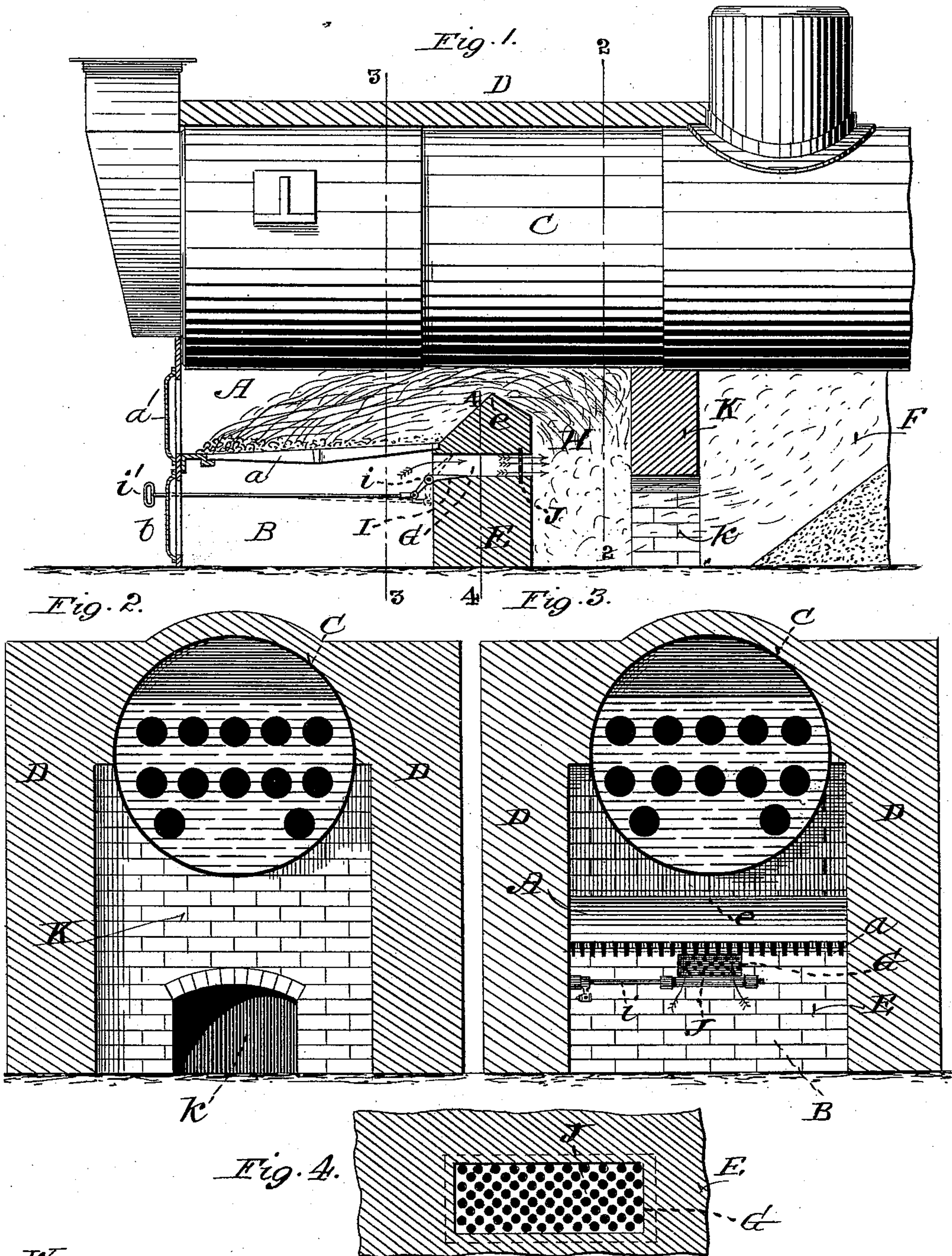


(No Model.)

F. PERCIVAL & F. H. LUDINGTON.
SMOKE ABATING FURNACE.

No. 532,578.

Patented Jan. 15, 1895.



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FREDERICK PERCIVAL AND FRANCIS H. LUDINGTON, OF ST. LOUIS,
MISSOURI.

SMOKE-ABATING FURNACE.

SPECIFICATION forming part of Letters Patent No. 532,578, dated January 15, 1895.

Application filed October 25, 1893. Serial No. 489,101. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK PERCIVAL and FRANCIS H. LUDINGTON, of St. Louis, Missouri, have made a new and useful Improvement in Smoke-Abating Furnaces, of which the following is a full, clear, and exact description.

The invention under consideration is an improved means whereby familiar principles involved in the prevention or abatement or, as it is apt to be styled, the consumption, of smoke in or from a furnace are advantageously applied. The construction involved in carrying out the improvement is easily set up and at a comparatively small cost. But little or no repairs are required. No power is needed for operating it, nor is any special skill. It can be used in almost any style of furnace and with almost any kind of furnace-bars, doors, or boiler-front. The fuel is economized, and a very thorough combustion is obtained. The means referred to are largely elements or features some of which have been previously employed. Others of them it is thought are now for the first time exhibited, and they are useful not only in the special construction here shown but also in other constructions more or less analogous, and the entire combination of parts as shown is especially valuable in that by means thereof the avoidance or abatement of smoke from a furnace is very effectually accomplished.

The improvement, which is illustrated in connection with a steam-boiler consists mainly in the provision for completely, or more thoroughly, consuming that portion of the fuel which passes the bridge-wall of the furnace, substantially as is hereinafter set forth and claimed, aided by the annexed drawings, making part of this specification, in which—

Figure 1 is a view showing, in vertical-longitudinal central section, a furnace having the improvement embodied therein; the associated boiler being shown in side elevation; Fig. 2, a vertical cross section on the line 2—2 of Fig. 1; Fig. 3, a vertical cross section on the line 3—3 of Fig. 1; and Fig. 4 is a vertical cross section on the line 4—4 of Fig. 1.

The last named view is upon an enlarged scale, and the three last named views are looking aft.

The same letters of reference denote the same parts.

The fire-place, A, of the furnace is of ordinary construction. Its grate-bars are shown at *a*, and at *a'* is the doorway to the fire-place. B represents the ash-pit whose doorway is at *b*. C represents the boiler; D, the boiler-setting; E, the bridge-wall, and F the flue through which the products of combustion ultimately escape. All these enumerated parts are such as are usually employed saving as they may be modified or supplemented by the improvement under consideration.

G represents a passage extending through the bridge-wall. Its preferred position and shape are indicated in the drawings. Its office is to supply air to the flue-space, H, just aft of the bridge wall. We preferably introduce the air to the passage in question through the ash-pit, and to that end the passage at its forward end connects with the ash-pit; but wherever the air is admitted its inflow is controlled by some suitable means such, for instance as the valve I. The valve in the present case is attached to a crank-shaft *i* which is adapted to be operated by means of the handle *i'*, and the operation is indicated by the different positions of the valve shown respectively in the full and in the broken lines in Fig. 1. The inlet to the passage is preferably as close to the under side of the grate-bars as is practicable, and in order thereby to cause the air entering the passage to previously pass close or near to the grate bars and thereby become warmed. The passage, I, in width is preferably considerably less than that of the ash-pit and fire-place, and it is arranged centrally in the bridge-wall, substantially as shown. We consider it desirable to divide the air current flowing through the passage into many small currents or jets and to this end a perforated plate, J, is arranged crosswise in the passage substantially as shown.

To carry out the improvement more fully the gases and unconsumed portion of the fuel

which pass the crest, *e*, of the bridge wall are not allowed to escape directly along the under side of the boiler but are compelled to meet the air flowing from the passage G. Accordingly they are turned downward after passing the bridge-wall, and are directed across the path that the air takes coming from the bridge-wall passage and the two currents are thereby intermingled. The flue-space H through which the gases, &c., are thus directed is, in the present instance, included between the bridge-wall and a cross wall K. This last named wall at its sides and top meets the boiler-setting and boiler to prevent any direct escape from the fire-place, but at a point opposite or below the level of the bridge wall passage there is an opening, *k*, in the wall, or the wall is so made, to provide opportunity for the escape from the flue-space H into the flue F.

To more effectually intermingle the fire-place and the bridge-wall currents the opening *k* is arranged centrally in the width of the wall K and is narrowed to a width much less than the width of the flue-space H. The preferable relative arrangement of the bridge wall and the wall K is shown. In the event the furnace is employed in connection with some other object than the boiler here shown the currents from the fire place are directed downward after passing the bridge wall by means of any part or parts that are the equivalents of the boiler and wall K.

In operation the fuel is consumed in the fire-place in the ordinary manner. The products of combustion pass over the bridge wall in a highly heated condition and are thence directed downward through the flue space H. At this point they meet the air delivered through the bridge wall passage and the unconsumed portion of the fuel that escapes from the fire place is in consequence very thoroughly if not entirely consumed before it reaches the opening *k* in the wall K. The combustion is facilitated by reason of the air being heated in passing through the bridge-wall, and in this respect an advantage is derived from the air being heated by passing through the ash-pit in the vicinity of the grate-bars. The division of the air current into jets as described further promotes the desired action. The quantity of air introduced through the bridge wall can be carefully graduated by means of the described valve, the valve being opened wider when more air is desired. The operator with a little experience can accurately determine the quantity of air needed. It will be noticed that the valve-pivot is arranged at the bottom of the bridge wall passage. We consider this desirable in that thereby the inflowing air is always directed upward into the vicinity of the grate-bars and the upper portion of the bridge-wall which with the grate-bars is more highly heated than the lower portions of the

construction. We also consider it desirable for the outlet from the flue space H to be choked substantially as described as thereby the fire place current and the air current are more surely intermixed. By using all of the described features in combination the best results are attained. The flue space H may be considered an auxiliary combustion chamber.

We claim—

1. In a boiler furnace, the combination of the fire-place, A, provided with a grate, the ash-pit B, below the grate; the bridge wall E, back of the fire-place and ash-pit, the flue space H, back of the bridge-wall, the central air passage in the bridge wall, opening at one end at a point below the grate into the ash-pit and at the other end at a point not higher than about the level of the grate into the flue space H, the plate I, having small perforations through it and arranged crosswise in the passage J near its inner end and delivering jets of air into the flue space H; the cross wall K, the central opening *k* opposite the air-passage I, narrower than the width of the flue space H, and having its top at about the level of the top of the passage I, and a passage from the rear of the wall K for the escape of the products of combustion, substantially as described.

2. In a boiler furnace, the combination of the fire-place A, provided with a grate, the ash-pit B, below the grate, the bridge-wall E, back of the fire place and ash-pit; the flue space H, back of the bridge wall; the central air passage in the bridge wall, opening at one end at a point below the grate into the ash-pit and at the other end at a point not higher than about the level of the grate into the flue space H, the plate I, having small perforations through it and arranged crosswise in the passage J near its inner end but back of the rear face of the bridge-wall and delivering jets of air into the flue space H, the cross wall K, the central opening *k* opposite the air passage I, narrower than the width of the flue space H, and having its top at about the level of the top of the passage I, and a passage from the rear of the wall K, for the escape of the products of combustion, substantially as described.

3. In a boiler-furnace the combination of the fire-place A, provided with a grate, the ash-pit B, below the grate, the bridge wall E, back of the fire place, the ash-pit; the flue space H, back of the bridge-wall; the central air passage I, in the bridge-wall, opening at one end into the ash-pit, at a point near the grate, and at the other end, at a point not above about the level of the grate, into the flue space H; the valve attached to the crank shaft *i* and the handle *i'*, and arranged at the ash pit end of the passage I, the perforated plate J arranged crosswise in the passage I, near its inner end, and delivering jets of air into the flue space H, the cross wall K; the

opening $\frac{1}{2}$ in the cross-wall, opposite the air
passage I, narrower than the width of the flue
space H, and having its top at about the
level of the top of said passage I, and a pas-
5 sage from the rear of the wall K, for the es-
cape of the products of combustion, substan-
tially as described.

Witness our hands this 23d day of Octo-
ber, 1893.

FREDERICK PERCIVAL.
FRANCIS H. LUDINGTON.

Witnesses:

C. D. MOODY, '
A. BONVILLE.