(No Model.) 2 Sheets—Sheet 1.

W. L. DRAKE.

SMOKE CONSUMING FURNACE.

No. 420,534. Patented Feb. 4, 1890.

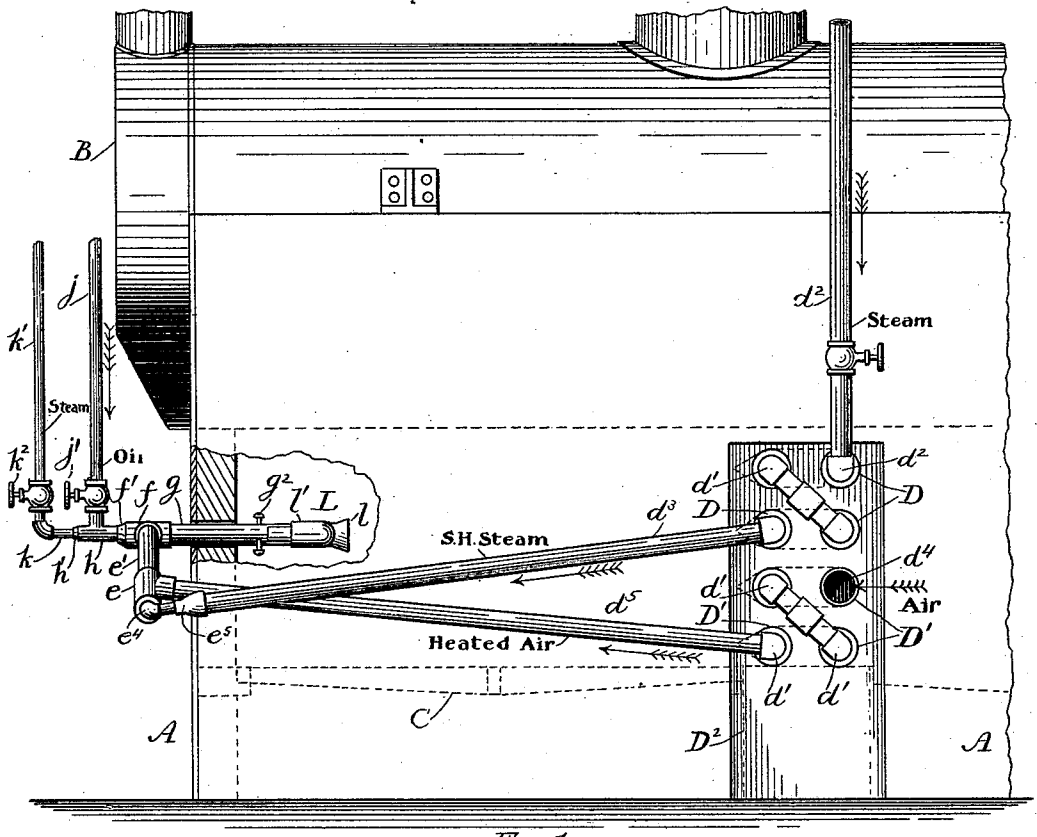


FIG. 1.

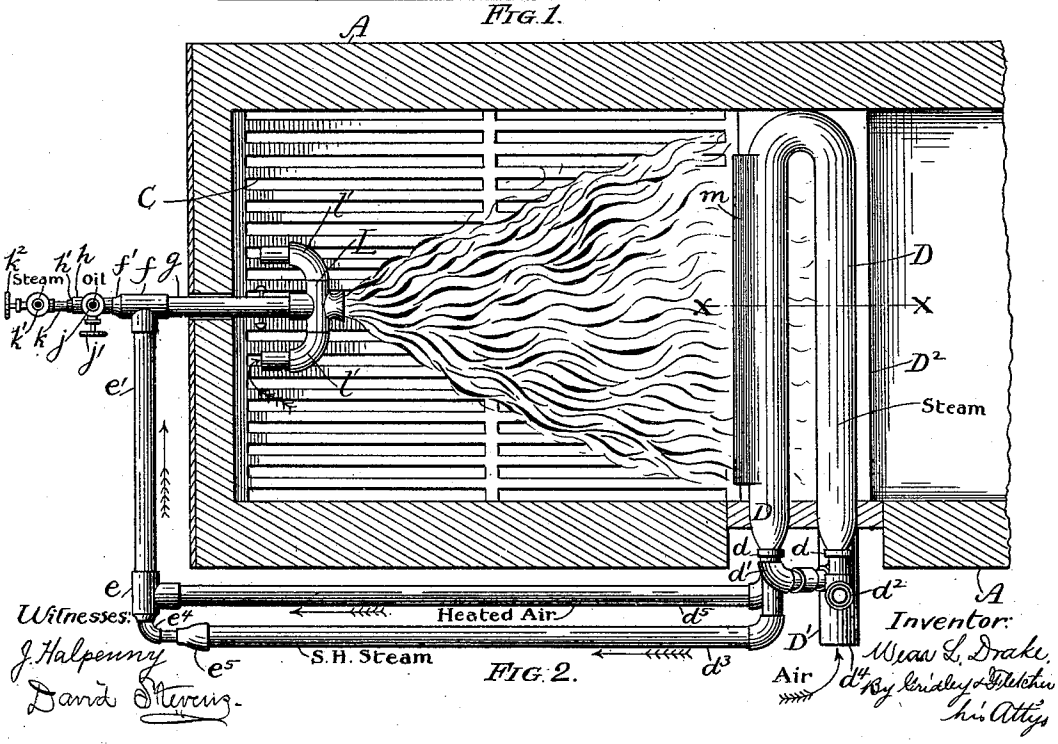


FIG. 2.

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David Stevens

Inventor:
Wm. L. Drake,
By Bridley & Fletcher
his Attys

N. PETERS, Photo-Lithographer, Washington, D. C.

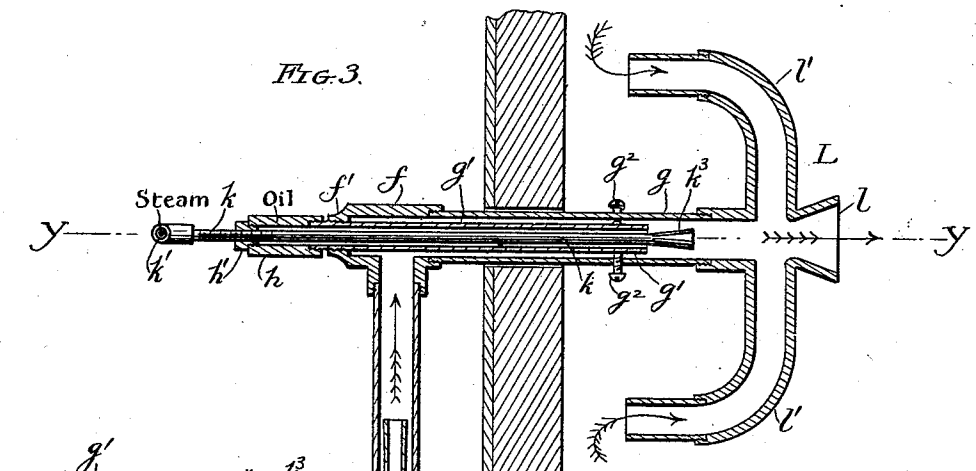
(No Model.) 2 Sheets—Sheet 2.

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FIG. 3.



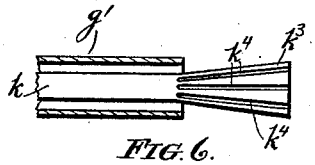


FIG. 6.

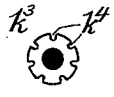


FIG. 7.

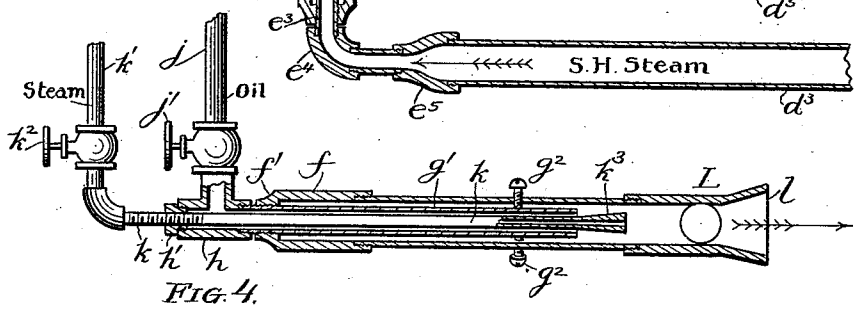


FIG. 4.

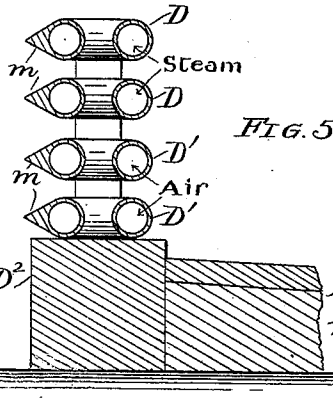


FIG. 5.

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Inventor:
Wear L. Drake.
By Gridley & Fletcher
his Attys.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

WEAR L. DRAKE, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO FREEMAN LANE, OF SAME PLACE.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 420,534, dated February 4, 1890.

Application filed May 27, 1889. Serial No. 312,226. (No model.)

To all whom it may concern:

Be it known that I, WEAR L. DRAKE, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Smoke-Consuming Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a side view of a portion of a boiler and furnace, the latter being partially broken away to show the interior. Fig. 2 is a plan view of said furnace in horizontal section. Fig. 3 is a horizontal sectional view in detail of a portion of said furnace and the pipes which form the burner. Fig. 4 is an enlarged detail view, in section, of the pipes by which the oil, air, and steam are delivered to the mixer, said view being taken upon the line *y y*, Fig. 3. Fig. 5 is a vertical sectional view taken upon the line *x x*, Fig. 2. Fig. 6 is a detail view of the oil-pipe and cone-shaped valve; and Fig. 7 is an end view of said cone-shaped valve, showing the grooves therein.

Like letters of reference in the different figures indicate like parts.

The object of my invention is to provide a smoke-consuming furnace for burning coal, wood, oil, or other fuel, but preferably oil, and to so construct and arrange the coils of pipe therein as to enable air and steam passing through them to be superheated for the purpose of promoting combustion, while at the same time said pipes may form a bridge-wall beneath the boiler adapted to spread and thoroughly distribute the flame, all of which is hereinafter more particularly described and claimed.

Referring to the drawings, A represents the usual wall or "boiler-setting," while B indicates the boiler, which is placed therein in the ordinary way.

C represents the usual grate, which may be used, if preferred, with a wood or coal fire, in connection with superheated steam and air, to promote combustion or to generate steam in first starting the fire, preliminary to lighting the oil, if the latter be employed.

Within the furnace, at the rear end of the grate and in the position occupied by the usual bridge-wall, I place a series of coils D D′, (better represented in Figs. 2 and 5,) the pipes in said coils being arranged transversely to the furnace and parallel to but separated from each other, so as to leave spaces between them horizontally, as well as vertically, for the purpose hereinafter stated. The bottom coil rests upon a suitable base D^2, Fig. 5, and one end of each of said coils protrudes through the side wall of the furnace, where the members of the respective sets D D′ are connected by means of thimbles *d d*, unions *d′*, and the usual pipe-connections with each other, and with induction and eduction pipes d^2 d^3 and d^4 d^5, respectively. The pipe d^2 connects the coil D with the steam-dome of the boiler, while the pipe d^4 is open for the admission of air thereto. The pipe d^5 leads directly to a junction *e*, (better shown in Fig. 3,) with which it is connected by means of a T, as clearly shown in the drawings.

The interior diameter of the junction *e* is preferably the same as that of the pipe d^5, and a pipe *e′* is connected therewith, into which is inserted a shorter and smaller pipe e^2, Fig. 3, which also passes through the junction *e*, into which it is tapped at e^3, protruding sufficiently to receive a union e^4, with which the steam-pipe d^3 is connected by means of a reducer e^5 and an intermediate pipe. The pipe *e′* is connected with a junction *f*, similar to the junction *e*, into which is tapped a pipe *g*, arranged at right angles to the pipe *e′*, and leading through the front wall A into the furnace. Placed within the pipe *g* and tapped through the outer end of the junction *f* at *f′* is a pipe *g′*, Figs. 3 and 4, which is somewhat shorter than the pipe *g*, and its free end is adjusted concentrically therein by means of three or more screws g^2, Figs. 3 and 4. The screw-threaded end of the pipe *g′* is caused to project sufficiently from the junction *f* to connect with another junction *h*, into which it is tapped, and to which is attached an oil-pipe *j*, communicating with a source of supply and provided with a valve *j′* for regulating the flow of oil. In the opposite end of the junction *h* from that of its connection with the pipe *g′* is inserted a screw-plug *h*, into which is tapped a small pipe *k*, which is inserted within the pipe *g′*. Said pipe *k* is

connected by means of a union with a steam-pipe k', communicating with the boiler and provided with a regulating-valve k^2. The pipe k is made somewhat longer than the pipe g', within which it is inserted, and the projecting end k^3 is made cone-shaped (see Figs. 3, 4, and 6) and provided with grooves k^4, Figs. 6 and 7, for the purpose hereinafter stated. The pipe k, by means of the screw-thread by which it is connected with the screw-plug k', is rendered adjustable, so that the cone-valve k^3 upon the end may be drawn into or protruded more or less from the pipe g'. Upon the end of the pipe g is screwed or otherwise attached a hollow mixer L, having a bell-shaped mouth l concentric with the axis of the pipe g, and provided with lateral inlet-pipes l' l', which are open at the ends and arranged, preferably, within the furnace for the purpose of receiving hot air therein.

Having thus described the specific parts of my invention, I will now describe its operation, first, in connection with oil, and, secondly, with coal or other fuel. The steam from the boiler entering from the pipe d^3 passes through the coil D, and the air entering through the pipe d^4 passes through the coil D'. Both become superheated and commingle in the pipe e', the air being drawn in around the pipe e^2 by the force of the steam issuing from the end of said pipe. The commingled superheated air and steam pass on, as indicated by the arrow, into and through the annular space between the pipes g g', at the end of which they are brought into contact with the oil admitted through the pipe g', which passes around the end of the conical projection k^3 and into contact with the steam from the pipe k, which is intended to aid in feeding the oil and in breaking up and decomposing it. The cone-valve k^3 may be adjusted to feed a greater or less quantity of oil, according as it is protruded from or drawn into the pipe g', and the grooves k^4 form a factor of safety, in that if the cone is drawn back tightly into the mouth of the pipe in which it is placed the grooves k^4 still permit the escape of oil, and thereby prevent danger from explosion. The commingled superheated steam and air, with the oil, are thus driven with great force through the mixer L, thus creating a draft of partially-heated air through the inlet-pipes l' l', and the whole is ejected in the form of an intensely-hot spreading flame from the bell-mouth l directly against the coils D D', which take the place of the usual bridge-wall, and thus, while serving to superheat the steam and air, serve also to separate and distribute the flame beneath the boiler. It is obvious that the pipes g g' k and their connections form not only a retort, but an inspirator by which the commingled oil, steam, and air are decomposed and forced into the furnace.

In order to enable the coils D D' to withstand the intense heat to which they are subjected, I cause them to be made thicker upon the front side by casting a knife-edge projection upon each, as shown at m, Figs. 2 and 5, while it will be observed that all of the joints by which connection is made with said coils are placed outside of the furnace-wall.

It is obvious that the pipes d^3, d^5, and e' may be protected by means of asbestus or otherwise to prevent loss of heat therefrom.

If it is desirable to dispense with the use of oil and to employ coal, wood, or other fuel, it is manifest that the supply of oil may be cut off by merely closing the valve j', or the pipe j may be dispensed with, in either of which cases the injection of the superheated steam and air over the flame of the coal or wood fire would cause complete combustion. It may often be found advantageous to employ oil with other fuel.

By means of my improved furnace the oil, coal, or other fuel may be completely burned with a widely and evenly distributed flame having an intense heat, while the formation of smoke is entirely prevented.

The economy and steam-generating power of my improved furnace is very great, as has been evidenced by practical tests.

Having thus described my invention, I claim—

1. The combination, in a smoke-consuming furnace, of a bridge-wall consisting of pipes having communication with the outer air and a source of steam-supply, respectively, and connected with an inspirator in operative communication with the furnace, substantially as described.

2. The combination, in a smoke-consuming furnace, of a bridge-wall consisting of pipes having communication, respectively, with the boiler and a source of air-supply, and an inspirator in operative connection with the furnace and arranged to project the commingled superheated steam and air against said bridge-wall, substantially as shown and described.

3. The combination, in a smoke-consuming furnace, of a bridge-wall consisting of pipes having communication, respectively, with a source of steam and air supply, an inspirator for injecting the commingled superheated air and steam into the furnace, and a mixer in operative connection therewith, whereby air may be added thereto to support combustion, substantially as shown and described.

4. The combination, with a smoke-consuming furnace, of a bridge-wall consisting of the coils D D', having connections, respectively, upon the outside of the furnace-wall with sources of air and steam supply and an inspirator, substantially as shown and described.

5. In a smoke-consuming furnace, the combination, with a bridge-wall composed of pipes arranged transversely within the furnace, of a source of steam and air supply, an inspirator, and a source of oil-supply, substantially as shown and described.

6. The combination of the coils D D', ar-

ranged as specified, means for supplying steam and air thereto respectively, pipes d^3 d^5 e' e^2 g g' k, a source of oil-supply, and a mixer L, substantially as shown and described.

7. The combination, with pipes for superheating air and steam, of the pipes e' e^2 in operative connection therewith, an oil-induction pipe g', arranged within the pipe to which said superheated air and steam are admitted, and a steam-pipe inclosed within said oil-pipe and protruding from the open end thereof, substantially as shown and described.

8. In a smoke-consuming furnace, the combination, with a bridge-wall composed of coils of pipe arranged transversely within the furnace, of a pipe, as e', for receiving the commingled air and steam from said bridge-wall, a pipe, as g, communicating therewith and arranged at right angles thereto, the oil-pipe g', and center steam-pipe k, said pipe g and those inclosed therein being arranged at right angles to said steam and air pipe coils forming the bridge-wall, whereby the flame may be spread and directed against said bridge-wall, substantially as shown and described.

In testimony whereof I have signed this specification, in the presence of two subscribing witnesses, this 23d day of May, 1889.

WEAR L. DRAKE.

Witnesses:
D. H. FLETCHER,
J. HALPENNY.