(No Model.)

2 Sheets—Sheet 1.

H. A. WHEELER.

SMOKELESS ECONOMIZER FURNACE.

No. 581,970. Patented May 4, 1897.

Fig. I

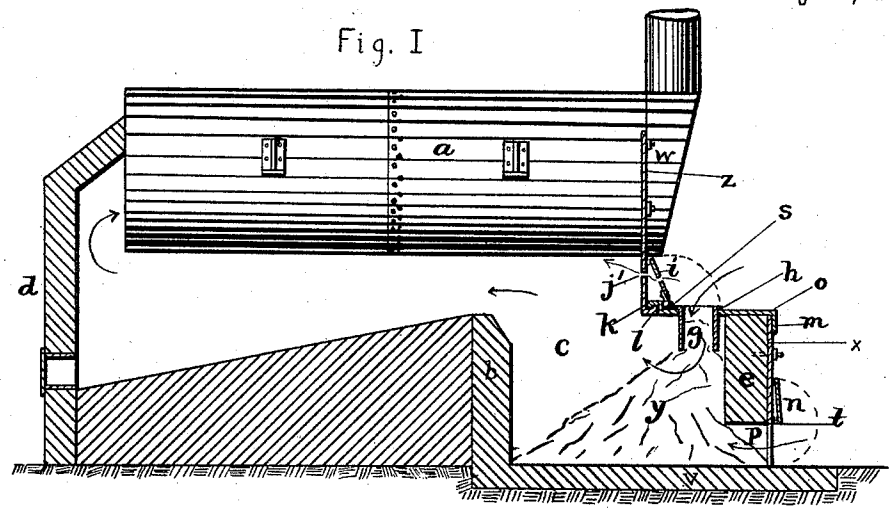


Fig. II

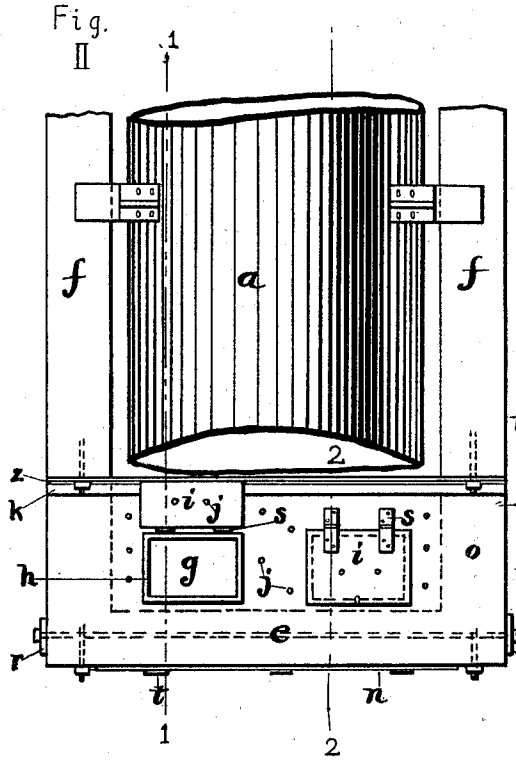
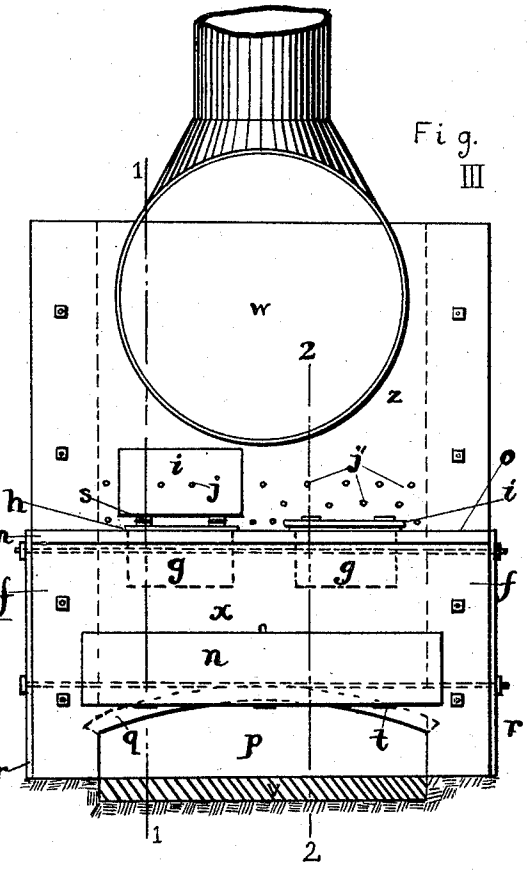


Fig. III



Witnesses,

Isaac L. Judson.

James B. Robertson.

Inventor,

Herbert Allen Wheeler.

(No Model.) 2 Sheets—Sheet 2.

H. A. WHEELER.

SMOKELESS ECONOMIZER FURNACE.

No. 581,970. Patented May 4, 1897.

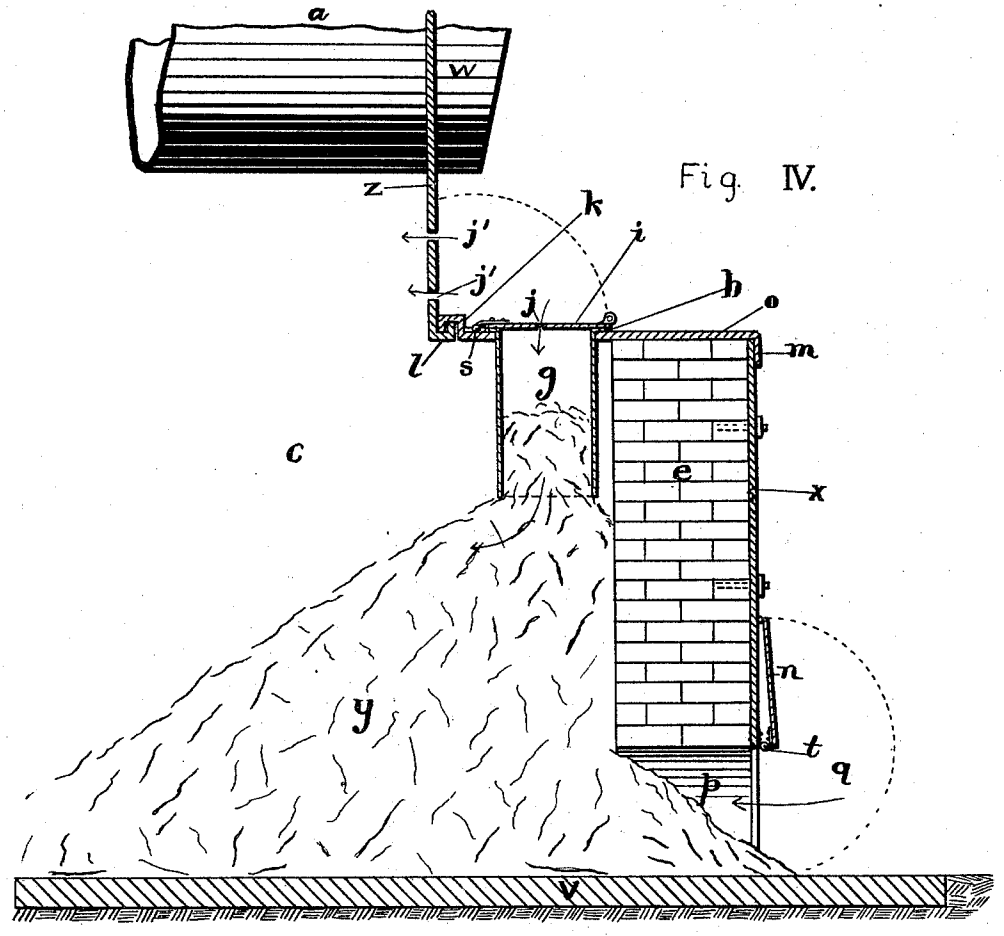


Fig. IV.

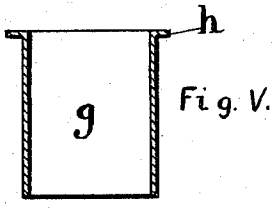


Fig. V.

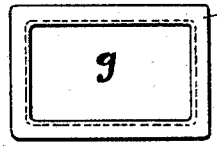


Fig. VI.

Witnesses,

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James D. Robertson.

Inventor,

Herbert Allen Wheeler.

UNITED STATES PATENT OFFICE.

HERBERT ALLEN WHEELER, OF ST. LOUIS, MISSOURI.

SMOKELESS ECONOMIZER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 581,970, dated May 4, 1897.

Application filed January 6, 1896. Serial No. 574,529. (No model.)

To all whom it may concern:

Be it known that I, HERBERT ALLEN WHEELER, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented new and useful Improvements in Smokeless or Smoke-Consuming Economizer Fire-Boxes or Furnaces, of which the following is a specification.

My invention relates to improvements in the fire-box or furnace of boilers, kilns, roasters, or other devices where the production of heat without smoke is desired, to obtain a maximum economy of fuel by securing complete combustion, to maintain a uniform heat, to reduce the cost and maintenance of the furnace, and to avoid the waste of fuel that usually arises when cleaning fires that are carried on grate-bars; and with these objects in view my invention consists of the novel devices and combinations hereinafter described and specifically claimed.

In the accompanying drawings, on two plates, Figure I is a longitudinal section through the furnace on the line 1 1. Fig. II is a plan. Fig. III is a front elevation. Fig. IV is an enlarged longitudinal section on the line 2 2. Fig. V is an enlarged section of the fire-pot, and Fig. VI a plan of the same.

Similar letters refer to similar parts in all the views.

Of the various applications that may be made of the furnace I have shown it applied to a boiler *a* for making steam, as this is the field in which there is the greatest demand for a non-smoke-making economical furnace, but I do not limit its use to this purpose, as there are many other uses where these advantages are greatly desired, as in kilns for clay-wares, lime and cement kilns, roasting-furnaces, heating-furnaces, or any purpose where the most economical production of heat is desired with the avoidance of smoke.

The fire-box or furnace consists of a combustion-chamber *c* between a fire-bridge *b*, made of fire-brick, and a front fire-wall *e*, made of fire-brick and lined on the bottom *v* with fire-brick, sand, or any suitable refractory material.

The furnace is fed through fire-pots *g*, that are made of cast-iron, steel, or any suitable material, and which are kept partially filled with fuel. The fire-pot has a door *i*, working on a hinge *s*, which can be used in starting or forcing the fire, though it is usually left open. This door is perforated with holes *j* to admit at least a little air for insuring complete combustion and to preserve the door by keeping it cool from the draft that will play through them. A flat plate *o*, resting on the front fire-wall *e* and side walls *f* and made of cast-iron or other suitable material, supports the fire-pots *g* by means of their lips *h*. The back of this fire-pot-carrying plate is carried by an angular lip *k*, which projects over and into a similar reversed lip *l* on the bottom of the front bearing-plate *z*, which latter rests on the side walls *f*. The front fire-wall *e* has an arched opening *p* at the bottom for the copious admission of air and the extraction of clinkers and ashes. This opening *p* is maintained by an arch *q* and is closed by a door *n*, hung on a hinge *t*. This front fire-wall is braced by an iron or steel plate *x*, which is tied into the side walls by suitable tie-rods or anchor-bolts in the usual manner and is protected on its upper edge by the overlapping lip *m* of the fire-pot plate *o*. The arch *q* is sustained by suitable buckstaves *r* and tie-rods in the usual manner.

The front plate *z*, the fire-pot plate *o*, and the fire-doors *i* are all perforated with air-holes *j* and *j'* to keep them cool and to admit air in small well-distributed streams to furnish the requisite oxygen for combustion, but not in such excess as to lower the temperature of the combustible gases.

The operation of the fire-box or furnace consists in filling the end of the combustion-chamber *c* with fuel and lighting it in the usual manner, during which the fire-door *i* is kept closed and the ash-pit door *n* open. The fuel is then fed in small amounts through the fire-pots *g*, when it forms a conical pile *y* against the front fire-wall, with its base projecting slightly into the ash-pit archway *p*. The fire-pots are kept nearly full of fuel, which as it burns away keeps settling down and needs frequent renewing. The ashes and clinkers resulting from the combustion of the fuel settle down to the ash-pit archway *p*, where they finally either fall out or are pulled out as a completely-burned clinkered mass with a hooked rod. The zone of active combustion is in front of the ash-pit door, which produces

such a heat that the ashes usually melt and slowly flow as a very stiff slag out at the base of the archway, from whence they are pulled away as desired. Their removal has a very great influence on the heat produced, as, if they are promptly removed, thus freely admitting the air, a very high temperature is attained, which readily softens the ashes and clinkers, so that they flow out. If they are not removed, they keep collecting until they form such an obstruction to the admission of air as to greatly check the fire, and the temperature of the fire is usually regulated by this method only—in more or less frequently and thoroughly removing the clinkers from this archway. A very important feature is the fact that the fuel is entirely burned up by the time it reaches the archway, so that no partly-burned fragments of fuel are removed in taking away the clinker, which alone often causes a loss of ten per cent. with poor fuels when cleaning the clinkers from the usual furnace in which the fuel rests on grate-bars. The air that enters the ash-pit archway, in passing through such a thick bed of fuel, would produce more or less carbonic oxid, and hence result in incomplete combustion of the fuel. To prevent this waste of fuel, the fire-pot doors are left open, which admits large quantities of air, that in passing through a thin bed of fuel in the fire-pot is raised to quite a high temperature, yet still retains an excess of free oxygen from the thinness of the fuel-bed in the fire-pot. A further supply of oxygen is furnished by the numerous small air-holes j', that are freely distributed in the front plate z, and j in the fire-pot plate o, by which air enters in small but numerous streams, which are warmed by abstracting heat from these metal plates, and thus ample oxygen is supplied for the complete combustion of the carbonic oxid or other imperfectly-burned gases, yet without lowering the temperature, so as to decompose the hydrocarbon gases that produce smoke. Hence the gases produced in the gas-producer action of the big pile of fuel in front of the ash-pit archway are thoroughly burned by the excess of oxygen that is supplied by the open-top fire-pots and innumerable small air-holes in the iron framework of the furnace, thus insuring complete combustion without producing any smoke, with the consequent economy in the fuel resulting therefrom, which is often as great as twenty-five per cent.

The removal of clinkers without the inrush of great quantities of cold air and the further prevention of access of cold air in large amounts in coaling, as happens with the usual grate-bar fire-boxes, permit of a uniform heat being maintained, with the resulting economy of fuel, maintenance of uniform pressure if used under a boiler, and with a great improvement in the quality of the brick or other claywork, if used in a clay-kiln, by preventing the checking that occurs when the hot ware is struck by cold air.

The clinkers that occasionally collect on the front fire-wall e are worked off by inserting a sharpened bar through the fire-pots and are withdrawn through the ash-pit archway p, and the clinkers are similarly removed from the sides and bottom of the combustion-chamber, though nearly all of the clinkers are found immediately in front of the archway, as this is by far the most active zone of combustion of the solid fuel.

This furnace is very much more economical to build than the usual type by dispensing with the grate and bearing bars, while for this reason its maintenance is much less.

The fire-pots g are made slightly smaller than the holes in the plate o for their reception, so that they can be easily removed as they burn out, and the lip h covers and protects the space that is allowed for this freedom of movement.

The lower edges of the fire-pots will burn out occasionally, but they are very simple cheap castings and can be quickly and easily replaced while the furnace is going by having them freely slip through the holes made for the min the bearing-plate o; yet the lip h prevents the leakage of air on account of the space.

The fire-pots can be made of cast-iron, steel, bronze, or any suitable material, or lined with slabs of fire-clay. They can be made of any size or number, according to the size and demands of the specific application, and of any shape or depth, though an elliptical or rectangular shape and a moderate depth will usually be found most convenient.

The fire-doors i may be hinged or hung or made to roll or slide, as may suit the convenience of the particular application, and may be made of cast-iron, steel, fire-slabs, asbestos boarding, or other convenient material, which may be perforated with air-holes or not, as preferred.

The ash-pit door n may be hung or hinged or slide and be made of any suitable material.

The bridge or fire-wall b at the back of the combustion-chamber is desirable to confine the fuel to the base of the cone formed by the sloping fuel and to retain the gases in a chamber for their thorough mixing and combustion.

The ash-pit archway p may be subdivided into a series of smaller ports or openings through the front fire-wall e, if desired, but I prefer to make this a single low archway across the entire furnace for the more convenient removal of the clinkers and to admit a larger supply of air, which can always be throttled down when a low fire is desired by lowering or partially closing the ash-pit door.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in a fire-box or furnace, of a combustion-chamber with a front fire-wall, with a dead or solid fireproof bottom to said combustion-chamber, with one or

more openings at the base of said front fire-wall, with removable fire-pots to said combustion-chamber, with said fire-pots suspended by a lip from an overhead plate, with said plate perforated with numerous small holes, substantially as shown.

2. The combination, in a fire-box or furnace, of a combustion-chamber with a solid or fireproof bottom, with a front fire-wall to said combustion-chamber, with one or more openings at the base of said fire-wall, with removable fire-pots hung from an overhead plate, with said plate interlocking with a more or less vertical front plate, with said front plate perforated with numerous small holes, substantially as shown.

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

HERBERT ALLEN WHEELER.

Witnesses:

JAMES D. ROBERTSON,

H. N. WOODRUFF.