

[54] **SHEATHING FOR METAL FURNACE MEMBERS**

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138/147

[56] **References Cited**

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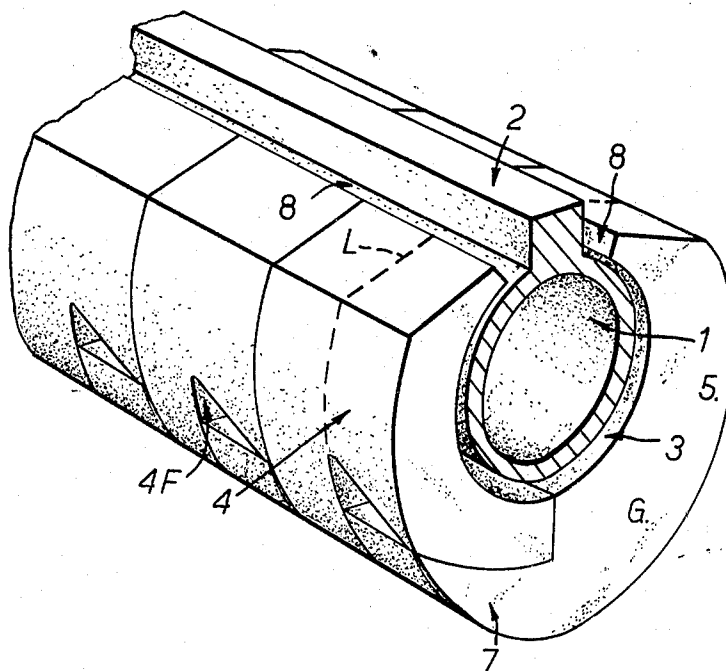
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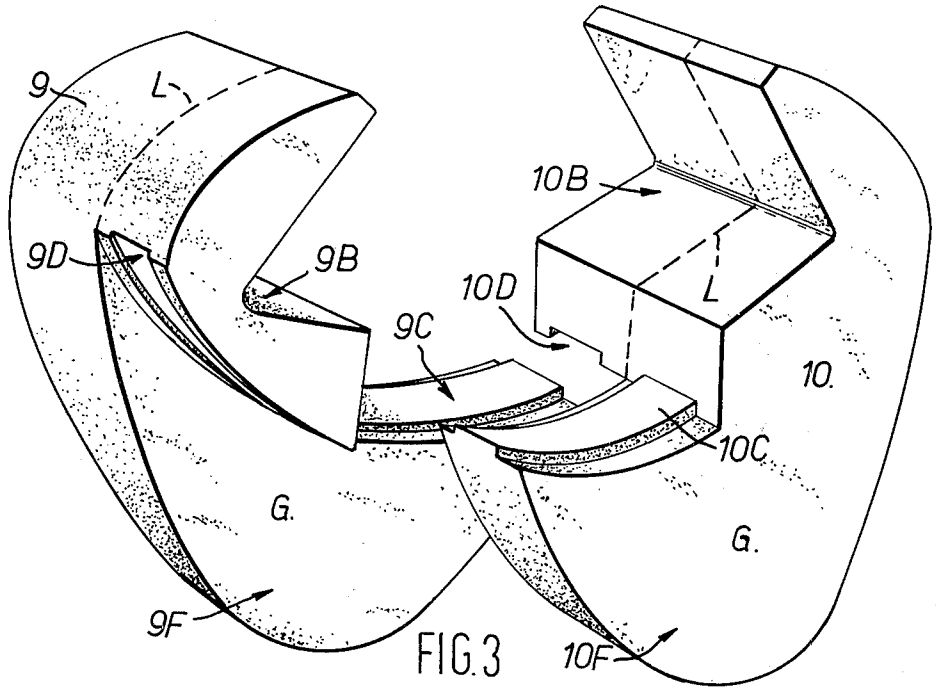
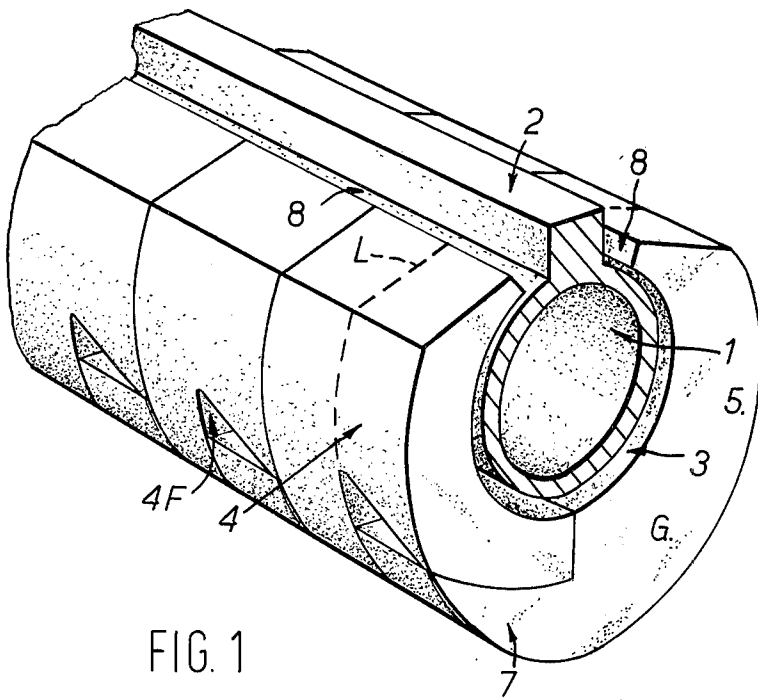
Attorney, Agent, or Firm—Larson, Taylor & Hinds

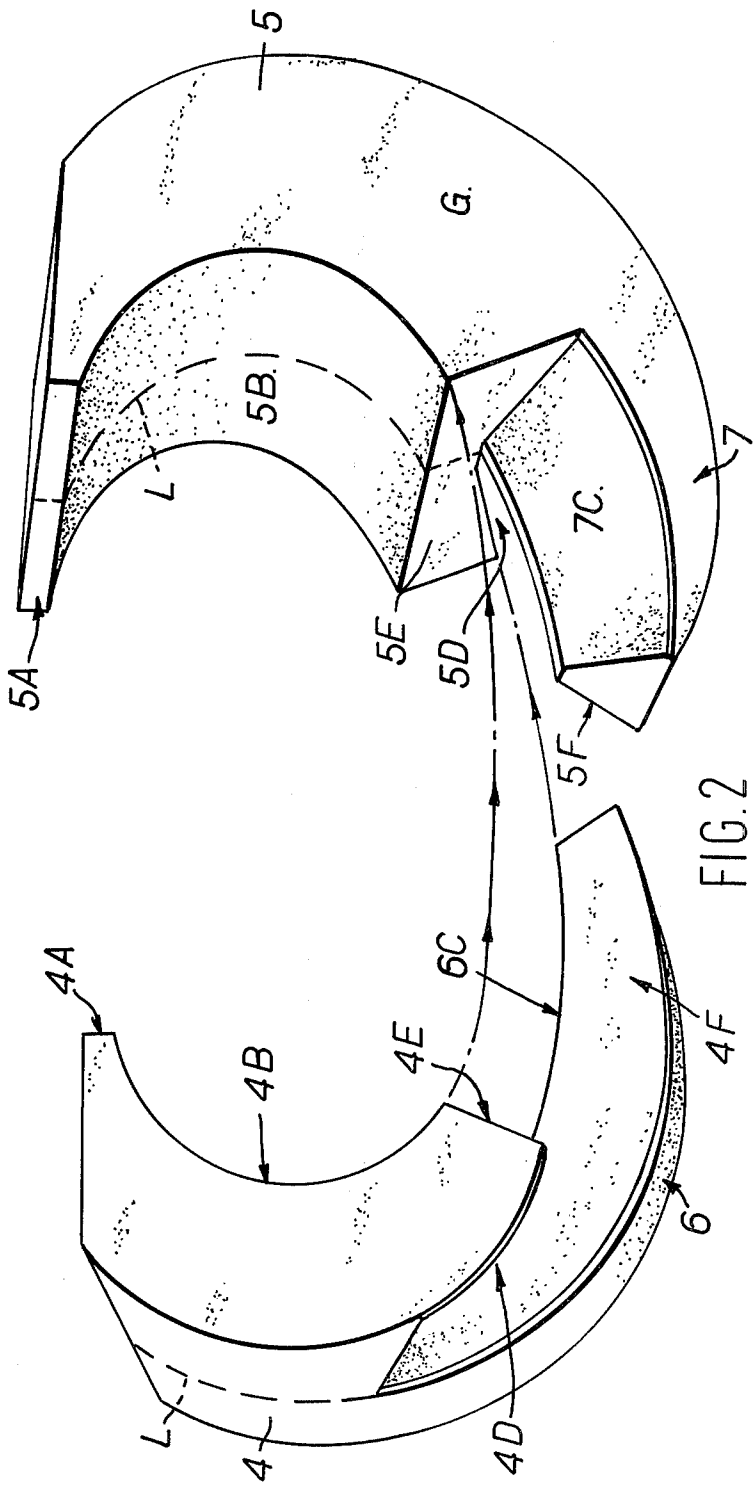
[57] **ABSTRACT**

The invention comprises a refractory tile for sheathing a furnace skid rail or other horizontal furnace member, preferably around an inner layer of fibrous refractory material. The tile consists of a C-shaped block to embrace one side of the furnace member hooking on at the top and swinging into engagement underneath with a complementary tile. In accordance with the invention the tile has a lower end terminal portion with oppositely facing axial surfaces so that when two complementary tiles, preferably identical tiles, are interengaged as a collar around a furnace member they hold in position against axial separation.

23 Claims, 5 Drawing Figures







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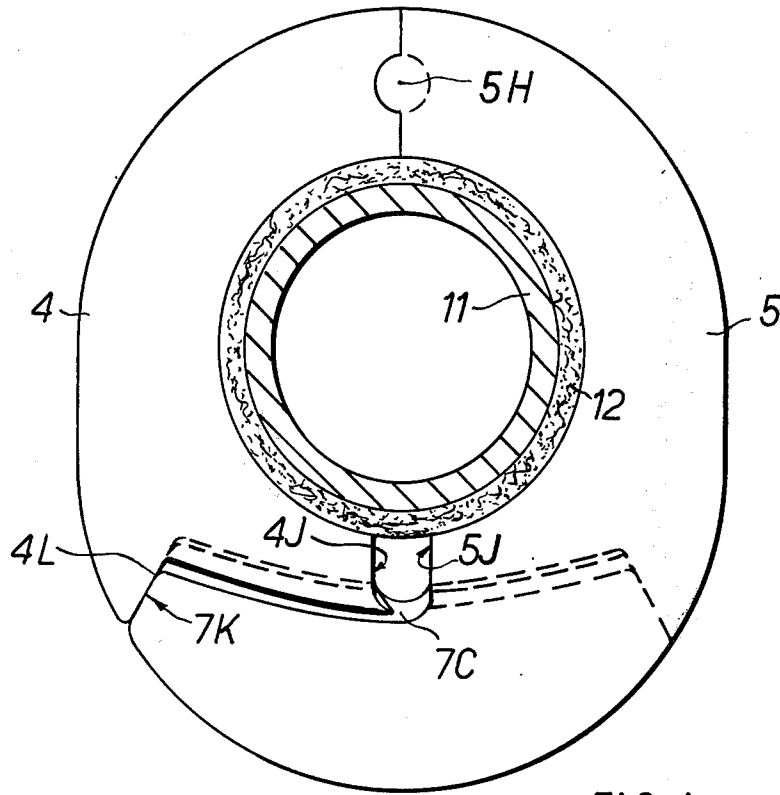


FIG. 4

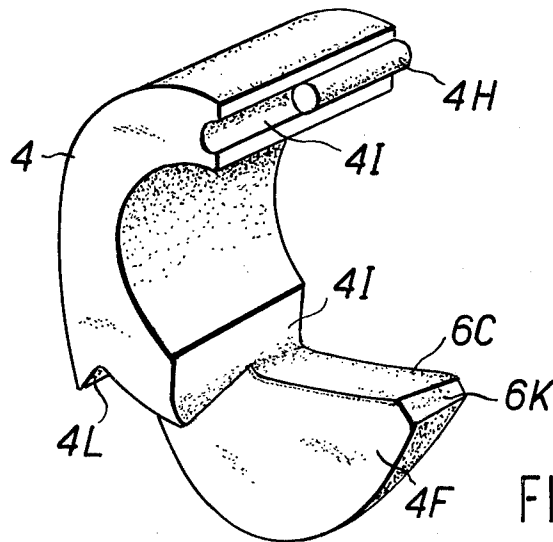


FIG. 5

SHEATHING FOR METAL FURNACE MEMBERS

This invention relates to refractory sheathing for horizontal metal members in furnaces, such as re-heat furnace skid rails and thier supporting structure, particularly cross-over pipes.

The invention is particularly concerned with refractory tiles for cladding thermal insulation on skid rails and the cross-over pipes which support the rails in re-heat furnaces for ferrous slabs and will be described as applied thereto but application of the invention to other members in furnaces where similar conditions exist is not precluded.

In a re-heat furnace, slabs must be heated to a very high temperature, for example 1,260°C, as uniformly as possible and the slabs are therefore moved along raised skid rails, usually water-cooled hollow rails supported by a gantry-like structure of water-cooled hollow members, while they are heated from above and below by intensely hot gas blast from burners.

The supporting structure is directly in the path of the hot gas and, as well as being water-cooled, the hollow rails and supports are sheathed with refractory material. The present invention, in its preferred application, improves sheathing of the kind consisting of an inner layer of refractory fibrous material and an outer layer of refractory tiles.

For such an outer layer, the invention provides a refractory tile of the kind consisting of a substantially C-shaped block with a hollow side to embrace one lateral side portion of a furnace member of appropriate size, an upper end to engage over the furnace member and a lower end designed to swing, under gravity, beneath the furnace member so as to extend more than half-way thereunder in engagement with a complementary tile.

According to the invention, the lower end of the block has a circumferentially projecting terminal portion with a reduced cross-sectional dimension and with circumferential surfaces facing respectively with a component in both axial directions whereby, when the terminal portion of the tile is interengaged with a complementary tile to form a collar around the surface member, the circumferential surfaces provide abutments to oppose axial separation of the tile from its complementary tile.

Either an opposed pair of such tiles or one such tile and an opposed hollow-sided complementary tile can together constitute a sheathing collar of which the two components can be applied around the rail and will hold themselves in place.

When the two collar components are hooked by their upper ends on to the rail, they swing together for their lower ends to interengage or interlock by abutting surfaces which oppose tilting apart and axial separation of the components so that they stay together as a collar around the rail. This is an important technical advance, prior sheathing tiles of this kind having required additional securing means, such as lugs welded to the metal furnace member, or not being held against axial separation, especially under the effect of vibration.

In preferred embodiments of the invention the lower end terminal portion extends from one axial face of the block for not more than half the axial width of the block and in the other half of the width of the block there is a circumferential recess with surfaces complementary to the circumferential surfaces of the terminal portion whereby any two such tiles can form a comple-

mentary pair to interengage by their lower ends and form a collar around a furnace member.

The axially directed circumferential surfaces preferably comprise respectively a plane transverse inner axial surface and a segmental frusto-conical surface, this configuration providing a basis for simple and strong shapes important for moulded refractories.

In the preferred use of the tiles, the rail is first provided with a layer of refractory fibrous material of sufficient thickness to undergo some resilient compression when the tiles are placed as a collar around the layer so that the tendency for the layer of fibrous material to recover its thickness, by reaction from compression, holds the collar components in circumferential stress. To sheath any length of rail or pipe, pairs of tile components are applied as collars in axially-abutting longitudinal series.

As mentioned above, it is an important feature of the invention that the interengagement of the tile components of each collar is such that they interlock against axial separation along the rail.

Such interlocking against axial separation is provided by the respective circumferential surfaces, of the collar components, and these may be provided by undercut, partially frusto-conical, tongue-and-groove or equivalent engaging faces.

In order to provide the concentration of weight required for location of the centre of gravity to promote swinging of the tiles beneath their rail, and incidentally a convenient grip for manipulating the tiles, the lower part of each tile may be increased in mass by increase in the substantially radial overall transverse thickness of the block towards its lower end.

The invention is suitable for use with rails or pipes of circular-section or of other cross-sectional shapes, in particular triangular or figure "8" cross-sectional shape. The hollow side of each tile is shaped accordingly.

Further features of the invention are incorporated in embodiments which are illustrated, by way of example, on the accompanying drawings, in which:-

FIG. 1 is a fragmentary perspective cross-section of a skid rail clad with tiles in accordance with the invention, the usual inner sheathing layer of refractory fibre material being omitted to assist illustration of the tiles.

FIG. 2 is an exploded perspective view, on a larger scale, of a pair of tiles such as form the cladding shown in FIG. 1.

FIG. 3 is a view similar to FIG. 2 but showing a pair of tiles for a triangular-section rail.

FIG. 4 is a cross-section through a furnace pipe member, such as a cross-over pipe, with an inner insulating layer of refractory fibrous material and a sheathing collar formed by a pair of tiles according to another embodiment, and

FIG. 5 is a perspective view of one of the pair of tiles of FIG. 4.

As shown in FIG. 1, a skid rail consists of a steel pipe 1 along the top of which extends a stout steel rib 2 on which billets can rest and slide in a furnace, as is well known.

The pipe 1, up to each side of the rib 2, is covered by an inner layer of ceramic fibre, which is not shown but fills the space 3, and this is encased by opposed identical pairs of substantially C-shaped tiles 4 and 5. The tiles are moulded from any suitable refractory material, such as mullite blended with plastic refractory clay to

mention only one example, each in the form of a strong relatively massive block.

At the underside, beneath the pipe 1, the tiles 4 and 5 (FIG. 2) interengage, as described below, by respective lower-end terminal portions 6 and 7.

At the top, gaps 8 between the upper ends of the tiles 4 and 5 and the sides of the rib 2 are packed with refractory mortar (not shown). The width of the gaps 8 is somewhat exaggerated for illustration.

The tiles 4 and 5 being identical, their shape as seen from either end is shown by FIG. 2 wherein the two tile components of a collar are opposed in the positions they would occupy in being applied around the pipe 1.

Each tile has an upper end 4A, 5A, shaped to engage over, in effect to hook on to, the upper surface of the pipe 1, and an arcuate hollow side 4B, 5B, to embrace around the respective side of the pipe 1. On each of the lower-end terminal portions 6 and 7, which are of half the axial width of the tile, there is formed a part frusto-conical surface 6C, 7C, which fits into an undercut recess 5D or 4D respectively in the outer side of the other tile. Each terminal portion 6 and 7 springs from a respective shoulder 4E, 5E across the width of the tile and these shoulders provide terminal abutment surfaces for the pair of tiles closing together, as indicated by the arrowed lines in FIG. 2.

The inner axial surface 4F, 5F respectively of the terminal portion is a plane transverse surface contiguous with an inner circumferential surface of the recess of the respective tile. The frusto-conical surface, 6C, 7C respectively, slopes from the face 4F or 5F to the outer axial surface of the terminal portion.

Each tile has its centre of gravity located away from its lower end extremity, in about the area indicated by the reference G, so that when hooked on to the pipe 1 each tile tends constantly to swing under the pipe and interengage with the other tile of the pair.

Although the tiles 4 and 5 have been shown as of identical shape, so that any two such tiles may compose a collar, it can be seen that if a single tile was divided through the medial transverse plane, along the dotted line L, the two resulting parts of the tile could be opposed to fit around the pipe 1 as a half-width collar. The two components of the collar would then comprise a tile with a terminal portion, such as 6 or 7, in accordance with the invention, and an arcuate complementary tile with a rebated part, corresponding to the undercut recess 4D or 5D, to interengage with the terminal portion of the other tile.

In any event, the frusto-conical surfaces and shoulders form abutting surfaces which, once interengaged, oppose tilting-apart and axial separation of the collar components. Successive pairs of collar components along a rail or pipe may be arranged alternately to oppose axial separation.

For a triangular skid rail, an identical pair of tiles 9 and 10, as shown by FIG. 3, can be provided with angular hollow sides 9B and 10B to clasp around a triangular section pipe.

Also, the tiles 9 and 10 have tongues 9C and 10C to fit in grooves 10D and 9D instead of the frusto-conical and undercut interlocking parts of the tiles 4 and 5.

To provide the concentration of weight required for appropriate location of the centre of gravity at G, the substantially radial overall dimension of the tiles 9 and 10 is enlarged towards the lower ends to form protuber-

ances 9F and 10F which provide mass and also form convenient hand grips for manipulating the tiles.

The embodiment illustrated by FIGS. 4 and 5 is similar in many respects to that of FIGS. 1 and 2 and corresponding parts have corresponding references.

There are two main modifications. The upper ends of the tiles meet with half-width interengaging tongues 4H, 5H and grooves 4I and 5I respectively so that they completely enclose a pipe 11 with an inner fibrous layer 12. At the lower ends of the tiles, the shoulders 4J and 5J are set back so that they do not abut, interengagement of the tiles being limited by abutment of the ends 6K and 7K against the ends 4L and 5L of the respective recesses. The circumferential projection of the terminal portions 6 and 7 in this embodiment is thus greater than the circumferential extent of the recesses.

It will be appreciated that any of the features described above for one of the examples could be embodied in other embodiments of the invention.

I claim:

1. A refractory tile for sheathing a horizontal metal furnace member and consisting of a substantially C-shaped block with a hollow side to embrace one lateral side portion of a furnace member of appropriate size, an upper end to engage over the furnace member and a lower end designed to swing, under gravity, beneath the furnace member so as to extend more than half-way thereunder in engagement with a complementary tile, characterised thereby that the lower end of the block includes means for interengaging with a complementary tile to form a collar around the furnace member and oppose axial separation of the tile from its complementary tile, said means comprising a circumferentially projecting terminal portion with a reduced cross-sectional dimension, and with circumferential surfaces facing respectively with a component in both axial directions and so constructed, arranged and oriented that when said terminal portion of the tile is interengaged with a complementary tile to form a collar around the furnace member, said circumferential surfaces provide abutments to oppose axial separation of the tile from its complementary tile.

2. A refractory tile according to claim 1, characterised thereby that the lower end terminal portion extends from one axial face of the block for not more than half the axial width of the block and in the other half of the width of the block there is a circumferential recess with surfaces complementary to the said circumferential surfaces of the terminal portion whereby any two such tiles can form a complementary pair to interengage by their lower ends and form a collar around a furnace member.

3. A refractory tile according to claim 2, characterised thereby that said circumferential surfaces of the terminal portion comprise respectively a plane transverse inner axial surface which is contiguous with an inner circumferential surface of the recess and a segmental frusto-conical surface of the terminal portion sloping from the inner axial surface to an outer axial surface of the terminal portion.

4. A refractory tile according to claim 3, characterised thereby that the substantially radial overall transverse thickness of the block increases towards its lower end.

5. A refractory tile according to claim 2, characterised thereby that the circumferential projection of the

terminal portion is greater than the circumferential extent of its recess.

6. A refractory tile according to claim 1, characterised thereby that the upper end has a half-width tongue and groove to interengage with the upper end of a similar tile.

7. In combination in a furnace, a generally horizontal, elongate member, and refractory sheathing carried by and surrounding a substantial portion of said member, said sheathing comprising at least in part a plurality of refractory tiles arranged in pairs such that each pair sheathes an axial section of said member, each pair comprising a first tile member having an upper end resting on an upper surface of said member, an intermediate portion extending downwardly along one lateral side of said member, and a lower end with a terminal portion extending beyond a vertical plane passing through the centre of said member, said terminal portion being of reduced axial and radial dimensions relative to said intermediate body portion, said intermediate body portion having a recess formed therein axially adjacent said terminal portion for receiving a corresponding terminal portion of an oppositely disposed tile, and a second tile disposed oppositely from said first tile, said second tile having an upper end resting on an upper surface of said member, an intermediate portion extending downwardly along the other lateral side of said member, and a lower end with a terminal portion extending beyond said vertical plane, said terminal portion of said second tile being of reduced axial and radial dimensions relative to said intermediate body portion of said second tile and projecting into said recess in the intermediate body portion of said first tile, and said intermediate body portion of said second tile having a recess therein formed axially adjacent said terminal portion of said second tile, into which recess said terminal portion of said first tile projects, the terminal portion of each tile lying radially outwardly of the innermost surface of the recess of the other tile so as to oppose pivoting apart of the upper ends.

8. Apparatus as claimed in claim 7 wherein said terminal portions and said recesses have adjacent surface portions opposing axial separation of the two tiles.

9. Apparatus as claimed in claim 7 wherein, when the two tiles are engaged to the maximum extent, the extreme ends of the terminal portions abut surfaces of the recesses, and thus define the maximum degree of interengagement.

10. Apparatus as claimed in claim 7 wherein, when the two tiles are engaged to their maximum extent, opposing faces of the intermediate body portions are in abutting engagement to define the maximum degree of interengagement.

11. Apparatus as claimed in claim 7 wherein the radially innermost surface of each terminal portion lies radially outwardly of the interior surface of the intermediate body portion of the same tile.

12. Apparatus as claimed in claim 11 wherein one axial end surface of each terminal portion is a smooth continuation of one axial end surface of the intermediate body portion, and the axial extent of the terminal portion is approximately one-half the axial length of the intermediate body portion, such that the inner axial end surface of the terminal portion lies approximately in the centre of the axial length of the intermediate body portion.

13. Apparatus as claimed in claim 12 wherein said first and second tiles are identical.

14. Apparatus as claimed in claim 13 wherein said member has a skid rail extending along its upper surface, and the upper ends of said tiles lie on opposite sides of and adjacent to said skid rail.

15. Apparatus as claimed in claim 12 wherein the upper ends of said tiles contact each other so as to sheathe the entire periphery of an axial section of said member, said upper ends having mating projections and recesses for sealing their line of contact.

16. For use in sheathing an elongate member oriented generally horizontally in a furnace, a refractory sheathing tile comprising a refractory body having a concave side for encompassing at least a substantial portion of one side of an axial section of the member, the upper portion of said concave side terminating in an upper end for resting on an upper surface of the member, the lower portion of said concave side terminating in a face extending generally normally and downwardly therefrom, a projecting portion extending generally normally from said face, the innermost surface of said projecting portion lying radially outwardly from the lower portion of said concave side, a recess opening into said face axially adjacent said projecting portion and radially outwardly from the lower portion of said concave side, said recess being of generally complementary configuration with said projecting portion so as to be capable of matingly receiving the projecting portion of an identical but oppositely disposed tile.

17. Apparatus as claimed in claim 16 wherein the radially innermost surface of said projecting portion includes a surface portion having an axially facing component, and wherein the base surface of said recess has a surface portion of complementary orientation, such that said surface portions would oppose pure axial separation of an identical but oppositely disposed tile mated with said tile.

18. For forming a refractory sheathing collar around at least a substantial portion of the periphery of an elongate generally horizontal member, a pair of identical tiles each having a concave inner face, an upper end, and, at the lower end, a circumferentially extending, radially outwardly open recess underlying the lower end of said concave inner surface, and an axially adjacent projection extending generally oppositely from said recess for fitting into the recess of the other tile of the pair when oppositely disposed, such that the projection of each tile of an engaged pair underlies the lower end of the concave surface of the other tile so as to limit pivoting apart of the upper ends of the pair, the tiles being so configured that their centres of gravity tend to pivot each tile of an engaged pair toward the other about their respective upper ends.

19. Apparatus as claimed in claim 18 wherein the projection and recess of each tile have surface portions configured to engage with and prevent axial separation of an engaged pair.

20. In combination in a furnace, a generally horizontal elongate member, and a refractory sheathing collar carried by and surrounding a substantial portion of the periphery of said member, said collar comprising two refractory tiles disposed oppositely on opposite sides of said member, each tile having a concave inner face facing said member, an upper end resting on an upper surface of said member, a radially outwardly open recess

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at its lower end, and a terminal portion which overlaps the lower end of the opposite tile, lies in said recess of the opposite tile, and opposes pivoting apart of said upper ends by bearing radially inwardly against the base surface of said recess in the opposite tile, the centres of gravity of the two tiles being located so as to urge the two tiles to pivot about their upper ends into engagement at their lower ends.

21. Apparatus as claimed in claim 20 further com-

prising means for opposing axial separation of the engaged tiles of said collar.

22. Apparatus as claimed in claim 21 wherein said last mentioned means comprise surface portions on each tile configured to engage with and prevent axial separation of the tiles.

23. Apparatus as claimed in claim 20 wherein the two tiles of an engaged pair are substantially identical.

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