(No Model.) 3 Sheets—Sheet 1.

M. D. LEGGETT.

SMOKE CONSUMING FURNACE.

No. 259,767. Patented June 20, 1882.

Fig. 1.

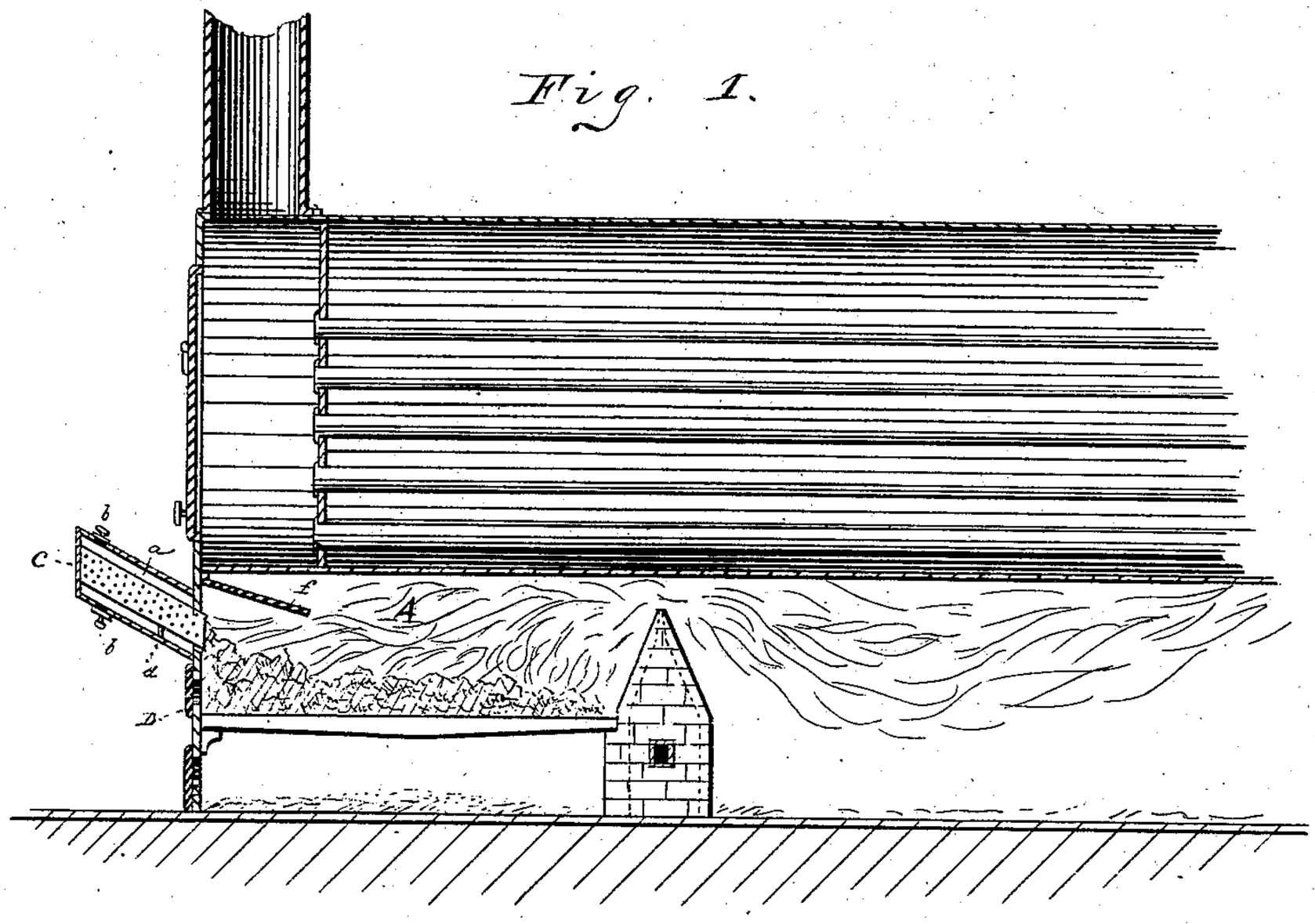
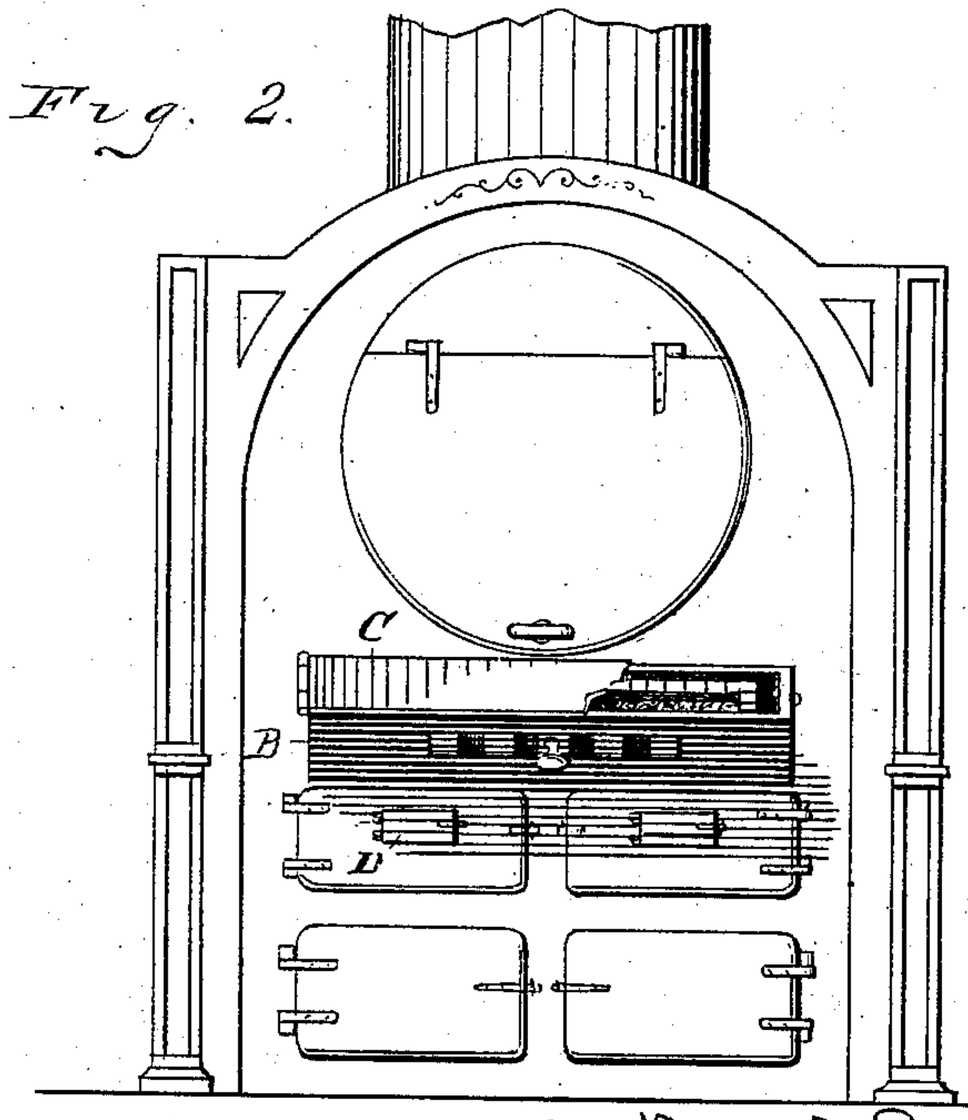


Fig. 2.



WITNESSES

W. H. Engel

Albert E. Lynch

M. D. Leggett INVENTOR

By

Leggett & Leggett

ATTORNEYS

(No Model.) 3 Sheets—Sheet 2.

M. D. LEGGETT.

SMOKE CONSUMING FURNACE.

No. 259,767. Patented June 20, 1882.

Fig. 3.

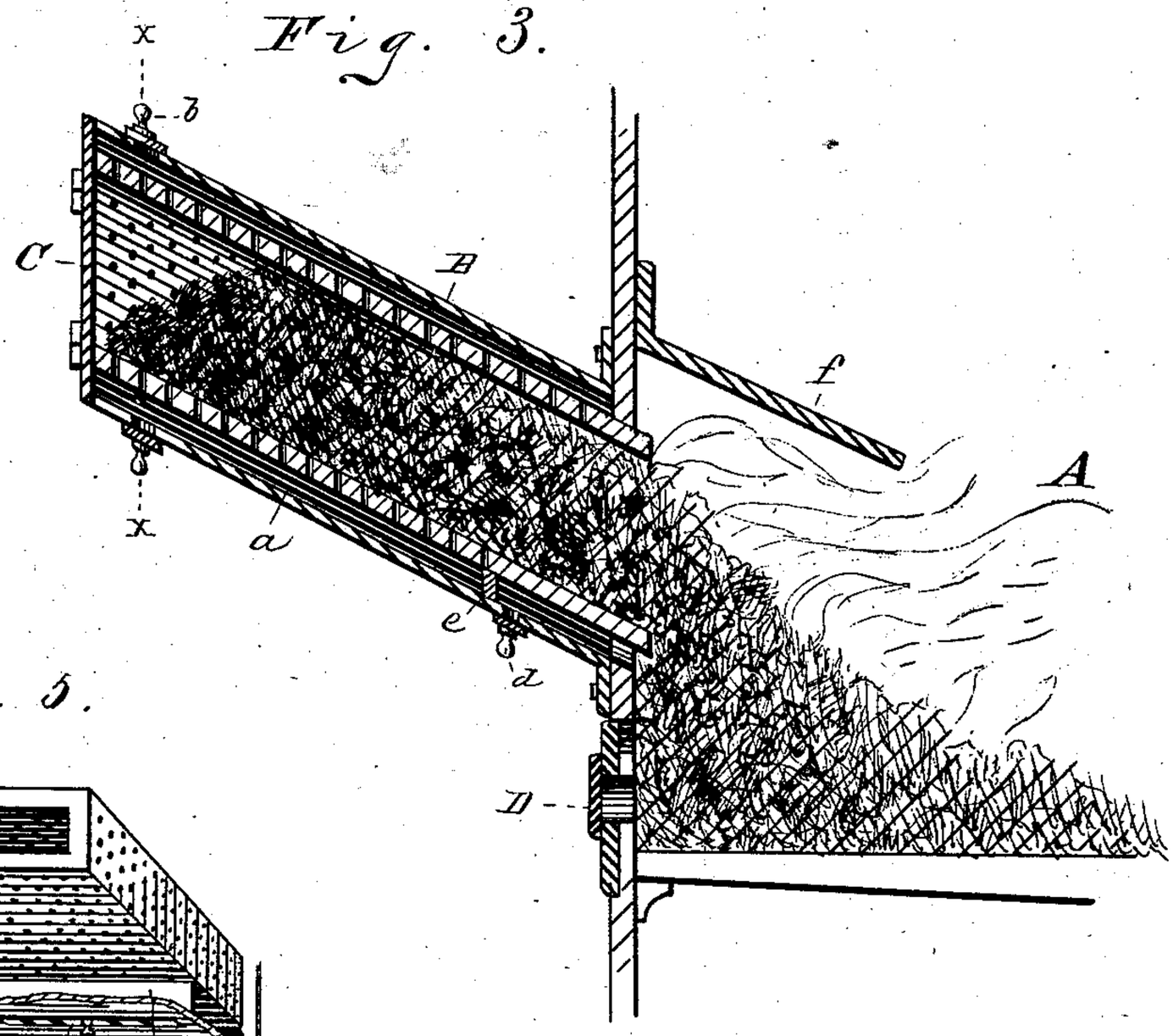


Fig. 5.

Fig. 4.

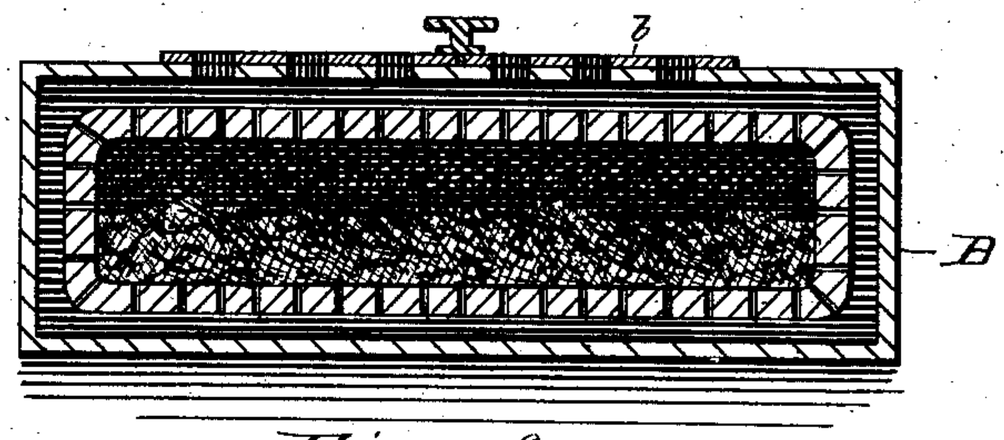
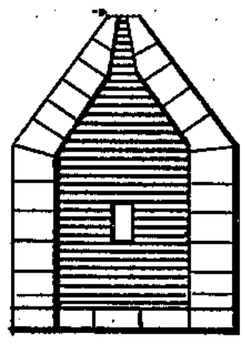


Fig. 6



WITNESSES

W. Engel

Albert E. Lynch

M. D. Leggett. INVENTOR

By

Leggett & Leggett

ATTORNEYS

(No Model.) 3 Sheets—Sheet 3.

M. D. LEGGETT.

SMOKE CONSUMING FURNACE.

No. 259,767. Patented June 20, 1882.

Fig. 7.

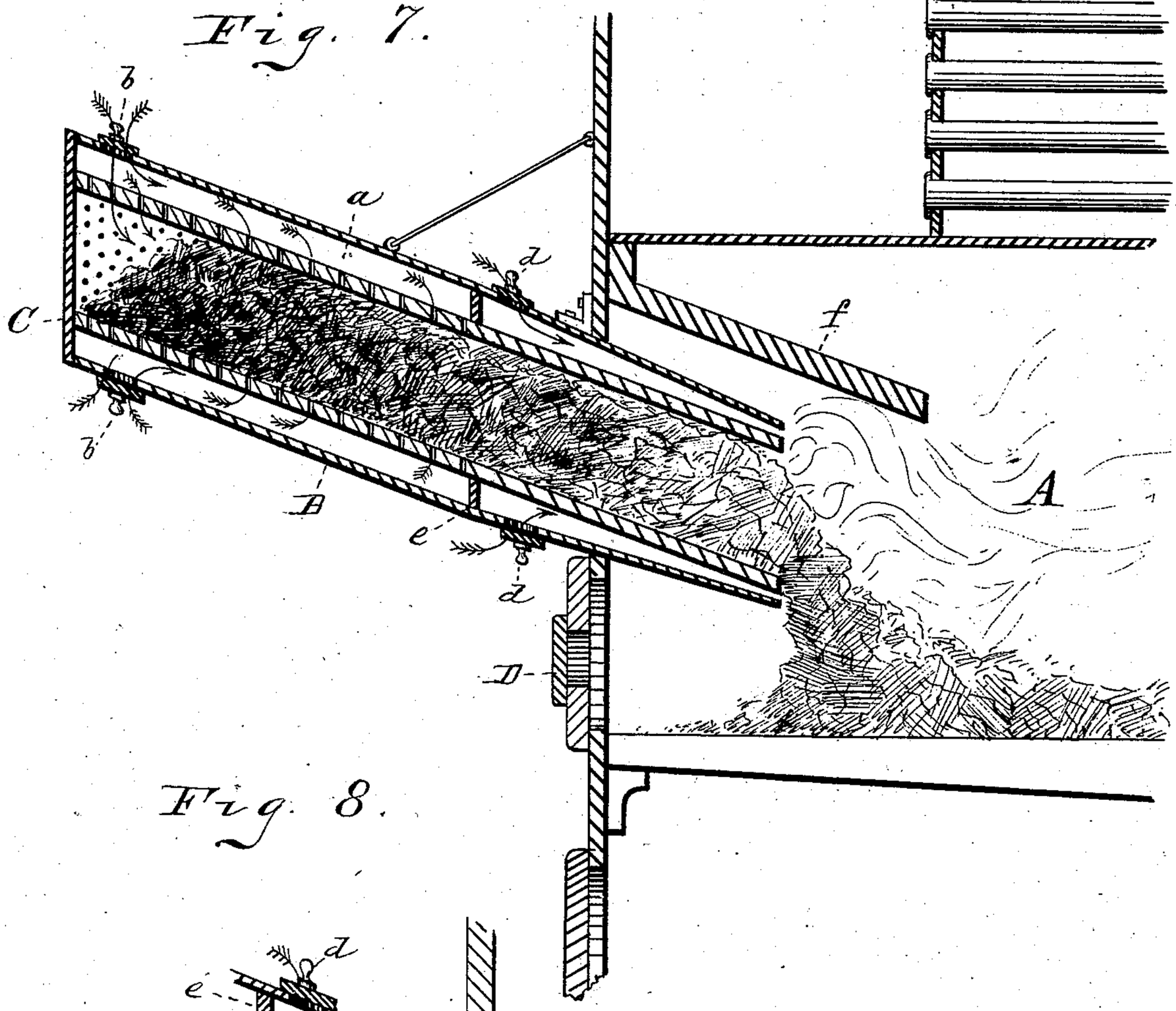
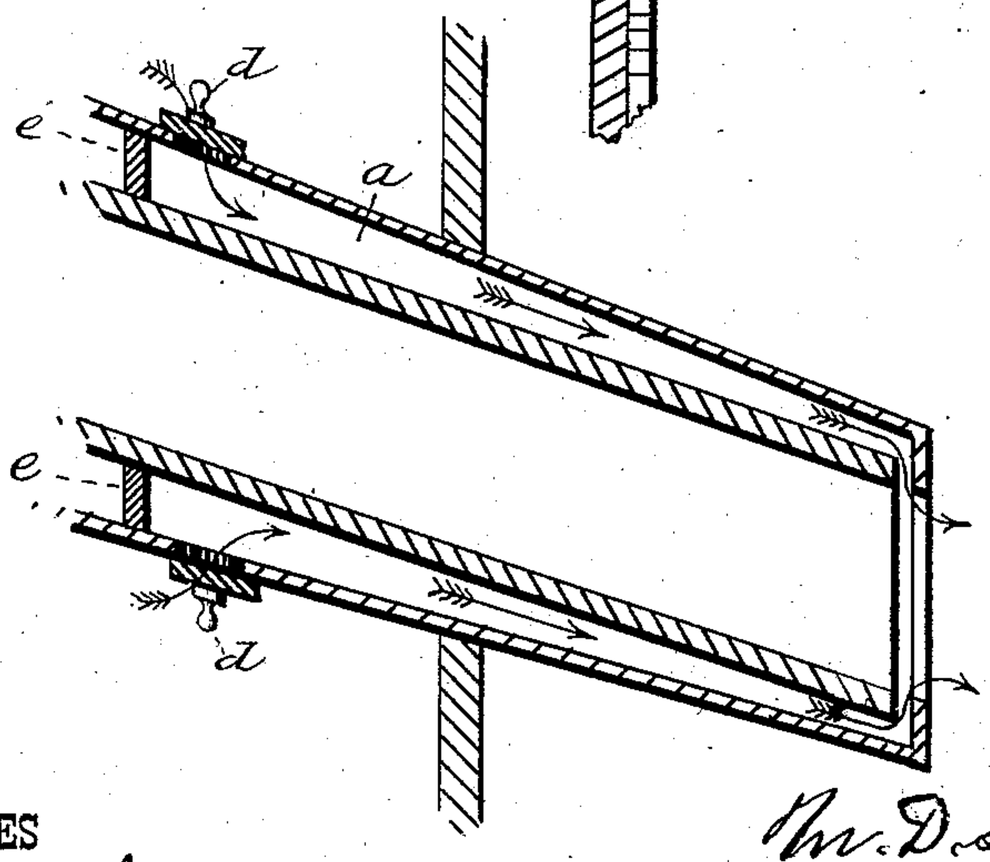


Fig. 8.



WITNESSES

W. Engel

Albert E. Lynch.

M. D. Leggett INVENTOR

By Leggett & Leggett

ATTORNEYS

UNITED STATES PATENT OFFICE.

MORTIMER D. LEGGETT, OF CLEVELAND, OHIO.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 259,767, dated June 20, 1882.

Application filed March 13, 1882. (No model.)

To all whom it may concern:

Be it known that I, MORTIMER D. LEGGETT, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Smoke-Consuming Furnaces; 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 pertains to make and use the same.

My invention relates to an improvement in smoke-consuming furnaces for generating steam; and it consists substantially in a hopper so constructed as to perform the double function of a coking-oven and a fuel-feeder to the furnace, and the means of protecting the mouth of said hopper from the excessive action of heat, and the introduction of hot air into the furnace-chamber in such a manner as to effectually consume the smoke generated in the coking process.

In the drawings, Figure 1 represents a longitudinal sectional view of a furnace with my improvement attached. Fig. 2 represents a front elevation of a furnace with the door of the hopper partly broken away. Fig. 3 represents a sectional view of the hopper attached to a portion of a furnace. Fig. 4 is a vertical sectional view taken through the line *x x* in Fig. 3. Fig. 5 represents an isometric view of the inner shell or portion of the hopper. Fig. 6 shows a sectional view of a form of a bridge-wall that may be used to co-operate with the hopper. Fig. 7 shows a desirable method of attaching the coking-hopper to the furnace in such a manner as to deliver the coke onto the grates well away from the furnace-front, and of delivering hot air into the furnace-chamber in such a manner as to protect the mouth of the hopper from the excessive action of heat. Fig. 8 shows a modification of Fig. 7, so as to deliver hot air into the mouth of the hopper in such a mannner as to insure its being commingled with the gases evolved in the coking-oven just before their escape into the furnace-chamber.

A represents a furnace, to the front of which is attached the hopper B. In this form of furnace the hopper is preferably inclined and attached at the end of the furnace over the front door; but it may be placed in a vertical position and be placed directly over or in the side of the furnace; or it may be placed in a horizontal position, in which case other means than gravity must be depended upon to force the fuel into the furnace. This hopper consists of an outer and inner shell. The inner shell (better shown in Fig. 5) is preferably made of fire-clay, but may be made of cast-iron or any other suitable material. This inner shell should be perforated with a large number of small holes of proper size, say one-fourth of an inch in diameter, or thereabout.

If intended to stand inclined, as in the drawings, or to lie horizontal, the perforations should be more numerous on the under side; or they may be entirely omitted on the upper side. The lower end may project just through the furnace-shell, as shown in the drawings; but it is preferable to have it pass sufficiently far into the furnace to deliver the fuel well away from the furnace-front. This inner shell may be of the form shown in Fig. 5, or with the corners rounded, as in Fig. 4, or of any other desired form. In burning soft coal it will, in general, be found desirable to have this perforated shell slightly increase in dimensions from the top to the bottom, as in the process of coking the coal somewhat increases in bulk and will be liable to clog if the hopper is all the way of the same size, and especially so if it should diminish from top to bottom. The size of this inner shell of the hopper must depend entirely upon the size of the furnace and the amount of coal to be fed through it.

The outer shell of the hopper may be made of boiler-iron or any other suitable material, and the two shells should be so attached as to leave a free open air-space around the inner shell, or at least so much of the inner shell as it may be found desirable to perforate.

The outer shell should be as nearly air tight as practicable, and registers *b b* should be placed near the upper end, so as to regulate the amount of air admitted into the air space or chamber *a*.

The upper end of the two shells should be as nearly as practicable in line, so that the end of both shells of the hopper may be closed by the same door, C. It is preferable that as little air as possible enter the inner shell except through the perforations, that it may be well distributed and restricted in quantity. I

prefer also that the hopper should be detachably attached to the furnace, so that it may be removed to facilitate cleaning or for entering the furnace for repairs.

The operation of this device is as follows: Through the doors, just under the hopper, in the form shown in the drawings, the fire is kindled on the grates. When well burning coal is fed into the hopper until the hopper is nearly or quite full, when the door C is closed and the registers *b b* are opened to admit the desired amount of air. The air will then be drawn by the chimney-draft through the perforations and through the body of the coal in the hopper and to the fire in the furnace. By a well-known law of combustion the fire will gradually work toward the source of the air by which it is supplied, and in a short time a slow combustion will work up into the hopper nearly or quite to the top. The intensity of this combustion in the hopper will depend entirely upon the amount of air admitted through the perforations in the inner shell, and this may be controlled by the registers *b b*. If the right amount of air is admitted into the air-chamber, it will be found to produce a bright incandescence at and near the mouth of the coking-oven, and this incandescence will gradually decrease, so that the coal at the top of the oven will only be heated sufficiently to draw off the moisture. In this manner the coal will gradually increase in temperature as it descends in the coking-oven, first giving off its moisture and then its smoke-gases, all of which must pass through the more incandescent coke near the mouth of the oven. When these gases reach the mouth of the oven they become commingled with fresh heated air, introduced as hereinafter described, when they are effectually consumed in the furnace-chamber. The coke is delivered upon the grate-bars and there consumed, and the temperature is thereby continually kept up to a degree that not only perfectly consumes the smoke, but utilizes the heat in generating steam.

Through the doors or elsewhere should be a small opening with a small door or valve, D, to close it when not used, through which a tool may be inserted to push the coke back on the grates and permit it to feed down from the hopper.

It will rarely be found necessary to open the doors of the furnace, for as the coal is coked or partially coked in the hopper there will be scarcely any tendency to form clinkers on the grates, and thus cold air and cold fuel are substantially excluded from the furnace.

It will be found that a furnace constructed with this improvement will not only burn the smoke, but will be extremely economical of fuel. Perfect combustion and exclusion of cold air and cold fuel are essential to great economy.

It will be found necessary to supply oxygenized air to commingle with the gases in the furnace-chamber as they emerge from the coking oven or hopper, in order that they may be properly burned. This air should be so introduced as to be raised to a high temperature before reaching the furnace-chamber. To secure this the lower end of the inner shell of the hopper may be left unperforated for a short distance, especially on the bottom, and the chamber surrounding this unperforated portion should be partitioned off from the balance by a partition-wall, *e*. This chamber should entirely surround the lower end of the inner hopper, as shown in Fig. 7; or it may include only a portion of the lower end, as shown in Fig. 3, just as experience may show most efficient. I think, however, that it is preferable that most of the air should emerge into the furnace from the lower side of the inner shell, in order to secure a more perfect commingling with the gases as they escape from the coking-oven. If the air emerges from all around the mouth of the inner shell, as shown in Fig. 7, it will tend to protect the shell from destruction by the heat. The lower part of the inner shell will be at a very high temperature, because of the coking process inside, and this will heat the air that is introduced at this point through the register *d*. The bridge-wall may also be so constructed as to heat a column of air that may be delivered into the burning gases at the crest of the bridge-wall, as indicated in Figs. 1 and 6.

There are many other well-known methods of introducing hot air into the furnace-chamber. The method I prefer, however, is to introduce it around the mouth of the inner shell of the hopper, as this will both protect the mouth of the hopper and deliver the hot air where it is most needed. I also find it advantageous to place a deflector, *f*, made of some refractory material, directly over the mouth of the hopper to aid in commingling the air and coal-gases, to deflect the same down upon the incandescent coke, where it will more certainly be consumed, and to protect the boiler at the point where it is most exposed to excessive heat.

The inner shell of the hopper is represented as equally perforated on all sides. This will be proper only when the hopper or coking-oven is standing in nearly or quite a vertical position. When the coking-oven is inclined, as shown in the drawings, the coal will be most compact on the under side, and consequently more impervious to air on the under side. Hence the air will tend to find its way to the furnace through the looser coal on the top, and that on the lower portion will be less subjected to the coking process. To avoid this the perforations should be much more numerous on the under side. If found necessary, they may be almost or entirely omitted on the upper side, when such portion may well be included in the chamber to supply heated air around the mouth of the coking-oven in the furnace.

In a furnace having my attachment, fine coal and even slack may be used, and will in many cases be found preferable to coarser and more expensive coals.

This furnace will also be found useful in burning anthracite or hard coal, as it will avoid opening the furnace-doors and will deliver hot burning coal into the furnace instead of cold fuel.

What I claim is—

1. The combination, with a furnace, of a coking fuel feeder or hopper consisting of a solid or unperforated outer casing or shell provided with suitable registered air-inlets and a perforated inner casing or fuel-holder, said outer and inner shells being separated from each other by the air-space *a*, substantially as and for the purpose shown.

2. The combination, in a furnace, of a coking fuel feeder or hopper consisting of an imperforate outer casing or shell provided with suitable registered air-inlets and a perforated inner casing or shell, the two shells being separated to form an intervening air-space, and a deflector placed above the mouth of said fuel feeder or hopper, substantially as set forth.

3. The combination, with a furnace, of a coking fuel feeder or hopper externally projecting from the furnace, and provided with the solid outer shell and the perforated inner shell and the intervening air-space, *a*, substantially as and for the purpose shown.

4. The combination, with a furnace, of a fuel-coking feeder or hopper having its inner or perforated shell non-perforated beyond the partition *e*, substantially as and for the purpose shown.

5. The combination, with a furnace, of a fuel-coking feeder or hopper consisting of two casings or shells with an air-space separating them, the outer shell being non-perforated, but provided with suitable registered air-inlets, and the inner shell or fuel-holder proper, having perforations in front of but not beyond a partition, *e*, substantially as and for the purposes shown.

6. In combination with a furnace, a coking fuel feeder or hopper provided with a partition, *e*, interposed between the inner and outer shells, and located between the perforated and non-perforated sections of the inner shell, substantially as and for the purpose shown.

7. The combination, in a furnace, of a coking fuel feeder or hopper consisting of an imperforate outer casing or shell provided with suitable registered air-inlets and a perforated inner casing or shell, the two shells being separated to form an intervening air-space, and a door or inlet, D, opening to the interior of the furnace above its floor or grate, substantially as set forth.

8. The combination, with a furnace, of a fuel-coking feeder or hopper consisting of two shells, one within the other and separated by an air-space, the outer shell constructed to supply a predetermined amount of air to the said air-space, and the inner shell, or fuel-holder proper, perforated to admit air from said air-space to the fuel, substantially as and for the purposes shown.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

M. D. LEGGETT.

Witnesses:
W. ENGEL,
CHAS. FRYE.