

July 7, 1925.

1,545,155

H. MEHNER

FLAME FURNACE

Original Filed Feb. 14, 1922

4 Sheets-Sheet 1

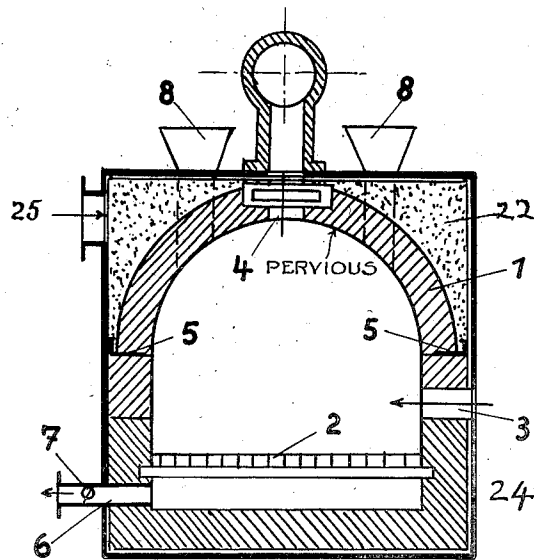


Fig. 1.

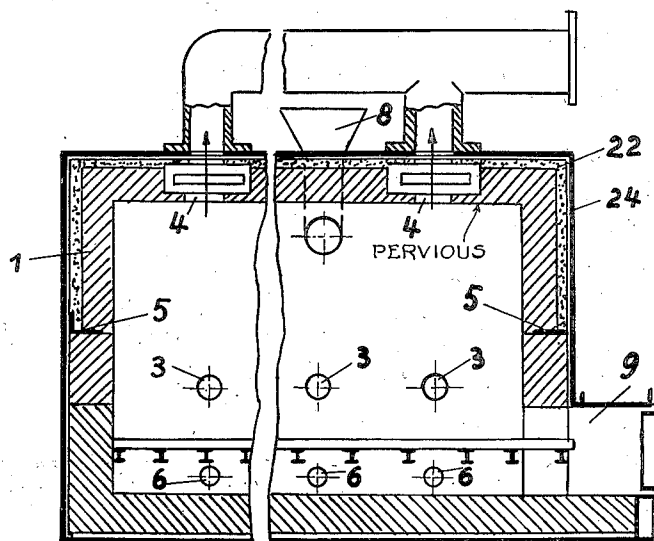


Fig. 2.

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4 Sheets-Sheet 2

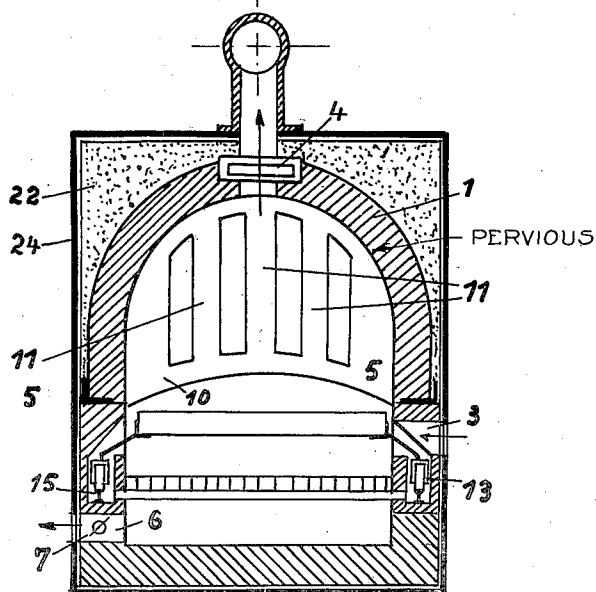


Fig. 3.

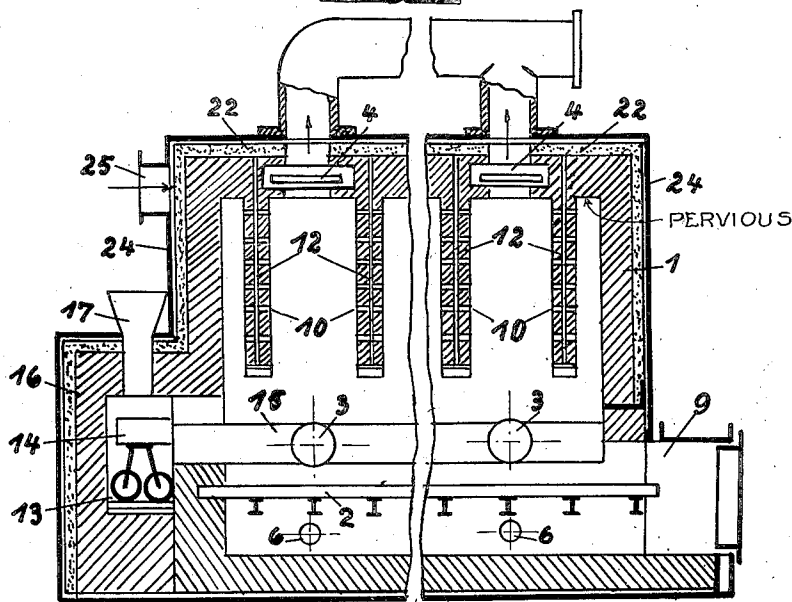


Fig. 4.

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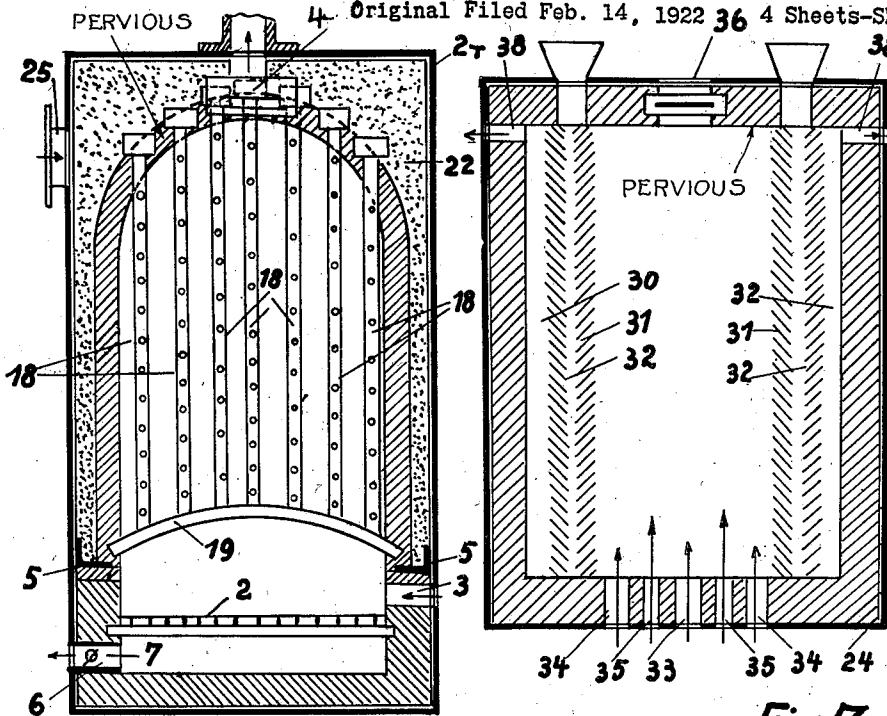
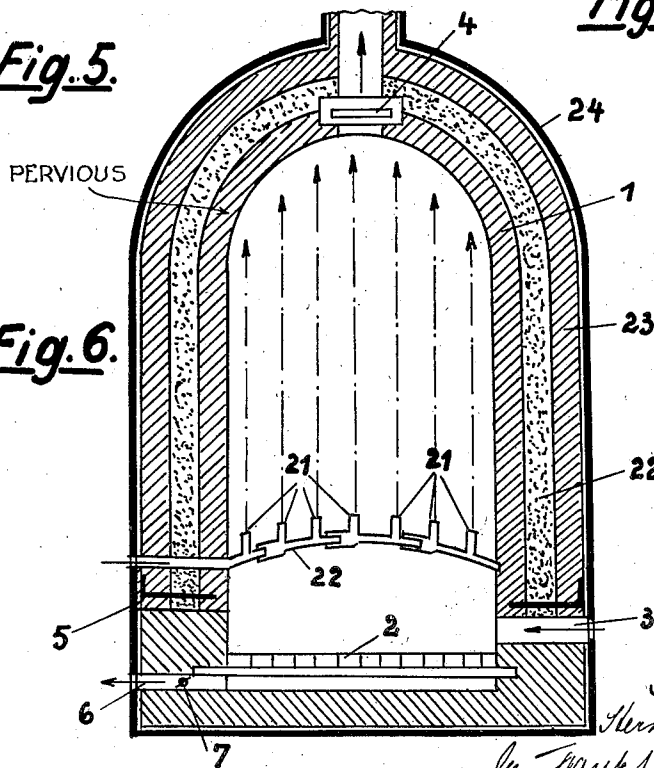


Fig. 5.

Fig. 7.

Fig. 6.



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4 Sheets-Sheet 4

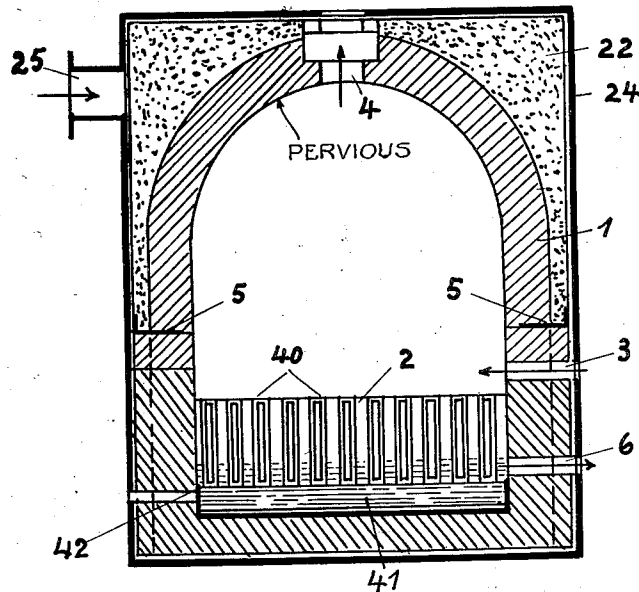


Fig. 8.

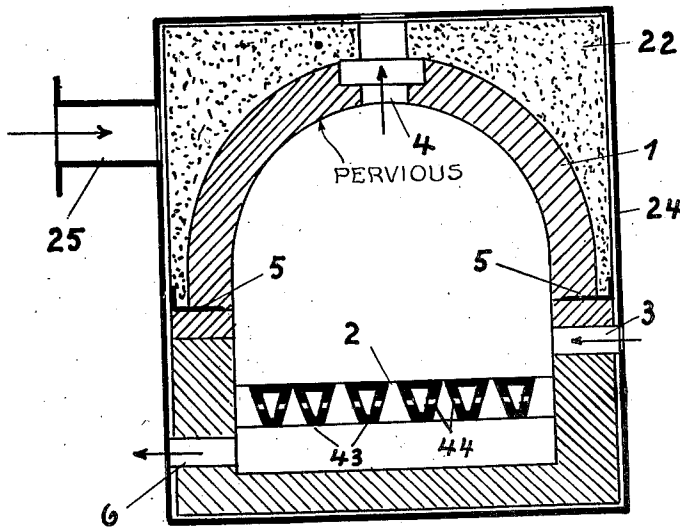


Fig. 9.

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Patented July 7, 1925.

1,545,155

UNITED STATES PATENT OFFICE.

HERMANN MEHNER, OF BERLIN-CHARLOTTENBURG, GERMANY.

FLAME FURNACE.

Original application filed February 14, 1922, Serial No. 536,569. Divided and this application filed April 10, 1925. Serial No. 22,212.

To all whom it may concern:

Be it known that I, HERMANN MEHNER, a citizen of the German Republic, and residing at Berlin-Charlottenburg, Schlossstrasse 66, Germany, State of Prussia, have invented certain new and useful Improvements in a Flame Furnace, of which the following is a specification.

The invention, which is a division of my application Serial Number 536,569 filed February 14, 1922, relates to a flame furnace for carrying out chemical reactions and physical processes at high temperatures, this furnace being particularly adapted for carrying out strongly endothermic processes, in which the material to be treated is exposed to the action of radiant heat produced by a flame acting as source of heat above the charge, a gaseous layer being interposed between the charge and the flame, which layer does not disturb the chemical or physical process or which may promote the same and which keeps the flame gas remote from the charge. This principle of heating is clearly described in my above-named application Serial Number 536,569.

In the accompanying drawings several constructions of flame furnaces according to the invention are shown. Fig. 1 is a cross-section and Fig. 2 a fragmentary longitudinal section through a simple form of furnace construction. Fig. 3 represents a cross-section through a modification of which Fig. 4 is a fragmentary longitudinal section. Figs. 5, 6, 7, 8 and 9 all show cross-sections through further constructional modifications. The same reference letters are used for identical parts in the several figures.

In Fig. 1 underneath the furnace vault 1, the grate or pervious hearth 2 is arranged upon which a suitable charge of material is placed. In the following explanation the expression "grate" means not exclusively a usual grate of iron bars but generally any kind of pervious hearth. In the case of the manufacture of metallic sodium, for instance the grate may be charged with coal and sodium carbonate. For heating this charge and maintaining it at high temperature, producer gas is admitted to the preferably adjustable openings 3, and ignited while air is forced into the small space between the casing of the furnace and through the filling, also through the pervious arch 1 which is made of fire-proof bricks, care being taken

to feed the air in the required amount. The arch or vault of the furnace will then become heated to glowing, and its heat and the heat of the air flames i. e. air currents issuing in an atmosphere of gas are radiated upon the grate. The gas contents of the furnace are not capable of transferring any heat in the usual manner of convection or conduction, inasmuch as the gases of combustion, which are underneath the upper part of the vault 1 and which escape through the flue 4, are very hot, while on the other hand the heating gases remain comparatively cool as there is an intermediate gaseous layer between the charge on the pervious grate or hearth 2 and the flames.

A portion of the heating gases which becomes heated in contact with the charge on the grate, may be drawn off from below with the products of reaction, for which purpose the escape conduits 6 with the adjustable throttling means 7 are provided below the grate or pervious hearth 2. The entire furnace 1 is incased air-tightly within a sheet metal casing 24, the upper portion thereof having an opening 25 through which air is admitted to the filling material 22 and passes therefrom in heated condition through the pervious arch, which arch is separated from the lower portion of the furnace by means of a gas-tight insertion member 5, which in the present instance may consist of an angle iron. The maximum of pressure desired is imparted to the incoming air, while a lower pressure is imparted to the heating gases, the entire apparatus will operate permanently like any other kind of furnace if the flues 4 and the throttling means 7 are adjusted in accordance with the gases formed directly in the reaction, these gases being led off downwardly. The downwardly directed part of the current of reaction gases is considerably cooled when flowing through the grate, provided the charge is sufficiently high. The charge must be sufficiently high, because hot gases give up their heat, as experience proves, to a layer of colder, solid bodies, if this layer is not too shallow. The furnace may also be provided with charging openings 8 and with cleaning apertures 9, and with windows (not shown) for watching the process, and auxiliary means for initially heating that is forced or drawn into a space between the wall of the furnace and its casing to heat the air of combustion. The

grate may be made movable so as to facilitate the removal of the slags.

Furthermore, as shown in Figures 3 and 4, the heat producing burning surface in the furnace 1 may be increased by arranging transverse partitions 10 in the furnace which partitions may be further subdivided so as to constitute columns 11. The transverse partition and columns may be provided with recesses or openings which communicate with a conduit 12 carrying the hot air which is forced into them through the filling 22, the heated air entering the interior of the furnace, by openings through the portions 11 of the partitions 10, which openings communicate with the openings 12. For feeding the furnace with soda, a special strewing or sprinkling car 13 and 14 may be displaceable arranged within the furnace, which is caused to be moved periodically or intermittently over the carbon charge on the grate 2 by means of any suitable gear or rack mechanism, not shown by the drawing. The sprinkling car may be provided with an appropriate strewing or sprinkling means that is associated with the bed 14 and its supporting wheels 13, as an endless carrier. The wheels of the car and the rails on which the car runs, are arranged outside of the zone reached by radiation, preferably within the recesses 15 in the walls. In the comparatively long intermissions of the sprinkling or strewing operation, the car remains in a chamber above which is a suitable feeding device 17, conventionally indicated in the drawing as a hopper or the like. The introduction of the soda or other material upon the pervious grate 2 may be effected by means other than a car, for example by injection by means of nozzles or twyers, or manually by throwing into the furnace, or in any other manner placing a charge of material upon the grate.

The construction of a high furnace is shown in Figure 5, in which figure the vaulted structure has a chamber of greater height than width. While it would also be possible to broaden the combustion chamber which would produce the same result as regards radiating energy, yet, the direction of radiation would be unfavourable, and dispersion would be increased in this case.

With the view of avoiding brick structures or the like in the interior, the necessary heated air, as shown in Figure 5, may be admitted, through tubes 18 which are suspended in the furnace, and consisting of a ceramic mass with sufficient strength, for example of a body made of material suitable for melting crucibles. These tubes or pipes 18 which are suspended from the top of the vault or arch 1 by means of flanges which open into the space which contains the filling 22 and the tubes need only to be supported from below at appropriate height

above the grate 2, for instance by means of an arch 19 of fire clay or chamotte. The tubes 18 are provided with suitable holes of a number sufficient for the discharge of heated air into the combustion chamber.

Thin jets of flame may be burnt in a furnace space unobstructed by solid constructional parts below the vaulted roof in contradistinction to those provided with tubes (Fig. 5), by injecting air from below by means of jacketed cooling pipes with offset ends for receiving adjacent pipes. This construction is illustrated in Fig. 6 of the drawing. In this figure sections of pipe 22 made in clay of curved shape are mounted in the lower part of the furnace vault, the pipe consisting of sections with long telescopic joints and with upwardly directed vertical nozzles 21 or with narrow holes through which jets of air may be injected under pressure into the free space of the furnace. The furnace according to Figure 6 is preferably supplied with preheated air, and it is therefore provided with an additional furnace vault 23 as a heat insulator outside of the layer 22 of broken filling material. By admitting and burning air from the nozzles 21 columns of fire are obtained which take the place of the solid walls and columns of Figures 3 and 4.

As shown in Figure 7, the process according to this invention may also be carried out in a furnace in which the charge to be treated is situated in a vertical wall. In this case, the grate should consist of two parts 30 and 31 between which the charge 32 is arranged. Each grate element 30, 31 may be rectangular or circular. Figure 7 shows a furnace of this kind in sectional view, the furnace being either of cylindrical cross section with circularly enclosed charge or of rectangular shape with two opposite charging walls. Within the charging walls, and preferably in the centre, the heating radiating flame burns, which is preferably arranged as an air flame in a gas space, but this flame may also consist of a gas flame in an air space. The admission openings 33 serve for the feeding of the flame zone with air, while the admission of the heating gases is effected through the openings 35, other gases of different chemical properties being admitted through the openings 34. The discharge of the gases of combustion takes place through the flue 36. The charge is fed through the hoppers 37. The escape of the volatile products takes place through the passages 38. The furnace vault 1 in the case of Figure 7 is also enclosed in a sheet metal casing 24.

Figure 8 shows another form or embodiment of the invention. In this furnace, the grate consists of flat, hollow plates 40 placed on edge, and immersed in a tank 41

which is filled with a sealing liquid such for example, as kerosene, and which is provided with an outlet opening 42. Otherwise, the arrangement and the construction of the furnace according to Figure 8 shows a furnace which is similar to Figures 1 and 2 and in this furnace the vaporous products of reaction escape between the plates 40 of the grate 2, becomes condensed, and collect in the tank 41, from which they are discharged, while the remaining gases are conducted downwardly to the surface of the kerosene, and may be sucked off, through duct 6 located directly above the liquid level. The sodium condensate runs down the plates 40, falls into the oil and is discharged through duct 42. Instead of kerosene, any other suitable cooling agent may, of course, be employed in the tank or container 41.

Figure 9 illustrates the employment of a grate cooled by injection of water in combination with a furnace according to this invention. In this case, the grate 2 consists of hollow bars 43 having a downwardly decreasing cross section, and provided with holes 44 on the opposite side walls. Into the hollow grate bars the cooling agent, water for example, is introduced which is then injected into the spaces between the grate bars through the holes 44. The reaction products which flows down between the grate bars is cooled by the injection of this cooling agent. Otherwise, the construction of this furnace may conform for example to the construction shown in Figures 1 and 2.

It is pointed out that the expression "grate" used in this specification and claims should be broadly interpreted. Thus, for example, the invention also comprises a construction in which, instead of an ordinary grate made from bars, a pervious or perforated hearth of fireproof, porous material, as for instance, fire clay, chamotte, or the like may be used.

The invention is also capable of other modifications and changes, as local conditions, and the nature of the substances to be treated may direct.

I claim:

1. A furnace comprising a combustion chamber having a pervious wall adjacent to the upper portion of said chamber, an airtight casing which surrounds said pervious wall, a heat absorbing filling material between the combustion chamber and the casing, means for supplying air to the combustion chamber through the filling material and said pervious wall, whereby the temperature of the air is raised and discharged into the combustion chamber of the furnace.

2. A furnace having a combustion cham-

ber of pervious fire-proof material through which air may be passed under pressure, means for supplying fuel gas to the combustion chamber above the material to be treated in the furnace, said material being supported upon a pervious grate maintained above the bottom of the furnace and below a port through which gas is supplied to the combustion chamber of the furnace, and means for supplying heated air into an upper zone of the furnace through pervious material used in the construction of said upper portion of the furnace.

3. A furnace of the character shown having a combustion chamber for burning gaseous fuel and air, the combustion chamber of said furnace being made of pervious material, a casing of non-pervious material which surrounds the upper portion of the combustion chamber of the furnace, a filling between the combustion chamber and the casing, means for admitting air into the combustion chamber through said filling and the wall of the combustion chamber of the furnace, and a controlled aperture through which the products of combustion may be passed.

4. A furnace structure having a sheet metal casing, an arch of pervious material and a filling between the arch and the casing, a pervious charge support located above the floor of the furnace, a fuel gas inlet opening above the charge support, an exit opening below said charge support, a controlled opening at the upper portion of the furnace, an air supply opening through the casing by means of which heated air is supplied to the combustion chamber of the furnace, and means for maintaining the filling about the upper portion of the furnace.

5. In a furnace of the character described having a non-pervious casing about the combustion chamber of the furnace, a pervious wall forming said combustion chamber, a heat absorbing filling between said casing and the pervious wall, an opening through the non-pervious casing for admitting heated air into the combustion chamber of the furnace, an outlet for the products of combustion, means for admitting a gaseous fuel to the combustion chamber, and a charge supporting grate above the lower portion of the furnace and a controlled outlet opening which communicates with the space below the charge supporting grate.

In testimony whereof I affix my signature in presence of two witnesses, this 16th day of March, 1925.

HERMANN MEHNER.

Witnesses:

WLAD. ENDER,
ROY V. FOX.