April 29, 1941. L. S. LONGENECKER 2,240,190

FURNACE STRUCTURE

Filed Dec. 5, 1939 3 Sheets-Sheet 1

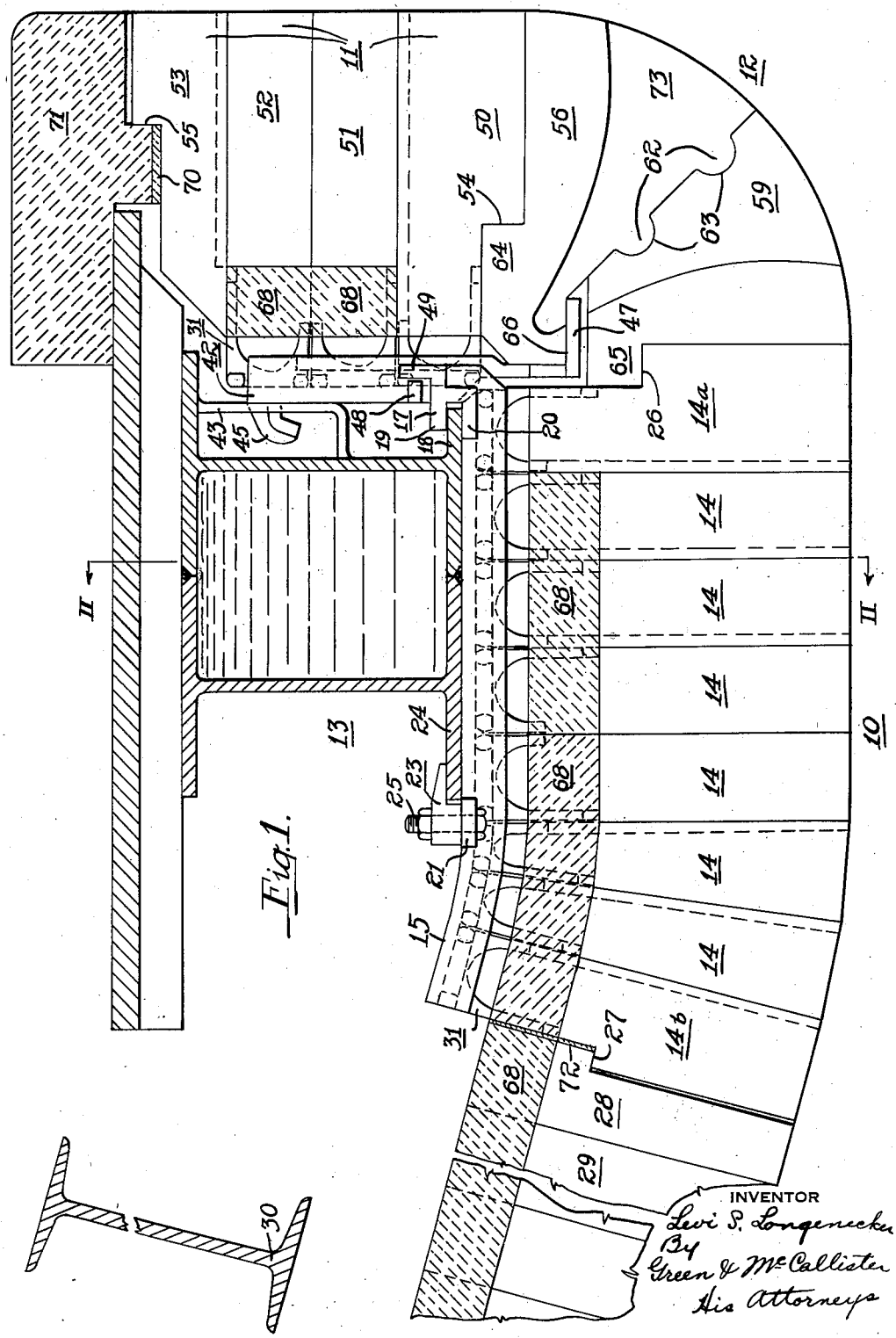


Fig. 1.

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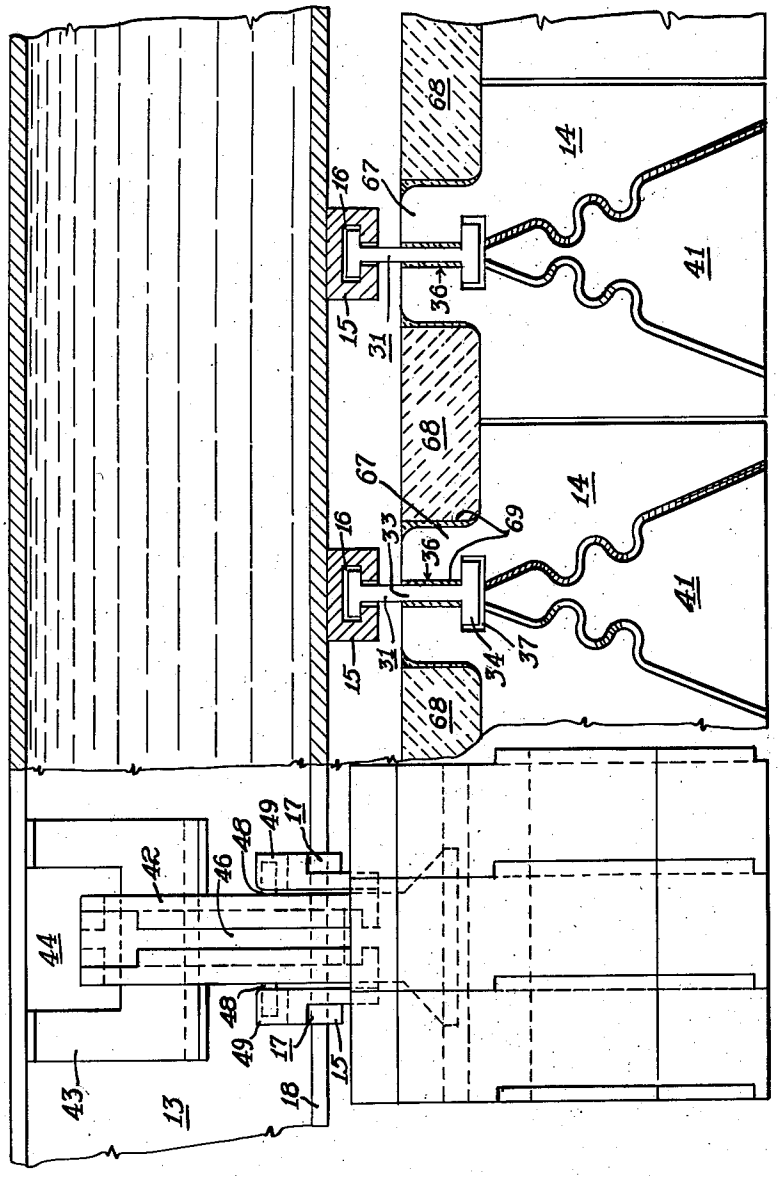


Fig. 2.

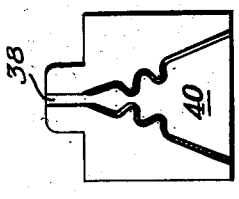


Fig. 9a.

INVENTOR
Levi S. Longenecker
By Green & McCallister
His Attorneys

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FURNACE STRUCTURE

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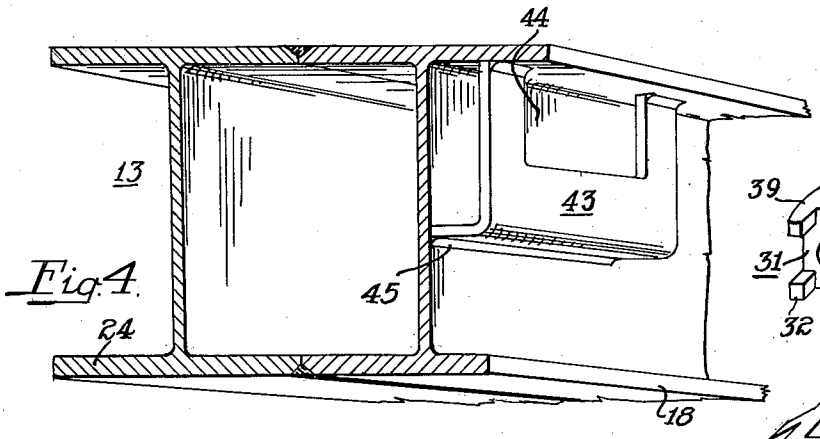


Fig. 4.

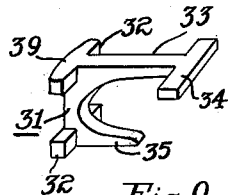


Fig. 9.

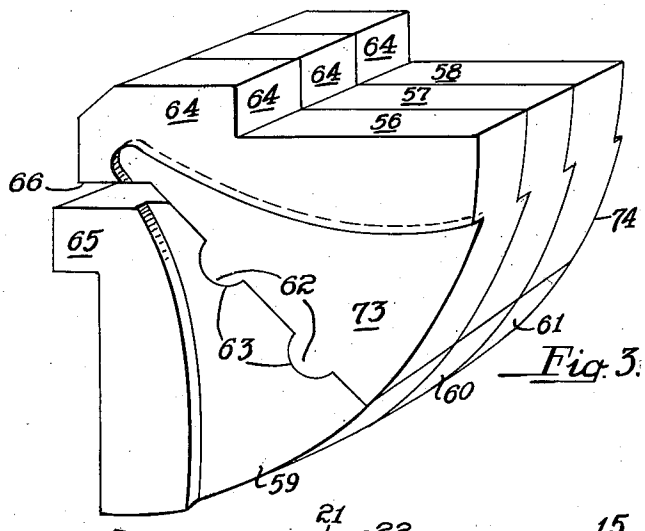


Fig. 3.

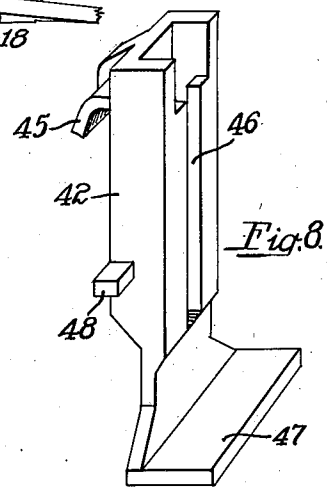


Fig. 8.

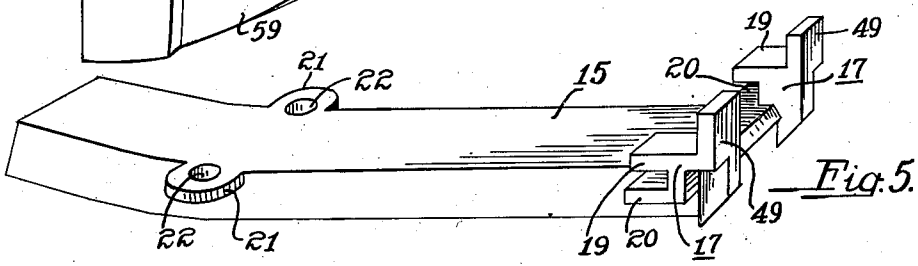


Fig. 5.

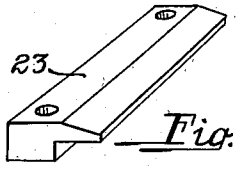


Fig. 7.

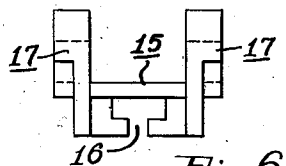


Fig. 6.

INVENTOR

Levi S. Longenecker

By Green & McCallister

His Attorneys

Patented Apr. 29, 1941

2,240,190

UNITED STATES PATENT OFFICE

2,240,190

FURNACE STRUCTURE

Levi S. Longenecker, Mount Lebanon, Pa.

Application December 5, 1939, Serial No. 307,631

5 Claims. (Cl. 110—99)

This invention relates to furnace structures, an improved nose for such structures and one object of this invention is to produce an improved nose structure for joining a vertical wall and an adjacent furnace roof or arch.

Another object is to produce a new and improved refractory block or tile for use in furnace nose structures.

A further object is to produce a new and improved nose structure for closing the gap between the lower end of a vertical furnace wall and the adjacent end of a furnace roof or arch.

A still further object is to improve upon the furnace structure disclosed in Patent 1,977,799 issued to me on October 23, 1934; and

A still further object is to improve upon the furnace nose structure disclosed in said patent.

These and other objects which will readily appear to those skilled in this particular art, I attain by means of the structures described in the specification and illustrated in the drawings accompanying and forming part of this invention.

In the drawings, throughout which similar elements are denoted by like characters:

Figure 1 is a view partially in section and partially in side elevation of part of a furnace structure embodying this invention;

Fig. 2 is a composite view looking from the right toward the structure of Fig. 1. The right-hand portion of this view is taken on section line II—II of Fig. 1, while the left-hand portion is an elevational view of the nose structure; the blocks above the nose portion and forming the vertical wall or apron being omitted.

Fig. 3 is a view in perspective of a group of nose blocks such as are utilized for filling the spaces between the adjacent ends of the arch or roof and the apron or vertical wall of the furnace;

Fig. 4 is a perspective view of a portion of the water cooled beam from which are supported the vertical wall or apron, the forward part of the furnace roof or arch and the furnace nose;

Fig. 5 is a perspective view of one of the support members utilized in my improved furnace structure;

Fig. 6 is a view looking from the right toward the right-hand end of the support member of Fig. 5;

Fig. 7 is a perspective view of a part of the clamp device for securing one end of the support member of Fig. 5 to the water cooled support beam;

Fig. 8 is a perspective view of one of the hanger members used in supporting the vertical wall or apron from the water cooled support beam;

Fig. 9 is a perspective view of one of the hangers such as are used in securing the vertical wall or apron blocks to the bracket of Fig. 8 and the roof or arch blocks to the support member of Fig. 5; and

Fig. 9a is a view on a reduced scale of the opposite face of the blocks or tiles shown at the right-hand side of Fig. 2.

In Figs. 1 and 2 of the drawings, I disclose a furnace arch or roof 10, an apron or vertical wall 11 and a nose structure 12 which joins the adjacent ends of the roof or arch and the apron or vertical wall and which with said roof and apron form a continuous furnace wall.

The apron or vertical wall 11, the nose structure, and that portion of the furnace arch or roof adjacent the nose structure are all supported from a water cooled support beam 13 by means of suitable support members and hangers as hereinafter set forth.

Roof or arch 10 comprises a number of refractory blocks or tiles 14 disposed in collaterally arranged courses and of the interlocking type disclosed in Patent 1,590,303 of June 29, 1926 and preferably as modified in Patent 2,126,901 granted to me on August 16, 1938. These blocks or tiles instead of being supported in bundles as in said later patent, are individually supported from a support member 15 which in turn is clamped to and supported by support beam 13.

Support member 15, which is shown in more or less detail in Figs. 5 and 6, in transverse section resembles a shallow channel member with its flanges inturned and with the edges of such inturned portion spaced apart to provide a longitudinally extending centrally located slot 16 in its lower side. One end of member 15—that end adjacent nose 12—is provided with spaced bracket members 17—17 having inwardly facing upper and lower jaw-like portions for engaging flange 18 of support beam 13. These are respectively numbered 19—19 and 20—20. As shown in Fig. 1, jaw-like portions 19—19 bear on the top of flange 18 of the support beam, while the lower jaw portions 20—20 lie beneath said flange. Adjacent its opposite end, member 15 is provided with outwardly extending side lugs or pads 21—21 having bolt openings 22. A clamp member 23 which overlies flange 24 of support beam 13 is bolted in place by means of bolts 25.

The end block 14a of each course, or that block adjacent the nose is a special block and is provided with a shoulder 26 which assists in

supporting the nose structure as will be later described. The block at the opposite end of the course, block 14b, is also a special block and is provided with a shoulder 27 which assists in sealing the joint between this and block 28 of the sloping part of the roof structure comprising blocks such as 29. These blocks are also of the interlocking type disclosed in Patent 1,590,303 and preferably as modified in Patent 2,126,901. These are supported in bundles from longitudinal beams, such as beam 30, in a manner similar to that of Figure 1 of said later patent.

Each course made up of blocks 14, 14a and 14b is supported from support member 15 by means of hangers 31, shown in detail in Fig. 9 and disclosed in said Patent 1,977,799. Each of these hangers is provided with a head portion having laterally extending projections 32; the head in effect being T-shaped. Hanger 31 is also provided with one long leg 33 having a cross member 34 at its outer end and a shorter straight member 35. Such a hanger when it is slightly tilted with relation to the blocks or tiles is readily slipped over the end of the tile with long leg 33 lying within groove 36, cross member 34 within cross groove 37 and short leg 35 lying within groove 38 formed in the opposite side or face from groove 36 (Fig. 9a).

The body of the hanger is of such width that it can be readily inserted within the end of slot 16 of support member 15 with the T-shaped head 39 within the support member.

In assembling a course such as disclosed, blocks 14, 14a and 14b are fitted with hangers and the hangers are moved into and slid along support member 15; the depression 40 of one block fitting into the projection 41 of the block next thereto.

Certain of the blocks such as those adjacent the center of Fig. 1 are preferably formed with one flat face, while certain blocks such as those toward the left of Fig. 1 are longitudinally tapered to obtain proper merging of the horizontal and sloping portions of the roof.

Each course of vertical wall 11 is supported from support beam 13 by a hanger support member 42 (Fig. 8). Beam 13 is provided with a bracket 43 for each such course and the bracket is preferably formed from plate-like material which is bent to form and welded to one flange and the web of the support beam, as indicated in Fig. 4. This bracket is formed with an opening 44 to receive a hook-like part 45 which projects from the rear face of hanger 42 adjacent the upper end.

Hanger 42 which depends from bracket 43 is formed in the nature of an elongated box-like structure having a longitudinally extending front slot 46, a forwardly projecting shelf 47 at its lower end and lateral projections 48—one only being shown—which, when the hanger is in position, lie behind upstanding flanges 49—49 formed on the same end of support member 15 as jaw portions 19 and 20. The upper end of the wall of hanger 42 having slot 46 therein is cut away at its top, as shown in Fig. 8, to facilitate removal and replacement of the blocks forming the vertical wall or apron 11.

In the particular structure shown in the drawings, each course of the vertical wall or apron comprises but four blocks or tiles and these are numbered 50, 51, 52 and 53. Block 50 is a special block and is provided with a shoulder 54 similar to shoulder 26 of block 14a and assists in holding the nose structure in place. Blocks 50, 51 and 52 are fitted with hangers 31 and these are carried by hanger support member 42. The upper block 53 is a special block, is provided with a shoulder 55 and is held in place on block 52 by the same kind of interengaging triangular portions as the blocks of the roof or arch courses.

The nose structure for each course of aligned roof and vertical wall blocks comprises six nose blocks instead of but three as in the structure of my Patent 1,977,799. In the structure of the present application, the curved face of each nose block instead of extending 90° extends but 45°, but each nose block as in said patent is substantially one third the width of the broad face of one of the roof or vertical wall blocks.

A group of nose blocks for filling the space between the forward end of one course of roof blocks and the lower end of one course of vertical wall or apron blocks is shown in perspective in Fig. 3 and consists of upper blocks 56, 57 and 58 and lower blocks 59, 60 and 61. Each upper block is provided with laterally extending projecting portions 62 and each lower block is provided with laterally extending depressions 63 cooperating therewith in preventing relative longitudinal movement between said blocks.

Each of the three upper blocks of the series is provided with an upward extension 64, while each of the three lower blocks is provided with a rearwardly extending projection 65. The projections of a pair, consisting of one upper and one lower block, when in position constitute a key of such size and shape as to fit the keyway defined by shoulders 26 and 54 on blocks 14a and 50 respectively.

Face 66 of the projecting portion 64 of each upper nose block rests upon flange 47 of hanger 42. In fact, the upper nose blocks are securely held in place by said flange and shoulder 54 of block 50.

The blocks forming the roof or horizontal wall as well as those forming the apron or vertical wall except special blocks 14a and 50 are preferably of the same shape as blocks of my Patent 2,126,901. Each block is provided with a neck 67 which is formed as an extension of the body of the block. Hangers 31 are attached to these necks. The neck has the same thickness as the body of the block but as disclosed in the drawings is much narrower. The grooves 36 and 38 into which the hangers are fitted are formed in the neck portions and the hangers therefore, are, in effect, embedded in the cooler ends of the blocks.

The spaces between the neck portions of the blocks of adjacent courses, in effect, form troughs and within these troughs, as in the structure of my said Patent 2,126,901. I place slabs of insulating material 68 similar to the slabs 34 of said patent. Plastic heat insulating material 69 is forced into the spaces between these slabs and the walls of such troughs as well as around those portions of hangers 31 which lie within grooves 36 and 38. Heat insulating material 70 is placed between the top block 53 of the vertical wall and lower block 71 of the brickwork above the apron wall. This in effect forms an expansion joint between the vertical wall and such brickwork. An expansion joint 72 of insulating material is interposed between block 14b and block 28 of the roof structure.

In this improved nose structure, the three upper blocks 56, 57 and 58 are carried by hanger 42 through the agency of flange 47 and shoulder 54 of special block 50, while the lower blocks 59, 60 and 61 are carried by shoulder 26 of block 14a. By supporting the upper nose blocks from

hanger 42 by means of its flange 47, I free the lower nose block from any load and thus secure an extremely serviceable nose structure.

Each pair of nose blocks made up of one upper and one lower block is provided with a generally fan-shaped or generally triangular depression 73 in one of its broad faces and with a similarly shaped tongue 74 projecting from its opposite face. These tongues and depressions occupy substantially the same position with respect to each other and when the nose blocks are laid up as shown in Fig. 3, the tongue of one combined block interlocks with the depression in the adjacent combined block. This prevents fragments, which may break away from these blocks from falling into the furnace.

While, in the present structure, I have retained all of the advantages of the nose structure of my Patent 1,977,799, I obtain a somewhat cheaper structure and a structure which will stand up for a materially longer time under operating conditions.

By cutting the size of the tile to substantially half that of said patent, I secure a better burned block; then again, since the length of the arc-shaped faces of the nose blocks is but one half that of the blocks of said patent, failure of the blocks due to thermal expansion is greatly reduced. I believe that I will be able to obtain at least three times the life of the blocks of said patent.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a furnace structure, a support beam, a furnace roof portion supported from said beam, a hanger supported from said beam, a vertical wall supported from said hanger, a series of pairs of refractory blocks forming the furnace nose and closing the space between adjacent ends of the furnace roof and the vertical wall; each such pair of refractory blocks comprising an upper block primarily supported by said hanger and a lower block supported by the end block of the furnace roof.

2. In a furnace structure, a support beam, a furnace roof portion supported from said beam, a hanger supported from said beam, a vertical wall supported from said hanger, a series of pairs of refractory blocks closing the space between adjacent ends of the furnace roof and the vertical wall and forming the furnace nose; each such pair of refractory blocks comprising an upper block which is primarily supported by said hanger and a lower block which is supported by the end block of the furnace roof; the blocks of each pair being interconnected by laterally expanding projections and depressions.

3. In a furnace structure, a beam, refractory blocks forming a portion of the furnace roof, means for independently supporting said blocks from said beam, a hanger carried by said beam, a vertical wall portion supported by said hanger, and upper and lower nose blocks closing the space between the adjacent ends of said roof and vertical wall; said upper nose blocks being supported by an extension of said hanger, the furnace roof having means to support the lower nose blocks, and said vertical wall having means for holding the upper nose blocks in position on the hanger extension.

4. In a furnace structure, a support beam, a furnace roof portion supported from said beam, a hanger supported from said beam, a vertical wall supported from said hanger, a series of pairs of refractory blocks closing the space between adjacent ends of the furnace roof and the vertical wall and forming the furnace nose; each such pair of refractory blocks comprising an upper block which is primarily supported by said hanger and a lower block which is supported by the end block of the furnace roof; the blocks of each pair being interconnected by laterally extending generally triangular tongues and grooves with one-half of each tongue and one-half of each groove formed in one block of each pair and the other half of each tongue and each groove formed in the other block of the pair.

5. In a furnace structure, a support beam, a furnace roof portion supported from said beam, a hanger supported from said beam, a vertical wall supported from said hanger, a series of pairs of refractory blocks closing the space between adjacent ends of the furnace roof and the vertical wall and forming the furnace nose; each such pair of refractory blocks comprising an upper block which is primarily supported by said hanger and a lower block which is supported by the end block of the furnace roof; the blocks of each pair being interconnected by laterally extending generally triangular tongues and grooves with one-half of each tongue and one-half of each groove formed in one block of each pair and the other half of each tongue and each groove formed in the other block of the pair; the blocks of each pair having a pair of interengaging projections and depressions formed in their contacting faces and which extend at right angles to the side faces of said blocks.

LEVI S. LONGENECKER.

CERTIFICATE OF CORRECTION.

Patent No. 2,240,190. April 29, 1941.

LEVI S. LONGENECKER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 3, claim 2, for the word "expanding" read --extending--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of May, A. D. 1941.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)