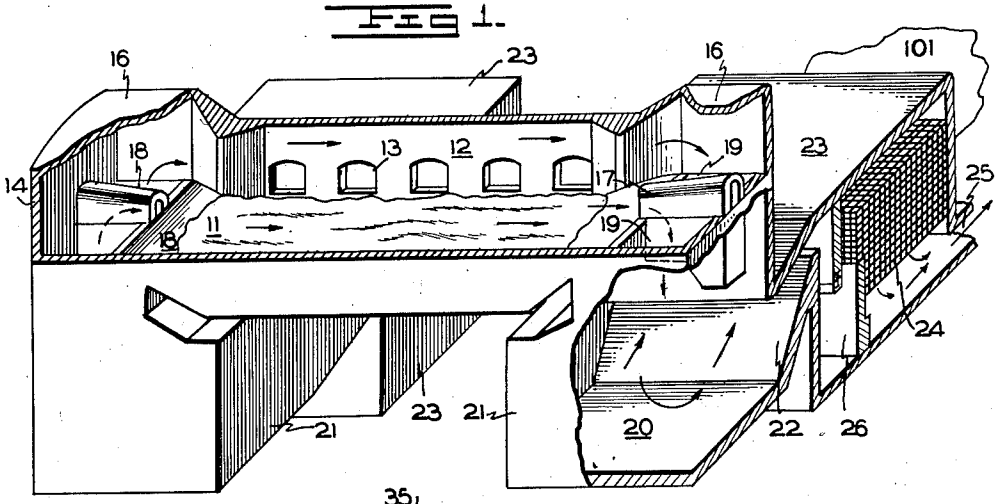
July 2, 1957 A. USMIANI 2,797,910

OPEN HEARTH FURNACE CONSTRUCTION

Filed March 10, 1954 4 Sheets-Sheet 1

FIG 1.



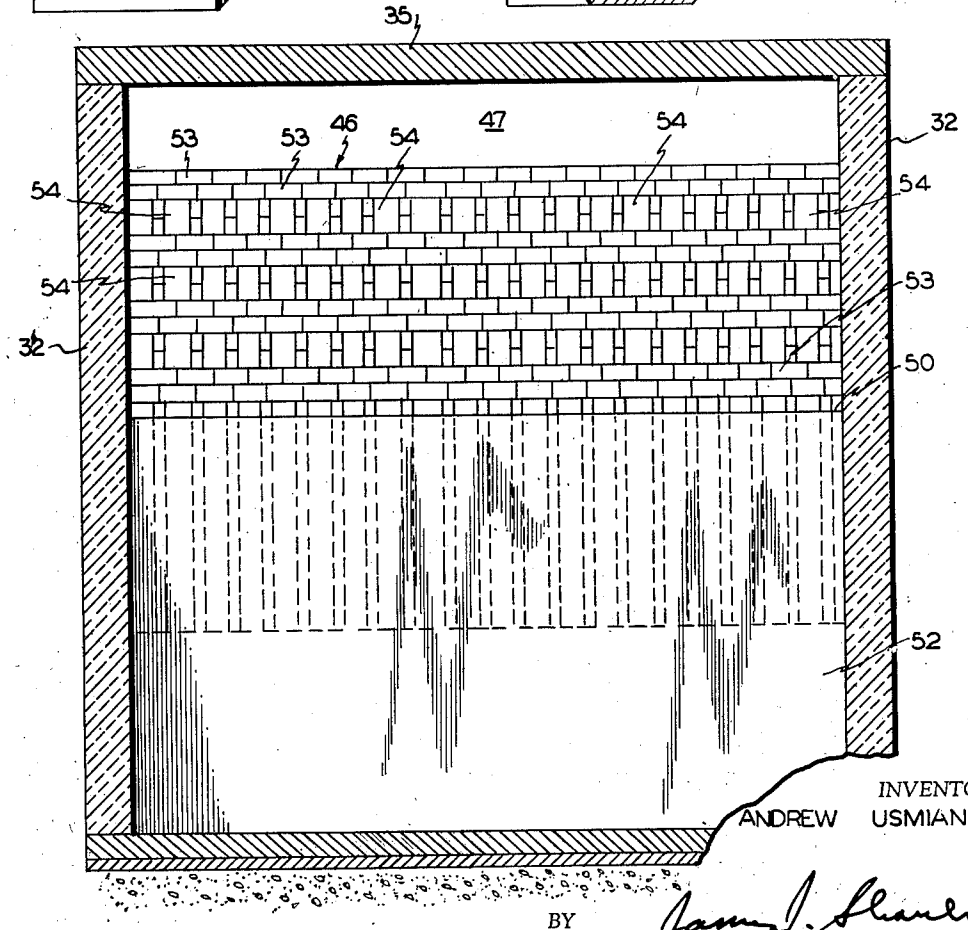


FIG 3.

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OPEN HEARTH FURNACE CONSTRUCTION

Filed March 10, 1954 4 Sheets-Sheet 2

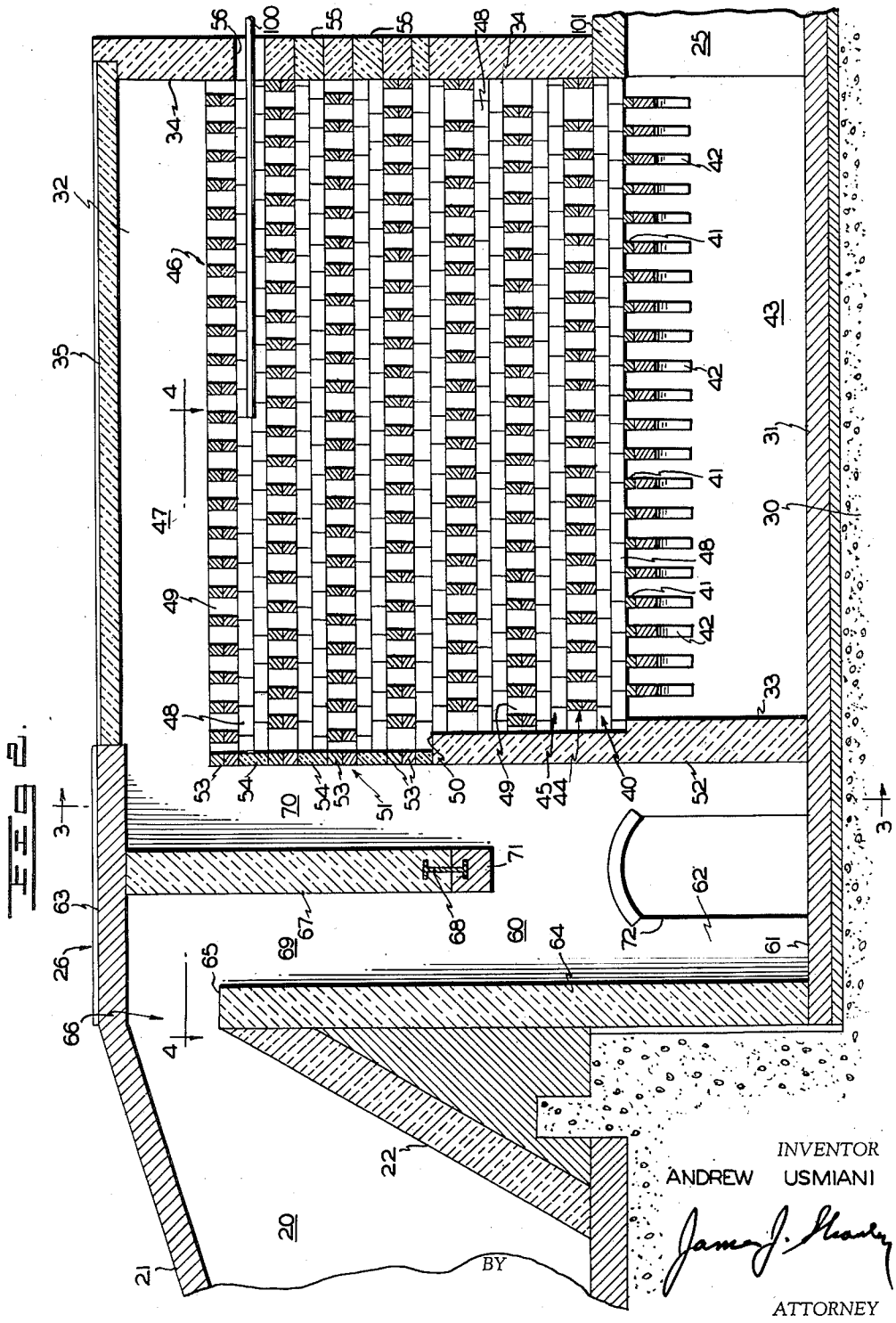


FIG. 2.

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July 2, 1957 A. USMIANI 2,797,910

OPEN HEARTH FURNACE CONSTRUCTION

Filed March 10, 1954 4 Sheets-Sheet 3

Fig 4.

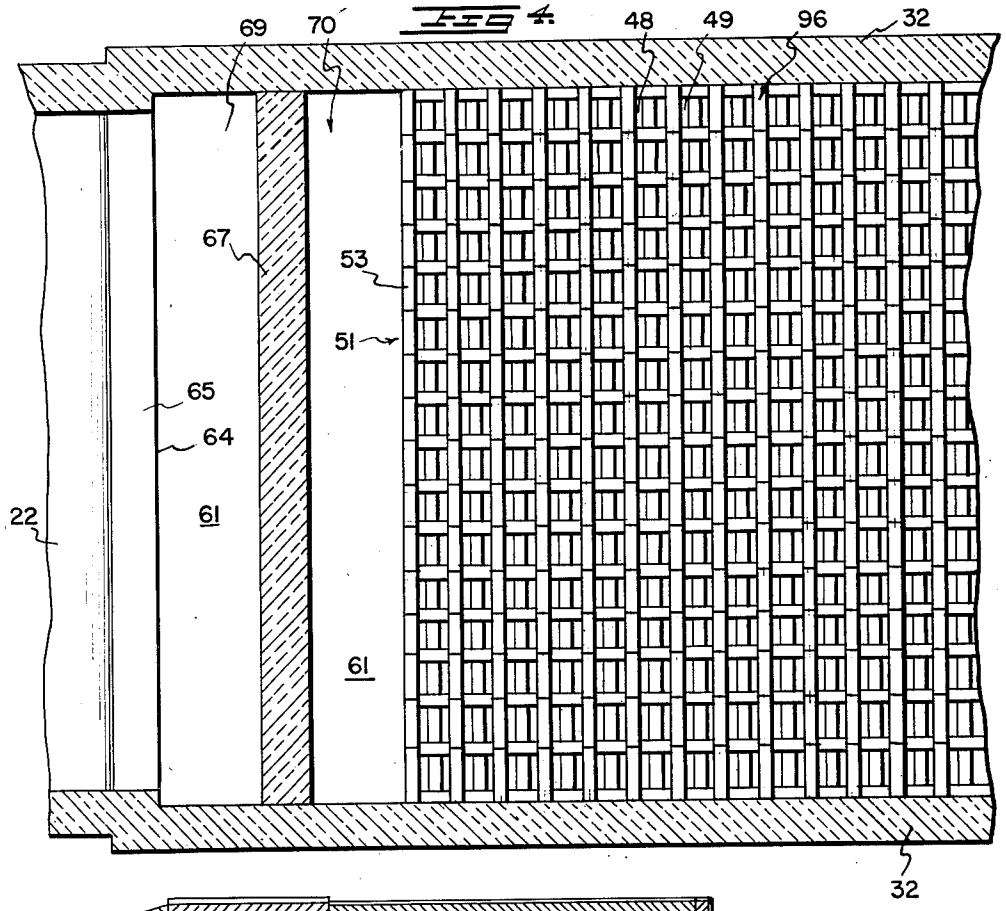
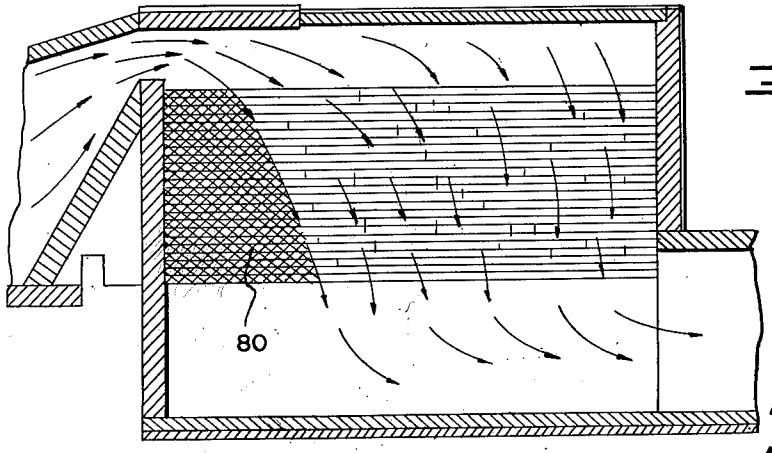


Fig 5.



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July 2, 1957 A. USMIANI 2,797,910

OPEN HEARTH FURNACE CONSTRUCTION

Filed March 10, 1954 4 Sheets-Sheet 4

Fig 6.

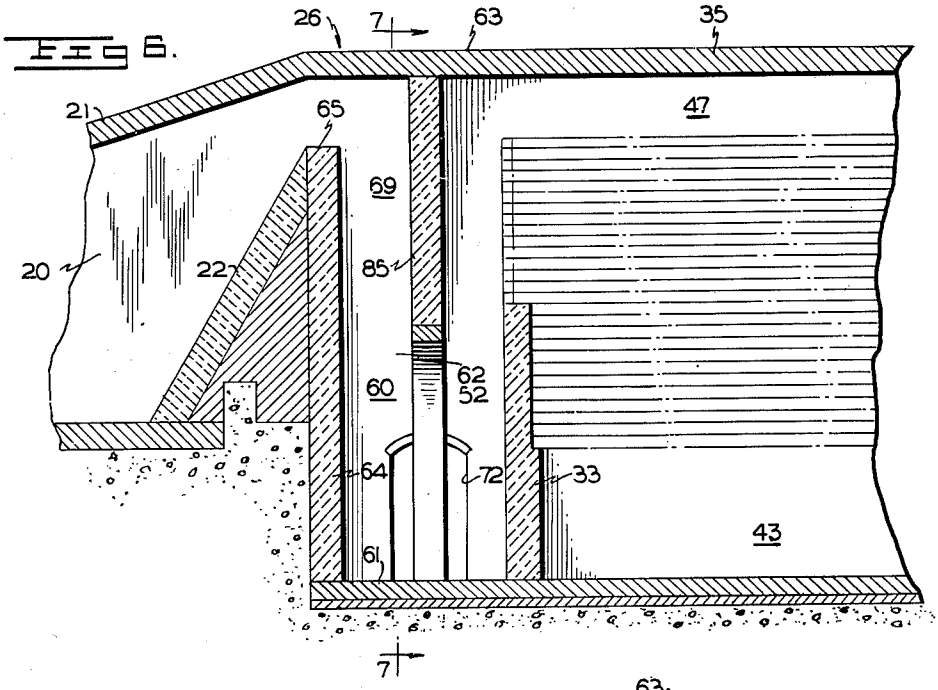
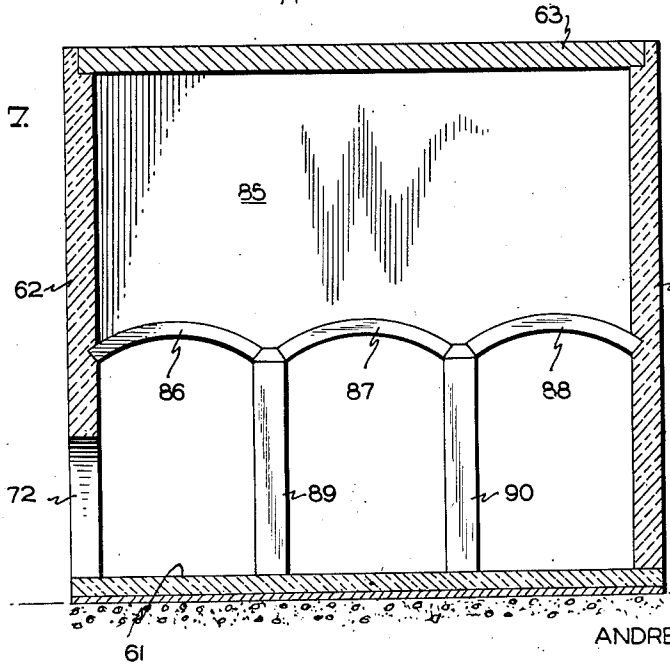


Fig 7.



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United States Patent Office

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OPEN HEARTH FURNACE CONSTRUCTION

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Application March 10, 1954, Serial No. 415,247

14 Claims. (Cl. 263—51)

This invention relates to reducing furnaces and more particularly to furnaces of the type including regenerators employing checkerwork operable during one cycle for absorbing heat from the hot gases leaving the furnace and operable in another cycle giving up the stored heat to air on its way to the furnace.

Regenerators of the type employed in reducing furnaces, such as open hearth furnaces, include a chamber of comparatively large volume filled with checkerwork made up of bricks of a material having good heat absorbing and dissipating characteristics. The bricks are arranged in the chamber in such a manner as to provide a plurality of passageways for the flow of gas through the checkerwork and to present a large area of the brick surfaces to be contacted by the gases flowing therethrough. Generally, as in the case of regenerators employed with open hearth furnaces, during one cycle of operations hot exhaust gases from the furnace are fed to the regenerator and flow in one direction through the passageways or the checkerwork, giving up heat to the bricks. During the other cycle, the hot exhaust gases are directed through another regenerator, and air is fed through the heated regenerator in a direction toward the furnace. During its passage through the passageways of the checkerwork, the air streams come into contact with the heated bricks, absorb stored heat from the bricks, and leave the regenerator at an elevated temperature.

The hot exhaust gases from the furnace carry a considerable quantity of small particles of soot, dust and other matter, and when the exhaust gases flow through the regenerator, the small particles are dislodged from the gas and collect on the bricks forming the entrance to the checkerwork passageways, the collected particles being in somewhat of a fused state due to the high temperatures involved. After an extended period of operation, the magnitude of the deposits is such that the size of the entrances to the checkerwork passageways is so decreased that the rate of flow through the checkerwork necessary for efficient operation cannot be maintained. It then becomes necessary to shut down the furnace and allow the regenerator chamber to cool to a low temperature, allowing workmen to enter the regenerator chamber and clean the checkerwork passageways. This necessity of periodically shutting down furnace operation for checkerwork cleaning materially reduces the furnace output, and the requirement of cooling the regenerator to a low cleaning temperature constitutes a substantial loss in heat, and the overall efficiency of the installation would be materially increased if the periods of operation between cleaning stoppages could be increased.

It is therefore an object of the present invention to provide a novel furnace installation of the type including regenerators having checkerwork capable of operation during extended periods between periodic shut-downs for checkerwork cleaning.

Another object is to provide a novel furnace installation of the above type including an arrangement for dislodging a portion of the small particles of dust, soot

and so forth from the hot exhaust gases prior to entry of the gases into the checkerwork and thus decrease the rate of deposit formation around the entrance to the checkerwork passageways.

Still another object of the invention is to provide a novel regenerator structure provided with auxiliary entrances for the checkerwork passageways adapted to be opened when the area of the primary entrance is substantially reduced by deposits from the exhaust gases.

Still another object is to provide a regenerator structure of the above type in which an arrangement is provided for opening the auxiliary entrances from without the regenerator during normal operation of the furnace installation.

A still further object of the invention is to provide a novel regenerator arrangement for reducing the rate of deposit formation on the entrances to the checkerwork passageways and for increasing the length of the operating period of the furnace between furnace shut-down for checkerwork cleaning, which may be incorporated in an existing regenerator without substantially decreasing the regenerator capacity.

Other objects and features of the invention will appear more fully from the following detailed description considered in connection with the accompanying drawings which disclose several embodiments of the invention. It is to be expressly understood, however, that the drawings are designed for purposes of illustration only and not as a definition of the limits of the invention, reference for the latter purpose being had to the appended claims.

In the drawings, in which similar reference characters denote similar elements throughout the several views:

Fig. 1 is a diagrammatic presentation, partially broken away, of an open hearth furnace construction embodying the principles of the present invention;

Fig. 2 is a view in section of a regenerator, adapted for use with an open hearth furnace, in which the principles of the present invention are shown in greater detail;

Fig. 3 is a view in section taken along the line 3—3 of Fig. 2;

Fig. 4 is a view in section taken along the line 4—4 of Fig. 2;

Fig. 5 is a diagrammatic sectional illustration of a conventional regenerator installation in an open hearth furnace used as an aid in describing the present invention;

Fig. 6 is a sectional view of a regenerator constructed in accordance with another embodiment of the present invention; and

Fig. 7 is a view in section taken along the line 7—7 of Fig. 6.

Referring more particularly to Fig. 1 of the drawings, an open hearth furnace embodying the principle of the present invention is disclosed therein, including a hearth 10 carrying a bath 11 of molten metal and being provided with a front wall 12 having charging doors 13, and a back wall and a main roof, not shown. The port ends of the furnace each include end wall 14, side walls 15 and a port roof 16. Fuel burner enclosures 17 are centrally positioned in the port ends longitudinally of the hearth, and end uptakes 18 and 19 extend from the port ends on both sides of the enclosures 17 into the slag pockets 20 formed by slag pocket chambers 21 located beneath the port ends. The slag pocket chambers are provided with a fantail flue 22 leading to a regenerator chamber 23 housing checkerwork 24 and being connected to a flue 25 communicating with the air supply or the exhaust stack. According to the present invention, the fantail flue 22 is connected to the regenerator chamber 23 through an intermediate flue 26, the purpose of which will appear more fully below.

Open hearth furnaces of the foregoing type operate

on alternate cycles in order to utilize the heat in the combustion gases to preheat the incoming air and/or gaseous fuel fed to the furnace. In one cycle the incoming air passes through the checkerwork in one of the regenerative chambers 23 where it absorbs heat from the checkerwork heated during the previous cycle and enters the furnace at one end through the uptakes 18, such as the left end as viewed in Fig. 1. During this cycle the fuel burner in the enclosure at the left end of the furnace operates and the direction of the flame across the hearth is indicated by the arrows shown in Fig. 1, with the exhaust gases leaving the furnace by the uptakes 19 and passing through the regenerator chamber 23 wherein the checkerwork 24 absorbs heat from the hot gases. During the next cycle, the direction of the flows are reversed and the incoming air is caused to flow through the regenerative chamber 23 housing the heated checkerwork wherein the stored heat is given up to the air flowing therethrough, while the exhaust gases flow through and heat the checkerwork in the other regenerative chamber. These cycles are alternated upon operation of suitable valve means positioned in conduits connected between the flues 25 and the air supply and the exhaust stack in such a manner as to maintain efficient operation of the furnace.

The principles of the present invention embodied in the construction of the regenerators 23 and the intermediate flues 26 and their relationship with the slag pocket chambers 21 is shown more clearly in Figs. 2, 3 and 4. As shown, each regenerator is constructed on a suitable foundation, such as a reinforced concrete slab 30, and includes a floor 31, side walls 32, end walls 33 and 34, and a roof 35, forming a regenerator chamber for the checkerwork 24. The floor, roof and walls are constructed of suitable fire clay brick in accordance with conventional practice. The checkerwork 24 positioned in the regenerator chamber is made up of high-quality fire clay bricks 36 having good heat absorbing and dissipating characteristics. The bricks 36 are positioned relative to each other to provide a large number of passageways in the checkerwork for the passage of gases through the regenerator chamber onto or away from the furnace so as to provide a large area of brick for contact with the gases for efficient heat transfer. The checkerwork may be formed by a plurality of courses of transversely and longitudinally extending spaced bricks alternately stacked one on top of the other. The lowermost course 40 may comprise a plurality of transversely spaced coplanar double rows of bricks, one on top of the other, extending longitudinally of the regenerator chamber. The rows of bricks forming the lowermost course 40 are supported on a plurality of longitudinally spaced members 41 extending transversely between the side walls 32. The members 41 are each supported by an arch member 42 bridging the side walls. The members 41 and 42 are spaced along the length of the checkerwork chamber and are located a substantial distance above the floor 31 to provide a flue passageway 43 forming a communication between the flue 25 and the checkerwork. The second course of bricks 44 comprise double rows of bricks supported on the bricks of the first course and extend transversely of the bricks of the first course. The second course of bricks are spaced longitudinally of the checkerwork chamber and extend transversely from side wall to side wall. The third course of bricks 45 is similar to the first course 41 and is supported by the second course 44. The checkerwork is thus made up of a plurality of longitudinally extending and transversely spaced courses of bricks and a plurality of transversely extending longitudinally spaced courses of bricks, alternately stacked one on top of the other to form a checkerwork of desired capacity in which the uppermost course of bricks 46 is spaced from the roof 35 a sufficient distance to provide flue means 47 for the passage of fluid into and from the passages in the checkerwork. In order that

the alternate courses of bricks may be supported by courses of bricks immediately below, the longitudinal spacing of the transversely extending courses and the transverse spacing of the longitudinally extending courses are less than the length of the bricks making up the courses. In this way the bricks of the checkerwork are self-supporting.

Each course of longitudinally extending transversely spaced bricks forms a plurality of longitudinally extending transversely spaced passages 48, and each course of transversely extending longitudinally spaced bricks forms a plurality of longitudinally spaced transversely extending passages 49. Due to the alternate arrangement of the different courses of bricks, the longitudinally extending transversely spaced passages and the transversely extending longitudinally spaced passages are interconnected to form a plurality of tortuous passages through the checkerwork extending from the uppermost course of bricks 46 to the lowermost or first course of bricks 40. The flow of fluid through the checkerwork between the flues 43 and 47 is in contact with a high percentage of the area of the bricks forming the checkerwork and provides a checkerwork having high heat absorbing and dissipating characteristics.

The entrances to the passageways extending through the checkerwork at the surface of the checkerwork adjacent the flue 47 are formed by the transversely extending longitudinally disposed spaces between the uppermost course of transversely extending longitudinally spaced bricks 46, the transversely extending spaces being divided transversely by the next lower course of longitudinally extending transversely spaced course of bricks. When the fluid passage through the checkerwork is such that the hot exhaust gases from the furnace flow through the checkerwork and then into the flue 25 onto the stack, the hot exhaust gases enter the passageways in the checkerwork from the flue 47 and pass through the passageway entrances formed by the uppermost course of bricks. As mentioned before, even though the hot exhaust gases pass downwardly through the slag pockets, the oxides and other dust particles carried by the hot exhaust gases are not completely removed prior to entry into the checkerwork. Consequently, as the hot exhaust gases pass through the passageway entrances in the uppermost courses, the oxides and other dust particles collect on the bricks forming the uppermost courses. As operation of the furnace continues, the oxides and foreign dust particles continue to accumulate on the bricks, collecting in a fused mass, and the cross-sectional areas of the passageway entrances become smaller and the rate of gas flow through the checkerwork is decreased. Finally a degree of accumulation is reached in which the heat dissipating characteristics of the checkerwork is so impaired that the furnace must be shut down. Heretofore it has been necessary when this condition developed, to allow the regenerator structure to cool to a safe temperature for the workmen to enter the structure and remove the deposits. This procedure is time-consuming and materially reduces the furnace production, as a considerable period is required for the furnace to cool to a safe temperature.

As previously discussed, the present invention overcomes these disadvantages by providing an arrangement the utilization of which materially increases the operating period and hence the production output, of a regenerative type furnace between shutdowns for checkerwork cleaning. Briefly, the arrangement provided by the present invention includes means operable from without the furnace when at normal operating temperature for opening auxiliary entrances provided in the side wall of the checkerwork for the passage of hot exhaust gases into the passageways through the checkerwork without necessitating shutting down furnace operation, together with means for normally conducting the exhaust gases to the checkerwork past the auxiliary entrances in such a manner as to further remove oxides and other fine dust from the exhaust gases

prior to their entry into the checkerwork, and thus further retard closing up of the normal entrances to the passageways.

The foregoing arrangement is shown more particularly in Figs. 2 and 3, in which the end wall **33** of the regenerator chamber is illustrated as terminating in a horizontal edge **50** extending across the checkerwork chamber at a medial point of the checkerwork. The portion of the checkerwork above the medial point of the horizontal edge **50** is extended longitudinally of the checkerwork and is terminated in an end face **51** coplanar with the outer surface **52** of the end wall **33**. Bricks **53** forming the end face **51** of the checkerwork function as structural members providing a support for the courses of bricks above the horizontal edge **50**, and a means for closing the one side of the transversely extending longitudinally spaced passages **49** adjacent the end face. Bricks **54** of the end face **51** function as closure means for the ends of the longitudinally extending transversely spaced passages **48**.

For a purpose that will appear more fully below, the bricks **54** are removably secured in the end face **51** of the checkerwork, and are adapted to be pushed outwardly from the checkerwork beyond the end face. For this purpose the end wall **34** of the checkerwork chamber is provided with a plurality of removable plugs **55** located in the ends of the longitudinally extending, transversely spaced passages **48**. Each of the passages **48** in each of the courses above the medial point of the horizontal edge **50** is provided with a removable plug. The plugs **55** are adapted to be removed from without the regenerator to provide an opening **56** for the insertion into the checkerwork of an operating member **57** adapted to extend throughout the length of the checkerwork against the inside of the bricks **54** and knock the bricks **54** from the end face **51**.

The intermediate flue **26** is located between the fantail flue **22** and the checkerwork chamber to provide a path for the fluids flowing therebetween. In addition, the intermediate flue provides a tortuous path for the hot exhaust gases to reduce the debris carried to the checkerwork and functions as a means for conducting the exhaust gases past the end face **51** on the way to the checkerwork. As shown more particularly in Fig. 2, the intermediate flue **26** comprises intermediate flue chamber **60** positioned between the checkerwork chamber and the fantail flue. The intermediate flue chamber **60** is formed by a floor **61**, side walls **62**, and a roof **63**, each of which may comprise an extension of the floor **31**, side walls **32** and roof **35**, respectively, of the regenerator chamber. One end of the flue chamber **60** comprises the end wall **33** and the end face **51** of the regenerator, while a wall **64** forms the other end, the wall **64** extending upwardly from the floor **61** between the side walls **62** and terminating at a top edge **65** adjacent the upper passageway **66** of the fantail flue. A vertically disposed wall **67** extends from the roof **63** downwardly into the intermediate flue chamber substantially equally between the end walls thereof, to a point below the horizontal edge **50** of the wall **33**. The intermediate wall may be supported by an I-beam **68** extending between and being supported by the side walls. The wall **67** divides the upper portion of the intermediate flue chamber **60** into separate compartments **69** and **70**; the compartment **69** communicating with the fantail flue and the compartment **70** communicating with the flue **47** feeding the top of the checkerwork and with both of the compartments communicating with each other through the lower portion of the intermediate flue chamber. With this construction, the hot exhaust gases flowing from the upper passageway **66** of the fantail are caused by the wall structure **67** to flow downwardly through the chamber **69** toward the low end of intermediate flue chamber **60** and into the low end of the intermediate flue chamber **60**. The exhaust gases then flow around the bottom edge **71** of the wall **67** and upwardly away from the low end of the intermediate flue into the chamber **70** and across the end face **51** toward the flue **47**. The intermediate flue chamber with the partition wall **67** thus directs the flow of hot exhaust gases on the way to the regenerator across the end face **51**. Also, the tortuous path of the hot exhaust gases through the intermediate flue chamber is effective in dislodging particles of fine dust from the hot exhaust gases so that the gases carry a smaller quantity of dust upon entrance into the checkerwork. This feature materially reduces the rate of dust accumulation on the bricks forming the entrances to the passageways of the checkerwork and increases the operating time between which the furnace must be shut down for cleaning the checkerwork. The flue dust so dislodged from the hot exhaust gases fall to the bottom of the intermediate flue chamber and collect on the floor **61**. These particles may be removed while the furnace is in operation through a suitable cleaning doorway **72** provided in the side wall. Also, the bricks **54** which may be pushed outwardly from the end face **51** in the manner described above, fall downwardly in the intermediate flue chamber and collect on the floor **61**. These bricks may also be removed through the doorway **72**.

The principles of the present invention may be applied to existing regenerators without substantially decreasing their capacity. It has been determined that the normal flow of hot exhaust gases through conventional checkerwork is not through an appreciable portion of the checkerwork adjacent the end wall of the regenerator chamber nearest the fantail flue. This is illustrated in Fig. 5 of the drawings in which the arrows indicate the normal path of flow through the checkerwork which excludes the shaded portion **80**. Since the portion **80** is not in the path of the hot exhaust gases and cannot absorb heat, and hence cannot give up heat to the incoming air, its presence has very little, if any, material effect upon regenerator efficiency. Consequently, the portion **80** of the checkerwork may be removed from the regenerator and the regenerator modified in accordance with the principles of the present invention by installing an intermediate flue of the character described above, without materially effecting the efficiency of the regenerator due to the decrease in the quantity of checkerwork.

Another form of intermediate flue construction is shown in Figs. 6 and 7. In this construction a dividing wall **85**, extending downwardly from the roof **63** a part way into the chamber **60** and forming the chambers **69** and **70**, is constructed of fire bricks and supported on a masonry arch structure also of fire brick. The arch structure includes archways **86**, **87** and **88** extending across the chamber **60** from side wall to side wall and beneath the wall **88**. One end of the archways **86** and **88** are supported by the side walls, while adjacent ends of the archways are supported by columns **89** and **90** constructed of fire brick.

In operation of an open hearth furnace including regenerators embodying the principles of the present invention, during one cycle of operation the hot exhaust gases from the hearth flow into one end port down the uptakes and into the slag pit, while the incoming air enters at the other end port of the furnace. The hot exhaust gases leave the slag pit through the fantail flue and enter the upper end of the intermediate flue. Upon entry into the intermediate flue the wall **67** causes the direction of flow of the hot exhaust gases to change abruptly and flow downwardly through the chamber **69** toward the bottom of the intermediate flue. In the lower end of the intermediate flue the direction of flow again changes, with the exhaust gases flowing upwardly through the chamber **70** and across the end face **51** toward the roof **63** and into the flue **42**. The tortuous path of the hot exhaust gases through the intermediate flue causes a substantial percentage of the dust carried by the hot exhaust gases to be dislodged therefrom so that less dust particles are

carried into the checkerwork. The dislodged dust particles collect on the floor of the intermediate flue and are removed therefrom through the doorway 72.

The hot exhaust gases, with a portion of the dust particles removed, enter the flue 47 and are conducted along the top of the checkerwork in communication with the entrances to the passageways through the checkerwork. The gases enter the passageways and flow through the checkerwork, giving up heat to the checkerwork, and enter the flue 43 beneath the checkerwork. From the flue 43 the exhaust gases flow from the regenerator through the flue 25 and are conducted onto the stack. During the foregoing air is caused to flow through the other regenerator onto the furnace; this regenerator having been previously heated by hot exhaust gas flowing in the opposite direction. When the next cycle commences, the direction of flow through the regenerators is reversed so that the air now flows through the regenerator which was previously absorbing heat from the exhaust gases, and the other regenerator is heated up by the exhaust gases.

As mentioned above, during the cycle in which hot exhaust gases flow through the checkerwork, oxides, dust and other flue particles collect in a fused state on the bricks in the uppermost course forming the entrances to the passageways. These deposits gradually increase and eventually, if the process is allowed to continue, the cross sectional area of the entrance of the passageways through the checkerwork become so small that the resulting low rate of flow through the checkerwork materially effects regenerative action. However, according to the present invention, when the efficiency of the regenerator begins to drop, the operator removes the top course of removable bricks 54 in the end face 51 to provide an opening or an auxiliary entrance in the end face 51 leading to each of the longitudinally extending passages 48. Thus the rate of flow through the checkerwork is maintained at an efficient rate.

After the operation continues, the deposits on the bricks forming the entrance to the checkerwork passageways along the flue 47 will continue to increase and further block the rate of flow through the checkerwork by way of these entrances, and deposits will also begin to form around the openings in the end face 51, requiring additional auxiliary entrances to be formed in the end face. This is accomplished by removing the next course, or a portion thereof, of the removable bricks 54. As furnace operation continues, the bricks 54 are removed to form auxiliary entrances to the checkerwork passageways in such a manner as to maintain sufficient regenerative action for efficient furnace operation.

The removable bricks 54 are removed from without the regenerator and when the furnace is in normal operation by removing a corresponding removable plug 55 in the opposite wall 34 of the regenerative chamber. When a plug 55 is removed, a suitable tool such as an elongated rod 100 may be inserted through the opening 56 in the wall 34 formed by the removed plug and into the longitudinally extending passage 48 in the checkerwork communicating with the opening 56. The rod 100 is extended into the checkerwork throughout the length of the passage 48 and used to operate upon the removable bricks 54 in the opposite end of the longitudinal passage. When the brick 54 is pushed from the end face 51, the rod 100 is removed from the passage, the plug 55 is replaced to close the opening 56, and a similar process is followed for removing another brick 54 to form an additional auxiliary entrance to the passageways of the checkerwork. As shown clearly in Fig. 1, the region of the wall 34 of the regenerator chamber including the removable plugs is easily reached from the floor 101.

Although two embodiments of the invention have been disclosed and described above, it is to be expressly understood that various changes and substitutions may be made therein without departing from the spirit of the invention, as well understood by those skilled in the art. Reference therefore will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A regenerator for abstracting heat from a stream of hot gas flowing therethrough in one direction and for dissipating the abstracted heat to a stream of relatively colder gas flowing therethrough in the opposite direction, comprising a checker chamber, checkerwork formed of heat abstracting and dissipating material located in the checker chamber, the checkerwork presenting a plurality of passageways therethrough for the passage of substreams of a stream of gas flowing through the checker chamber, means forming a first flue communicating with the passageways of the checkerwork, and means including a side wall of the checker chamber forming a second flue connected to the first flue for conducting the gas stream past the outside surface of the side wall on its way to and from the passageways of the checkerwork, the side wall of the checker chamber including a plurality of removable plugs filling entrances between the second flue and the passageways of the checkerwork.

2. A regenerator for abstracting heat from a stream of hot gas flowing therethrough in one direction and for giving up the abstracted heat to a stream of relatively colder gas flowing therethrough in the opposite direction, comprising a checkerwork chamber, checkerwork formed of heat abstracting and dissipating material located in the chamber, the checkerwork presenting a plurality of passageways for the passage of streams of gas therethrough, means forming a first flue in communication with one end of the passageways, means forming a second flue in communication with the other ends of the passageways, means including a side wall of the checker chamber forming a third flue connected to the second flue for conducting gas past the outside surface of the side wall on its way to and from the passageways, the side wall of the chamber including a plurality of removable plugs filling entrances between the third flue and the passageways of the checkerworks, and means operable for removing the removable plugs from without the checkerwork chamber and from without the third flue.

3. A regenerator for abstracting heat from a stream of hot gas flowing therethrough in one direction and for gving up the abstracted heat to a stream of relatively cold gas flowing therethrough in the opposite direction, comprising a checker chamber, checkerwork formed of heat abstracting and dissipating material located in the checker chamber, the checkerwork forming a plurality of passageways for the passage of streams of gas therethrough, means forming a first flue in communication with one end of the passageways, means forming a second flue in communication with the other ends of the passageways, means including a side wall of the chamber forming a third flue connected to the second flue for conducting gas past the outside surface of the side wall on its way to and from the passageways, the side wall of the chamber comprising a portion of the checkerwork and including a plurality of removable plugs to present a continuous surface, the removable plugs filling auxiliary entrances between the third flue and the passageways of the checkerwork.

4. A regenerator of the character set forth in claim 3 including means operable to permit selective removal of the removable plug from without the regenerator.

5. A regenerator for abstracting heat from a stream of hot gas flowing therethrough in one direction and for giving up the abstracted heat to a stream of relatively colder gas flowing therethrough in the opposite direction, comprising a checker chamber, checkerwork formed of heat abstracting and dissipating material in the checker chamber, the checkerwork presenting a plurality of vertically disposed passageways for the passage of streams of gas therethrough, means forming a first flue located below the checkerwork in communication with the passageways,

means forming a second flue located above the checkerwork in communication with the passageways, means including a side wall of the chamber forming a third flue connected to the second flue for conducting gas past the outside surface of the side wall on its way to and from the passageways, the side wall including a plurality of removable plugs filling entrances between the third flue and the passageways of the checkerwork.

6. A regenerator for abstracting heat from a stream of hot gas flowing therethrough in one direction and for giving up the abstracted heat to a stream of relatively colder gas flowing therethrough in the opposite direction, comprising a checker chamber, checkerwork formed of heat abstracting and dissipating material located in the checker chamber, the checkerwork presenting a plurality of vertically disposed passageways for the passage of a stream of gas therethrough, means forming a first flue positioned below the checkerwork in communication with the passageways, means forming a second flue positioned above the checkerwork in communication with the passageways, means including a side wall of the checker chamber forming a third flue connected to the second flue for conducting gas past the outside surface of the side wall on its way to and from the passageways, the upper portion of the side wall of the checker chamber including a plurality of removable plugs, each of the removable plugs filling a passage between the passageways of the checker chamber and the third flue.

7. A regenerator for abstracting heat from a stream of hot gas flowing therethrough in one direction and for giving up the abstracted heat to a stream of relatively colder gas flowing therethrough in the opposite direction, comprising a checker chamber, checkerwork formed of heat abstracting and dissipating material located in the checker chamber, the checkerwork presenting a plurality of vertically disposed passageways for the passage of streams of a gas therethrough, means forming a first flue positioned below the checkerwork in communication with the passageways, means forming a second flue positioned above the checkerwork in communication with the passageways, means including a side wall of the checker chamber forming a third flue connected to the second flue for conducting gas past the outside surface of the side wall on its way to and from the passageways, the side wall of the checker chamber having an upper portion including a plurality of removable plugs, the removable plugs filling passages between the passageways of the checker chamber and the third flue, and means operable for selectively removing the removable plugs from without the checker chamber.

8. A regenerator of the character set forth in claim 7 in which the upper portion of the side wall of the checker chamber includes a plurality of vertically spaced series of removable plugs, with each series comprising a plurality of removable plugs extending in spaced relation across the side wall.

9. In an open hearth furnace, a hearth, a checker chamber, checkerwork in the chamber forming a plurality of passageways for the passage of gas through the checker chamber, a closed chamber connected to the hearth and to the checker chamber for conducting a gas stream between the hearth and the checker chamber, the checker chamber and the closed chamber having a common side wall over which the gas stream flows as it passes through the closed chamber between the hearth and the checker chamber, and a plurality of removable plugs in the common side wall, the removable plugs filling passages forming communication between the passageways and the closed chamber.

10. In an open hearth furnace, a hearth, a checker chamber, checkerwork in the chamber forming a plurality of passageways for the passage of a gas through the checker chamber, means forming a flue communicating with the passageway, a closed chamber connected to the hearth and to the flue, for conducting a gas stream between the hearth and the checker chamber, the checker chamber and the closed chamber having a common side wall over which the gas stream flows as it passes through the closed chamber between the hearth and the flue, the common side wall including a plurality of removable plugs filling passages communicating between the passageways of the checkerwork and the closed chamber.

11. In an open hearth furnace, a hearth, a checker chamber, checkerwork in the chamber forming a plurality of passageways for the passage of a gas through the checker chamber, a flue communicating with the passageways, a closed chamber connected to the hearth and to the flue for conducting a gas stream between the hearth and the checker chamber, the checker chamber and the closed chamber having a common side wall over which the gas stream flows as it passes through the closed chamber on its way between the hearth and the flue, the common side wall including a plurality of removable plugs filling passages forming communication between the passageways and the closed chamber, and the closed chamber including means for providing a tortuous path for the gas stream from the hearth to the checker chamber.

12. In an open hearth furnace, a hearth, a checker chamber having a roof, checkerwork positioned in the checker chamber and having an upper surface and formed to provide a plurality of vertically disposed passageways for the passage of streams of gas through the checker chamber, the checkerwork being positioned in the checker chamber with its upper surface spaced below the roof of the checker chamber to provide a flue communicating with the passageways, a chamber forming a slag pocket communicating with the hearth, the chamber having a roof joined to the roof of the checker chamber and a side wall common with the checker chamber, the common side wall including an upper end lying in a plane spaced below the roof of the checker chamber to establish communication between the flue and the chamber, the common wall including a plurality of removable plugs filling passages between the chamber and the passageways of the checkerwork, and a partition member in the chamber extending downwardly from the roof of the chamber in spaced relation with the common wall to form a tortuous path through the chamber for the gas stream on its way between the hearth and the checker chamber.

13. In an open hearth furnace, a hearth, a checker chamber having a roof, checkerwork positioned in the checker chamber having an upper surface and formed to provide a plurality of vertically disposed passageways for the passage of streams of gas through the checker chamber, the checkerwork being positioned in the checker chamber with its upper surface spaced below the roof of the checker chamber to provide a flue communicating with the passageways, a chamber forming a slag pocket, the chamber having a roof joined to the roof of the checker chamber and a side wall common with the checker chamber, the common side wall including an upper end lying in a plane spaced below the roof of the checker chamber to establish communication between the flue and the chamber, the side wall of the chamber opposite the common wall having an upper end lying in a plane spaced below the roof of the chamber to provide an entrance to the chamber communicating with the hearth, the common wall including a plurality of removable plugs located in its upper portion filling passages communicating between the chamber and the passageways of the checker work, and a partition member in the chamber extending downwardly from the roof of the chamber in spaced relation with the common wall and the other side wall of the chamber to form a tortuous path through the chamber for the gas stream on its way between the hearth and the checker chamber.

14. An open hearth furnace as defined in claim 13 in which the side wall of the checker chamber opposite the common wall is provided with removable members located

above the surface of the charging floor to provide access through the checkerwork for removing the removable plugs from the common wall.

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