

[DESCRIPTION]

[TITLE OF INVENTION]

WATER PIPE PROTECTING REFRACTORY

[Technical Field]

5 [0001]

The present invention relates to a water pipe protecting refractory for protecting a water pipe of a heat exchanger such as a boiler from an atmosphere of a high temperature gas.

[Background Art]

10 [0002]

For example, in a combustion furnace with a boiler which uses heat generated when waste and the like are incinerated to generate electricity, a furnace wall of the combustion furnace is formed by a water pipe structure (a boiler panel) including a plurality of water pipes. Since the inside of the combustion furnace has a high temperature and is a highly corrosive environment, a water pipe protecting refractory such as a refractory tile is generally used in order to protect the water pipes. As a refractory tile, a refractory tile described in Patent Document 1 is known.

[0003]

The refractory tile described in Patent Document 1 is attached by a method of hooking a tile to a hook formed in the water pipe structure. Mortar is filled between the refractory tiles and the water pipe structure.

The refractory tile includes a pair of protective parts that have a shape conforming to a half circumferential part of each of the water pipes and a connecting part that connects the protective parts. The protective part is formed in an arc shape along the outer peripheral surface of the water pipe. Accordingly, it is possible to form a thin

protective part of the refractory tile and increase in surface temperature of the refractory tile is reduced. When increase in surface temperature of the refractory tile is reduced, adhesion of clinker caused by incineration of waste is reduced.

5 A receiving structure engaged with the hook provided in the water pipe structure is formed at the center of the connecting part in the vertical direction, that is, in the central part of the tile.

[Citation List]

[Patent Document]

[0004]

10 [Patent Document 1]

Japanese Utility Model (Registered) Publication No. 3163736

[Summary of Invention]

[Technical Problem]

[0005]

15 Incidentally, in the refractory tile described in Patent Document 1, since the hook receiving structure is formed at the center of the refractory tile, it is necessary to form a thick connecting part that connects the protective parts. When the thickness of the connecting part increases, there is a problem that a cooling effect on the water pipe is unlikely to occur on a surface (surface that faces an internal space of the combustion
20 furnace) of the connecting part.

In addition, there are problems that, in order to form the hook receiving structure at the center of the refractory tile, a method of molding the refractory tile becomes complicated and production costs of the refractory tile increase.

[0006]

25 An object of the present invention is to provide a refractory tile through which it

is possible to thin the center of the refractory tile and reduce production costs of the refractory tile.

[Solution to Problem]

[0007]

5 According to a first aspect of the present invention, a water pipe protecting refractory for protecting a water pipe structure, wherein the water pipe structure is provided with a plurality of water pipes extending in a vertical direction, a reinforcing member configured to connect the water pipes adjacent to each other across an extending direction of the water pipes, and a plurality of hooks disposed on the reinforcing member
10 to be separated from one another in the vertical direction, and wherein each of the hooks includes a base part projecting in a direction intersecting a surface of the reinforcing member, an upper hook part projecting upward from an end of the base part, and a lower hook part projecting downward from an end of the base part, the water pipe protecting refractory including: a pair of protective parts having a shape conforming to part of an
15 outer peripheral surface of each of the plurality of adjacent water pipes, and a connecting part configured to connect the protective parts, wherein the connecting part includes a connecting part main body, a first protrusion projecting upward from the connecting part main body and inserted into a space between the reinforcing member and the lower hook part, and a second protrusion projecting downward from the connecting part main body
20 and inserted into a space between the reinforcing member and the upper hook part, and wherein a projection length of the first protrusion from the connecting part main body is formed to be longer than a projection length of the second protrusion from the connecting part main body and a length from an upper end of the first protrusion to a lower end of the second protrusion is formed to be longer than a length from a lower end of the lower
25 hook part of the upper hook to an upper end of the upper hook part of the lower hook

among a pair of hooks adjacent to each other in the vertical direction. The connecting part includes a concave part in a middle section of the vertical direction on a side opposite to a surface facing the reinforcing member.

[0008]

5 In such a configuration, since the water pipe protecting refractory has a dropping fashion style structure in which the refractory is supported at the upper end and the lower end thereof, there is no need to form a hook receiving structure at the center of the water pipe protecting refractory, and it is possible to reduce the thickness of the central part of the water pipe protecting refractory. In addition, it is possible to produce the water pipe
10 protecting refractory at low cost.

[0009]

In the water pipe protecting refractory, the connecting part may include a cover part projecting downward from the connecting part further than the second protrusion on a side opposite to a side facing the reinforcing member of the connecting part.

15 [0010]

In such a configuration, it is possible to increase an area of the water pipe structure protected by the water pipe protecting refractory.

[0011]

According to a second aspect of the present invention, a water pipe protecting
20 refractory for protecting a water pipe structure, wherein the water pipe structure is provided with a plurality of water pipes extending in a vertical direction, a reinforcing member configured to connect the water pipes adjacent to each other across an extending direction of the water pipes, and a plurality of hooks disposed on the reinforcing member to be separated from one another in the vertical direction, and wherein each of the hooks
25 includes a base part projecting in a direction intersecting a surface of the reinforcing

member, an upper hook part projecting upward from an end of the base part, and a lower hook part projecting downward from an end of the base part, the water pipe protecting refractory including: a pair of protective parts having a shape conforming to part of an outer peripheral surface of each of the plurality of adjacent water pipes, and a connecting part configured to connect the protective parts, wherein the connecting part is attached between the upper hook part and the lower hook part of a pair of hooks adjacent to the upper hook part in the vertical direction via the dropping fashion style structure. The connecting part includes a concave part in a middle section of the vertical direction on a side opposite to a surface facing the reinforcing member.

10 [0012]

In the water pipe protecting refractory, the connecting part may include a cover part projecting downward from the connecting part on a side opposite to a surface facing the reinforcing member of the connecting part.

[0013]

15 In the water pipe protecting refractory, the protective part may include a protective part main body formed in which a gap is provided between the protective part main body and an outer peripheral surface of the water pipe, and a spacer formed on an inner peripheral surface of the protective part main body such that the height of the spacer is the gap.

20 [0014]

In such a configuration, a gap between the water pipe and the protective part can be kept constant.

[Advantageous Effects of Invention]

[0015]

25 According to the present invention, since the water pipe protecting refractory

has a dropping fashion style structure in which the refractory is supported at the upper end and the lower end thereof, it is possible to reduce the thickness of the central part of the water pipe protecting refractory. In addition, it is possible to produce the water pipe protecting refractory at low cost.

5 [Brief Description of Drawings]

[0016]

Fig. 1 is a schematic diagram showing a stoker-type combustion furnace to which a water pipe protecting refractory according to an embodiment of the present invention is applied.

10 Fig. 2 is a perspective view of a water pipe structure to which a water pipe protection structure according to an embodiment of the present invention is applied.

Fig. 3 is a front view of the water pipe structure to which the water pipe protection structure according to an embodiment of the present invention is applied.

Fig. 4 is a view seen from the arrow IV in Fig. 3 and a top view of the water
15 pipe structure to which the water pipe protection structure is applied.

Fig. 5 is a cross-sectional view taken along the line V-V in Fig. 3 and is a cross-sectional view of the water pipe structure to which the water pipe protection structure is applied.

Fig. 6 is a front view when viewed from the inside of a protective part of the
20 water pipe protecting refractory according to an embodiment of the present invention.

Fig. 7 is a view seen from the arrow VII in Fig. 6 and is a bottom view of the water pipe protecting refractory according to an embodiment of the present invention.

Fig. 8 is a cross-sectional view taken along the line VIII-VIII in Fig. 6 and a cross-sectional view of the water pipe protecting refractory according to an embodiment
25 of the present invention.

Fig. 9 is an explanatory diagram showing a method of attaching the water pipe protecting refractory according to an embodiment of the present invention to the water pipe structure.

[Description of Embodiments]

5 [0017]

A water pipe protecting refractory (refractory tile) according to an embodiment of the present invention and a water pipe protection structure including the water pipe protecting refractory will be described below in detail with reference to the drawings.

The water pipe protection structure of the present embodiment protects, for example, a

10 water pipe structure of a heat exchanger such as a boiler water pipe wall of a stoker-type combustion furnace.

[0018]

Fig. 1 is a schematic diagram showing a stoker-type combustion furnace 50 to which a water pipe protection structure 1 including a water pipe protecting refractory

15 (hereinafter referred to as a refractory tile) of the present embodiment is applied.

The stoker-type combustion furnace 50 includes an input hopper 51, a fire grate 52, an internal space 53, a boiler 54, a water pipe structure 10, and the water pipe protection structure 1.

[0019]

20 The input hopper 51 is a part that receives incineration objects such as waste. The input hopper 51 is connected to the internal space 53. The fire grate 52 forms a bottom of the internal space 53. The water pipe structure 10 is provided on a side (furnace wall) of the internal space 53.

The water pipe structure 10 includes a plurality of water pipes 11 (refer to Fig. 2). The plurality of water pipes 11 extend in a vertical direction. The plurality of water pipes 11 are connected to the boiler 54.

[0020]

5 An incineration object (waste) input from the input hopper 51 is guided to the internal space 53 and is incinerated on the fire grate 52. According to this incineration, heat is generated in the internal space 53. Heat is exchanged between water flowing through the plurality of water pipes 11 and the internal space 53. Heat received by water flowing through the plurality of water pipes 11 is exchanged in the boiler 54 and is
10 effectively used.

[0021]

High temperature and highly corrosive gases are generated in the internal space 53 due to the incineration. The water pipe protection structure 1 is provided to protect the plurality of water pipes 11 from a high temperature and highly corrosive gas and
15 protects the plurality of water pipes 11 on the side of the internal space 53.

[0022]

As shown in Fig. 2, Fig. 3, Fig. 4 and Fig. 5, the water pipe structure 10 includes the plurality of water pipes 11 extending in a vertical direction V, a reinforcing member 12 (fin) configured to connect the water pipes 11 adjacent to each other across an
20 extending direction of the water pipes, and a plurality of hooks 13 disposed on the reinforcing member 12 to be separated from one another in the vertical direction V. The plurality of hooks 13 are disposed at uniform intervals in the vertical direction V. A refractory tile 2 of the present embodiment is disposed between adjacent hooks 13 in the vertical direction V.

Here, a vertical direction V, an upward direction V1, and a downward direction V2 are shown in the drawings.

[0023]

The plurality of water pipes 11 each have cylindrical shape. The plurality of
5 water pipes 11 have the same diameter and arranged with a uniform pitch.

The reinforcing member 12 has a flat plate shape. The reinforcing member 12
is disposed on the same plane as a plane including the axis of the plurality of water pipes
11.

[0024]

10 As shown in Fig. 5, the hook 13 includes a base part 14 projecting from a
surface of the reinforcing member 12 on the side of the internal space 53 to the side of
the internal space 53, an upper hook part 15 projecting upward from an end of the base
part 14, and a lower hook part 16 projecting downward from an end of the base part 14.
The base part 14 projects in a direction orthogonal to (intersecting) a surface of the
15 reinforcing member 12.

[0025]

Spaces are formed between the upper hook part 15, the lower hook part 16, and
the reinforcing member 12. A first space S1 between the lower hook part 16 and the
reinforcing member 12 is a space into which a first protrusion 6 of the refractory tile 2 to
20 be described below is inserted. A second space S2 between the upper hook part 15 and
the reinforcing member 12 is a space into which a second protrusion 7 of the refractory
tile 2 to be described below is inserted. As shown in Fig. 3, the widths of the upper
hook part 15 and the lower hook part 16 in the horizontal direction are smaller than the
width of the reinforcing member 12.

25 [0026]

A projection length L1 of the lower hook part 16 from the base part 14 is larger than a projection length L2 of the upper hook part 15 from the base part 14. For example, the projection length L1 of the lower hook part 16 from the base part 14 can be 1.5 times the projection length L2 of the upper hook part 15 from the base part 14.

5 In other words, the depth of the first space S1 formed for the lower hook part 16 from an end of the lower hook part 16 is deeper than the depth of the second space S2 formed for the upper hook part 15 from an end of the upper hook part 15.

[0027]

Next, a configuration of the water pipe protection structure 1 that protects the
10 water pipe structure 10 will be described.

The water pipe protection structure 1 includes the hook 13 provided on the reinforcing member 12, the plurality of refractory tiles 2 that are attached to the water pipe structure 10 by the hooks 13, and mortar 17 filled between the water pipe structure 10 and the refractory tile 2. The refractory tile 2 of the present embodiment can be
15 attached to the water pipe structure 10 via a dropping fashion style structure.

The dropping fashion style structure is adapted to attach a plate-like object to a body. The dropping fashion style structure is provided with upper and lower grooves formed on the body having a space to which the plate-like object is attached. An upper part of the plate-like object is put into the upper groove, and then the lower part of the
20 plate-like object is dropped into the lower groove.

[0028]

Each of the refractory tiles 2 has fire resistance. The refractory tile 2 is made of, for example, silicon carbide (SiC). Each of the refractory tiles 2 is configured to protect two adjacent water pipes 11. The refractory tile 2 is adhered to the water pipe
25 structure 10 through the mortar 17.

[0029]

As shown in Fig. 3, the refractory tile 2 that is attached to the water pipe structure 10 has a rectangular shape when viewed in a direction orthogonal to the water pipe structure 10. The refractory tiles 2 are regularly disposed in the vertical direction and horizontal direction to cover the entire surface that faces the side of the internal space 53 of the water pipe structure 10.

[0030]

As shown in Fig. 6, Fig. 7, and Fig. 8, the refractory tile 2 includes a first protective part 3A and a second protective part 3B (a protective part 3) having a shape conforming to a half circumferential part of each of the plurality of adjacent water pipes 11, and a connecting part 4 configured to connect the first protective part 3A and the second protective part 3B. The protective part 3 may have a shape that covers part of an outer peripheral surface 11a of the water pipe 11.

The protective part 3 includes a protective part main body 18 and a plurality of spacers 19 formed on the protective part main body 18.

[0031]

As shown in Fig. 4, an inner peripheral surface 31 of the protective part main body 18 is formed parallel to the outer peripheral surface 11a of the water pipe 11. In other words, the protective part main body 18 is formed such that a gap G1 between the water pipe 11 and the protective part 3 is substantially constant.

An outer peripheral surface 32 of the protective part main body 18 is formed parallel to the inner peripheral surface 31 of the protective part main body 18. In other words, the protective part main body 18 is formed such that the thickness is constant.

[0032]

As shown in Fig. 6, the spacer 19 includes a main spacer 19A disposed in the vicinity of the center of the inner peripheral surface 31 of the protective part main body 18 in the circumferential direction and a sub-spacer 19B disposed on both sides of the main spacer 19A. A plurality of main spacers 19A are provided in the vertical direction. The height of the main spacer 19A (a height of the protective part main body 18 from the inner peripheral surface 31) is substantially the same as that of the gap G1 (refer to Fig. 4) between the water pipe 11 and the protective part 3.

A plurality of sub-spacers 19B are provided in the vertical direction. The height of the sub-spacer 19B is slightly lower than that of the main spacer 19A.

Here, one main spacer 19A may be provide on each of the protective parts 3.
[0033]

As shown in Fig. 8, the connecting part 4 includes a connecting part main body 5, the first protrusion 6 projecting upward from the connecting part main body 5, and the second protrusion 7 projecting downward from the connecting part main body 5. The connecting part main body 5 includes a connecting part parallel surface 20 parallel to the reinforcing member 12 facing the side of the reinforcing member 12 and a connecting part surface 21 facing the internal space 53. In the refractory tile 2 of the present embodiment, the first protrusion 6 and the second protrusion 7 are attached to the first space S1 and the second space S2 via the dropping fashion style structure.

[0034]

The first protrusion 6 and the second protrusion 7 are provided on the connecting part main body 5 on the side of the connecting part parallel surface 20. That is, the first protrusion 6 and the second protrusion 7 are provided on the connecting part main body 5 on the side of the reinforcing member 12. The first protrusion 6 is inserted into the first space S1 between the reinforcing member 12 and the lower hook part 16.

The second protrusion 7 is inserted into the second space S2 between the reinforcing member 12 and the upper hook part 15.

[0035]

5 The first protrusion 6 is formed by forming a first hole 8 which is a bottomed hole on the upper surface of the connecting part 4. The second protrusion 7 is formed by forming a second hole 9 which is a bottomed hole on the lower surface of the connecting part 4.

10 A projection length P1 of the first protrusion 6 from the connecting part main body 5 is longer than a projection length P2 of the second protrusion 7 from a main body of the connecting part 4. The projection length P1 of the first protrusion 6 from the connecting part main body 5 is substantially the same as the projection length L1 of the lower hook part 16 from the base part 14. The projection length P2 of the second protrusion 7 from the connecting part main body 5 is substantially the same as the projection length L2 of the upper hook part 15 from the base part 14.

15 [0036]

A length L4 from an upper end of the first protrusion 6 to a lower end of the second protrusion 7 is longer than a length L3 (refer to Fig. 5) from a lower end of the lower hook part 16 of the upper hook 13 to an upper end of the upper hook part 15 of the lower hook 13 among a pair of hooks 13 adjacent in the vertical direction. That is,
20 while the first protrusion 6 is disposed in the first space S1, the second protrusion 7 is disposed in the second space S2, and the lower part of the refractory tile 2 is supported by the hook 13, the first protrusion 6 and the lower hook part 16 interfere with each other, and the refractory tile 2 is prevented from falling.

[0037]

In addition, in the tile of the present embodiment, a distance L5 between the bottom of the first hole 8 and a lower end of the second protrusion 7 is smaller than the length L3 from the lower end of the upper hook part 15 to the upper end of the lower hook part 16.

5 When the above configuration is used, the refractory tile 2 can be attached to the water pipe structure 10 via the dropping fashion style structure.

[0038]

As shown in Fig. 8, in the connecting part 4, a concave part 22 that reduces the thickness of the connecting part 4 is formed. The concave part 22 is formed on the
10 connecting part surface 21 (surface that faces the internal space 53) of the connecting part 4. The concave part 22 is formed on a middle section of the connecting part 4 in the vertical direction.

Since the concave part 22 is formed, the thickness of the connecting part 4 becomes thinner in the middle section of the center of the connecting part 4 in the
15 vertical direction. The concave part 22 includes an inclined plane 24 connecting the concave part center 23 and an end portion between the concave part center 23 and the connecting part 4 in the vertical direction. The inclined plane 24 is formed such that the thickness of the connecting part 4 gradually increases from the concave part center 23 to the end of the connecting part 4.

20 [0039]

As shown in Fig. 8, the connecting part 4 includes a first cover part 25 projecting upward on the side of the connecting part surface 21 of the connecting part main body 5 and a second cover part 26 projecting downward on the side of the connecting part surface 21 of the connecting part main body 5.

A projection length of the first cover part 25 from the connecting part main body 5 is substantially the same as the projection length P1 of the first protrusion 6. A projection length of the second cover part 26 from the connecting part main body 5 is larger than the projection length P2 of the second protrusion 7. The second cover part 5 26 has a length sufficient to fill a gap between it and the downward adjacent refractory tile 2 when the plurality of refractory tiles 2 are attached to the water pipe structure 10. [0040]

Next, a method of attaching the refractory tile 2 according to the embodiment to the water pipe structure 10 will be described.

10 First, as shown in Fig. 9(a), the refractory tile 2 is tilted, and the first protrusion 6 of the refractory tile 2 is inserted into a lower part of the hook 13 (the first space S1) of the water pipe structure 10.

Next, as shown in Fig. 9(b), the first protrusion 6 of the refractory tile 2 is brought into contact with the base part 14 of the hook 13. Next, the lower part of the 15 refractory tile 2 is moved toward the water pipe structure 10, and the refractory tile 2 is set to be parallel with the water pipe structure 10. [0041]

Finally, as shown in Fig. 9(c), the refractory tile 2 falls so that the second protrusion 7 of the refractory tile 2 is supported by the base part 14 of the hook 13.

20 When such a method is used, the refractory tile 2 can be attached to the water pipe structure 10 via the dropping fashion style structure. [0042]

According to the above embodiment, since the refractory tile 2 has the dropping fashion style structure in which the refractory is supported at the upper end and the lower 25 end thereof, there is no need to form a hook receiving structure at the center of the

refractory tile 2, and it is possible to reduce the thickness of the central part of the refractory tile 2. That is, the concave part 22 can be formed in the connecting part 4 of the refractory tile 2. Accordingly, a cooling effect on the water pipe 11 is likely to occur on a surface (the connecting part surface 21, surface that faces the internal space 53) of the connecting part 4 and adhesion of clinker to the connecting part 4 can be reduced. In addition, since a temperature difference between the side of the water pipe structure 10 and the side of the internal space 53 in the refractory tile 2 decreases, it is possible to reduce stress generated in the refractory tile 2 itself.

In addition, since a molding method when the refractory tile 2 is produced is simplified, it is possible to produce the refractory tile 2 at low cost. For example, when the refractory tile 2 is press-molded using a mold, rod-shaped tools for forming the first hole 8 and the second hole 9 are disposed at predetermined positions on the mold and silicon carbide is then put into the mold and press-molding is performed. Then, the shape of the refractory tile 2 can be obtained by a simple method of pulling out these tools. Here, after the molding, baking and hardening are performed to obtain the refractory tile 2.

[0043]

In addition, since the second cover part 26 projects from a lower end of the connecting part main body 5, it is possible to increase an area of the water pipe structure 10 protected by the refractory tile 2.

[0044]

In addition, when the spacer 19 is formed on the inner peripheral surface 31 of the protective part 3, a gap G between the water pipe 11 and the protective part 3 can be kept constant. Accordingly, it is possible to ensure a uniform thickness for the mortar 17 and improve construction quality.

[0045]

While the embodiment of the present invention has been described above in detail, various modifications can be made within a range without departing from the spirit and scope of the present invention.

5 For example, while the water pipe protection structure 1 including the refractory tile 2 has been applied to a boiler water pipe wall of the stoker-type combustion furnace 50 in the above embodiment, the present invention is not limited thereto. The water pipe protection structure 1 can also be applied to a boiler water pipe wall of a furnace other than a stoker-type combustion furnace. The refractory tile 2 of the present
10 invention can be used for a heat exchanger that has a water pipe structure with the same shape as the water pipe structure 10 described in the above embodiment.

[Reference Signs List]

[0046]

1 Water pipe protection structure
15 2 Refractory tile (water pipe protecting refractory)
 3 Protective part
 3A First protective part
 3B Second protective part
 4 Connecting part
20 5 Connecting part main body
 6 First protrusion
 7 Second protrusion
 8 First hole
 9 Second hole
25 10 Water pipe structure

	11 Water pipe
	11a Outer peripheral surface
	12 Reinforcing member
	13 Hook
5	14 Base part
	15 Upper hook part
	16 Lower hook part
	17 Mortar
	18 Protective part main body
10	19 Spacer
	19A Main spacer
	19B Sub-spacer
	20 Connecting part parallel surface
	21 Connecting part surface
15	22 Concave part
	23 Concave part center
	24 Inclined plane
	25 First cover part
	26 Second cover part (cover part)
20	31 Inner peripheral surface
	32 Outer peripheral surface
	50 Stoker-type combustion furnace
	51 Input hopper
	52 Fire grate
25	53 Internal space

54 Boiler

S1 First space

S2 Second space

V Vertical direction

5

[CLAIMS]

[Claim 1]

A water pipe protecting refractory for protecting a water pipe structure, wherein the water pipe structure is provided with a plurality of water pipes extending in a vertical direction, a reinforcing member configured to connect the water pipes adjacent to each other across an extending direction of the water pipes, and a plurality of hooks disposed on the reinforcing member to be separated from one another in the vertical direction, and wherein each of the hooks includes a base part projecting in a direction intersecting a surface of the reinforcing member, an upper hook part projecting upward from an end of the base part, and a lower hook part projecting downward from an end of the base part, the water pipe protecting refractory comprising:

a pair of protective parts having a shape conforming to part of an outer peripheral surface of each of the plurality of adjacent water pipes, and

a connecting part configured to connect the protective parts,

wherein the connecting part includes

a connecting part main body,

a first protrusion projecting upward from the connecting part main body and inserted into a space between the reinforcing member and the lower hook part, and

a second protrusion projecting downward from the connecting part main body

and inserted into a space between the reinforcing member and the upper hook part, and wherein

a projection length of the first protrusion from the connecting part main body is formed to be longer than a projection length of the second protrusion from the connecting part main body and

a length from an upper end of the first protrusion to a lower end of the second

protrusion is formed to be longer than a length from a lower end of the lower hook part of the upper hook to an upper end of the upper hook part of the lower hook among the pair of hooks adjacent to each other in the vertical direction, and

wherein the connecting part includes a concave part in a middle section of the vertical direction on a side opposite to a surface facing the reinforcing member.

[Claim 2]

The water pipe protecting refractory according to claim 1,

wherein the connecting part includes a cover part projecting downward from the connecting part further than the second protrusion on a side opposite to a side facing the reinforcing member of the connecting part.

[Claim 3]

A water pipe protecting refractory for protecting a water pipe structure, wherein the water pipe structure is provided with a plurality of water pipes extending in a vertical direction, a reinforcing member configured to connect the water pipes adjacent to each other across an extending direction of the water pipes, and a plurality of hooks disposed on the reinforcing member to be separated from one another in the vertical direction, and wherein each of the hooks includes a base part projecting in a direction intersecting a surface of the reinforcing member, an upper hook part projecting upward from an end of the base part, and a lower hook part projecting downward from an end of the base part, the water pipe protecting refractory comprising:

a pair of protective parts having a shape conforming to part of an outer peripheral surface of each of the plurality of adjacent water pipes, and

a connecting part configured to connect the protective parts,

wherein the connecting part is attached between the upper hook part and the lower hook part of the pair of hooks adjacent to the upper hook part in the vertical direction via a dropping fashion style structure, and

wherein the connecting part includes a concave part in a middle section of the vertical direction on a side opposite to a surface facing the reinforcing member.

[Claim 4]

The water pipe protecting refractory according to claim 3, wherein the connecting part includes a cover part projecting downward from the connecting part on a side opposite to a surface facing the reinforcing member of the connecting part.

10 [Claim 5]

The water pipe protecting refractory according to any one of claims 1 to 4, wherein the protective part includes

a protective part main body formed in which a gap is provided between the protective part main body and an outer peripheral surface of the water pipe, and

15 a spacer formed on an inner peripheral surface of the protective part main body such that the height of the spacer is the gap.