

No. 654,250.

Patented July 24, 1900.

A. HEBERER.
SMOKELESS COAL BURNING FURNACE.

(Application filed Oct. 24, 1898.)

(No Model.)

Fig. 1.

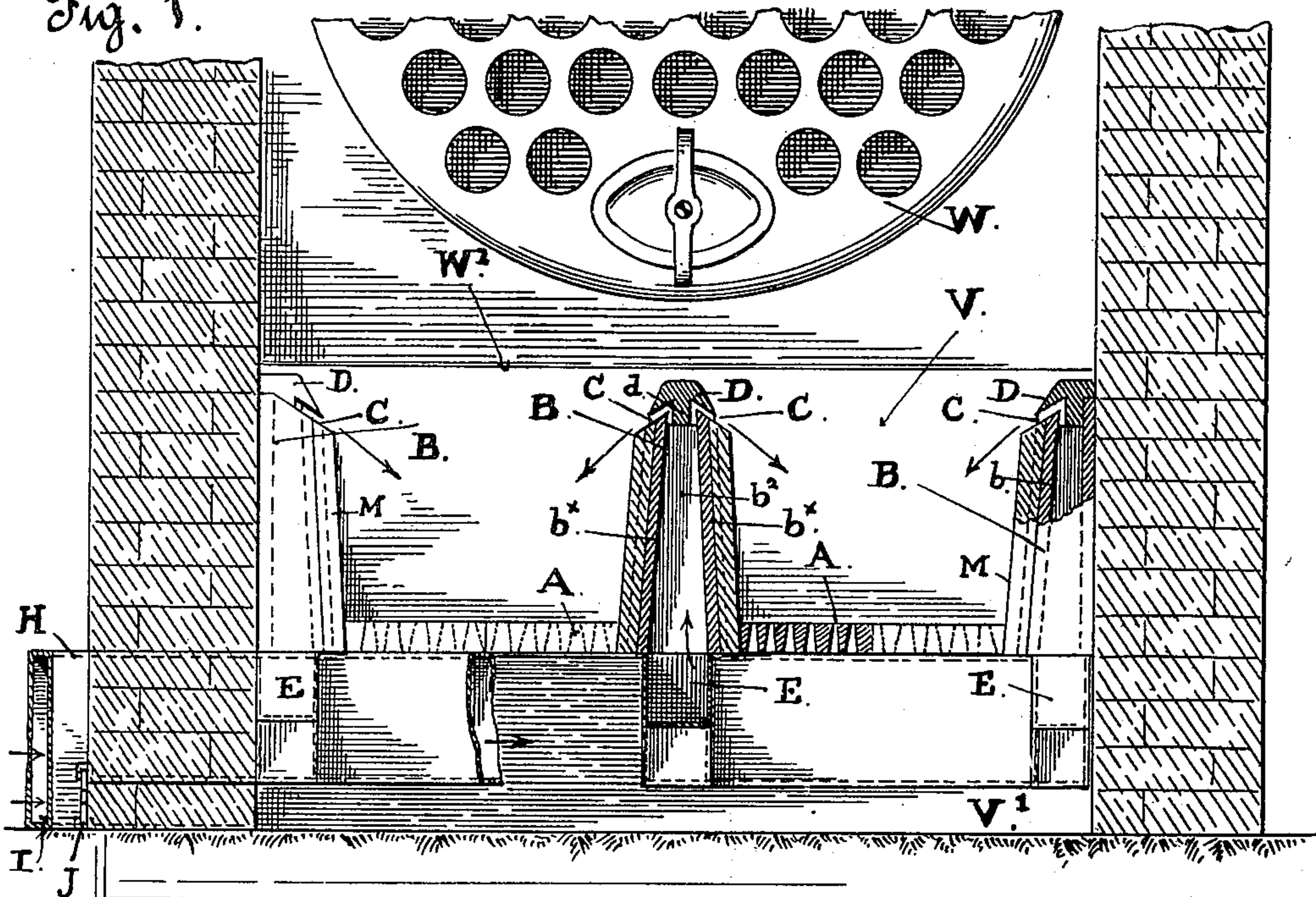
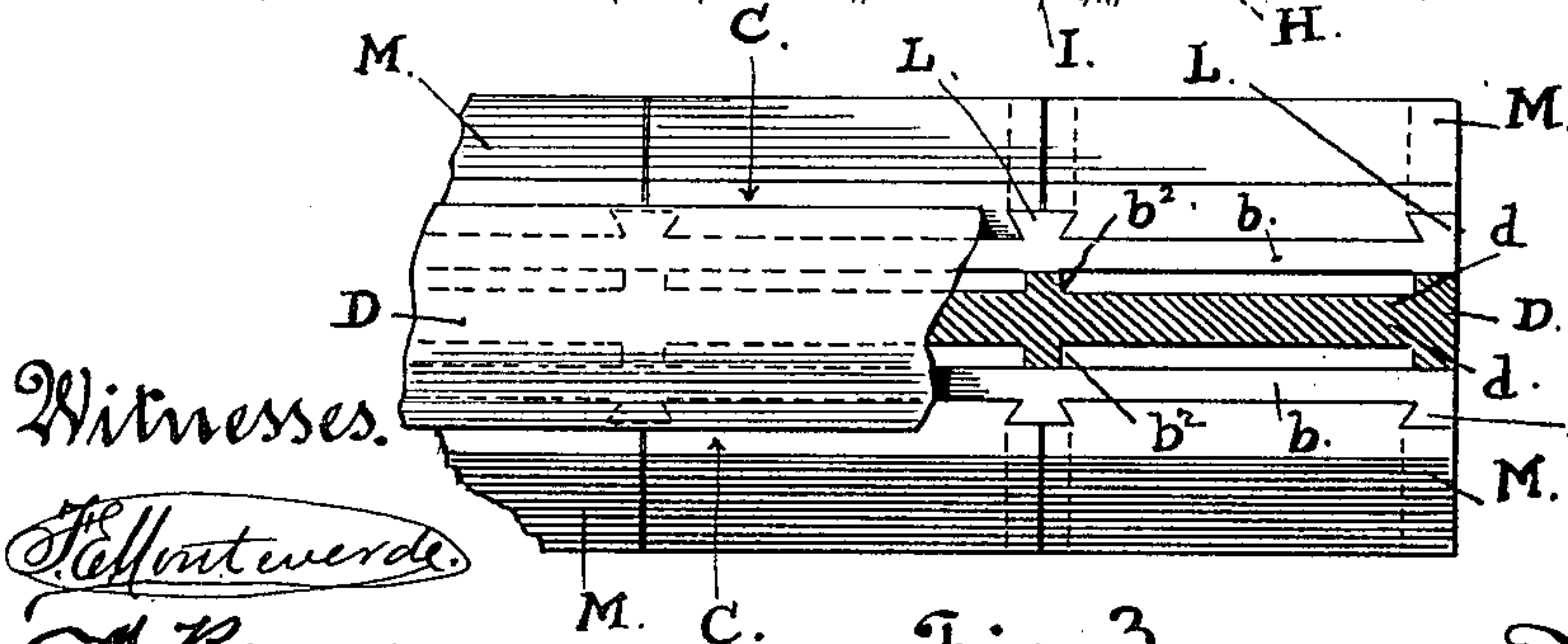
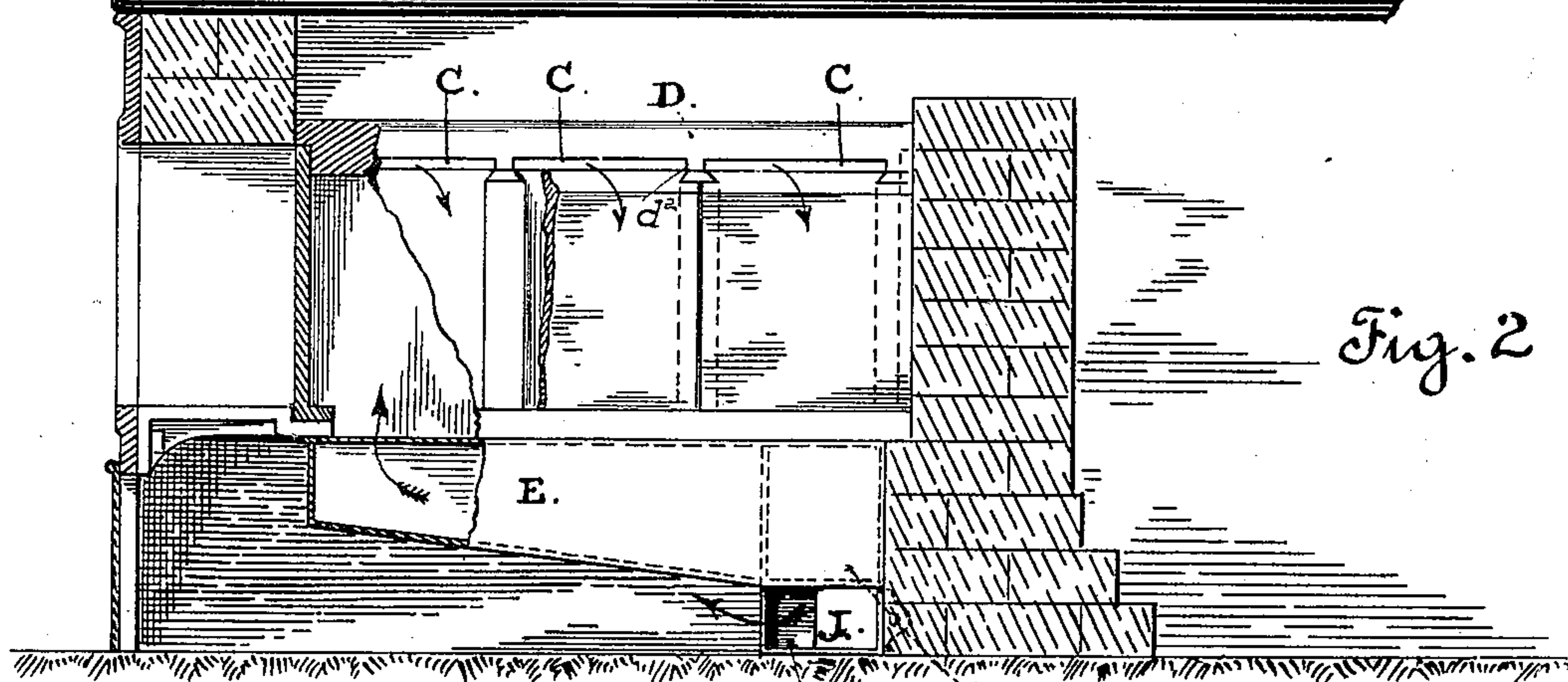


Fig. 2



Witnesses.

P. Montwerde
A. Regner

Fig. 3.

Inventor.

Adam Heberer

by
Smith & Son,
his attorney.

UNITED STATES PATENT OFFICE.

ADAM HEBERER, OF ALAMEDA, CALIFORNIA.

SMOKELESS COAL-BURNING FURNACE.

SPECIFICATION forming part of Letters Patent No. 654,250, dated July 24, 1900.

Application filed October 24, 1898. Serial No. 694,456. (No model.)

To all whom it may concern:

Be it known that I, ADAM HEBERER, a citizen of the United States of America, residing in the city of Alameda, county of Alameda, and State of California, have invented certain new and useful Improvements in Smokeless Coal-Burning Furnaces, of which the following is a specification.

This invention relates to the construction of furnaces for burning coal under steam-boilers and in other situations in the arts and manufactures where heat is to be generated and applied for various purposes; and the invention consists in certain novel parts and combination of parts, as hereinafter fully described and claimed and as illustrated in the accompanying drawings, forming part of this specification, in which—

Figure 1 represents in front elevation a construction of furnace for burning coal under a tubular boiler embodying my invention, the front of the furnace and boiler setting being broken away and portions of the grate-surface shown in section to expose the interior construction. Fig. 2 is a longitudinal section through the furnace; Fig. 3, a top view, on an enlarged scale, of a portion of one of the partitions or standing sides of the fuel-troughs, the top of the partition being broken away in part.

The present improvements have for their object mainly to produce a furnace simple in construction and efficient in operation for burning bituminous and lignite coals without smoke, whereby coals of the soft kinds or varieties above mentioned can be used to advantage for fuel in many situations and localities where their use is practically prohibited at the present time in the ordinary furnace on account of their smoke-producing qualities.

Grate-bars A A, of ordinary construction, form the fuel-supporting surface, dividing the furnace-space under a boiler W into the usual fire-chamber V and ash-pit V'.

Extending perpendicularly upward from the grate-surface at uniform distances apart are standing partitions B B, that separate the fire-chamber into trough-like sections, the sides of which are formed by the partitions and the bottom by the grate-surface. These

partitions, running longitudinally from the front of the furnace back to the bridge-wall W', are constructed with hollow spaces or chambers open at the bottom through the base of the partition, but closed at the top end of the partition. Usually the sides are made sloping, giving the partition greater width across the bottom than at the top to gradually contract the interior air-passage. The plates $b \times b$, forming the sides, are joined together by cross-webs b^2 at intervals of distance apart, forming a stiff structure with a chamber or air-passage extending from top to bottom. The opening along the top between the standing sides is covered by a ridge plate or cap D, under which are long slits or elongated openings C C extending from front to rear. Each partition is thus composed of the standing side plates united by cross-webs and the cap or top piece covering the top opening. This last-named part D is formed with a tongue d along the bottom or under side setting into the space or opening between the plates $b \times b$, and in addition to this the under side of the cap is grooved or recessed or otherwise suitably formed to leave slits C and projecting ribs or lugs d^2 at intervals of distance apart to rest directly upon the top edges of the standing sides and support the cap above the edges of the plates at several points in its length of the cap. These supports d^2 are placed at points in the length of the partition where the cross-webs are situated, making the slits or openings C correspond in number and length with the air-compartments in the partition. As many of these upright partitions are set in a furnace as the width of the grate-surface may be found to require in producing the desired width and number of troughs, and they are set against the sides of the fire-box or furnace, as well as through the fuel-space between the sides of the furnace. Thus in a furnace of two troughs, which would be the smallest number arranged for operation in a narrow furnace, a central hollow partition would form the one side of each trough, while the remaining sides would be composed of a standing partition placed against each side of the brickwork setting or side walls of the furnace, thereby providing a set or row of air-apertures along both sides

of each trough. The number of intermediate partitions will be increased according as the fuel-space increases in width.

The hollow spaces or chambers in the whole
5 set or number of partitions are connected with a common air-supply trunk or pipe H by an air-box E in the ash-pit fixed in place against or immediately beneath the open bottom of the partition under the grate-surface. These
10 boxes extend from front to rear of the ash-pit and are united by a pipe H, carried through the outside of the furnace to the outside for convenience in connecting an air-pressure apparatus, such as an air-blower or a pressure-
15 fan. Such means of the kind is connected with this conducting-pipe as will maintain in the hollow partition a constant supply of air under pressure above that of the atmosphere and at such degrees of pressure that the
20 streams or currents of air issuing from the air-slits C in the sides of each trough will meet together over the middle of the trough above the top of the mass of fuel and be thrown or forced into contact with the top surface of
25 the fuel. A pressure between one-half an ounce and one ounce in excess of atmospheric pressure will be found to produce the most thorough and effective combustion of the fuel without the production of smoke,
30 and ordinarily this pressure will not exceed one-half an ounce. The air-outlets C are given an inclination downward at a suitable angle to deflect the air-streams from the sides of the trough and bring them together from
35 opposite directions over the grate-surface and above the top line of the fuel. The degree of this inclination of the air-slits is governed and determined by the height of the standing sides, the width of the trough, and the
40 depth to which the body of fuel is maintained in firing the furnace. Such variation is to be made in the inclination of these air-slits to accommodate or conform to the above conditions as will cause the slits to deliver the air-
45 streams properly over and against the body of fuel and always at such angles that the surface of the fuel will be completely covered by the opposing streams of air meeting together.

50 The outlets C should be situated below the level of the top of the bridge-wall of the furnace, so as to completely confine within the trough the volatile and gaseous products as they are generated and released from the
55 solid fuel and prevent them from passing beneath the air-currents and escaping over the bridge-wall without undergoing conversion and combustion. By placing the opening over the top of the bridge-wall, above the
60 line of the air-apertures, the gaseous compounds arising from the fuel are compelled to mingle and combine with the air-currents in such manner as to secure complete combustion before these products can condense
65 or precipitate in the form of smoke.

Air is admitted into the ash-pit under the grate-surface of each trough to supply to the

solid or carbonaceous portion of the fuel the necessary volume of oxygen to secure active combustion and maintain an incandescent
70 condition of the mass of fuel. This may be done through the usual draft-openings in the front of the ash-pit, or, as I prefer to do, by setting an air-pipe I through the side wall of the furnace and connecting it with the air-
75 supply pipe leading from the air-blower. The quantity of air so admitted beneath the grate-surface to pass through the fuel should be the least that will furnish the required volume of oxygen to the solid portion of the
80 fuel in the trough to maintain active combustion and an incandescent condition in the burning fuel, and any excess of pressure or upward draft which would tend to force or
85 carry the newly-formed volatile and gaseous compounds away from close relation or proximity to the incandescent body of fuel should be avoided.

In situations where the natural draft of the furnace will supply the required quantity
90 and pressure of air in the ash-pit the usual draft-openings can be made available or the air can be admitted through the pipe I.

A valve or damper J is provided in the air-supply pipe I for regulating the volume of
95 air introduced under the grate-surface.

The sides of the standing partitions are protected from the direct heat of the fire by slabs or tiles M, of fireproof material, such as fire-brick and tiles are made of. These
100 protectors are held in place against the sides of the partitions by casting dovetail ribs or projections L L on the outer face of the plates and suitably dovetailing or grooving the edges
105 of the slabs to interlock with them. This construction permits repairs to be readily made at any time as the slabs become broken or burned without removing or disturbing the partitions.

In addition to their functions as conducting and distributing passages the standing
110 partitions and the trunks or conductors under the grate-surface operate to raise the temperature of the air before it is introduced into the gaseous products in the fuel-troughs.
115

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

1. In a boiler-furnace a grate-surface, hollow standing partitions extending from the
120 front plate to the bridge-wall the entire depth of the furnace, said partitions being composed of cast-iron plates inclosing a central air-space open at the top and opening at the bottom into the air-spaces below the grate-
125 surface, dovetailed ribs or projections on the outer faces of said plates, tiles of fireproof material fitted to said ribs and covering the metal plates, and a fixed cap covering the open top of the partition and having over-
130 hanging downwardly-slanting sides which stand clear of the top of the metal plates in combination, for operation as described.

2. In a boiler-furnace the combination with

a grate-surface, of hollow standing partitions
dividing the grate-surface longitudinally and
for the entire depth with separate fuel-
troughs, said partitions being composed of
5 cast-metal plates inclosing an air-space which
opens at the top into the fire-space, and at
the bottom into the space below the grate-
surface, detachable fireproof tiles covering
the outer side of the metal plates, a cap
10 partly closing the opening in the top of the
partition and having downwardly-extending

sides adapted to direct the escaping air in
streams at an angle toward the grate-sur-
face, and an air-box closing in the opening
in the bottom of the partition and provided 15
with a regulating-gate.

In testimony that I claim the foregoing I
have hereunto set my hand and seal.

ADAM HEBERER. [L. S.]

Witnesses:

EDWARD E. OSBORN,
M. REGNER.