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PATENTED JUNE 18, 1907.

G. WIEGMANN & C. DÖRR.

KILN.

APPLICATION FILED MAR. 24, 1902.

3 SHEETS—SHEET 1.

Fig. 1.

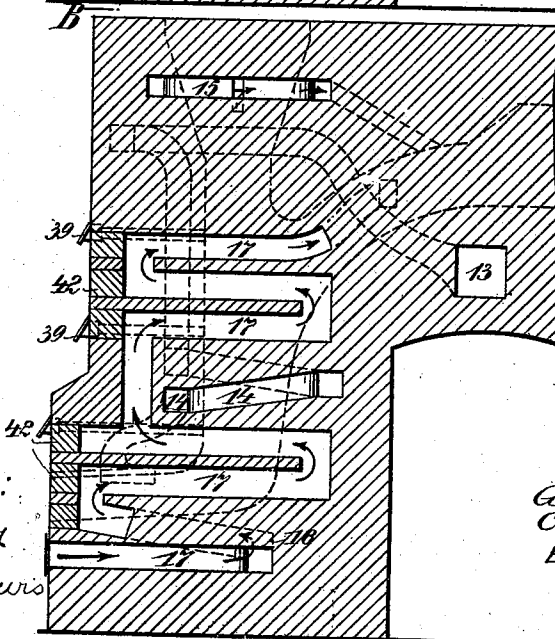
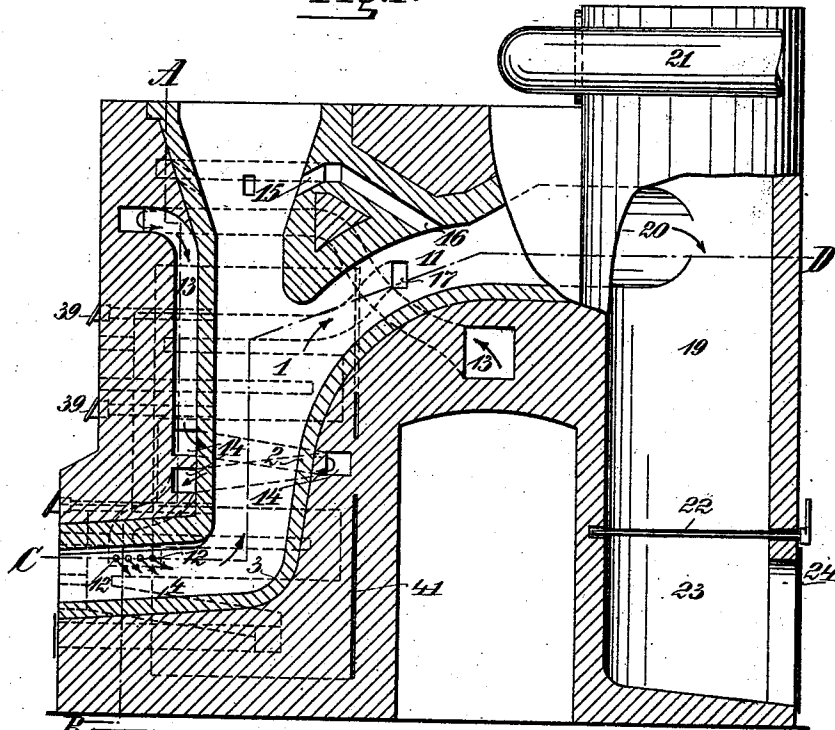


Fig. 2.

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Fig. 3.

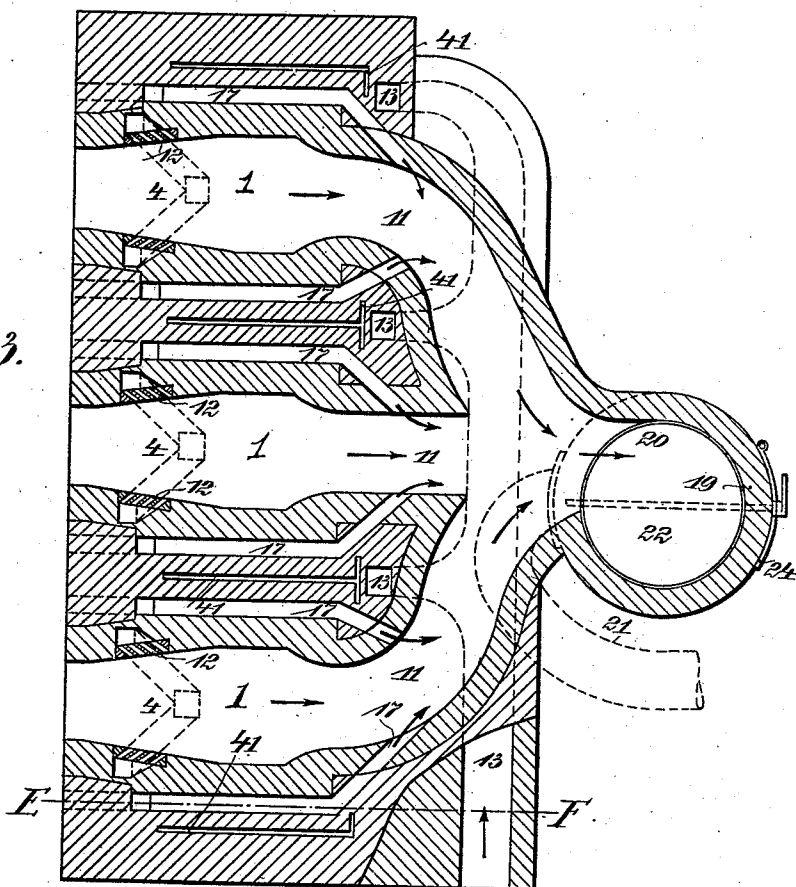
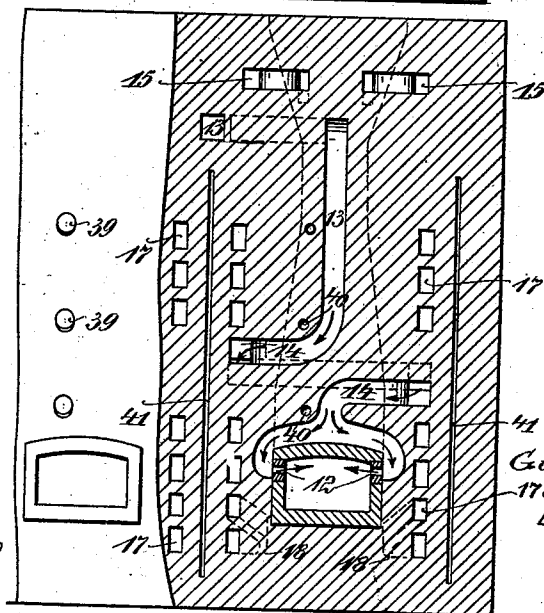


Fig. 4.



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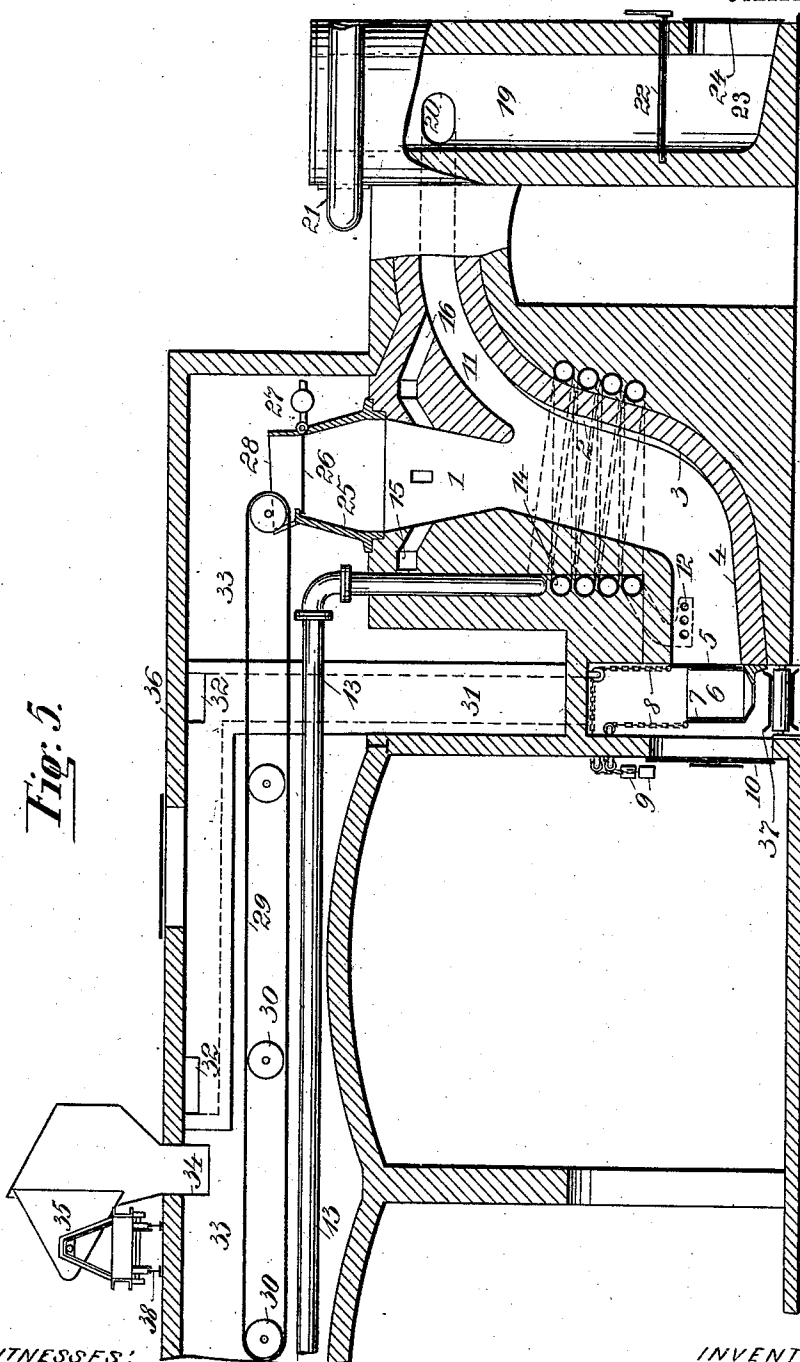
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UNITED STATES PATENT OFFICE.

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KILN.

No. 857,429.

Specification of Letters Patent.

Patented June 18, 1907.

Application filed March 24, 1902. Serial No. 99,696.

To all whom it may concern:

Be it known that we, GUSTAV WIEGMANN and CLEMENS DÖRR, both subjects of the King of Prussia, and residents of Berlin, in the Kingdom of Prussia and German Empire, have invented new and useful Improvements in Kilns, of which the following is a specification.

Our invention relates to the construction of kilns for heating, burning or smelting metals, metal alloys, combustible and non-combustible materials, as also for roasting and reducing ores, and is especially adapted for house-refuse and similar waste-materials.

In order that our invention may be readily understood and carried into effect, we describe the same fully with reference to the accompanying drawings which show three forms of kiln embodying the invention.

Figure 1 is a central vertical section of a kiln constructed in accordance with this invention; Fig. 2, a section taken on the line E F of Fig. 3; Fig. 3, a section taken on the line C D of Fig. 1; Fig. 4, a section partly in elevation, taken on the line A B of Fig. 1; and Fig. 5, a vertical central section of a modified form of kiln.

Similar reference letters indicate corresponding parts in all the figures.

Referring to the form shown in Figs. 1 to 4, the kiln is open at the top and may be provided with means such as flaps or slides for closing it. It consists of a shaft which takes mainly a vertical direction except its wall 2, which is not vertical but forms an obtuse angle with the horizon. The angle may advantageously be from about 92° to 130° . The opposite wall of the furnace is preferably vertical and therefore forms with the horizon an angle of 90° , although it may be built at a larger angle up to 130° . The upper part of the shaft forms the feed portion and the lower part forms a vertical combustion portion. The wall 2 of the vertical combustion portion of the shaft is connected with the sole of the furnace shaft 4, by a rounded portion 3, which may advantageously be of segmental form. The sole 4 which preferably forms a smooth plane, can if desired be channeled in a longitudinal direction. In most cases the sole is not exactly horizontal but slightly inclined. If the furnace or kiln is intended for the combustion of house-refuse the incline is preferably from 4° to 6° to the horizon. For other uses, say for the produc-

tion of iron, the incline of the sole may differ. The sole 4 leads immediately to the lower mouth of the furnace which may be fitted with a door, slide or any appropriate means for closing it and for allowing the removal of slags or of the materials treated or produced in the kiln. As shown in Fig. 3 this form of kiln is provided with three furnace-shafts 1, side by side, and the furnace flues 11 lead from the junction of the feed and vertical combustion portions of the shafts to a common chimney. A smoke-dust separator is formed at 19 to receive at 20 the furnace gases laden with dust; the gases finally escaping through the channel 21 into the chimney. The inlet 20 for the flue gases is lower than the passage 21. The dust carried off with the gases enters at great velocity in the dust-separator 19, where the dust particles strike violently against the opposite wall—or when the gases enter the chamber tangentially they receive an eddying motion—and then fall down upon the disk 22 which closes the lower collecting room 23. By turning the disk 22 edgewise as indicated by dotted lines in Fig. 3, the dust is caused to drop into the collecting room from which it can be removed (after reclosing the disk 22) by opening the door 24. For the purpose of utilizing the flue-gases which collect in the upper part of the shaft, it is advantageous to form a passage 15 having any desired number of openings into the shaft 1 and entering the channel 16 which leads into the flue.

In order to obtain a very high temperature in the furnace, the two following conditions are requisite, viz. where the flame enters the flue secondary combustion air must be introduced and in addition there must be a blower above the sole 4. The secondary air enters below the sole into the passages 17 which are first continued in the form of loops 18 and then ascend in a zig-zag form to the flue. The long passage through which the secondary combustion air is thus obliged to flow in constant contact with the highly heated walls, provides an exceedingly hot air-current for combustion which will not injuriously affect the flame. It is advisable to provide removable stones 42 in the front wall of the furnace, in order to permit access to the channels 17 from outside.

The compressed air is supplied from suitable blast engines and enters beneath the fire-bridge into the channel 13. This latter

at first surrounds the furnace-flue and then after ascending it dips vertically down near the vertical furnace wall, then circulates at 14 around the furnace shaft and finally leads 5 into the twyers of the air blast. There are provided two twyer-batteries 12 in opposite positions and so arranged that the air-jets are caused to cross each other in front of the curvature 3. This arrangement of circulating 10 the air-blast has been found exceedingly advantageous for the production of high temperatures in the furnace. It may here be mentioned that the twyer batteries 12 require to be arranged at such an angle as will 15 prevent the nozzles thereof becoming choked by the material collecting near them. This angle is naturally different for various materials; and is about 30° for house refuse.

In order to enable the heating process 20 within the furnace to be inspected, sight-glasses 39 are provided at the end of narrow passages 40. It is advantageous to form internal spaces 41 in the brickwork of the furnace so as to permit of the brickwork expanding and contracting in accordance with 25 the changes of temperature.

The furnace constructed as hereinbefore described operates in the following manner; it being presumed that house refuse forms 30 the material to be burnt. A small quantity of coal is ignited upon the sole 4 of the furnace and the blast turned on until the coal has reached an incandescent state, some of the refuse is then introduced into the furnace 35 from the top which is then closed and the blast again started. In this manner a higher temperature is produced and the refuse then begins to burn, whereupon fresh refuse is charged into the furnace to fill the latter up 40 to the top. The air-blast is continued and finally the mineral parts of the refuse are rendered sufficiently liquid to sink to the bottom and gradually run down the sole of the furnace whereupon it can be withdrawn 45 through the furnace mouth.

Beyond the smoke-dust which is deposited in the collector 23, no ash is formed because the furnace has no grate and the internal temperature is sufficiently high to reduce all 50 the materials in the furnace to slags. As the consumption of the materials proceeds, fresh material is introduced so as to render the operation continuous. In case the refuse is very poor in combustible matter a little coal 55 may be added, which however need never exceed 4% of the refuse. The furnace-gases which escape through the channel 21 are not led direct into the chimney, but are utilized for the generation of steam or for 60 other purposes.

The modified construction shown in Fig. 5 is also designed for the use of refuse and other matter. The material for combustion is charged in wagons 35 running on rails 38 65 and is tipped into hoppers 34 and falls into

a room 33 provided with an endless conveyer-belt or apron. The latter carries the materials to the furnace mouth and discharges them into a hopper 28 forming the extension 70 of the furnace-top 25. The material is discharged upon the oscillating damper or flap 26 provided with a counterweight 27. When the charge is sufficiently heavy it lowers the flap 26 and falls into the furnace shaft 1 whereupon the flap 26 again closes. 75

In order to utilize the heat of the slags, which is considerable, the following arrangement may be used:—The lower end of the furnace is closed by a sliding or other door 5 and at its exterior is mounted a box 6 80 which is open toward the door 5. The opposite side of the box 6 is also open but normally covered by a slide 7. Each of these slides is suspended from a chain 8, 8 passed over rollers and having a counterweight at 85 the free end. In order to reach the box 6 it is necessary to open the door 10. After raising the slides 5 and 7 the slag which slowly flows down the sole 4 can be raked into the box 6 from which it falls upon an endless 90 conveyer band 37 of suitable construction. The air which is strongly heated by the slowly removed slags ascends through the channels 31 and enters through orifices 32 beneath the top of the furnace 36 into the 95 room 33 and there serves to dry the materials upon the conveyer 29. In lieu of utilizing the air, which is strongly heated by the slags, as drying air in the room 33 it may if desired be used as secondary combustion air 100 for the kiln, and with this object it would in the arrangement shown in Figs. 1 to 4 pass through the channel 17. Again the drying air may be conducted to the rear of the boiler into the flue where all deleterious matter in it 105 will be destroyed by reason of the high temperature (at least 180°C). Obviously the drying air may also be heated to the required temperature by causing atmospheric air to pass through channels in the heated brick- 110 work of the furnace and thus become strongly heated. The heated drying air is then introduced into the room 33 in which latter the combustible materials are brought to the mouth of the furnace. 115

As an exception the use of secondary combustion air has not been adopted in the installation shown in Fig. 5. The air blast is conducted through a pipe 13 in the drying room 33 and then through a coil 14 around 120 the furnace-shaft. The furnace in this arrangement is of a different form as it has no vertical walls, although in other respects the general installation is essentially the same as that described with reference to Figs. 1 to 4. 125

The advantages of the installations hereinbefore described as regards the combustion of refuse are, hygienically considered, of 130 great importance, as the combustion is complete, no ash is formed, the residues are re-

covered as molten slags adapted for various uses and only occupy a small percentage of the volume of the refuse. Further it is also important that a complete smoke-consumption be effected, as the gases escaping from the chimney consist with the exception of very small quantities of carbonic oxid gas, exclusively of nitrogen and carbonic acid.

What we claim and desire to secure by Letters Patent of the United States is:—

1. The combination in a kiln, of a vertical shaft having a feed portion and a combustion portion, an approximately horizontal shaft communicating with the lower end of the combustion portion of said vertical shaft, blast nozzles opening into both sides of the approximately horizontal shaft, a flue leading off from that point where the feed portion of the vertical shaft meets with the combustion portion, and a channel connected with the feed portion of the vertical shaft at a point above the connection of said feed portion with the flue, the said channel leading to the flue, substantially as set forth.

2. In a kiln, the combination with the vertical shaft and flue leading therefrom, of a channel connecting the upper part of said shaft with said flue, the said channel communicating with said shaft at a point above the connection of the latter with the flue, substantially as set forth.

3. In a kiln, the combination with a vertical shaft having a feed portion, and a combustion portion, of a flue leading off from that point where the feed portion of the shaft meets with the combustion portion, an approximately horizontal shaft in direct communication with the lower end of the combustion portion of said vertical shaft, blast nozzles opening into both sides of the approximately horizontal shaft, and passages built in the walls of the said shafts, said passages being adapted to be heated by the fire in said shafts and opening into said flue, substantially as set forth.

4. The combination in a kiln, of a vertical shaft having plane walls, and comprising an upper feed portion and a lower combustion portion, a flue leading off from said shaft at the point where the feed portion meets the combustion portion, an approximately horizontal shaft in direct cornerless communication with the lower end of the combustion portion of said vertical shaft, blast nozzles opening into said approximately horizontal shaft, and passages built in the walls of said shafts, said passages being adapted to be heated by the fire in said shafts, the passages extending upward in a zigzag form and opening into said flue, substantially as set forth.

5. In a kiln, the combination with a vertical shaft having an upper feed portion and a lower combustion portion, a flue leading from the shaft at the point where the feed

and combustion portions meet, an approximately horizontal shaft in direct communication with the lower end of the combustion portion of the vertical shaft, blast nozzles opening into both sides of the approximately horizontal shaft, and an air passage in the walls of the vertical shaft, the said air passage beginning underneath the said flue, and after passing along near to the inner surface of said vertical shaft terminating in the said blast nozzles, substantially as set forth.

6. The combination in a kiln, of a vertical shaft having plane walls, a flue leading off from said shaft, an approximately horizontal shaft in direct cornerless communication with the lower end of the vertical shaft, blast nozzles opening into the said approximately horizontal shaft, and an air passage built in the walls of said shafts, said passage beginning underneath the said flue and after passing along near to the inner surface of said vertical shaft and extending around the lower part of the same, terminating in said nozzles, substantially as set forth.

7. A kiln having a vertical shaft comprising a feed portion and a combustion portion, a flue leading off from the point where the feed portion meets with the combustion portion, a dust chamber to which the flue leads, an approximately horizontal shaft in direct communication with the combustion portion of the vertical shaft, an air channel disposed in the walls of the vertical shaft and adapted to be heated by the fire in said shaft, blast nozzles at the end of said air channel and opening into said approximately horizontal shaft, and a second air channel disposed in the walls of said shafts and opening out into the flue and adapted to be heated by the fire in said shafts.

8. A kiln, comprising in combination a vertical shaft having plane walls, a flue leading from said shaft, an approximately horizontal shaft in direct communication with the vertical shaft, an air channel disposed in the walls of said shafts and adapted to be heated by the fire in said shafts, blast nozzles at the end of said air channel and opening into said approximately horizontal shaft, a second air channel likewise disposed in the wall of said shafts and opening out into said flue and adapted to be heated by the fire in said shafts, a smoke-dust separating chamber to which the said flue leads, and a gas outlet channel disposed above the inlet for the flue gases, and leading from the smoke-dust separating chamber substantially as set forth.

9. A kiln comprising a vertical shaft, an approximately horizontal shaft in direct communication with the vertical shaft, blast nozzles opening into said approximately horizontal shaft, a smoke-dust separating chamber, a flue connecting said chamber with said vertical shaft, an air channel

disposed in the walls of said shafts and adapted to be heated by the fire in said shafts, the said air channel opening into the said flue, and a gas outlet channel disposed
5 above said flue and leading from the smoke-dust separating chamber, as set forth.

In testimony whereof we have signed our

names to this specification in the presence of two subscribing witnesses.

GUSTAV WIEGMANN.
CLEMENS DÖRR.

Witnesses:

FRANZ SCHNAYTERLEY,
WOLDEMAR HAUPT.