

PATENT SPECIFICATION (11)

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- (21) Application No. 24242/76 (22) Filed 11 June 1976 (19)
 (23) Complete Specification filed 8 June 1977
 (44) Complete Specification published 25 Feb. 1981
 (51) INT. CL.³ F27D 1/16
 (52) Index at acceptance
 F4B 35B3 FC
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(54) FLAME INJECTION THROAT FOR A FURNACE

(71) We, POULTON & SON (REFRAC-
 TORIES) LIMITED, a British Company, of 435
 Cannock Road, Hednesford, Staffordshire,
 England, do hereby declare the invention, for
 which we pray that a patent may be granted
 to us, and the method by which it is to be
 performed, to be particularly described in
 and by the following statement:—

This invention relates to a flame injection
 throat for a furnace.

Furnaces fired by oil, gas and powdered
 coal usually have the burners fitted outside of
 the furnaces and project a flame through an
 injection throat into the furnace. Because of
 the intense heat generated in the injection
 throat it is customary for these throats to be
 lined with refractory material. One early
 method of providing the refractory lining
 was to form a monolithic lining in place in
 the throat but a modern development has
 been to form the throat in the form of a ring
 of refractory tiles thus providing much the
 same appearance as a monolithic lining but
 making it easier to renew the lining when the
 lining becomes no longer serviceable. The
 known method of attaching the tiles is to fit
 them to studs attached to the furnace struc-
 ture, the studs penetrating holes formed in
 the tiles and carrying nuts which retain the
 tiles in place, the nuts being located in
 recesses which are filled with refractory
 material. A difficulty associated with this
 form of construction is that the refractory
 material filling the recesses in which the nuts
 are located both corrodes the material of the
 studs and also becomes firmly embedded in
 the screw threads so that the nuts cannot be
 unscrewed from the studs when tile replace-
 ment is required. Another drawback is that
 if the refractory lining deteriorates as some-
 times happens and part of the lining falls out
 the studs are exposed to the heat and often
 become damaged. When new tiles have to
 be fixed it is necessary first to break off the
 old tiles then cut off the studs close to their
 points of fixing and weld on new studs. As a
 large furnace throat can carry a large number

of tiles with a corresponding large number of
 studs the operation is time-consuming and
 costly. It would be of great advantage to be
 able to replace tiles in the throat without
 requiring to renew the studs.

It is an object of the present invention to
 provide a flame injection throat which offers
 this advantage.

In the following specification the word
 "ring" is used to denote a closed ring-like
 structure which may be non-circular, e.g.
 elliptical or having parallel sides joined by
 curved ends as well as truly circular struc-
 tures.

According to the invention a flame injec-
 tion throat incorporates refractory tiles
 arranged in at least one ring within an open-
 ing in a furnace structure, in which at least
 some pairs of adjacent tiles are formed with
 undercut recesses on the particular surfaces
 of the tiles which define the outer diameter
 of the ring of tiles, the recesses in each said
 pair of adjacent tiles extending away from
 the adjacent end faces of the tiles of the pair
 and being aligned with one another whereby
 to form a single continuous recess extending
 across the pair of tiles, pins each of which
 presents an enlarged head at its outer end are
 attached to the furnace structure within the
 opening in the furnace structure and each
 projects into a respective one of said single
 continuous recesses so that the enlarged head
 is within the single continuous recess, and a
 single locking member fits within each single
 continuous recess so as to bridge the pair of
 tiles presenting the recess and engage the pin
 whereby to hold the pair of tiles to the pin,
 and in which each locking member comprises
 a block of heat-resisting metal bifurcated
 along a portion of its length whereby to
 present two limbs each of which is formed
 with an outwardly projecting flange extending
 lengthwise of the limb, the two flanges pro-
 jecting away from one another and an in-
 wardly projecting flange also extending
 lengthwise of the limb, the two inwardly
 projecting flanges projecting towards one

another, the dimensions of the locking member being such that the outwardly projecting flanges are capable of being engaged with the undercut portions of a recess in a tile while the limbs straddle the pin projecting into that recess and the inwardly projecting flanges fit under the enlarged head presented by the pin.

The flame injection throat may incorporate several coaxial rings of refractory tiles the tiles of at least selected rings being attached as described.

One end face of each pair of adjacent end faces presented by adjacent tiles may be formed with a tongue disposed in an axial direction with respect to the throat, the other end face being formed with a groove engaged by the tongue.

Where the furnace throat is formed of several coaxial rings of tiles all the faces of the tiles of one ring forming one end face of the ring of tiles may be formed with tongues, the abutting end faces of the tiles of the other ring being formed with grooves engaged by the tongues.

Alternatively, instead of tongues and grooves the abutting faces of adjacent tiles may be rabbetted or stepped into one another.

The undercut grooves may be of dovetail form or may be tee-shaped.

The pins may be screw-threaded pins, the enlarged heads presented by the pins being constituted by nuts screwed on to the outer ends of the pins. Alternatively the pins may be presented by bolts the enlarged heads being constituted by the heads of the bolts.

Each locking member may be a block, conveniently of heat-resisting metal, bifurcated along a portion of its length whereby to present two limbs arranged when fitted into a recess in a tile to straddle a pin projecting into the recess and simultaneously engage the undercut portion of the recess.

Each limb may be formed with an outwardly projecting flange extending lengthwise of the limb and an inwardly projecting flange also extending lengthwise of the limb the dimensions of the locking member being such that it will fit within the recess in a tile with the outwardly projecting flanges engaging the undercut portion while the limbs straddle a pin projecting into the groove in the tile with the inwardly projecting flanges engaging under the enlarged head presented by the pin.

Where the recesses in the tiles are of dovetail form, the outer faces of the limbs of the block may also be of dovetail form in cross-section.

Refractory sealing material, which may be compressible, in sheet form may be fitted between the adjacent faces of the tiles.

In the accompanying drawings Fig. 1 is a section through two adjacent tiles of a ring of tiles forming a flame injection throat on the centre line of the aligned recesses in said two

tiles, Fig. 2 is a section through the line 2—2 in Fig. 1, Fig. 3 is a view to a larger scale of the portion ringed in Fig. 2 to illustrate the invention more clearly and Fig. 4 is a perspective view of the locking member used in the construction illustrated in Figs. 1 and 2.

In the drawings 1 denotes several refractory tiles forming part of two adjacent rings of tiles lining the inner face of the furnace opening, the complete rings of tiles forming the lining of a flame injection throat. Selected adjacent tiles in each ring are formed with recesses 2 open to the surfaces of the tiles defining the outer diameter of the respective ring, said recesses 2 presenting undercut portions 3. The recesses 2 are so located that they extend inwardly into the selected tiles away from the adjacent end faces of the tiles, the adjacent recesses being in alignment with one another when the adjacent tiles are in place forming part of the respective ring of tiles. 4 denotes pins presenting enlarged heads at their outer ends constituted by nuts screwed on to the pins attached at one end to the furnace structure, said pins projecting radially inwards towards the axis of the throat and penetrating the recesses 2 in the tiles where each pin 4 engages a locking member 5 fitted into the aligned recesses 2 in adjacent tiles so that each locking member 5 bridges the gap between the adjacent tiles. In the illustrated construction the part of the furnace structure to which the pins 4 are attached is formed by pipes 6 located within the throat opening and forming part of the furnace structure. These pipes 6 which are customarily provided where the furnace structure is part of a steam raising or water heating installation serve to convey water to the installation and perform the double purpose of helping to cool the furnace throat and at the same time provide warmed feed water. It is to be understood that in furnaces not associated with water heating or steam raising there may be no tubes surrounding the flame injection throat. In such a situation the pins will be attached to any other conveniently situated portion of the furnace structure. Each locking member 5 comprises a block preferably of heat-resisting metallic material such as cast iron bifurcated along a portion of its length so that it presents two limbs 7 which straddle the associated pin 4 projecting into the recess 2 in the tile to which the locking member 5 is fitted. Each limb 7 is formed with an outwardly projecting flange 8 extending lengthwise of the limb and adjacent one surface of the block and an inwardly projecting flange 9 also extending lengthwise of the limb and adjacent the opposite surface of the block. The block is so dimensioned that when it is fitted into a recess 2 the flanges 8 fit under the undercut portion 3 in the recess 2 while the nut 4A of the pin 4 engages the flanges 9 of the block 5.

10 denotes a tongue on an end face of each tile of one ring engaging a groove 11 in the end face of the adjacent tile of an adjoining ring of tiles.

5 In practice, a refractory flame injection throat is formed in a furnace opening by attaching pins 4 presenting enlarged heads constituted in the illustrated construction by nuts 4A to the furnace structure within the throat opening so that the pins 4 project radially towards the centre line of the throat opening and are spaced to suit the dimensions of the tiles 1 so that at least one pin 4 will coincide approximately with the junction of each of selected pairs of adjacent tiles 1. The first tile is fitted in place in the furnace throat so that the respective pins 4 fit into the recesses 2 substantially on the lines of the end faces of the tile. Locking members 5 are pressed into the recesses 2 so that the locking members engage the recesses 2 and at the same time engage below the enlarged heads 4A of the pins 4. Approximately half of each locking member 5 will project from the respective end face of the first tile. The next tile is now applied to each exposed face of the first tile by fitting the said next tile in such a way as to cause the recess 2 at the appropriate face of the tile to fit over the projecting locking member 5 of the tile already in place, i.e. the first tile. The recess extending inwards from the opposite edge face of the newly fitted tile i.e. the edge face remote from the first tile will now fit over the enlarged head of another pin 4. A locking member 5 is now fitted into that recess and this procedure is followed until each ring is completed except for one tile. This tile may be a plain tile or may be a recessed tile like the others but since no pins are fitted at the position of the last tile and no locking members have to be engaged the last tile may be slid into place to complete the ring and because of its completion of the ring this tile remains in place like the keystone of an arch without any attachment other than any grouting which may be applied to lute the flame injection throat. It will be understood that refractory material in sheet form may be inserted between the adjacent faces of the tiles as the tile rings are built up or refractory material may be applied as a lute after the rings are completed.

The locking members 5 isolate the pins 4 from the refractory tiles 1 so that these pins are also much cooler than the tiles when the furnace is in operation. Additionally where the furnace is a boiler furnace as in the illustrated construction the pins are conveniently attached to the feed water tubes 6 normally surrounding the throat and forming part of the furnace structure again as illustrated and are thus additionally cool. As the locking members 5 may be cast from a refractory metal such as cast iron and are robust in

construction they are expected to have a life as long as the furnace and if it becomes necessary to replace any of the tiles in the furnace throat the faulty tiles may be driven out and the locking members 5 simply slid off the ends of the pins 4 without damaging the pins. It may be necessary to remove undamaged tiles to facilitate removal and replacement of the damaged tiles but this causes little additional difficulty and the undamaged tiles can be used again. Replacement tiles may then be fitted and the locking members 5 replaced without requiring any replacement of the pins 4.

An additional advantage of the construction of the invention is that since the tile surface is not formed with any recess for providing access to the fixing means requiring subsequent filling with refractory material the tile surface is much smoother than in known constructions employing rings of tiles thus promoting the best conditions for air flow through the throat and the best combustion conditions.

WHAT WE CLAIM IS:—

1. A flame injection throat incorporating refractory tiles arranged in at least one ring within an opening in a furnace structure, in which at least some pairs of adjacent tiles are formed with undercut recesses on the particular surfaces of the tiles which define the outer diameter of the ring of tiles, the recesses in each said pair of adjacent tiles extending away from the adjacent end faces of the tiles of the pair and being aligned with one another whereby to form a single continuous recess extending across the pair of tiles, pins each of which presents an enlarged head at its outer end are attached to the furnace structure within the opening in the furnace structure and each projects into a respective one of said single continuous recesses so that the enlarged head is within the single continuous recess, and a single locking member fits within each single continuous recess so as to bridge the pair of tiles presenting the recess and engage the pin whereby to hold the pair of tiles to the pin, and in which each locking member comprises a block of heat-resisting metal bifurcated along a portion of its length whereby to present two limbs each of which is formed with an outwardly projecting flange extending lengthwise of the limb, the two flanges projecting away from one another and an inwardly projecting flange also extending lengthwise of the limb, the two inwardly projecting flanges projecting towards one another, the dimensions of the locking member being such that the outwardly projecting flanges are capable of being engaged with the undercut portions of a recess in a tile while the limbs straddle the pin projecting into that recess and the inwardly projecting flanges fit under the enlarged head presented by the pin.

10 denotes a tongue on an end face of each tile of one ring engaging a groove 11 in the end face of the adjacent tile of an adjoining ring of tiles.

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construction they are expected to have a life as long as the furnace and if it becomes necessary to replace any of the tiles in the furnace throat the faulty tiles may be driven out and the locking members 5 simply slid off the ends of the pins 4 without damaging the pins. It may be necessary to remove undamaged tiles to facilitate removal and replacement of the damaged tiles but this causes little additional difficulty and the undamaged tiles can be used again. Replacement tiles may then be fitted and the locking members 5 replaced without requiring any replacement of the pins 4.

An additional advantage of the construction of the invention is that since the tile surface is not formed with any recess for providing access to the fixing means requiring subsequent filling with refractory material the tile surface is much smoother than in known constructions employing rings of tiles thus promoting the best conditions for air flow through the throat and the best combustion conditions.

WHAT WE CLAIM IS:—

1. A flame injection throat incorporating refractory tiles arranged in at least one ring within an opening in a furnace structure, in which at least some pairs of adjacent tiles are formed with undercut recesses on the particular surfaces of the tiles which define the outer diameter of the ring of tiles, the recesses in each said pair of adjacent tiles extending away from the adjacent end faces of the tiles of the pair and being aligned with one another whereby to form a single continuous recess extending across the pair of tiles, pins each of which presents an enlarged head at its outer end are attached to the furnace structure within the opening in the furnace structure and each projects into a respective one of said single continuous recesses so that the enlarged head is within the single continuous recess, and a single locking member fits within each single continuous recess so as to bridge the pair of tiles presenting the recess and engage the pin whereby to hold the pair of tiles to the pin, and in which each locking member comprises a block of heat-resisting metal bifurcated along a portion of its length whereby to present two limbs each of which is formed with an outwardly projecting flange extending lengthwise of the limb, the two flanges projecting away from one another and an inwardly projecting flange also extending lengthwise of the limb, the two inwardly projecting flanges projecting towards one another, the dimensions of the locking member being such that the outwardly projecting flanges are capable of being engaged with the undercut portions of a recess in a tile while the limbs straddle the pin projecting into that recess and the inwardly projecting flanges fit under the enlarged head presented by the pin.



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2. A flame injection throat for a furnace incorporating several coaxial rings of refractory tiles lining the throat opening in which the tiles of at least selected rings are attached as claimed in claim 1. 25
3. A flame injection throat as claimed in claim 1 in which one end face of each pair of adjacent end faces presented by adjacent tiles is formed with a tongue disposed in an axial direction with respect to the throat, the other end face being formed with a recess engaged by the tongue. 30
4. A flame injection throat as claimed in claim 2 in which all the faces of the tiles of one ring forming one end face of the ring of tiles are formed with tongues, the abutting end faces of the tiles of the other ring being formed with grooves engaged by the tongues. 35
5. A flame injection throat as claimed in claim 2 in which the abutting faces of adjacent tiles are stepped into one another. 40
6. A flame injection throat as claimed in claim 1 in which the undercut recesses are of dovetail form.
7. A flame injection throat as claimed in claim 1 in which the undercut recesses are tee-shaped in cross section.
8. A flame injection throat as claimed in claim 1 in which the pins are screw-threaded pins, the enlarged heads presented by the pins being constituted by nuts screwed on to the ends of the pins.
9. A flame injection throat as claimed in claim 1 in which the pins are presented by bolts, the enlarged heads presented by the pins being constituted by the heads of the bolts.
10. A flame injection throat for a furnace substantially as described with reference to the accompanying drawings.
11. A furnace incorporating a flame injection throat substantially as described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1981.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.



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