E. HOHMANN.

AIR BLAST HEATER.

APPLICATION FILED AUG. 31, 1911.

1,038,887. Patented Sept. 17, 1912.

Fig. 1.

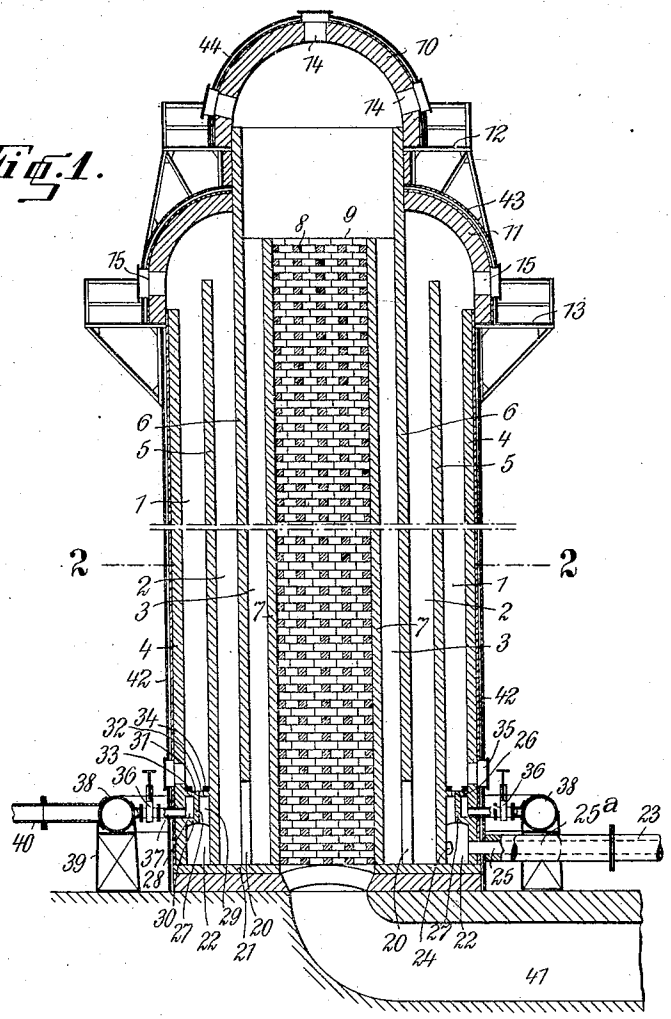
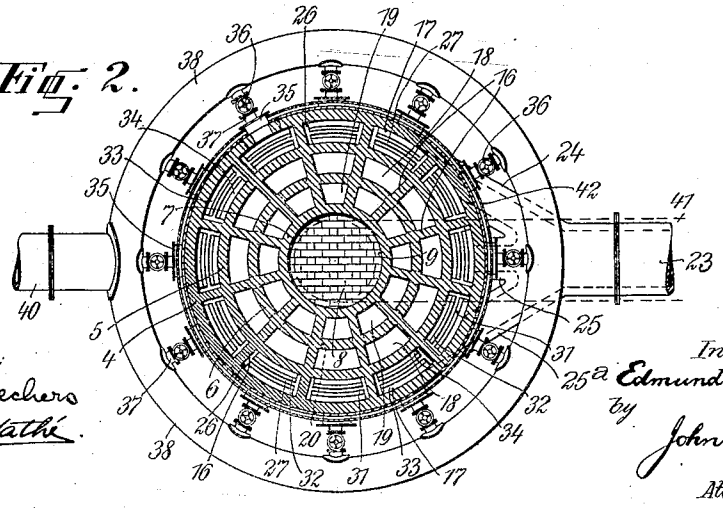


Fig. 2.



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AIR-BLAST HEATER.

1,038,887. Specification of Letters Patent. Patented Sept. 17, 1912.

Application filed August 31, 1911. Serial No. 646,965.

To all whom it may concern:

Be it known that I, EDMUND HOHMANN, a subject of the German Emperor, and resident of Stettin, Germany, have invented certain new and useful Improvements in Air-Blast Heaters, of which the following is a specification.

My present invention relates to air-blast heaters, particularly to those having nested annular chambers, and is intended for use especially in connection with blast furnaces.

According to my invention radial partitions are provided in the nested annular chambers serving alternately to convey first inwardly gas and air for supporting combustion and then in opposite direction the air for the hot blast. These partitions subdivide the annular chambers into segmental flues which are connected in series in radial groups and form a sinuous channel for the passage of the gases or the blast respectively. Each flue of the outermost annular chamber contains an inlet for fuel and another inlet for the air to support combustion. By virtue of this arrangement the heat-exchange area of the air-blast heater is increased considerably without increasing the external dimensions of the heater; at the same time, the gases and the air are uniformly distributed over the entire cross section of the chambers. The economical efficiency of the heater is thus increased materially. When blast-furnace gas is supplied as fuel, the improved air-blast heater offers the further advantage of causing almost the entirety of the stone-vitrifying and other deposit-forming constituents of the gases to be thrown down on the large surfaces with which the gases come in contact as they pass through the successive flues. The gases issuing from the last annular chamber are therefore practically free from such constituents. At or beyond the outlet of the last chamber I may therefore provide checkerwork my means of which the gases will transfer the remainder of their heat to the heater, without any danger of clogging or soiling such checkerwork by the blast-furnace gases. The periodically required cleaning of the flue walls of the heater presents no difficulty, inasmuch as the nested annular chambers are subdivided into straight flues.

In the accompanying drawing I have illustrated, as an example of carrying out my invention, an air-blast heater in which blast-furnace gases are utilized as fuel.

Figure 1 is a central vertical section through the improved air-blast heater, and Fig. 2 is a horizontal section taken on line 2—2 of Fig. 1.

The heater shown comprises three annular chambers 1, 2, 3 formed by co-axially arranged ring walls 4, 5, 6, 7 of different diameters, the walls surrounding one another and also inclosing a central space or well 9 which contains checkerwork 8. The annular chamber 3 and the well 9 are roofed over by a cover or cupola 10, against which abuts an annular cover 11 forming a roof for the chambers 1 and 2. Bridges 12 and 13 encircle the cupolas or covers 10 and 11 respectively, which latter are provided with manholes 14 and 15 respectively. Partitions 16 extend radially from the ring wall 4 to the wall 7, and subdivide the annular chambers 1, 2, 3 into segmental upright flues 17, 18 and 19 respectively. The flues 17 communicate with the flues 18 by way of the interior of the cover 11, and the flues 18 are connected with the corresponding flues 19 of the chamber 3 by means of openings 20 located at the bottom of the ring wall 6. The radial partitions 16 extend upwardly beyond the walls 4 and 5 to the cover 11, but between the walls 6 and 7, the partitions 16 extend upwardly only to the upper edge of the inner wall 7. In the annular chambers 2 and 3, the partitions 16 extend downward to the bottom 21. Within the chamber 1, the partitions 16 are not continued to the common bottom 21 of the annular chambers, but leave an annular free space 22 at the bottom of said chamber 1, and with this space or air conduit are connected three pipes 24, 25, 25^a which, exteriorly of the heater proper, are merged into a single pipe 23. A horizontal wall 26 situated above the annular space 22 and an upright cylindrical partition 27 coaxial with the ring walls 4, 5, 6, 7 and located between the walls 4, 5 at a distance from each of them, form chambers 28, 29 above the annular space 22. A horizontal wall 30 separates the chambers 28 from the annular space 22, the chambers 29 being in open communication with said space. By means of slots 31, 32 the chambers 28, 29 respectively communicate with the flues 17 of the annular chamber 1. The effective outlet

area of the slots 31, 32 may be varied by means of slides 33 and 34 respectively which are movably supported on the wall 26. Immediately above these slides manholes 35 are provided in the ring wall 4. Each chamber 28 is connected with a conduit 37 provided with a valve or other regulating device 36. All the conduits 37 are branched off from a common annular conduit 38 supported by a framework 39 and connected with a gas supply pipe 40.

A channel 41 is connected with the lower end of the central well 9. The outermost ring wall 4 and the covers 10, 11 are surrounded in the well-known manner by jackets 42, 43 and 44 respectively made of iron or the like and arranged out of contact with the masonry work so as to leave insulating air-spaces between them and the masonry. In order to secure good heat insulation the outer portions of the ring wall 4 and of the covers 10, 11 are preferably made of insulating bricks (hollow bricks).

When it is desired to supply heat to the heater, the valves 36 are opened so as to allow the blast-furnace gases to pass from the pipe 40 and the conduit 38 to the conduits 37 and the chambers 28. From the latter the gas passes into the flues 17 through the slots 31. The air required to support combustion enters the annular space 22 from the pipes 23, 24, 25, 25ª and passes to the same flues 17 from the said annular space 22, by way of the chambers 29 and slots 32. By making the slots 31, 32 of great length and arranging them close to each other a very thorough mixing of gas and combustion air is insured, so that the blast-furnace gas will be consumed quickly and completely over the entire area of the flues 17. The combustion products rise in the flues 17 and passing through the interior of the cover 11 reach the flues 18 in which said products travel downward to enter the flues 19 through the bottom openings 20. While traveling in a sinuous path through the flues 17, 18, 19, which are connected in series to form radial groups, the combustion gases transfer most of their heat to the walls of said flues, and are also freed almost completely of the suspended blast-furnace dust, which is deposited on the flue walls. From the flues 19 the combustion gases pass into the central well 9, give up the remainder of their heat to the checkerwork 8 and finally leave through the channel 41. After the supply of fuel has been cut off by closing the valves 36, the air-blast to be heated is conducted to the heater through the channel 41 and, flows successively through the well 9 and the flues 19, 18, 17 in the direction opposite to the flow of the combustion gases during the preceding period or stage. The air-blast, thus heated by a regenerative action, enters the annular space 22 through the slits 32 and chambers 29 and passes out of the heater through the pipes 24, 25, 25ª, 23.

With the herein described heater the utilization of heat is very thorough, for the reason that the gases and the air respectively are distributed with perfect uniformity over the entire cross section of the heater, and for the further reason that the draft conditions, path length and resistance are identical for each radial group of series-connected flues 17, 18 and 19.

An important feature of my invention is the direct connection of the air and gas to the outermost chamber, or in other words, the arrangement of the combustion chamber at the outer part of the heater. This presents the advantage that the hottest combustion products are distributed over the largest area or cross section, and as the combustion products cool off, they travel toward the center of the structure and pass through channels of smaller cross section. The combustion products therefore have a relatively slow motion where they are hottest, and a higher speed where they are cooler. The apparatus will therefore become heated much more effectively than with the usual arrangement in which the combustion gases travel from the central space to the outermost chamber. During the heat-absorbing period my heater is also of high efficiency, since the air to be heated travels first at a relatively high speed, which however decreases as the air travels from the central space through the several chambers, the air traveling slowest in the outermost chamber 1 which has the largest heating surface.

The duty of each individual set or group of flues can be regulated accurately by means of the slides 33, 34 and valves 36, thereby preventing a premature wearing out of portions of the heater. Since some of the sets of flues are nearer to the pipes 24, 25, 25ª than other sets, it will be obvious that a greater proportion of hot or cold air will tend to pass through the flues which afford a shorter path. This tendency is counteracted by a proper adjustment of the slides 34, opening passages of a larger cross section for those flues which are farther away from the pipes 24, 25, 25ª, than for those which are adjacent to said pipes. Thus, notwithstanding the fact that the several sets of flues are at different distances from the pipes 24, 25, 25ª, the flow of hot or cold air may be regulated in such manner as to secure a practically uniform distribution of hot or cold air among the several sets of flues. The valves 33 36 serve a similar purpose to equalize the supply of gas to the several flue groups, notwithstanding the fact that said flue groups are at different distances from the pipe 40. The flues being straight, they are cleaned readily through

the manholes 14, 15 and 35. Each set or group of flues comprises a segmental flue located between the walls 4 and 5, an adjacent flue located between the walls 5 and 6, and a third flue located between the walls 6 and 7. All the flues of the same radial group communicate with each other by means of individual connecting channels or openings as shown in Fig. 1 at the top of the chambers 1 and 2, and at the bottom of the chambers 2 and 3 (openings 20). That is to say, air or gases which have entered one of the flues of a radial group, are compelled to pass exclusively through the other flues of the same group, and cannot reach the flues of any other group. Each sinuous path constituted by the flues of one group, is therefore entirely separate or disconnected from the other paths or flue groups, between one end or inlet and the other end or outlet of such path or group.

While I have shown ring walls 4, 5, 6, 7 of circular cross section, this is not essential to my invention, as I may give these walls different cross sections, for instance oval or polygonal. These modifications and others may be made without departing from the nature of my invention as set forth in the appended claims.

I claim:

1. A heater comprising walls forming nested chambers and partitions extending outwardly through said chambers and subdividing them into flues, the adjacent flues of the several chambers being connected in series by individual connections to form a group of flues constituting a sinuous path, each of these paths, between its inlet and its outlet, being entirely separate or disconnected from the other paths or flue groups.

2. A heater comprising walls forming nested chambers and partitions extending outwardly through said chambers and subdividing them into flues, the adjacent flues of different chambers being connected in series to form a group of flues constituting a sinuous path, the individual flues of the outermost chamber being each provided with separate inlets for fuel and for air to support combustion respectively.

3. A heater comprising ring walls forming nested co-axial annular chambers and radial walls subdividing said chambers into segmental flues, the adjacent flues of the several chambers being connected in series by individual connections to form a radial group of flues constituting a sinuous path, each of these paths, between its inlet and its outlet, being entirely separate or disconnected from the other paths or flue groups.

4. A heater comprising ring walls forming nested co-axial annular chambers and radial walls subdividing said chambers into segmental flues, the adjacent flues of different chambers being connected in series to form a radial group of flues constituting a sinuous path, the individual flues of the outermost chamber being each provided with closely adjacent segmental slots forming inlets for fuel and air to support combustion respectively.

5. A heater comprising walls forming nested chambers surrounding a central space, and partitions subdividing said chambers into flues, the flues of the innermost chamber communicating with said central space, and the adjacent flues of the several chambers being connected alternately at opposite ends, a conduit extending adjacent to the outermost flues of the several groups and having individual connections with such outermost flues, and means for regulating said connections individually.

6. A heater comprising walls forming nested chambers surrounding a central space, and partitions subdividing said chambers into flues, the flues of the innermost chamber communicating with said central space, and the adjacent flues of the several chambers being connected alternately at opposite ends, a conduit extending adjacent to the outermost flues of the several groups and having individual connections with such outermost flues, a pipe connected with said conduit, and means for regulating said connections individually, whereby a wider passage may be provided in those connections which are at a greater distance from the point where said pipe connects with the conduit, so as to equalize the flow in the several groups.

7. A heater comprising walls forming a central space and flues located around said space at different distances from the center, the innermost flues communicating with said central space, and the other flues communicating with the innermost flues in groups, a gas conduit and an air conduit extending adjacent to the outermost flues of the several groups, each conduit having individual connections with such outermost flues.

8. A heater comprising walls forming a central space and flues located around said space at different distances from the center, the innermost flues communicating with said central space, and the other flues communicating with the innermost flues in groups, a gas conduit and an air conduit extending adjacent to the outermost flues of the several groups, each conduit having individual connections with such outermost flues, and means for regulating such connections individually.

9. A heater comprising walls forming a central space and flues located around said space at different distances from the center, the innermost flues communicating with said central space, and the other flues communicating with the innermost flues in

groups, a gas conduit and an air conduit extending adjacent to the outermost flues of the several groups, each conduit having individual connections with such outermost flues and also having a gas connection and an air connection respectively at one portion of its length, and means for regulating individually, the connections of said conduits with the respective outermost flues.

10. A heater comprising walls forming nested communicating chambers surrounding a central space which communicates with the innermost chamber, partitions subdividing said chambers into flues, each of the flues of the outermost chamber being formed at its bottom with two circumferential slits arranged adjacent to each other, and means for supplying air and fuel respectively to said slits.

11. A heater comprising walls forming chambers subdivided into groups of flues connected in series, individual inlet conduits for supplying air to support combustion, to each group of flues, regulating devices controlling the flow of air through the several inlet conduits, and means for supplying fuel to the flues.

12. An air-blast heater comprising walls forming chambers subdivided into groups of flues connected in series, individual outlet conduits for conveying the hot blast away from each group of flues, and regulating devices controlling the flow of air through the several outlet conduits.

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

EDMUND HOHMANN.

Witnesses:
GEORGE LILIEQUIST,
GEORG KRAUSS.