

F. DAHL.
HEARTH FURNACE.

APPLICATION FILED SEPT. 23, 1908.

931,916

Patented Aug. 24, 1909.

2 SHEETS—SHEET 1.

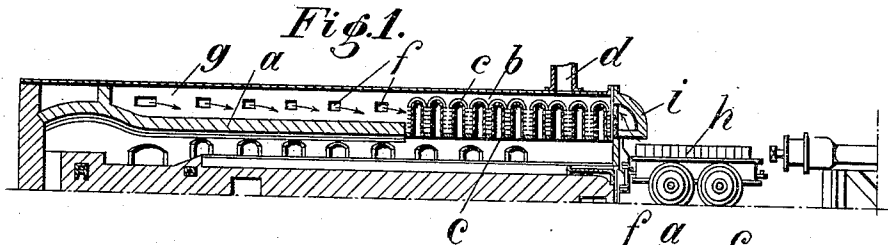


Fig. 2.

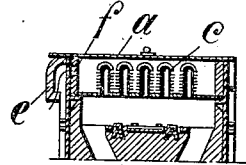


Fig. 3.

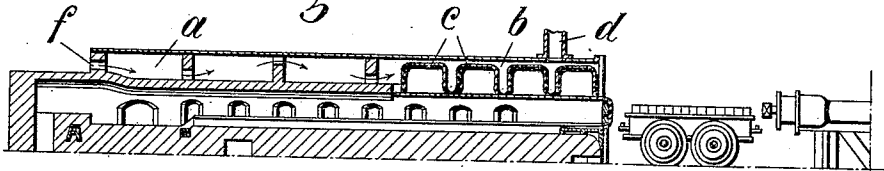


Fig. 4.

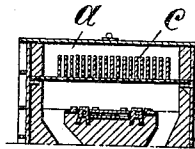


Fig. 5.

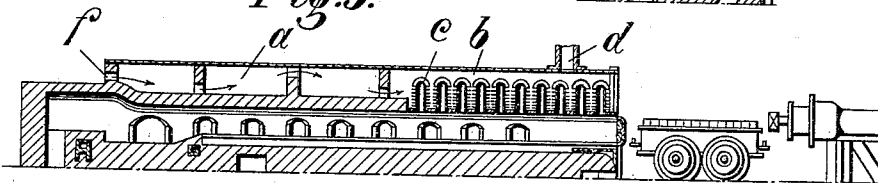


Fig. 6.

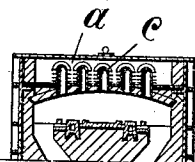


Fig. 7.

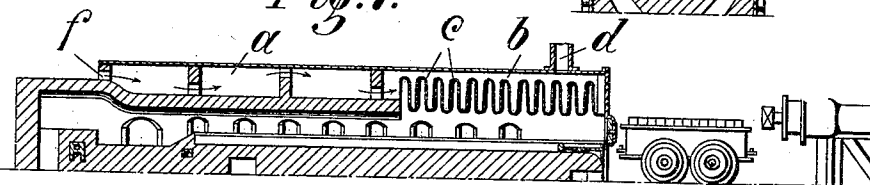
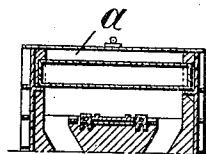


Fig. 8.



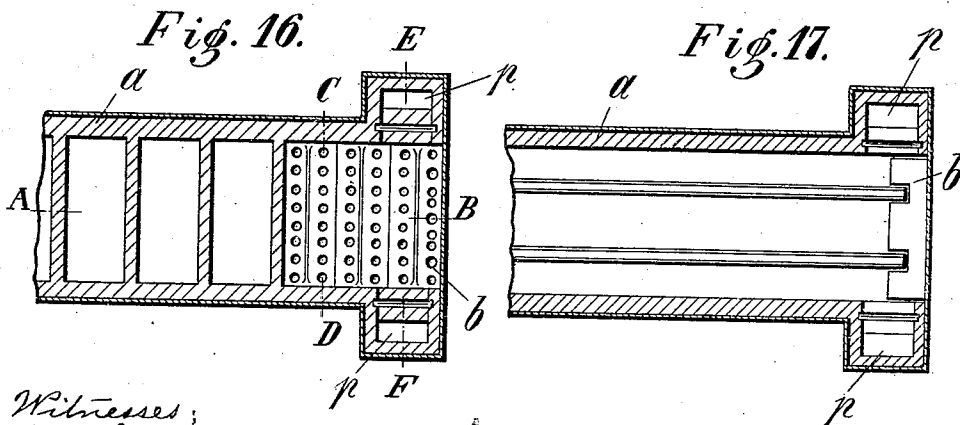
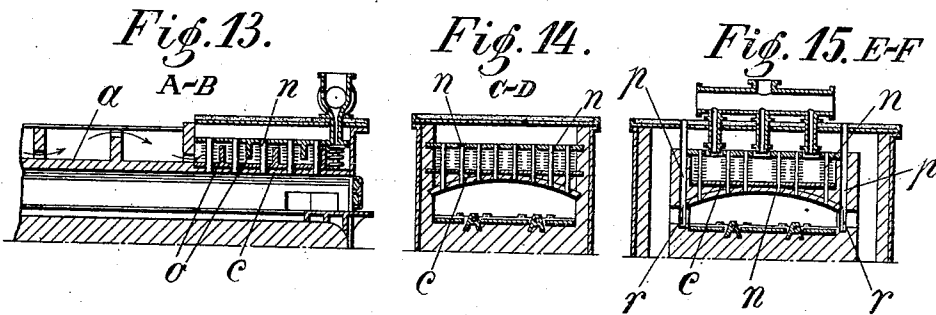
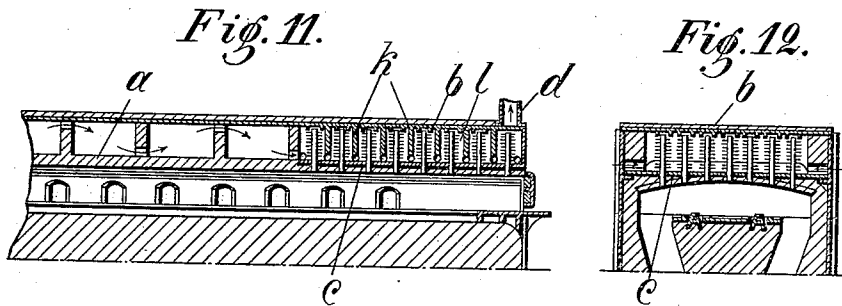
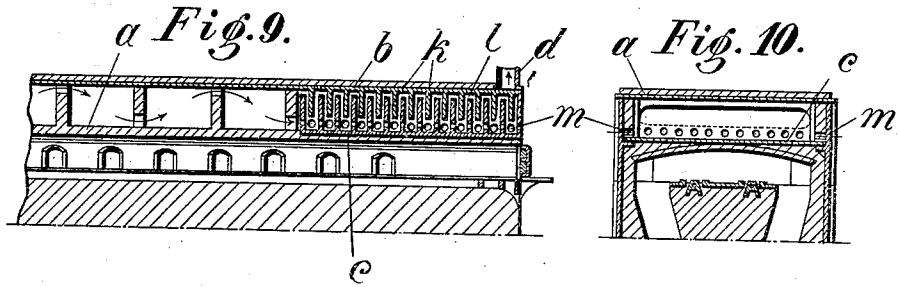
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UNITED STATES PATENT OFFICE.

FRANZ DAHL, OF BRUCKHAUSEN, GERMANY.

HEARTH-FURNACE.

931,916.

Specification of Letters Patent.

Patented Aug. 24, 1909.

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To all whom it may concern:

Be it known that I, FRANZ DAHL, engineer, a citizen of the German Empire, residing at Kaiserstrasse No. 112^a, Bruckhausen-on-the-Rhine, in the Province of Rhineland and State of Prussia, Germany, have invented new and useful Improvements in a Hearth-Furnace with a Partly-Metallic Pre-heating-Chamber for the Air of Combustion in the Vault-Roof, of which the following is a specification.

The invention relates to a hearth-furnace or similar device, in the vault-roof of which chambers are provided by which air for combustion is directed for pre-heating it.

The essential feature of the invention is, that at a suitable point a part of the vault-roof and preferably its rear end is entirely or partly made of a suitable metal. This part of the vault forms in consequence an exceedingly good conductor of heat which is quickly heated to a very high degree by the gases of the furnace passing over it and which correspondingly communicates the heat of the furnace quickly and effectually to the air of combustion, by which means the latter is heated sufficiently for rendering unnecessary further regenerators or recuperators.

In the annexed drawing, in which similar letters refer to similar parts throughout the several views, Figure 1 is a vertical longitudinal section of my improved oven; Fig. 2 a cross section through the rear part thereof; Figs. 3, 5, 7, 9 and 11 are vertical longitudinal sections through as many modifications; Figs. 4, 6, 8, 10 and 12 are respective cross sections thereof; Figs. 13, 14, and 15 are vertical sections on lines A—B, C—D, and E—F, respectively, of Fig. 16, and Figs. 16 and 17 are horizontal sections through a further modification.

As is shown in the drawing in Figs. 1 to 4 and 7 to 8 the front part of the vault-roof *a* is exposed to the most intense heat and it is made as usual of masonry as under these conditions it would not be advisable to supplant it by metal or like material. On the other hand its rear part *b* consists of metal plates. The material to be selected for this purpose may be iron in form of cast iron, steel castings or rolled or pressed sheets or in any other suitable form. In the part *b* of the vault-roof *a*, see Figs. 1 and 2, which may also consist of masonry, as shown in

Figs. 5 and 6, there may be placed hollow members *c*, preferably bearing ribs, to provide a large heating surface, while in Figs. 3 and 4, the members *c*, are composed of a series of parallel upright plates resting upon lower plate *b*. The part *b* could also be shaped undulatory, in order to obtain hollow chambers, closed at the top. By reason of the outwardly bent curvings of the part *b* an exceedingly enlarged contact surface is formed for the gases of the furnace and for the air of combustion.

In the form of embodiment shown in Figs. 9 to 12, over the vault part or plate *c*, provided with ribs (see Figs. 9 and 10), ribbed pipes (see Figs. 11 and 12), undulating or other metallic hollow members, one or several for instance metallic plates *k* are placed, carrying undulations, ribs or similar devices in such a manner, that these engage intermediate the undulations, pipes or like arrangements of the plate *c*, by which means a narrow labyrinthiform passage *l* is formed through which air for combustion is sucked or forced in such a way that it is brought as frequently into contact with the hot vault-plate as there are sinuosities in the passage, so as to heat it to a high temperature. In order to allow of an easy cleaning of those parts of the passages which are formed by the ribs, or similar devices, in spite of their engaging into one another, openings *m* are arranged at the side walls of the furnace, discharging intermediate the walls or similar devices. By such means the air passage can be thoroughly cleaned even while the furnace is in action for instance by blowing through.

In the form of embodiment as shown in Figs. 13 to 17 the vault-part or the plate *c* is provided with metallic smoke discharging pipes *n*, or such pipes of fire proof or similar material and with ribs *o*, engaging into a correspondingly arranged cover plate, besides a regulating device for the eduction of the waste gases is provided. These waste gases pass through the pipes *n* by which means air for combustion is forced or sucked through, which owing to the arrangement of the ribs etc. moves up and down, which in this way is in alternative counter-current relative to the waste gases passing through the pipes *n*, brings about an intense heating of the air. In the service of gas furnaces it is from an economical point of

view important that air for combustion at a temperature remaining constant combines itself with the gas in that point of the furnace where the combustion takes place.

5 With a view to attain this effect, the pre-heating chamber or the recuperator is to be adjusted in such a manner that it can be regulated *i. e.* waste gases are to be conducted through the smoke eduction pipes *n* 10 to such an amount only as it is required for heating air for combustion to a precisely given degree of temperature whereas the remaining part is educted directly into the smoke-flue, conducting to the chimney. To 15 this effect the furnace is provided apart from the recuperator, with special eduction passages *p*, carrying valves, in order to obtain by throttling that air-temperature most favorable for combustion. Also valves 20 could be arranged allowing of closing more or less the pipes *n*.

Air for combustion is sucked up through the pipe *d* by means of blower. It passes, as shown in Figs. 1 and 2, upwardly along- 25 side the hot furnace-wall, moves through the hood *e* and canals *f*, the latter being arranged in the form of embodiment as shown in Figs. 3 to 17, at one of the front sides, thereupon through the canal *g* above the 30 vault roof *a* over the hot furnace vault or over the material to be fed *h*, passing the hood *i* to the actual heating system *b*, *c*, as shown in Figs. 1 and 2. At this point the heating of the pre-heated air is continued 35 and thus it is sucked away to the hearth for combustion.

The arrangement of heat in the vault-roof of the hearth-furnaces presents as compared with known arrangements in which it is 40 placed in the gas eduction passage, the advantage, that easy cleaning, commodious access in case of repairs and on the other

hand a longer durability of the vault roof are assured.

The part *b*, when it consists of metallic 45 plates as well as the outwardly bent curvings of the plate or of the member *c* and the smoke eduction pipes *n* may be provided with a coating of fire proof material or with correspondingly made fire proof bricks for 50 increasing their durability.

I claim:

1. A hearth furnace comprising a fire chamber and a hollow roof above said chamber which forms a chamber for pre-heating 55 the air for combustion, said hollow roof consisting of a front section forming a poor heat conductor and of a rear section forming a good heat conductor, substantially as specified. 60

2. A hearth furnace comprising a fire chamber, a hollow roof above said chamber which forms a pre-heating chamber, said hollow roof consisting of a front section forming a poor heat conductor and of a rear 65 section forming a good heat conductor, metallic hollow gas conductors in the rear section of said pre-heating chamber and a channel formed above said gas conductors and communicating therewith, substantially as 70 specified.

3. A hearth furnace comprising a fire chamber, a hollow roof above said chamber which forms a pre-heating chamber, flanged metal plates mounted in said preheating 75 chamber, and flanged metal pipes intermediate said plates, substantially as specified.

Signed by me at Frankfort-on-the-Main this 10th day of September 1908.

FRANZ DAHL.

Witnesses:

JEAN GRUND,
CARL GRUND.