulation through the water-diaphragm and boiler by one or more pipes extending into the diaphragm
50 at one end and into the water-space at the other, and provided with one or more forcing-jets, substantially as shown and herein described.

2. In an apparatus for heating and circulating water, the combination of the hollow grate or tubes with the ordinary grate, arranged as shown and described. 55

3. In an apparatus for heating and circulating water, a water-diaphragm, *H*, arranged in the furnace and connected by tubes *h* to the water-space above the crown-sheet, and by tubes *I*, provided with a jet, substantially as specified. 60

4. In an apparatus for heating and circulating water, constructed substantially as described, the furnace-door *K*, consisting of a hollow shell having a right-angled branch, *b*, provided with pendent tubes *c*, as and for the purpose set forth. 65

5. In an apparatus for heating and circulating water, the method of creating an artificial circulation from the water-space near front end of the boiler, toward the rear end of the same, by means of one or more tubes extending from front to rear, into which a jet of steam, water, or air is introduced, substantially as shown and specified. 70

In testimony whereof I affix my signature in presence of two witnesses.

ALFRED BERNEY.

Witnesses:

GEO. M. MILLER,
ROBT. GUARD.