April 6, 1937. A. E. NASH 2,075,863

HEAT TRANSFER APPARATUS AND REFRACTORY WALL STRUCTURE THEREFOR

Filed Dec. 19, 1934 3 Sheets-Sheet 1

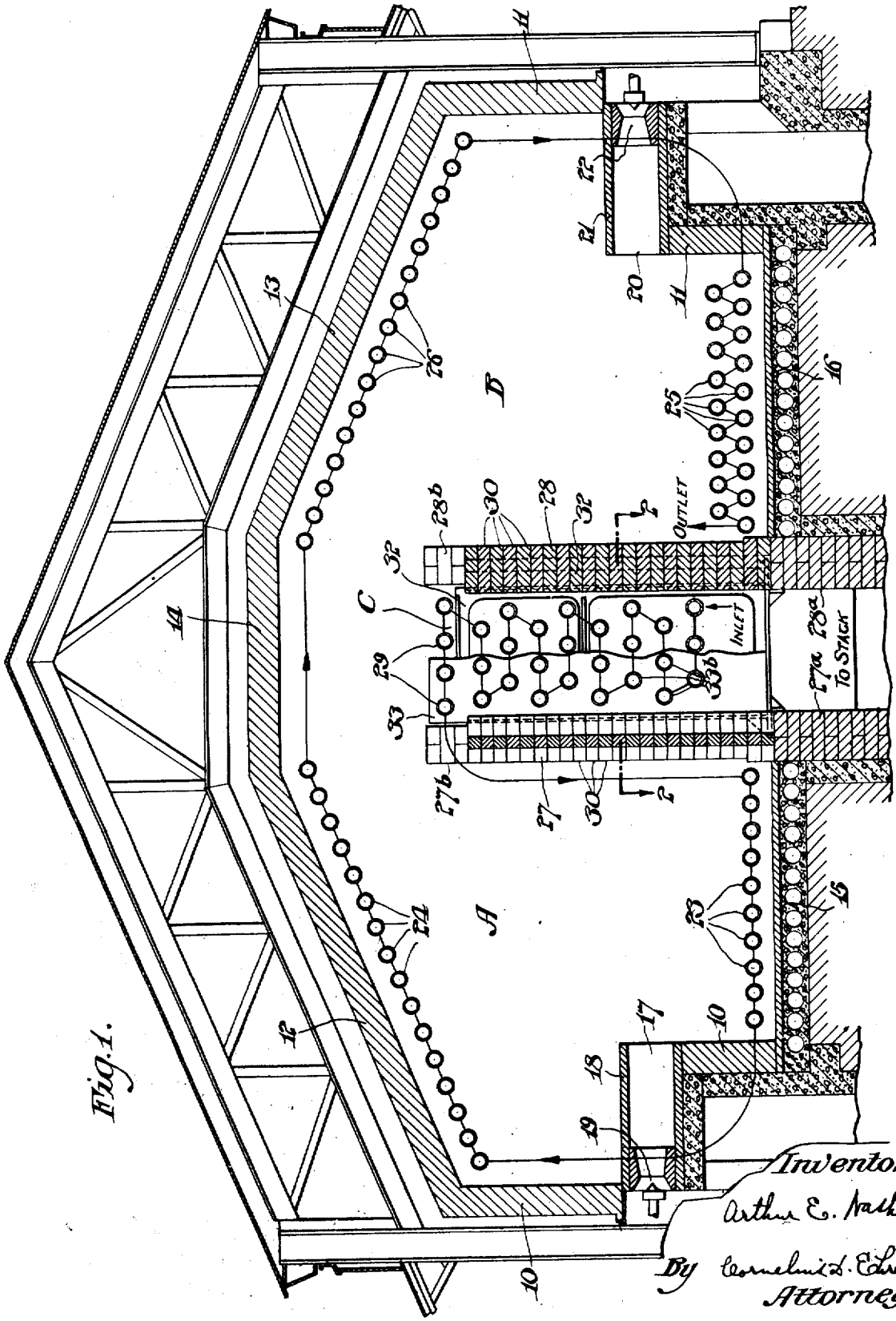


Fig. 1.

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HEAT TRANSFER APPARATUS AND REFRACTORY WALL STRUCTURE THEREFOR

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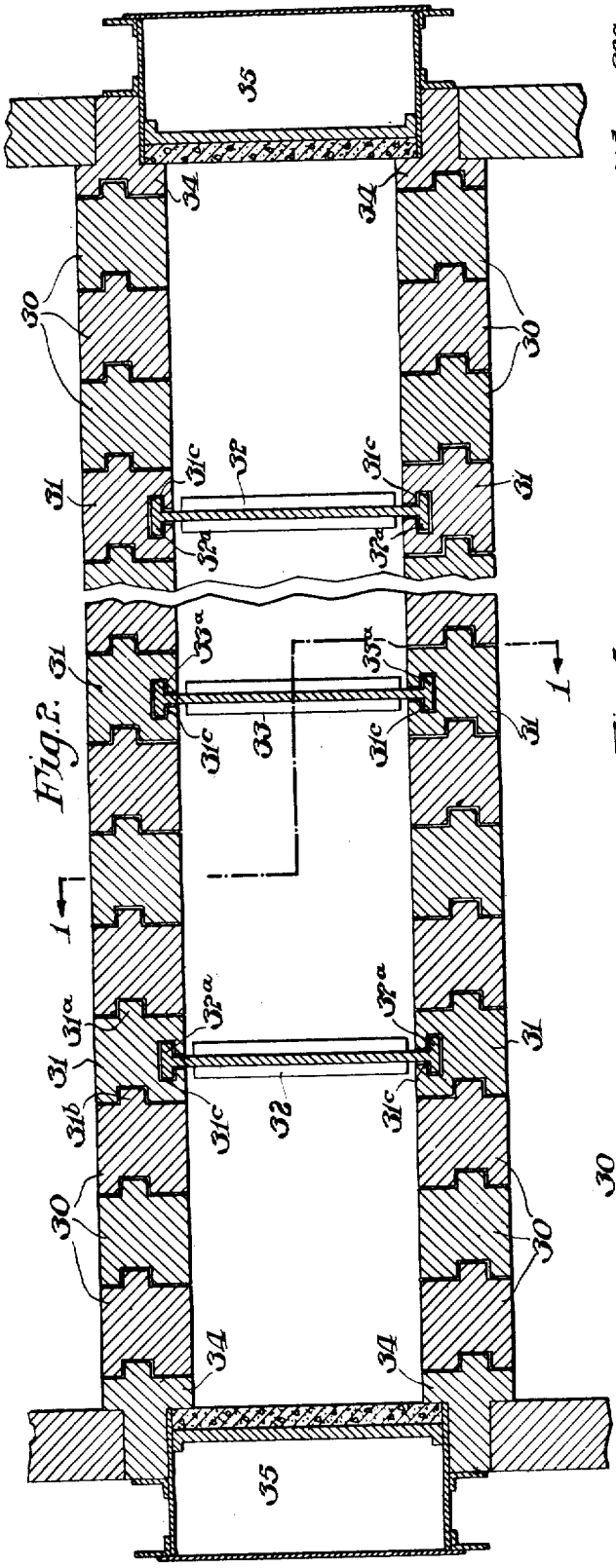


Fig. 2.

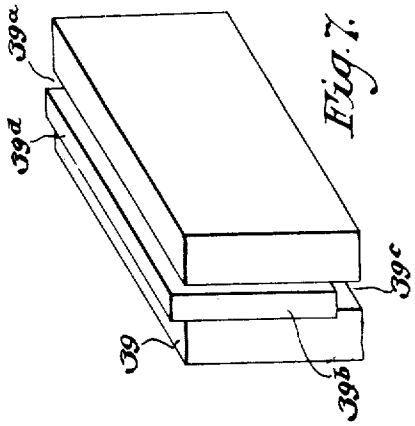


Fig. 7.

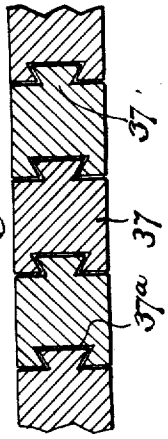


Fig. 5.

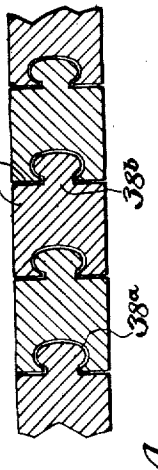


Fig. 6.

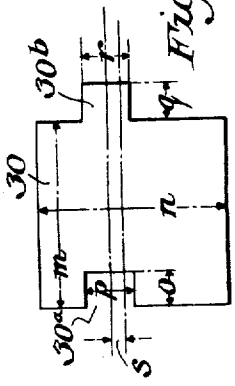


Fig. 3.

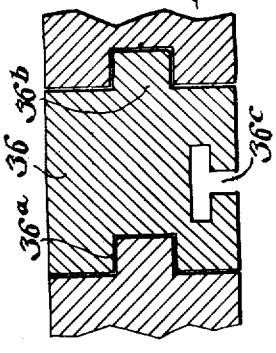


Fig. 4.

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HEAT TRANSFER APPARATUS AND REFRACTORY WALL STRUCTURE THEREFOR

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Fig. 8.

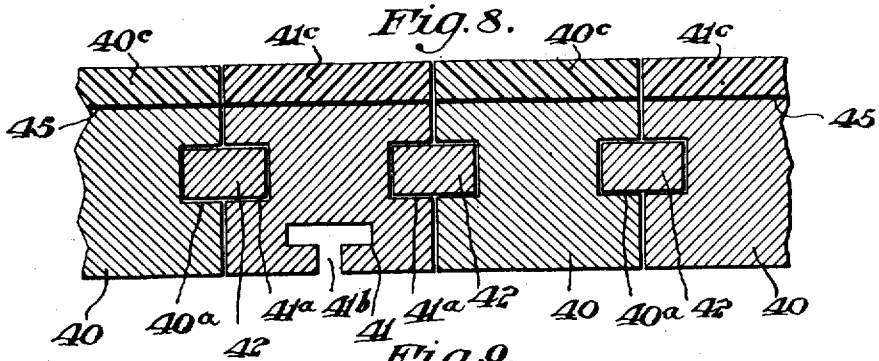


Fig. 9.

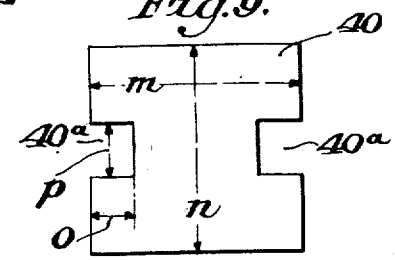


Fig. 10.

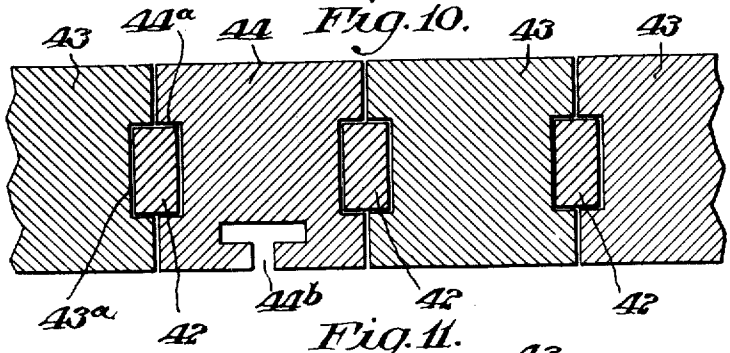
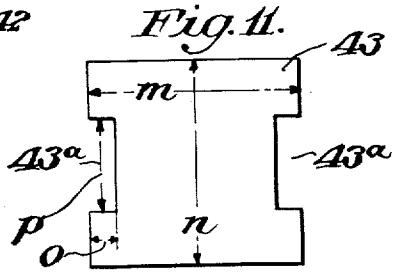


Fig. 11.



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Patented Apr. 6, 1937 2,075,863

UNITED STATES PATENT OFFICE

2,075,863

HEAT TRANSFER APPARATUS AND REFRACTORY WALL STRUCTURE THEREFOR

Arthur E. Nash, Philadelphia, Pa., assignor to Alcorn Combustion Company, Philadelphia, Pa., a corporation of Delaware

Application December 19, 1934, Serial No. 758,851

21 Claims. (Cl. 122—356)

My invention relates to heat transfer apparatus and more particularly to refractory walls therefor and to refractory units, elements or blocks for use in such walls. While my invention is of general application, it is particularly suitable for use in heat transfer apparatus for heating, cracking, or converting hydrocarbon oils. This application is a continuation-in-part of my copending application, Serial No. 729,173, filed June 6, 1934.

In accordance with my invention, certain of the refractory walls of a heat transfer apparatus comprise a plurality of refractory units, elements, blocks, or a series of the same, loosely stacked in a course to define a wall structure. By the term "loosely stacked", as used hereinafter in the specification and claims, is meant the stacking of the units or blocks uniformly in contiguous relationship to form a wall of conventional configuration without the use of the usual cement or other binding or bonding medium. However, in certain instances, I have found it desirable to lay the units or blocks with fireclay, which serves to fill in any irregularities or imperfections in the blocks without bonding or cementing the units to any appreciable extent. Further, an appreciable clearance or spacing is provided between the individual units or blocks, preferably between the adjacent vertical faces thereof, so that they have a substantially unrestrained but limited freedom of motion to provide completely for the expansions and contractions thereof occasioned by variations in temperature within a wide range, incident to the operation of the heat transfer apparatus. In certain cases, it is permissible, and may be desirable, to cement or otherwise bond the refractory units or blocks of a vertical series or tier, allowing the vertical tiers substantially unrestrained but limited freedom of motion with respect to each other. The term "loosely stacked" is employed herein to embrace all of the above described arrangements. Such a loosely stacked structure is to be contrasted with the arrangements of the prior art in which refractory walls are generally built of blocks or units bonded or cemented together into a single rigid structure by means of cement or like bonding medium.

The units, elements, blocks, or tiers of the same comprising the refractory walls of my invention may be of fireclay or like refractory and heat-insulating material, and preferably comprise molded and heat-treated blocks. The units, blocks, or tiers of the same, are provided with interengaging or interlocking surfaces to maintain them in proper alignment or position; more particularly, they may be provided with loosely fitting projections and complementary recesses extending longitudinally of the wall. By either of the terms interengaging surfaces or "interlocking surfaces", as used hereinafter, is meant any pair of complementary irregular engaging surfaces effective to prevent relative lateral movement of the blocks, such as complementary projections and recesses, complementary recesses adapted to receive locking blocks or elements, and the like; it is not limited to such engaging surfaces which are positively interlocked against any relative movement, although, if desired, the configuration of the complementary surfaces may be such as to prevent substantial longitudinal, as well as lateral movement.

The refractory walls of my invention may be self-sustaining, without auxiliary support, or of the "suspended" type, in which an auxiliary supporting or bracing member or members engage the wall at one or more spaced points to secure it in its proper relationship in the heat transfer apparatus. Further, the refractory walls may comprise two or more mutually supporting structures. In case the refractory walls are of the suspended or mutually supporting type, the refractory units comprising the walls are provided also with engaging or locking surfaces normal to the face of the wall. More particularly, a vertical group or groups of units or blocks are provided with locking recesses or projections disposed in vertical alignment and an auxiliary supporting or bracing member, such as a steel or other metallic supporting member, engages each group of vertically aligned recesses or projections. By the term "supporting member" is meant a member which engages the wall and braces or supports it from lateral movement or collapse and which may or may not, and preferably does not, carry any weight of the wall, which preferably rests directly upon its foundations.

While my invention is of general application to any of the refractory walls of a heat transfer apparatus, it is particularly suitable for embodiment in a pair of mutually supporting bridge walls dividing the apparatus into a plurality of heating chambers, in connection with which my invention will be specifically described.

For a better understanding of my invention, together with other and further features thereof, reference is had to the following description taken in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

In the drawings, Fig. 1 is a view in cross-sec-

tional elevation of a heat transfer apparatus embodying my invention in a pair of mutually supporting bridge walls, the sectional view of the walls being taken along the lines 1—1 of Fig. 2;

Fig. 2 is a plan view in cross-section of the bridge wall structure of Fig. 1 taken along the lines 2—2 of Fig. 1;

Figs. 3–11, inclusive, are detailed views of modified forms of refractory units or blocks suitable for use in the refractory walls of my invention.

Referring now to Fig. 1 of the drawings, there is illustrated a heat transfer apparatus embodying my invention and comprising three distinct zones or chambers A, B, and C. The heating chambers are defined by side walls 10 and 11, sloping roof portions 12 and 13 joined by a horizontal roof portion 14, and floor sections 15 and 16. These wall, roof and floor sections may be of fire-brick or other suitable refractory material and are of conventional type, comprising no part of my present invention. A current of hot combustion gases is discharged into the chamber A from one or more firing muffles or combustion chambers 17 having top plates and/or walls 18 of highly refractory material, such as silicon carbide. The combustion gases are generated by supplying to the chambers 17 suitable solid or fluid fuel, such as gas or oil, through adjustable burners 19. The combustion chambers 17 discharge into the chamber A substantially above the floor, to make provision for radiantly-heated floor tubes therebeneath, as described hereinafter. Similarly, a current of hot combustion gases is discharged into the chamber B from one or more combustion chambers 20 having highly refractory top plates and/or walls 21 and supplied from adjustable burners 22. Disposed in the chamber A, adjacent and beneath the discharge of the combustion chambers 17, is a heat-absorption structure, such as a bank of oil-conducting tubes 23, receiving heat from the combustion gases preponderantly or substantially solely by radiation. Additional heat-absorption structure, such as a bank of oil-conducting tubes 24, is disposed adjacent the sloping roof portion 12 of the chamber A to receive heat predominantly by radiation, or by combined radiation and convection. Similarly, in the chamber B, there is disposed a double row of radiantly-heated floor tubes 25 and a bank of roof tubes 26 heated predominantly by radiation or by combined radiation and convection.

The combined currents of gases from the chambers A and B traverse the chamber C defined by a pair of bridge walls 27 and 28. In the chamber C are disposed a bank of oil-conducting tubes 29 heated preponderantly by convection from the combined currents of gases flowing through the chamber C. The lower end of the chamber C is connected to a flue or stack, not shown. The above-described general structural relationship of the refractory walls, chambers and heat-absorption structures comprises no part of my present invention, but is described and broadly claimed in a copending joint application of mine and F. E. Shelly, Serial No. 721,480, filed April 20, 1934.

The bridge walls 27 and 28 comprise a pair of mutually supporting refractory walls embodying my invention. As shown more clearly in the cross-sectional view of Fig. 2, each of the walls 27 and 28 is made up of a plurality of refractory units, elements or blocks 30 and 31 loosely stacked in single rows or courses one above the other, without the use of bonding or cementing material, and with an appreciable clearance or spacing therebetween, to allow for unrestrained but limited freedom of motion, providing for expansion and contraction incident to the use of the furnace. Each of the units or blocks 30 may comprise a molded refractory element of fireclay or other suitable refractory heat-insulating material. As shown in detail in Fig. 3, each of the blocks 30 is provided with an inwardly extending recess or groove 30*a* at one end and a complementary projection or tongue 30*b* at the other end. The complementary projections and recesses are also provided with appreciable clearances therebetween to allow a limited freedom of motion between the blocks. The blocks 31 are identical to the blocks 30 with the exception that they are provided with an additional engaging surface, such as a projection or, as illustrated, an inwardly extending T-shaped or other locking recess 31*c*.

Although it will be apparent that the relative dimensions of the blocks 30 and 31 may be varied within wide limits in accordance with the dimensions and requirements of the refractory wall or heat-transfer apparatus of which they form a part, a block having the following dimensions (as referred to Fig. 3) has found satisfactory application:

	Inches
m	11¾
n	12
o	2
p	3
q	1⅞
r	2¾
Thickness	2½ or 3

It will be noted that the axes of symmetry of the blocks as a whole, and of the complementary recesses 30*a*, 31*a* and projections 30*b*, 31*b* are displaced by a distance *s* in a direction away from the recesses 31*c*. It has been found that such a displacement increases the shortest distance between the recesses 31*b* and the recesses 31*c* and is thus effective materially to increase the strength of the blocks 31. In the blocks having the dimensions given above, this displacement *s* amounts to 1½ inches.

As shown in Fig. 2 of the drawings, the blocks 31 are substituted for the blocks 30 at regularly spaced intervals and the recesses 31*c* of the vertical groups of blocks 31 are in vertical alignment. Engaging opposed vertically aligned recesses 31*c* are rigid tube supporting plates 33 which may be of the conventional form of the prior art but provided with end flanges 33*a* at opposite ends complementary to the recesses 31*c* but affording a substantial clearance. The plates 33 are provided with spaced apertures 33*b* through which the oil-conducting tubes extend and by which they are supported. These plates are effective mutually to brace and support the walls 27 and 28 and retain them in their proper relation in the furnace. In case it is desired to brace the walls 27 and 28 at points more closely spaced than is required for supporting the tubes 29, auxiliary braces or supporting members 32 may be provided, engaging intermediate or, as shown, alternate opposed vertically aligned recesses. The members 32 are also provided with flanges 32*a* complementary to the recesses 31*c*. The braces 32 and 33 may be steel castings, fabricated structures, or any other suitable rigid structures.

In order to provide a satisfactory junction with the end walls of the furnace and the supporting structure, designated generally at 35 in

Fig. 2, the end units or blocks 34 of the refractory walls may comprise blocks molded into a special form, or they may comprise blocks 30 which have been mutilated or cut into the desired form.

With mutually supporting bridge walls 27 and 28 of the type described above, it will be seen that the component refractory units or blocks have an unrestrained but limited freedom of motion due to the above-mentioned spacing between the blocks and to the clearances between the complementary interengaging or interlocking surfaces, and between the recesses and the supporting or bracing members 32 and 33. This individual unrestrained movement of the component units or blocks prevents cracking or deformation of the bridge walls 27 and 28 which might otherwise be occasioned by the high or elevated temperatures occurring in such a heat-transfer apparatus, and, at the same time, avoids the use of auxiliary cooling means or of auxiliary highly refractory protective structure. At the same time, the dimensions of the walls 27 and 28, particularly their thickness, may be reduced to a moderate value, for example, of the order of 12 inches as contrasted with the self-supporting bridge walls of the prior art which have generally required a thickness several times this value. At the same time, such bridge walls may be assembled most economically since they are substantially self-aligning and require the use of no bonding or cementing material. The interengaging or interlocking projections and recesses form an effective gas seal to prevent substantial leakage of the combustion gases directly from the chambers A and B into the chamber C without passing over and heating the oil-conducting tubes in the chamber C. In case fireclay is used in the laying of the blocks to fill in irregularities, as described above, it also aids in minimizing gas leakage through the wall.

The operation of the above-described heat-transfer apparatus will be well-understood by those skilled in the art, or may be found explained in detail in the above-mentioned Nash and Shelly application. In brief, the oil to be treated passes from the inlet through the bank of tubes 29 in the chamber C, receiving heat preponderantly or substantially solely by convection from the combined currents of combustion gases from the chambers A and B, washing or sweeping the tubes. The oil passes from the tubes 29 through the bank of floor tubes 23 disposed adjacent, but without the current of, the combustion gases issuing from the chamber 17. In this tube section the oil receives heat substantially solely by radiation directly from the gases. The oil then passes through the banks of roof tubes 24 and 26 in which it may be heated preponderantly by radiation directly from the currents of gases passing through the chambers A and B. In certain instances, an appreciable amount of heat may be transfered to the banks of tubes 24 and 26 by convection from the gases, although, in the particular arrangement illustrated, the transfer of heat by convection is minimized, due to the approximate conformance of the walls of the furnace structure to the natural streamline of the gases passing therethrough. Finally, the oil is passed through the double row of floor tubes 25 adjacent, but below the current of the gases discharged from the chambers 20, receiving heat substantially solely by radiation. By independently adjusting burners 19 and 22, the rates of heat transfer per unit area of heat absorbing structure and the temperatures prevailing in the chambers A and B may be independently determined in accordance with the requirements of the particular oil stock being treated. From the outlet of the bank of tubes 25, the heated oil stock may be passed through any other suitable conversion, refining, cracking or separating apparatus.

In Fig. 4 is shown a modified form of refractory unit or block 36 in which the axis of symmetry of the block coincides with that of the complementary recess 36*a* and projection 36*b*. This block is somewhat simpler than the blocks 30 and 31 and may be satisfactory in certain installations, especially where the mechanical strength of the blocks or units is higher than required in the particular installation.

A modified form of block or unit 37 is shown in Fig. 5 having interlocking surfaces comprising dovetailed recesses 37*a* and complementary projections 37*b*. In Fig. 6 the block 38 is provided with complementary lobe-shaped recesses 38*a* and projections 38*b*.

In the block 39 shown in Fig. 7, the horizontally extending complementary projections 39*b* and recesses 39*a* are supplemented by vertically extending complementary recesses 39*c* and projections 39*d* providing interlocking or engaging of the blocks both between their top and bottom faces, as well as between their end faces, as in the previously described modifications.

In the form of refractory block shown in Figs. 8 and 9 each of the blocks 40 is provided with similar recesses 40*a* in opposite ends which receive a fire brick or other refractory unit 42 preferably of standard dimensions; for example, 2½ inches by 4½ inches. Certain of the blocks, such as blocks 41, are provided with locking recesses 41*b*, as in the preceding forms. While these blocks may have any dimensions suitable to a particular installation, a block having the following dimensions has been found satisfactory:

	Inches
m	12
n	12
o	2½
p	2⅝
Thickness	3

The refractory blocks 43, 44 of Figs. 10 and 11 are like those of Figs. 8 and 9 with the exception that the interlocking refractory block 42 is disposed with its longitudinal axis normal to the course or axis of the wall, rather than parallel thereto, as in the arrangement of Figs. 8 and 9. As before, the recesses 43*a* and 44*a* in the ends of the blocks 43 and 44, respectively, are complementary to the blocks 42 but allow a limited freedom of unrestrained motion to care for normal expansion and contraction of the wall structure. The blocks 43 of Figs. 10 and 11 may have the following dimensions:

	Inches
m	12
n	12
o	1⅜
p	4¾
Thickness	3

The structures of Figs. 8 to 11, inclusive, have a number of distinct advantages over the preceding modifications. A large percentage of the total volume of the wall structure is composed of standard fire bricks, the cost per unit volume

of which is of the order of one-half that of the special forms in which the other blocks are constructed, thereby materially reducing the total cost of the furnace wall structure. In addition, the projections in the blocks or units of Figs. 1 to 7, inclusive, increase the difficulty of packing or crating the blocks for shipment and increase the liability to breakage. Furthermore, with the construction of Figs. 8 to 11, inclusive, there is no right-handed or left-handed block, but the blocks are symmetrical about their transverse axis, which somewhat simplifies the laying of a furnace wall.

It will be noted that the blocks of Fig. 8 are composite in form. The bodies of the blocks **40**, **41** are composed of a refractory substance of very low thermal conductivity, constituting essentially a heat insulating medium. For example, the body of these blocks may be a refractory made from ordinary fireclay in which there is produced, mechanically or otherwise, a very high percentage of minute voids resulting in a porous block weighing from one-half to one-third less than the ordinary refractory block; such a refractory is commercially available as Harbison-Walker refractory No. 111. Or, the bodies of the blocks **40**, **41** may comprise a diatomaceous earth, either natural or calcined, and commercially available as Silocell. Other equivalent refractories of high heat insulating characteristics may be used for this purpose. A refractory wall structure constructed of such blocks will withstand the temperatures ordinarily encountered by a heat transfer apparatus of the type to which my invention relates, but tends to be destroyed or eroded by the drive of the flame or combustion gases when directed on the wall structure, as in the arrangement of Fig. 1. In order to protect the bodies of the blocks **40**, **41**, they are faced with slabs **40***c*, **41***c*, respectively, of refractory material such as silicon carbide, refractory material similar to that of which the blocks of the structures of Fig. 2 to 7, inclusive, are constructed, or equivalent refractory material, cemented or bonded by a layer of high temperature or refractory cement **45**. The blocks of Fig. 8 are included in a furnace structure as, for example, that of Fig. 1, with the facings **40***c*, **41***c* opposed to the flame or the source of combustion gases, thereby protecting the bodies of the blocks composed of refractory constituting primarily a heat insulation material. At the same time, the superior heat insulating properties of the bodies reduce the heat transferred through the bridge wall, which passes directly to the stack, and thus constitutes a source of loss.

It will be apparent that the particular form of the interengaging or interlocking surfaces of the refractory units or blocks is not material and that my invention comprises any suitable interengaging or interlocking surfaces suitable for maintaining the component units or blocks in alignment to form a refractory wall structure.

While I have described what I at present consider the preferred embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention, and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim is:

1. In a heat transfer apparatus, a refractory wall comprising a plurality of loosely stacked refractory blocks having complementary interengaging tongues and grooves extending longitudinally of said wall, a group of said blocks having also locking recesses extending normal to said wall and in vertical alignment, and a supporting and locking member engaging said vertically aligned recesses.

2. In a heat transfer apparatus, a refractory wall structure comprising a plurality of loosely stacked refractory blocks each having similar recesses in the ends thereof, the recesses of adjacent blocks being in registration, and a refractory block interposed in each pair of registering recesses and complementary thereto for interlocking said recessed blocks.

3. In a heat transfer apparatus, a refractory wall structure comprising a plurality of loosely stacked refractory blocks each having similar recesses in the ends thereof, the recesses of adjacent blocks being in registration, a refractory block interposed in each pair of registering recesses and complementary thereto for interlocking said recessed blocks, a supporting member, said member and a group of said recessed blocks having respectively a recess and a complementary projection for interlocking said member and said group of blocks, said recess extending across and normal to each of the side faces of each block of said group.

4. In a heat transfer apparatus, a refractory wall comprising a plurality of loosely stacked refractory blocks having complementary projections and recesses extending longitudinally of said wall, a group of said blocks having also locking recesses extending normal to said wall and in vertical alignment, said longitudinally extending projections and recesses being offset from the plane of symmetry of said blocks and away from said locking recesses, and a supporting and locking member engaging said vertically aligned recesses.

5. In a heat transfer apparatus, a refractory wall comprising a plurality of loosely stacked refractory blocks having complementary interengaging projections and recesses extending longitudinally of said wall, supporting members, said members and a plurality of longitudinally spaced vertical groups of said blocks having complementary interengaging means for interlocking each group of said blocks with at least one of said supporting members.

6. In a heat transfer apparatus comprising a plurality of heating chambers, a pair of bridge walls defining one of said chambers and each comprising a plurality of loosely stacked refractory blocks having complementary interengaging surfaces extending longitudinally of said wall, a group of said blocks in each wall having engaging means extending normal to opposed faces of said walls and in vertical alignment, and a supporting and locking member interlocked with the opposed vertically aligned engaging means of each of said walls.

7. In a heat transfer apparatus comprising a plurality of heating chambers, a pair of bridge walls defining one of said chambers and each comprising a plurality of loosely stacked refractory blocks having complementary interengaging surfaces extending longitudinally of said wall, a group of said blocks in each wall having engaging means extending normal to opposed faces of said walls and in vertical alignment, heat absorption structure disposed in said chamber, and a supporting member for said structure extending between said walls, opposite edges of said member being complementary to, for interlocking engage-

having a heating chamber, and burner-means for producing a current of hot gases within said chamber, the combination of refractory wall structure comprising a plurality of loosely stacked refractory blocks having end portions extending longitudinally of said wall, each of said end portions having a complementary interengaging surface interlocked with adjacent end portions, a group of said blocks, from the sides thereof remote from said burner means, having locking recesses extending normal to said wall and in vertical alignment, a supporting and locking member engaging said vertically aligned recesses, and each of said blocks having integrally secured to the face thereof, exposed to said burner-means, a facing of dense erosion-resistant refractory material.

19. In a high temperature heating apparatus, a refractory unit comprising a rectangular block of refractory material selected primarily for its heat insulating properties and having at its opposite ends, and from one side thereof inwardly extending locking recesses, and a facing of refractory material, selected primarily for its erosion-resistant characteristics, integrally secured to the opposite side of said block.

20. In an apparatus for heating oil to a cracking temperature comprising a pair of opposed fire chambers, means individual to said chambers for maintaining therein currents of hot combustion gases, the combination of a pair of bridge walls spaced one from the other to form a convection chamber intermediate said fire chambers, each of said walls comprising a plurality of loosely stacked refractory blocks having their respective ends extending longitudinally of the wall and each end of each block having a complementary interengaging surface mechanically interlocked with an adjoining block, individual facings for said blocks formed of refractory erosion-resistant material integrally secured to the respective faces of the blocks exposed to said fire chambers, opposed vertically aligned recesses extending inwardly of said bridge walls from within said convection chamber, a supporting and bracing member extending across said convection chamber with its opposite ends nesting within said opposed recesses, and heat absorption structure disposed in each of said chambers.

21. In a high temperature heating apparatus, a heating chamber, at least one wall of which comprises a plurality of refractory blocks loosely stacked in single courses, one above the other, each block of each course having at its respective ends, engaging-means complementary to engaging-means of a corresponding end of an adjacent block, said engaging-means interlocking the blocks of each course to prevent lateral movement of the wall, a supporting and locking member, and a plurality of blocks intermediate the ends of the wall having vertically aligned recesses to receive one end of said supporting member, said one end being complementary to said recesses for interlocking a plurality of courses of said blocks.

ARTHUR E. NASH.

CERTIFICATE OF CORRECTION.

Patent No. 2,075,863. April 6, 1937.

ARTHUR E. NASH.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, first column, line 12, claim 8, for "conducted" read "conducting; and line 17, insert a comma after "with"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of June, A. D. 1937.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.

having a heating chamber, and burner-means for producing a current of hot gases within said chamber, the combination of refractory wall structure comprising a plurality of loosely stacked refractory blocks having end portions extending longitudinally of said wall, each of said end portions having a complementary interengaging surface interlocked with adjacent end portions, a group of said blocks, from the sides thereof remote from said burner means, having locking recesses extending normal to said wall and in vertical alignment, a supporting and locking member engaging said vertically aligned recesses, and each of said blocks having integrally secured to the face thereof, exposed to said burner-means, a facing of dense erosion-resistant refractory material.

19. In a high temperature heating apparatus, a refractory unit comprising a rectangular block of refractory material selected primarily for its heat insulating properties and having at its opposite ends, and from one side thereof inwardly extending locking recesses, and a facing of refractory material, selected primarily for its erosion-resistant characteristics, integrally secured to the opposite side of said block.

20. In an apparatus for heating oil to a cracking temperature comprising a pair of opposed fire chambers, means individual to said chambers for maintaining therein currents of hot combustion gases, the combination of a pair of bridge walls spaced one from the other to form a convection chamber intermediate said fire chambers, each of said walls comprising a plurality of loosely stacked refractory blocks having their respective ends extending longitudinally of the wall and each end of each block having a complementary interengaging surface mechanically interlocked with an adjoining block, individual facings for said blocks formed of refractory erosion-resistant material integrally secured to the respective faces of the blocks exposed to said fire chambers, opposed vertically aligned recesses extending inwardly of said bridge walls from within said convection chamber, a supporting and bracing member extending across said convection chamber with its opposite ends nesting within said opposed recesses, and heat absorption structure disposed in each of said chambers.

21. In a high temperature heating apparatus, a heating chamber, at least one wall of which comprises a plurality of refractory blocks loosely stacked in single courses, one above the other, each block of each course having at its respective ends, engaging-means complementary to engaging-means of a corresponding end of an adjacent block, said engaging-means interlocking the blocks of each course to prevent lateral movement of the wall, a supporting and locking member, and a plurality of blocks intermediate the ends of the wall having vertically aligned recesses to receive one end of said supporting member, said one end being complementary to said recesses for interlocking a plurality of courses of said blocks.

ARTHUR E. NASH.

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Patent No. 2,075,863. April 6, 1937.

ARTHUR E. NASH.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, first column, line 12, claim 8, for "conducted" read "conducting; and line 17, insert a comma after "with"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of June, A. D. 1937.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.