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N. M. PHILIPSEN
REGENERATIVE COKE OVENS
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Fig. 1.

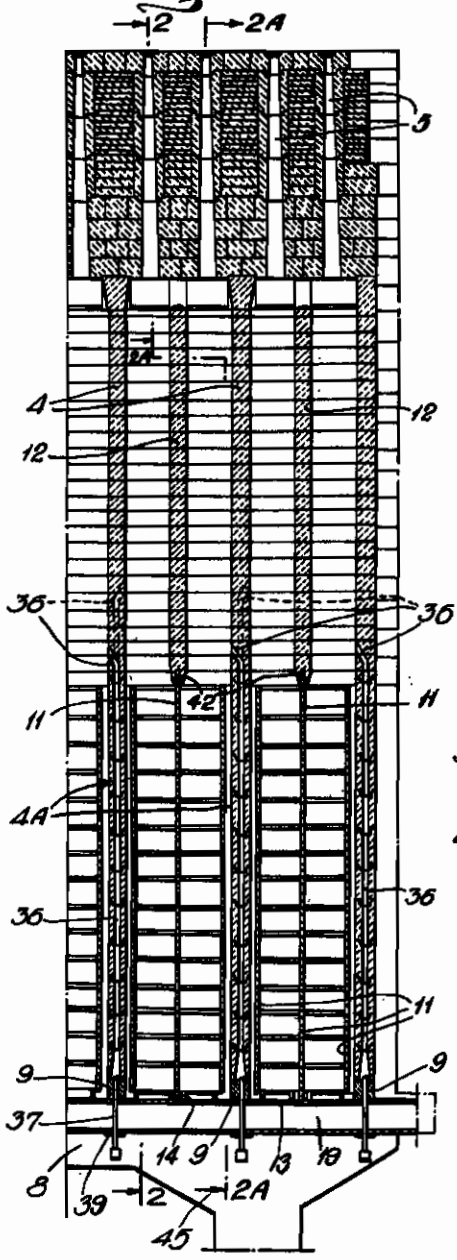
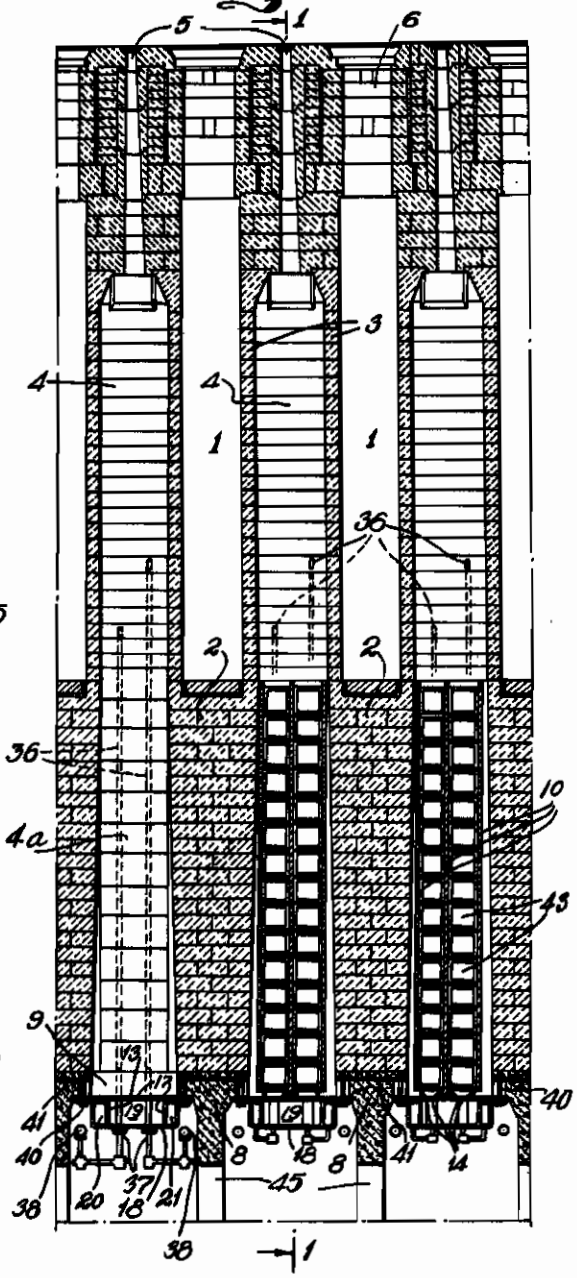


Fig. 2.



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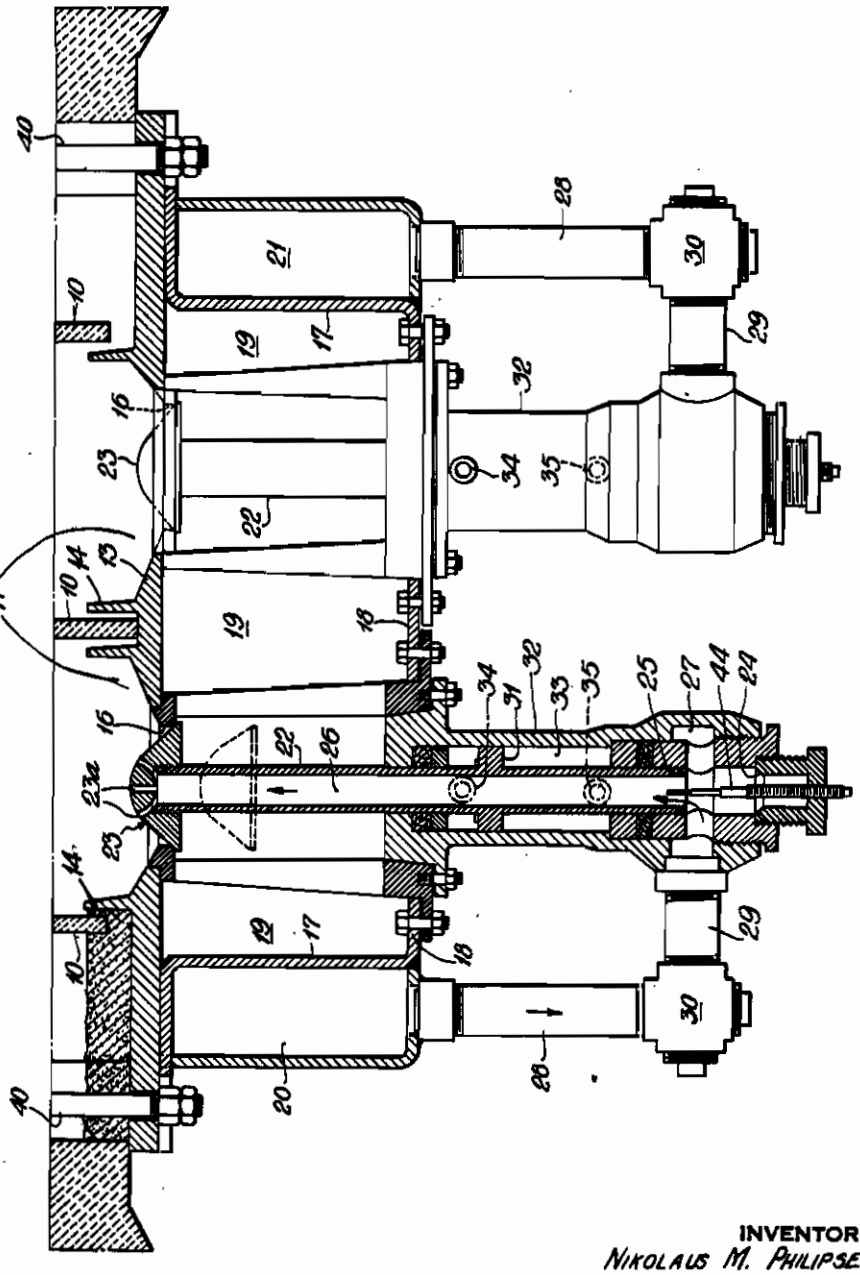

Fig. 3.

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ALIEN PROPERTY CUSTODIAN

REGENERATIVE COKE OVENS

Nikolaus M. Philipsen, Tokyo, Japan; vested in the Alien Property Custodian

Application filed July 3, 1941

The general object of the present invention is to improve the construction of horizontal regenerative coke oven batteries having groups of vertical heating flues each comprising a small number of flues connected at their upper ends. For example, each such group may consist of two limbs of a twin or hairpin flue.

The invention is characterized by the association with each such small group of flues of a separate group of vertical regenerators which are located within an individual space formed in the coke oven brickwork beneath the heating walls and coking chambers, and which comprise a multi-chambered regenerator housing supported independently of the walls of said chambers by a subjacent support on which the housing may slide or rock as the battery expansion causes the upper end of the housing to move horizontally relative to said support. The regenerator housing may be thus supported on a grate-like reinforced concrete supporting deck for the coke oven brickwork or on iron base plate supported by said deck. Each regenerator housing is thus free to tilt or slide as a result of battery expansion without being subjected to lateral pressure or thrust by the portions of the coke oven brickwork forming the walls of the chamber in which the housing is received, which facilitates the maintenance of gas-tight walls between the different vertical regenerator chambers or cells formed in each housing regenerator.

In a hairpin flue oven constructed in accordance with the present invention, the binder walls extending transversely to main supporting walls beneath the different oven chambers, may be constructed independently of said supporting walls and each may be formed with two uprising channels for supplying rich fuel gas alternately to the two vertical flues forming the limbs of a hairpin flue and separated by a flue division wall directly above said transverse binder walls. Advantageously the two rich fuel gas supply channels for adjacent twin flues have their upper ends extending into the corresponding flue division wall and terminating in burner outlets opening at opposite sides of said division wall.

In the preferred form of the present invention a transverse individual waste heat channel is provided in the basement space of the battery beneath each heating wall, and vertically adjustable valves are provided for connecting the lower end of each regenerator chamber associated with the heating wall alternately to the waste heat channel and to an adjacent transverse supply pipe for the combustible agent, i. e., combustion air or lean gas, preheated in that regenerator chamber. To effect the reversal of said valves they may be provided at their lower ends with pins or other cam engaging parts operatively engaging cams carried by reciprocating cam shafts located in the basement space of the battery and extending transversely of the later, or, in another form of the invention, each valve may be provided with individual fluid pressure operating means.

As each heating wall operates entirely independent of the other it is possible to separately reverse the direction of gas flow through the flues of the individual heating walls and associated regenerators, and to reverse the flow through the different heating walls of the battery successively in the course of a half reversal period. For this purpose the reversal mechanism for each heating wall must necessarily be so designed that its operation may be chronologically independent of the operation of the reversing mechanisms for the other heating walls.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages, and specific objects attained with its use, reference should be had to the accompanying drawing and descriptive matter in which I have illustrated and described preferred embodiments of the invention.

Of the drawings:

Fig. 1 is a vertical section through a portion of a coke oven battery taken transversely of the length thereof on the broken line 1—1 of Fig. 2;

Fig. 2 is a vertical section with its right hand portion taken on the line 2—2 of Fig. 1 except for a lower left hand portion taken on the line 2A—2A;

Fig. 3 is a partial section taken longitudinally of the battery on a larger scale than Fig. 2 and showing regenerator connection details not shown in Fig. 2;

The drawings illustrate the use of the invention in a horizontal underfired coke oven battery having twin flues in its heating walls which alternate along the length of the battery with transversely extending coking chambers 1. In accordance with the present invention the coke oven masonry is of relatively strong and rigid design and is formed for the most part of bricks which may be of ordinary rectangular brick shape. The said masonry comprises walls 2, one directly beneath and parallel to each coking chamber.

Each heating wall is formed with runner brick walls 3 extending longitudinally of the heating wall and forming the side walls of the heating flues, and binder brick walls 4 which are transverse to the walls 2 and separate the adjacent twin flues of the heating wall. Directly beneath each heating wall 4 is a wall 4A extending across the space between the two adjacent walls 2. The walls 3 and 4 extend to and directly support the oven roof structure which is traversed by the usual inspection holes 5 and charging openings 6.

The coke oven masonry rests upon a grate-like reinforced concrete deck or structure including girders 8 extending transversely of the battery and cross girders 9, one directly beneath each of the walls 4A. The grate-like structure which is located at the ceiling of the characteristic subway space of the underfired battery is supported by columns 45 extending upward through the basement space and resting on the usual battery foundation, not shown.

Each adjacent pair of walls 4 and the two subjacent walls 4A and adjacent portions of the walls 2 and 3 enclose a shaft or vertically elongated space generally rectangular in cross section and including in its upper portion a twin flue and including in its lower portion four regenerator cells, two of which are connected to the lower end of one limb and the other two of which are connected to the lower end of the second limb of the corresponding twin flue. The four regenerator chambers in each masonry shaft are formed in a housing structure comprising three walls 10 extending longitudinally of the walls 2 and three cross walls 11. The central cross wall 11 is connected by a centering pin part 42 to a vertical brick wall 12 midway between the corresponding binder brick walls 4 and separating the two limbs of the corresponding twin flue except for a connecting port provided at the top of the wall 12. Each regenerator housing structure rests upon a corresponding cast iron base plate 13 directly engaged by the central cross wall 11. The plate 13 serves as a closure for the corresponding regenerator or space and is removable to permit the removal and replacement of the regenerator housing. The plate 13 also supports the weight of the stacks of checker bricks in the corresponding regenerator cells or chambers through ribs 14 arranged on the plate 13 at a short distance from the inner sides of the walls 10 and 11. The ribs 14 are arch like having convex upper sides directly engaged by and supporting the lower most checker bricks. In consequence the checker brick stacks can follow the movements of the walls 2 and 4a independently of the battery expansion. The regenerator housing and checker brick stacks thus work in the manner of pendular supports.

The spaces between the ribs 14 and the housing walls 10 and 11 may be filled with a flexible or granular packing material so that notwithstanding the relative movements of the individual parts, gas tight seals between the lower end of the different regenerator chambers may be maintained. The spaces between the regenerator checker bricks and the regenerator housing walls can likewise be filled with a suitable refractory material; for example, loose ceramic cement.

Each cast iron base plate 13 is formed with an opening or port 16 directly beneath each of the regenerator cells above it, and beneath the plate 13 is a trough shaped metallic member 18 which unites with the base plate above it to form a waste heat sole channel 19. As shown, said metallic member 18 has outturned flanges 17 at the upper edges of its side wall portions 17, which bear against the underside of the plate 13 and may be secured to the latter by the bolts 40 provided to detachably connect the plate 13 to the reinforced structure above it. As shown in Fig. 2, the bolts 40 are connected at their upper ends to the ends of beams or bars 41 which extend across the girder portions of the deck member. Supplemental plates welded to each member 18, unite with the latter to form a lean gas distribution channel 20 alongside one, and a combustion air distribution channel 21 alongside the other of its walls 17. Each of said distribution channels may extend from one side of the battery to the other.

The two regenerator chambers connected at their upper ends to the same twin flue limb are separately connected at their lower ends, one to the corresponding lean gas channel 20 and the other to the corresponding combustion air channel 21, each through an individual valved connection. Each of said connections comprises a vertically movable tubular valve element 22 which carries a valve head 23 at its upper end. The latter in its elevated position closes communication through the port 16 between the corresponding regenerator chamber and the waste heat channel 19, and such communication is established when the valve head is moved into its lowermost position shown in dotted lines in Fig. 2. In the last-mentioned position the tapered lower edge 25 of the lower end of the tubular member 22 engages the valve seatt 24 and closes communication between the bore 26 of the tubular member and an annular space 27 formed in the valve housing member 32 in which the tubular part 22 and valve seat 24 are mounted, said annular chamber 27 being in communication with the corresponding distribution channel 20 or 21 through a pipe connection comprising pipe sections 28 and 29 and an elbow fitting 30. The central passage 26 or bore of the tubular member 22 is in open communication with the regenerator chamber above it through openings 26 in the valve head 23.

The rate at which lean gas is supplied through each passage 26 may be regulated by the use of adjustable or replaceable throttling elements of usual or suitable form. Thus, as shown by way of example, a throttling pin 44 extending axially into the lower end of the passage 26 through the lower end of the housing 32 may be axially adjusted from the basement space of the battery to move pin portions of different diameters into throttling relation with the passage 26.

The valve members 22 may be adjusted in one direction or the other at suitable reversal periods by suitable reversing mechanism which may be of any suitable form. As shown, each valve member 22 is provided with individual fluid reversing means comprising an external or annular piston part 31 surrounding the body of the valve member and working in a cylinder space 33 formed in the valve housing 32. Pipe connections 34 and 35 connected to the upper and lower ends of the chamber 33, form means for increasing the pressure above the piston 31 to effect a down movement of the valve 22, and for increasing the pressure below the member 31 to effect the reversal or up movement of the valve member.

Instead of heating the battery by the combustion of lean fuel gas regeneratively preheated, all of the regenerator chambers may be used in preheating combustion air then supplied through

the distribution channels 20 as well as through the distribution channels 21, and rich fuel gas may then be supplied to the heating flues through channels 36 two of which extend upwardly through each of the walls 4a, and terminate at their upper ends in burner outlets formed in the superposed wall 4 and opening respectively, at suitable levels to the heating flues at the opposite sides of the wall 4. Rich fuel gas is supplied to one channel 38 of each pair through branches 37 from a horizontal distribution pipe 38 during periods alternating with those in which rich fuel gas is supplied to the other channel of the pair through the branches 37 from a second horizontal distribution pipe 38. The pipes 38 may be associated with reversing valves, not shown, in the usual manner. The riser pipe portions of the pipe connections 37 have their upper ends embedded in the corresponding cross girders 9 and in register with the lower ends of the channels 38.

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