

H. MOOR.
FURNACE.

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986,934.

Patented Mar. 14, 1911.

2 SHEETS—SHEET 2.

Fig. 3.

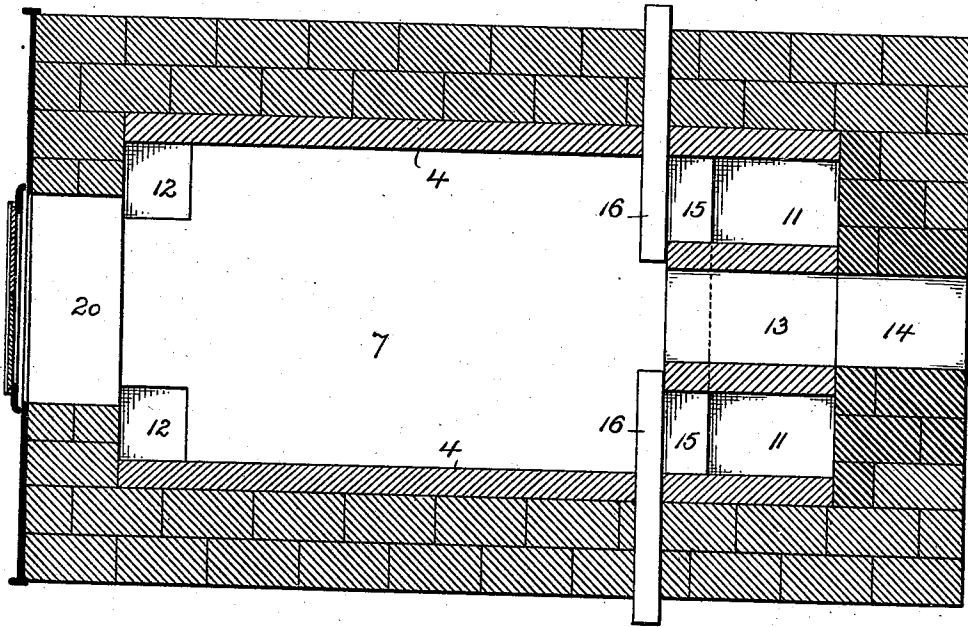
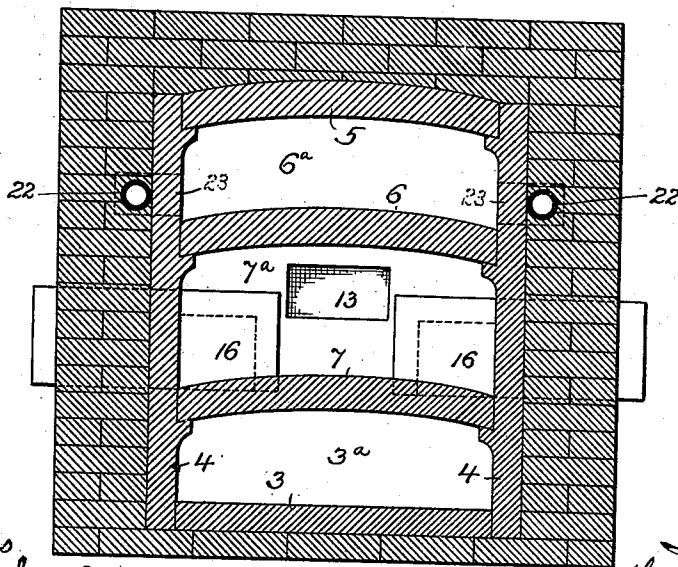


Fig. 4.



Witnesses
Harry L. Smith
Hamilton J. Turner

Inventor
Harry Moor
by his attorneys
Smith & Rogers

UNITED STATES PATENT OFFICE.

HARRY MOOR, OF PHILADELPHIA, PENNSYLVANIA.

FURNACE.

986,934.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HARRY MOOR, a subject of the King of Great Britain, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Furnaces, of which the following is a specification.

My invention consists of certain improvements in that class of furnaces which are intended for burning culm, bituminous slack, peat, saw-dust, or other comminuted fuel and which are provided with a series of shelves usually superposed and overlapping for receiving the layers of fuel, the object of my invention being to so construct such a furnace that the same will be especially adapted for burning, without the production of smoke, bituminous coal, bituminous slack, or other fuel containing a relatively large percentage of volatile matter.

In the accompanying drawings—Figure 1 is a longitudinal section of a furnace constructed in accordance with my invention; Fig. 2 is a horizontal section of the same taken on the line *a—a*, Fig. 1; Fig. 3 is a horizontal section taken on the line *b—b*, Fig. 1, and Fig. 4 is a transverse section taken on the line *c—c*, Fig. 1.

The furnace proper shown in the drawing comprises a front wall 1, a rear wall 2, a base 3, opposite side walls 4, and an arched crown or roof 5, the side walls, base, roof and back of the furnace being composed of suitable refractory bricks, blocks or slabs, and being, by preference, backed with ordinary brick work, so as to give the structure the desired stability and prevent radiation of heat from the furnace lining. The furnace also has two transversely arched shelves 6 and 7 of refractory material, each extending from one side wall to the other, these shelves, in connection with the base 3, providing three superposed fuel-receiving beds.

In front of the base 3 is an ash-pit 9 with grate 10, upon which a fire can be built in starting the operation of the furnace, although this is not absolutely necessary. Above each of the fuel-receiving beds or shelves is its corresponding combustion chamber 3^a, 7^a or 6^a, the lowermost combustion chamber 3^a communicating with the uppermost combustion chamber 6^a at the rear of the furnace through a vertical passage 11, and the intermediate combustion chamber 7^a communicating with the uppermost combustion chamber 6^a at the front of the furnace

through openings 12 at the opposite corners of the shelf 6, as shown in Fig. 3.

Crossing the vertical passage 11 and communicating with the rear end of the intermediate combustion chamber 7^a, is a flue 13, which, in the present instance, communicates with a passage 14 in the back wall, the latter being intended to communicate with a hot air or hot water furnace, a steam boiler, an oven, a metallurgical furnace, or other structure for utilizing the heat, although the flue 13 may, if desired, be so disposed as to discharge through the top of the furnace or through either or both sides of the same, as may be found to be most convenient in practice. The passage 11 is also in communication with the intermediate chamber 7^a through passages 15, one on each side of the flue 13, these passages being normally closed by means of laterally sliding slabs or cut-offs 16, as shown in Figs. 3 and 4.

When the furnace is in operation, the upper shelf 6 contains fresh fuel or that which is in the primary stage of combustion, the shelf 7 contains the fuel which is in the intermediate stage of combustion and the bottom shelf 3 contains the fuel which is in the final stage of combustion, the products of combustion from the latter mass of fuel rising through the passage 11 and mingling with the products of combustion from the green fuel on the top shelf 6, and these combined products passing through the openings 12 into the intermediate combustion chamber 7^a and there mingling with the products of combustion from the fuel in the intermediate stage of combustion lying upon the shelf 7. The gases from the green fuel on the upper shelf 6 are, therefore, mixed first with the highly heated products of combustion from the fuel in the final stage of combustion on the shelf 3 and then with the highly heated products of combustion from the fuel in the intermediate stage of combustion, and are brought into contact with the under faces of the roof 5 and shelf 6, which are heated to the point of incandescence. The gases driven off from the volatile portions of the fuel when the same is first introduced into the furnace are, therefore, completely consumed, the products of combustion finally issuing from the discharge flue of the furnace being absolutely smokeless.

After the furnace has been in operation

for such a time that the combustible portions of the fuel on the lower shelf 3 have been completely burned out, the fuel is drawn forward from said shelf onto the grate 10 and the ashes are raked down into the ash pit 9 from which they can be removed through an opening 17 in the front wall or in any other convenient way. The dampers 16 are then withdrawn laterally and the fuel on the shelf 7 which has passed the intermediate stage of combustion is moved rearwardly through the passages 15 and drops through the passage 11 onto the rear portion of the shelf 3, over which it can be spread by means of suitable implements introduced through an opening 19 in the front wall, access to the fuel on the shelf 7 being attained through an opening 20 in said front wall. The dampers 16 being again closed, the mass of fuel on the upper shelf 6 which has passed the primary stage of combustion, is drawn forward on said shelf and drops through the openings 12 onto the intermediate shelf 7 and is properly spread or distributed thereon, fresh fuel being introduced onto and properly spread upon the upper shelf 6, to which access is had through an opening 21 in the front wall.

All of the openings of the front wall are provided with suitable dampered doors in order that air in regulated quantities may be admitted through said openings as the proper operation of the furnace may require. It is also preferable, to combine a supply of heated air with the products of combustion passing from the fuel in the final stage of combustion on the lower shelf 3 to the fuel in the primary stage of combustion on the upper shelf 6 and for this purpose I locate, in the intensely heated side walls of the furnace, alongside of the upper combustion chamber 6^a, suitable pipes 22 which discharge superheated air into the upper portion of the passage 11 through pockets 23 in the side walls, as shown in Fig. 1, and also by dotted lines in Figs. 2 and 4.

My invention is distinct from that type of furnace in which the fuel is supported upon grates so that air can pass upwardly through the mass of fuel. In my improved furnace, the masses of fuel are supported upon imperforate beds, which, in the operation of the furnace, become very highly heated, so that all of the combustible products in the fuel are driven off by a species of distillation, the air or gases being in contact with the masses of fuel only at the surface of the same.

I claim:—

60 1. A furnace having imperforate shelves so disposed as to form three chambers in each of which a mass of fuel is maintained in a state of combustion, said chambers being so connected by passages that the products of combustion are caused to pass

finally through the middle or hottest chamber, and said furnace being provided with passages whereby the fuel can be passed from shelf to shelf as its combustion progresses.

2. A furnace having imperforate shelves so disposed as to form three chambers, each adapted to contain a mass of fuel, said chambers being so connected by passages that the products of combustion are caused to pass finally through the middle or hottest chamber, and the furnace being provided with a passage whereby the fuel can be passed from said middle chamber to that chamber of the series in which the fuel is in the final stage of combustion, in combination with means for normally closing said latter passage.

3. A furnace having three shelves each adapted to support an independent mass of fuel, said shelves being so disposed as to provide a passage for the products of combustion, and to cause the products from the fuel in the final stage of combustion to combine with the products from the fuel in the primary stage of combustion, the mixed products then passing to the fuel in the intermediate stage of combustion, and such furnace being provided with passages whereby the fuel can be passed from shelf to shelf as its combustion progresses.

4. A furnace in which are combined three shelves, one for receiving the fuel in the primary stage of combustion, another for receiving the fuel in the intermediate stage of combustion, and the third for receiving the fuel in the final stage of combustion, said shelves being so disposed as to form combustion chambers, one above each of said shelves, and said chambers being so connected by passages that the chamber containing the fuel in the final stage of combustion will communicate with that containing the fuel in the primary stage of combustion, and the latter will connect with the chamber containing the fuel in the intermediate stage of combustion, and said furnace being also provided with passages whereby the fuel can be passed from shelf to shelf as its combustion progresses, and being also provided with means providing an outlet from the intermediate combustion chamber.

5. A furnace in which are combined three shelves, one for receiving the fuel in the primary stage of combustion, another for receiving the fuel in the intermediate stage of combustion, and the third for receiving the fuel in the final stage of combustion, said shelves being so disposed as to form chambers, one above each of said shelves, said chambers being so connected by passages that the chamber containing the fuel in the final stage of combustion will communicate with that containing the fuel in

the primary stage of combustion, and the latter chamber will communicate with that containing the fuel in the intermediate stage of combustion, said furnace being also provided with means providing an outlet flue from the latter chamber, which outlet flue crosses the passage which connects the chamber containing the fuel in the final stage of combustion and the chamber containing the fuel in the primary stage of combustion.

6. A furnace in which are combined three shelves, one for receiving the fuel in the primary stage of combustion, another for receiving the fuel in the intermediate stage of combustion, and the third for receiving the fuel in the final stage of combustion, said shelves being so disposed as to form chambers, one above each mass of fuel, said chambers being so connected by passages that the chamber containing the fuel in the final stage of combustion will communicate with that containing the fuel in the primary stage of combustion, and the latter will communicate with the chamber containing the fuel in the intermediate stage of combustion, said furnace also having means providing an outlet from said intermediate chamber, means providing openings for the passage of fuel from the intermediate fuel shelf to the final fuel shelf, and cut-offs for normally closing the latter openings.

7. A furnace having imperforate shelves disposed so as to form three chambers, each adapted to contain a mass of fuel, said chambers being so connected by passages that the products of combustion finally pass

through the middle or hottest chamber, and said furnace being also provided with passages whereby the fuel can be passed from shelf to shelf as its combustion progresses, and with means for supplying heated air to the products of combustion as they pass from one chamber to another.

8. A furnace having three shelves, one for receiving the fuel in the primary stage of combustion, another for receiving the fuel in the intermediate stage of combustion, and the third for receiving the fuel in the final stage of combustion, said shelves being so disposed as to form passages connecting the chamber containing the fuel in the final stage of combustion with that containing the fuel in the primary stage of combustion, and the latter chamber with that containing the fuel in the intermediate stage of combustion, and said furnace being also provided with passages whereby the fuel can be passed from shelf to shelf as its combustion progresses, and with means providing an outlet from the intermediate combustion chamber, and means for supplying heated air to the products of combustion in their passage from the chamber containing the fuel in the final stage of combustion to that containing the fuel in the primary stage of combustion.

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

HARRY MOOR.

Witnesses:

HAMILTON D. TURNER,
KATE A. BEADLE.