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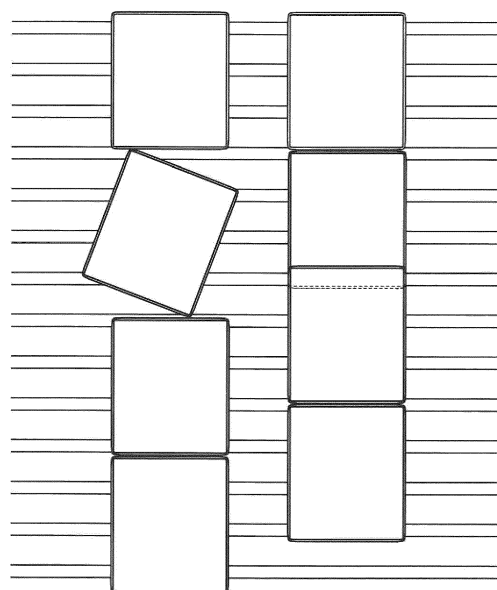
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(54) **Setter for roller hearth kiln**

(57) A setter for a roller hearth kiln of the present invention is made up of a substantially quadrate planar body (1), and a protrusion (2) formed at the edges of the planar body (1). Four sides defining an outline of the planar body (1) each have a central straight part (3) and tapered parts (4) at both ends of the straight part, the tapered parts being tapered inwards toward respective corners (5), so as to prevent damage to setters when adjacent setters contact each other. The protrusion (2) may be formed all around the circumference, or along two opposite sides.

Fig. 1



EP 2 851 639 A1

Description

Technical Field

5 **[0001]** The present invention relates to a setter for a roller hearth kiln used for firing various ceramic components such as, typically, ceramic electronic components or functional ceramic materials, in a roller hearth kiln.

Background Art

10 **[0002]** Ceramic components such as ceramic electronic components or functional ceramic materials are placed on ceramic support plates called a "setter" when fired. In order to reduce heat transferred out of the kiln by a setter as much as possible during firing of ceramic components, a setter is commonly formed in a thin quadrate planar shape, as shown in JP 08-178549 A. It is also common to form an anti-drop protrusion at the edges of the flat plate body to prevent products to be fired from dropping off.

15 **[0003]** Various types of kilns are known for firing ceramic components placed on such substantially planar setters, among which the roller hearth kiln is most commonly used in applications where mass-productivity matters. As well known, a roller hearth kiln has a large number of ceramic rollers arranged at constant pitches inside the kiln, which are rotated in the same direction to move the setters forward at constant speed during firing.

20 **[0004]** Sometimes, however, setters travelling on the rollers cannot maintain their aligned orientation due to some factors such as roller bending or foreign substances adhered on rollers, and their orientation may be disturbed as shown in Fig. 1. Although the corners of the setters are each rounded, the circumferential surfaces of the setters are straight, so that, when corners touch the straight surfaces of setters in the front and back as shown in the left row of Fig. 1, they make point contact, and the stress concentrated at the contact point would sometimes lead to chipping or cracking of setters.

25 **[0005]** When the setters are closely aligned to each other on the rollers, the corners of the setters would sometimes contact the straight surfaces of left and right setters as shown in Fig. 2, and, similarly, the stress concentrated at the contact point sometimes lead to chipping or cracking of setters.

30 **[0006]** Moreover, as the setters travel on the rollers, they may hit the preceding setters. In this case, one of the setters may ride over another setter as shown in Fig. 3, or, two setters may abut each other and their abutted ends may lift up, as shown in Fig. 4. These cases produce problems such as firing defects in ceramic components placed on the setter below, dropping of ceramic components from setters, or contact between ceramic components on the setters.

SUMMARY OF INVENTION

35 Problem to be solved by the Invention

[0007] Accordingly, an objective of the present invention is to solve these problems encountered by conventional technologies, and to provide a setter for a roller hearth kiln that can prevent chipping or cracking, or overriding or uplifting, even when setters contact each other inside the roller hearth kiln.

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Means for solving the problem

45 **[0008]** A setter for a roller hearth kiln according to the present invention made to solve the problems described above includes a substantially quadrate planar body, and a protrusion formed at edges of the planar body, wherein four sides defining an outline of the planar body each have a central straight part and tapered parts at both ends of the straight part, the tapered parts being tapered inwards toward respective corners.

[0009] Preferably, $PQ/L = 0.04$ to 0.15 , where PQ is a length from an intersection P between extension lines of straight parts of two adjacent sides and a start point Q of a tapered part, and L is a length of one side. Preferably, a round chamfer is formed at each corner. The protrusion may be formed either all around circumference of the planar body or at each corner and two opposite sides of the planar body. Preferably, the protrusion has an outer side face that is formed by a lower inclined surface inclined inwards from a vertical surface orthogonal to a bottom surface, and an upper inclined surface inclined at a larger angle inwards. The lower inclined surface should preferably be inclined from the vertical surface orthogonal to the bottom surface at an angle α of 1 to 5° , and the upper inclined surface should preferably be inclined from the vertical surface orthogonal to the bottom surface at an angle β of 5 to 25° . Preferably, an angled chamfer is formed at a bottom part of the outer side face of the protrusion.

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Effects of the Invention

[0010] The setter for a roller hearth kiln according to the present invention includes tapered parts tapered inwards toward respective corners at both ends of four sides that define the outline of the planar body, so that they tend to make surface contact when they touch each other, and cracking is less likely to occur in the contact parts. As set forth in claim 2, preferably, $PQ/L = 0.04$ to 0.15 , to achieve a good balance. With a configuration formed with a round chamfer at each corner as set forth in claim 3, the effect of reducing possible chipping in corners upon contact can be increased.

[0011] The protrusion may be formed all around circumference of the planar body as set forth in claim 4, to reliably prevent the products to be fired from dropping off. The protrusion may be formed at each corner and two opposite sides of the planar body as set forth in claim 5 so that two other sides where no protrusion is formed are flat surfaces, in which case there will be an advantage that foreign substances can be readily scraped off from the surfaces of the setters.

[0012] The protrusion may have an outer side face that is formed by a lower inclined surface inclined inwards from a vertical surface orthogonal to a bottom surface, and an upper inclined surface inclined at a larger angle inwards as set forth in claim 6, so that, even when the protrusions of the front and rear setters collide each other, there will only be generated a downward force in the contact point. Accordingly, overriding or uplifting of setters as would occur conventionally can be prevented. The effect described above will fully be achieved if the lower inclined surface is inclined from the vertical surface orthogonal to the bottom surface at an angle α of 1 to 5° , and the upper inclined surface is inclined from the vertical surface orthogonal to the bottom surface at an angle β of 5 to 25° .

[0013] With a configuration formed with an angled chamfer at a bottom part of the outer side face of the protrusion as set forth in claim 9, chipping or cracking in bottom parts of the setters contacting the rollers can be reduced.

BRIEF DESCRIPTION OF DRAWINGS

[0014]

Fig. 1 is a plan view illustrating disturbance in setters on rollers;
 Fig. 2 is a plan view illustrating disturbance in setters on rollers;
 Fig. 3 is a side view illustrating one setter riding over the other;
 Fig. 4 is a side view illustrating setters lifting up;
 Fig. 5 is a plan view illustrating a setter according to a first embodiment;
 Fig. 6 is a plan view illustrating adjacent setters contacting each other;
 Fig. 7 is an enlarged cross-sectional view of an essential part;
 Fig. 8 is a cross-sectional view illustrating front and rear setters contacting each other;
 Fig. 9 is a diagram for explaining dimensions and angles in Table 1;
 Fig. 10 is a plan view illustrating a setter according to a second embodiment;
 Fig. 11 is a cross-sectional view illustrating the setter according to the second embodiment; and
 Fig. 12 is an enlarged cross-sectional view of an essential part.

DESCRIPTION OF EMBODIMENTS

[0015] Embodiments of the present invention will be hereinafter described.

[0016] Fig. 5 is a plan view illustrating a setter according to a first embodiment. As shown in the figure, the setter for a roller hearth kiln of the present invention is made up of a planar body 1 that is substantially quadrate in plan view, and a protrusion 2 formed at the edges of the planar body 1. The planar body 1 may be square or rectangular, but should preferably have an aspect ratio in the range of $2/3$ to $3/2$, because the closer it is to square, the less likely the setters' orientation on the rollers will be disturbed. The illustrated example has an aspect ratio of $6/5$. The length L of one side may be suitably set in accordance with the purposes of use; commonly, it is about 300 to 800 mm.

[0017] As shown in Fig. 5, the four sides that define the outline of the planar body 1 each include a straight part 3, and tapered parts 4 and corners 5 at both ends thereof. The corners 5 are chamfered with a radius of curvature R . Such chamfers were also provided in conventional setters for preventing the corners 5 from chipping when hit. The suitable range of R is about 5 to 30 mm irrespective of the size of the setters.

[0018] The tapered parts 4, which are formed between the corners 5 and straight parts 3, are characteristic to the present invention and not provided in conventional counterparts. As shown in Fig. 5, the tapered part 4 has a surface inclined inwards toward the corner 5 at an angle of γ . The angle γ is 2 to 10° ; in this embodiment, it is 2.9° . The length PQ , from an imaginary corner point P shown in Fig. 5 to a start point Q of the tapered part 4, is about 4 to 15% of the side length L , i.e., $PQ/L = 0.04$ to 0.15 . Here, the "imaginary corner point P " refers to an intersection between extension lines of the straight parts 3 of two adjacent sides.

[0019] With such tapered parts 4 being formed, even when setters' orientation is disturbed as shown in Fig. 6, the

tapered part 4 of one setter will more likely contact the straight part 3 or tapered part 4 of an adjacent setter. In this case, the setters will make surface contact as shown in the enlarged view on the upper side in Fig. 6, so that stress concentration at contact parts will be prevented. Accordingly, the rate of cracking can be reduced as compared to conventional setters without tapered parts 4.

[0020] The protrusion 2 is formed to prevent ceramic components, which are the products to be fired, from dropping off, and its outer side face 6 is usually a vertical surface orthogonal to the bottom surface 7. However, in that case, if front and rear setters contact each other on the rollers, an upward force may be generated in the contact surfaces as shown in Fig. 4, as a result of which one setter may ride over the other, or abutted ends of both setters may lift up, as mentioned above.

[0021] To avoid this problem, in this embodiment, as shown in Fig. 7, the outer side face 6 of the protrusion 2 is formed by a lower inclined surface 9 inclined at an angle α inwards from a vertical surface 8 orthogonal to the bottom surface 7, and an upper inclined surface 10 inclined at a larger angle β inwards. The angle α is 1 to 5°; in this embodiment, it is 3°. The angle β is 5 to 25°; in this embodiment, it is 8°. If the angles α and β are smaller than these ranges, the effects described below will not be sufficiently achieved, and if they are larger, the lower parts may become too sharp.

[0022] The lower inclined surface 9 generates a downward force in contact surfaces when the setters contact each other as shown in Fig. 4, thereby preventing the setter ends from lifting up. They also prevent chipping or cracking in setters when they collide each other due to warping in rollers.

[0023] The upper inclined surface 10 generates a downward force in contact surfaces when the setters contact each other as shown in Fig. 8, thereby preventing one setter from riding over another. Namely, even if an end of one setter lifts up over the lower inclined surface 9, the downward force generated in the contact surfaces is larger, since the inclination angle β of the upper inclined surface 10 is larger than the inclination angle α of the lower inclined surface 9, so that overriding is reliably prevented. Also, the effect of preventing chipping or cracking when front and rear setters collide each other is achieved.

[0024] In this embodiment, further, an angled chamfer 11 is provided at an angle of 45° at the lower end of the outer side face 6 of the protrusion 2, as shown in Fig. 7. Such angled chamfers 11 can prevent chipping in the bottom part, and also prevent chipping or cracking in setters when they collide each other due to warping in rollers. This part may be substituted by a round chamfer. In this embodiment, a chamfer angle of the angled chamfer 11 is 45° and a chamfering length is 2 mm.

[0025] The top of the protrusion 2 may be a flat surface parallel to the bottom surface 7, but in this embodiment, it is formed as a round chamfer surface 12. It may have any size; in this embodiment, it is 4 mmR. Such a round chamfer surface 12 can prevent chipping in the tops of setters when the setters are stacked up in multiple stages.

[0026] A second embodiment of the present invention is shown in Fig. 10 onwards. In this embodiment, the protrusion 2 is formed at each corner and two opposite sides of the planar body 1. The setter according to the second embodiment is suitable for applications where the setters are closely aligned to each other on the rollers as shown in Fig. 2. The protrusions 2 are formed on two lateral sides on the left and right of the setters.

[0027] The protrusion 2 has such a cross-sectional shape as shown in Fig. 12, which is similar to that of the protrusion 2 of the previously described first embodiment. However, at the corners, the protrusions extend a length of about 30 to 60 mm as denoted at PQ in Fig. 10 along the front and rear sides. With the ends of the anti-drop protrusions 2 being extended in this way, damage to setters when adjacent setters contact each other as shown in Fig. 2 is prevented. Since the setters according to this second embodiment are closely aligned to each other side by side, they are unlikely to rotate largely as shown in Fig. 1. Therefore, there is little possibility that corners will contact the centers of the front and back sides as shown in Fig. 1, and so the protrusions 2 are not formed along the front and back sides except for the corners. While the setters' positions in the advancing direction may be misaligned between adjacent rows on the rollers, the protrusions 2 formed along the entire length of the two, left and right, sides reduce any possible damage when corners of adjacent setters contact each other.

[0028] Since the front and back sides do not have protrusions 2 and are flat surfaces in the second embodiment, when cleaning the setters taken out of the kiln to remove foreign substances adhered on the surface, this embodiment advantageously allows such foreign substances to be readily scraped off through the flat portions where no protrusions 2 are provided. Another advantage is that the area for placing products to be fired is increased by the area where no protrusions 2 are provided. Accordingly, the setter of the second embodiment provides the effect of improving the productivity.

[0029] The material of the setters in the present invention may be, but not limited to, ceramics such as alumina, zirconia, SiC, and the like, which are excellent in high temperature strength, and in particular, may preferably be SiC that has high thermal conductivity and thermal radiation.

Examples

[0030] Hereinafter, examples of the present invention will be presented with comparative examples.

[0031] Tables 1 and 2 show the results of firing tests conducted with the use of setters according to the examples of

the present invention and comparative examples, and a 10 m-long roller hearth kiln, at a maximum temperature of 1400°C to fire ceramic components made of a cordierite material. The dimensions and angles in the tables are defined as shown in Fig. 8. The setters were conveyed in two rows for a duration of 24 hours from the entrance to the exit. Examples 1 to 24 are the setters according to the first embodiment, and examples 25 to 30 are the setters according to the second embodiment. The distance PQ of the ends of the protrusions extending along the adjacent sides was 50 mm in all cases.

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[Table 1] 1/6

	Parts	Unit	Example 1	Example 2	Example 3	Example 4	Example 5
Dimensions	1	mm	40	40	40	40	40
	2	°	2.9	2.9	2.9	2.9	2.9
	3	mm	40	40	40	40	40
	4	°	2.9	2.9	2.9	2.9	2.9
	5	mm	R10	R15	R15	R10	R10
	6	°	11.3	11.3	11.3	11.3	11.3
	7	°	2.9	2.9	2.9	2.9	2.9
	8	Shape	R	C	C	R	R
		mm	2	2	2	2	2
	9	mm	10	10	10	15	10
	10	mm	10	10	10	15	10
	11	mm	20	20	20	30	15
	12	mm	600	900	650	400	650
	13	mm	700	1000	750	500	750
Ratio	1/12	—	0.07	0.04	0.06	0.10	0.06
	3/13	—	0.06	0.04	0.05	0.08	0.05
	9/10	—	1.00	1.00	1.00	1.00	1.00
	8/11	—	0.10	0.10	0.10	0.07	0.13
	9/11	—	0.50	0.50	0.50	0.50	0.67
Test results	Chipping/Cracking	%	0	0	0	0	0
	Collision and uplifting	%	0	0	0	0	0
	Overriding	%	0	0	0	0	0
	General evaluation	—	⊙	⊙	⊙	⊙	⊙

[Table 1] 2/6

	Parts	Unit	Example 6	Example 7	Example 8	Example 9	Example 10
Dimensions	1	mm	40	40	40	40	40
	2	°	2.9	2.9	2.9	2.9	2.9
	3	mm	40	40	40	40	40
	4	°	2.9	2.9	2.9	2.9	2.9
	5	mm	R15	R10	R15	R15	R15
	6	°	11.3	11.3	5	25	11.3
	7	°	2.9	2.9	2.9	2.9	1.5
	8	Shape	C	R	C	C	C
		mm	2	2	2	2	2
	9	mm	7	8	10	10	10
	10	mm	5	10	10	10	10
	11	mm	20	15	17	17	17
	12	mm	900	600	600	600	600
	13	mm	1000	700	700	700	700
Ratio	1/12	—	0.04	0.07	0.07	0.07	0.07
	3/13	—	0.04	0.06	0.06	0.06	0.06
	9/10	—	1.40	0.80	1.00	1.00	1.00
	8/11	—	0.10	0.13	0.12	0.12	0.12
	9/11	—	0.35	0.53	0.59	0.59	0.59
Test results	Chipping/Cracking	%	0	0	2	1	1
	Collision and uplifting	%	0	0	0	0	0
	Overriding	%	0	0	0	0	0
	General evaluation	—	⊙	⊙	○	○	○

[Table 1] 3/6

	Parts	Unit	Example 11	Example 12	Example 13	Example 14	Example 15
Dimensions	1	mm	40	40	40	40	40
	2	°	2.9	2.9	2.9	1	10
	3	mm	40	40	40	40	40
	4	°	2.9	2.9	2.9	1	10
	5	mm	R15	R10	R30	R15	R15
	6	°	11.3	11.3	11.3	11.3	11.3
	7	°	5	2.9	2.9	2.9	2.9
	8	Shape	C	R	C	C	C
		mm	6	6	2	2	2
	9	mm	10	10	10	10	10
	10	mm	10	10	10	10	10
	11	mm	17	20	17	17	17
	12	mm	600	600	600	600	600
	13	mm	700	700	700	700	700
Ratio	1/12	—	0.07	0.07	0.07	0.07	0.07
	3/13	—	0.06	0.06	0.06	0.06	0.06
	9/10	—	1.00	1.00	1.00	1.00	1.00
	8/11	—	0.35	0.30	0.12	0.12	0.12
	9/11	—	0.59	0.50	0.59	0.59	0.59
Test results	Chipping/Cracking	%	0	0	0	1	1
	Collision and uplifting	%	0	0	0	0	0
	Overriding	%	1	0	0	0	0
	General evaluation	—	○	○	○	○	○

[Table 1] 4/6

	Parts	Unit	Example 16	Example 17	Example 18	Example 19	Example 20
Dimensions	1	mm	30	50	100	40	40
	2	°	2.9	2.9	2.9	2.9	2.9
	3	mm	30	50	100	40	40
	4	°	2.9	2.9	2.9	2.9	2.9
	5	mm	R15	R15	R15	R15	R15
	6	°	11.3	11.3	11.3	3	30
	7	°	2.9	2.9	2.9	1	10
	8	Shape	C	C	C	C	C
		mm	2	2	2	2	2
	9	mm	10	10	10	10	10
	10	mm	10	10	10	10	10
	11	mm	17	17	17	17	17
	12	mm	600	600	600	600	600
	13	mm	700	700	700	700	700
Ratio	1/12	—	0.05	0.08	0.17	0.07	0.07
	3/13	—	0.04	0.07	0.14	0.06	0.06
	9/10	—	1.00	1.00	1.00	1.00	1.00
	8/11	—	0.12	0.12	0.12	0.12	0.12
	9/11	—	0.59	0.59	0.59	0.59	0.59
Test results	Chipping/Cracking	%	1	0	2	10	12
	Collision and uplifting	%	0	0	0	12	0
	Overriding	%	0	0	0	0	14
	General evaluation	—	○	○	○	△	△

[Table 1] 5/6

	Parts	Unit	Example 21	Example 22	Example 23	Example 24	Example 25
Dimensions	1	mm	40	40	40	40	40
	2	°	2.9	2.9	2.9	2.9	2.9
	3	mm	40	40	40	40	40
	4	°	2.9	2.9	2.9	2.9	2.9
	5	mm	R15	R15	R10	R10	R15
	6	°	30	30	11.3	11.3	9
	7	°	10	10	2.9	2.9	2.9
	8	Shape	C	C	R	R	C
		mm	2	2	2	2	2
	9	mm	10	10	13	5	10
	10	mm	10	10	10	10	10
	11	mm	12	40	15	15	16
	12	mm	600	600	600	600	650
	13	mm	700	700	700	700	730
Ratio	1/12	—	0.07	0.07	0.07	0.07	0.06
	3/13	—	0.06	0.06	0.06	0.06	0.05
	9/10	—	1.00	1.00	1.30	0.50	1.00
	8/11	—	0.17	0.05	0.13	0.13	0.13
	9/11	—	0.83	0.25	0.87	0.33	0.63
Test results	Chipping/Cracking	%	12	15	14	8	0
	Collision and uplifting	%	0	0	8	0	0
	Overriding	%	17	0	0	11	0
	General evaluation	—	△	△	△	△	⊙

[Table 1] 6/6

	Parts	Unit	Example 26	Example 27	Example 28	Example 29	Example 30
Dimensions	1	mm	38	38	38	38	38
	2	°	2.9	2.9	2.9	2.9	2.9
	3	mm	38	38	38	38	38
	4	°	2.9	2.9	2.9	2.9	2.9
	5	mm	R10	R10	R15	R15	R20
	6	°	9	11.3	20	25	30
	7	°	2.9	2.9	5	10	1
	8	Shape	C	C	C	C	R
		mm	2	4	6	2	5
	9	mm	8	8	8	10	10
	10	mm	10	10	10	10	10
	11	mm	15	15	20	20	20
	12	mm	650	650	650	650	650
	13	mm	730	730	730	730	730
Ratio	1/12	—	0.06	0.06	0.06	0.06	0.06
	3/13	—	0.05	0.05	0.05	0.05	0.05
	9/10	—	0.80	0.80	0.80	1.00	1.00
	8/11	—	0.13	0.26	0.30	0.10	0.25
	9/11	—	0.80	0.80	0.80	1.00	1.00
Test results	Chipping/Cracking	%	0	0	0	2	13
	Collision and uplifting	%	0	0	0	0	5
	Overriding	%	0	0	0	0	0
	General evaluation	—	⊙	⊙	⊙	○	○

[Table 2] 1/2

	Parts	Unit	Comparative example 1	Comparative example 2	Comparative example 3
Dimensions	1	mm	40	40	20
	2	°	0.5	15	2.9
	3	mm	40	40	20
	4	°	0.5	15	2.9
	5	mm	R15	R15	R15
	6	°	11.3	11.3	11.3
	7	°	2.9	2.9	2.9
	8	Shape	C	C	C
		mm	2	2	2
	9	mm	10	10	10
	10	mm	10	10	10
	11	mm	17	17	17
	12	mm	600	600	600
	13	mm	700	700	700
Ratio	1/12	—	0.07	0.07	0.03
	3/13	—	0.06	0.06	0.03
	9/10	—	1.00	1.00	1.00
	8/11	—	0.12	0.12	0.12
	9/11	—	0.59	0.59	0.59
Test results	Chipping/Cracking	%	46	45	36
	Collision and uplifting	%	0	0	0
	Overriding	%	0	0	0
	General evaluation	—	×	×	×

[Table 2] 2/2

	Parts	Unit	Comparative example 4	Comparative example 5	Comparative example 6
Dimensions	1	mm	150	150	150
	2	°	2.9	0.5	15
	3	mm	150	150	150
	4	°	2.9	0.5	15
	5	mm	R15	R5	R40
	6	°	11.3	11.3	11.3
	7	°	2.9	2.9	2.9
	8	shape	C	C	C
	9	mm	2	1	10
	10	mm	10	10	10
	11	mm	17	17	17
	12	mm	600	600	600
	13	mm	700	700	700
Ratio	1/12	—	0.25	0.25	0.25
	3/13	—	0.21	0.21	0.21
	9/10	—	1.00	1.00	1.00
	8/11	—	0.12	0.06	0.59
	9/11	—	0.59	0.59	0.59
Test results	Chipping/Cracking	%	41	46	45
	Collision and uplifting	%	0	0	24
	Overriding	%	0	0	20
	General evaluation	—	x	x	x

[0032] Setters of Examples 1 to 7 and Examples 25 to 28 showed the most favorable test results. Setters of Examples 8 to 18 showed good results although slight chipping occurred. Setters of Examples 19 to 24 and Examples 29 and 30 showed occasional chipping, collision and uplifting, overriding, or the like, but only to an extent considered non-problematic in practical applications. Setters of Comparative Examples 1 to 6 specified in Table 2 that were out of ranges of the present invention showed results that were unfavorable in practical applications, with frequent chipping and cracking.

Claims

1. A setter for a roller hearth kiln, comprising a substantially quadrate planar body, and a protrusion formed at edges of the planar body, wherein four sides defining an outline of the planar body each have a central straight part and tapered parts at both ends of the straight part, the tapered parts being tapered inwards toward respective corners.
2. The setter for a roller hearth kiln according to claim 1, wherein $PQ/L = 0.04$ to 0.15 , where PQ is a length from an intersection P between extension lines of straight parts of two adjacent sides and a start point Q of a tapered part, and L is a length of one side.
3. The setter for a roller hearth kiln according to claim 1 or 2, wherein a round chamfer is formed to each corner.
4. The setter for a roller hearth kiln according to any one of claims 1 to 3, wherein the protrusion is formed all around circumference of the planar body.
5. The setter for a roller hearth kiln according to any one of claims 1 to 3, wherein the protrusion is formed at each corner and along two opposite sides of the planar body.
6. The setter for a roller hearth kiln according to claim 4 or 5, wherein the protrusion has an outer side face that is formed by a lower inclined surface inclined inwards from a vertical surface orthogonal to a bottom surface, and an upper inclined surface inclined at a larger angle inwards.
7. The setter for a roller hearth kiln according to claim 6, wherein the lower inclined surface is inclined from the vertical surface orthogonal to the bottom surface at an angle α of 1 to 5° .
8. The setter for a roller hearth kiln according to claim 7, wherein the upper inclined surface is inclined from the vertical surface orthogonal to the bottom surface at an angle β of 5 to 25° .
9. The setter for a roller hearth kiln according to claim 4 or 5, wherein an angled chamfer is formed at a bottom part of an outer side face of the protrusion.

Fig. 1

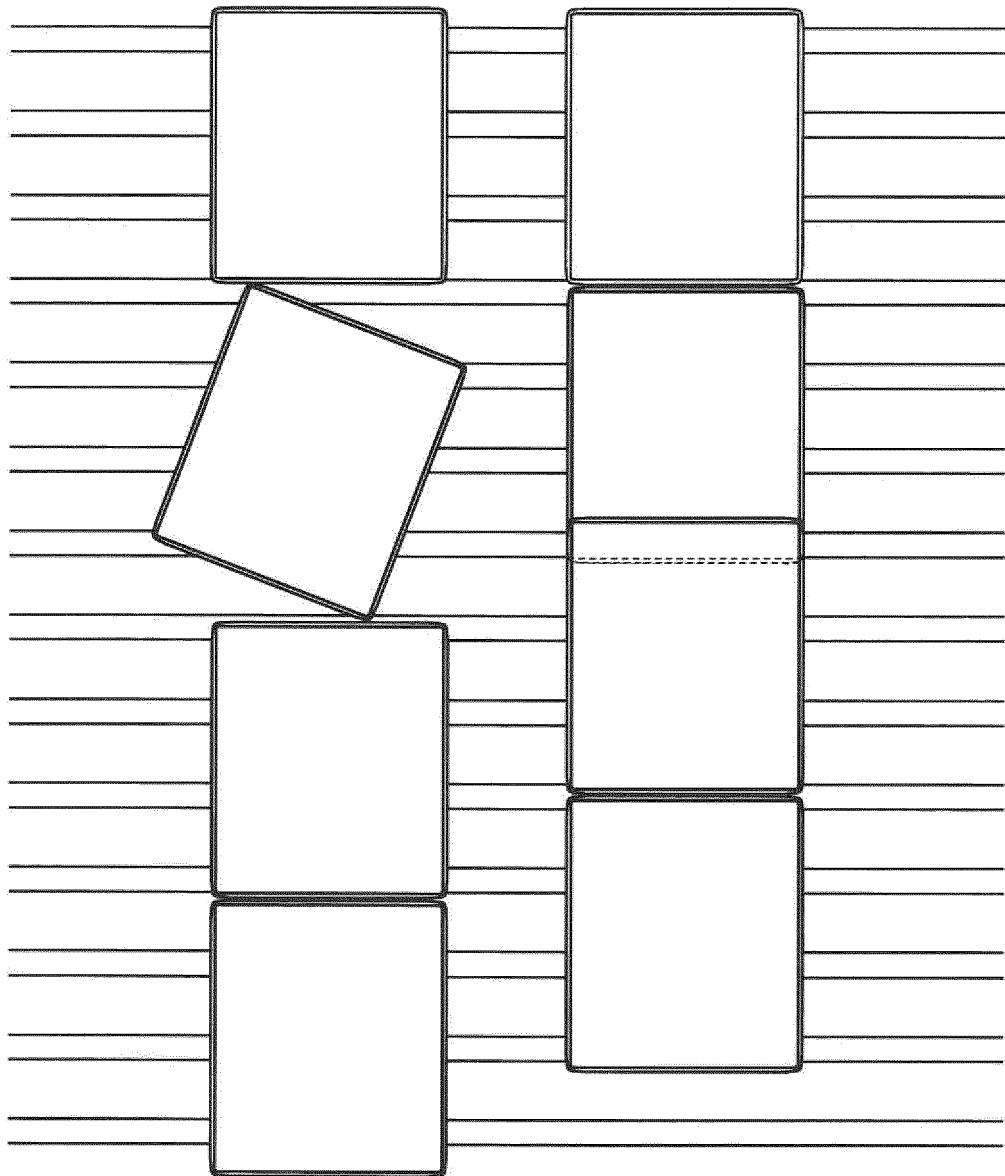


Fig. 2

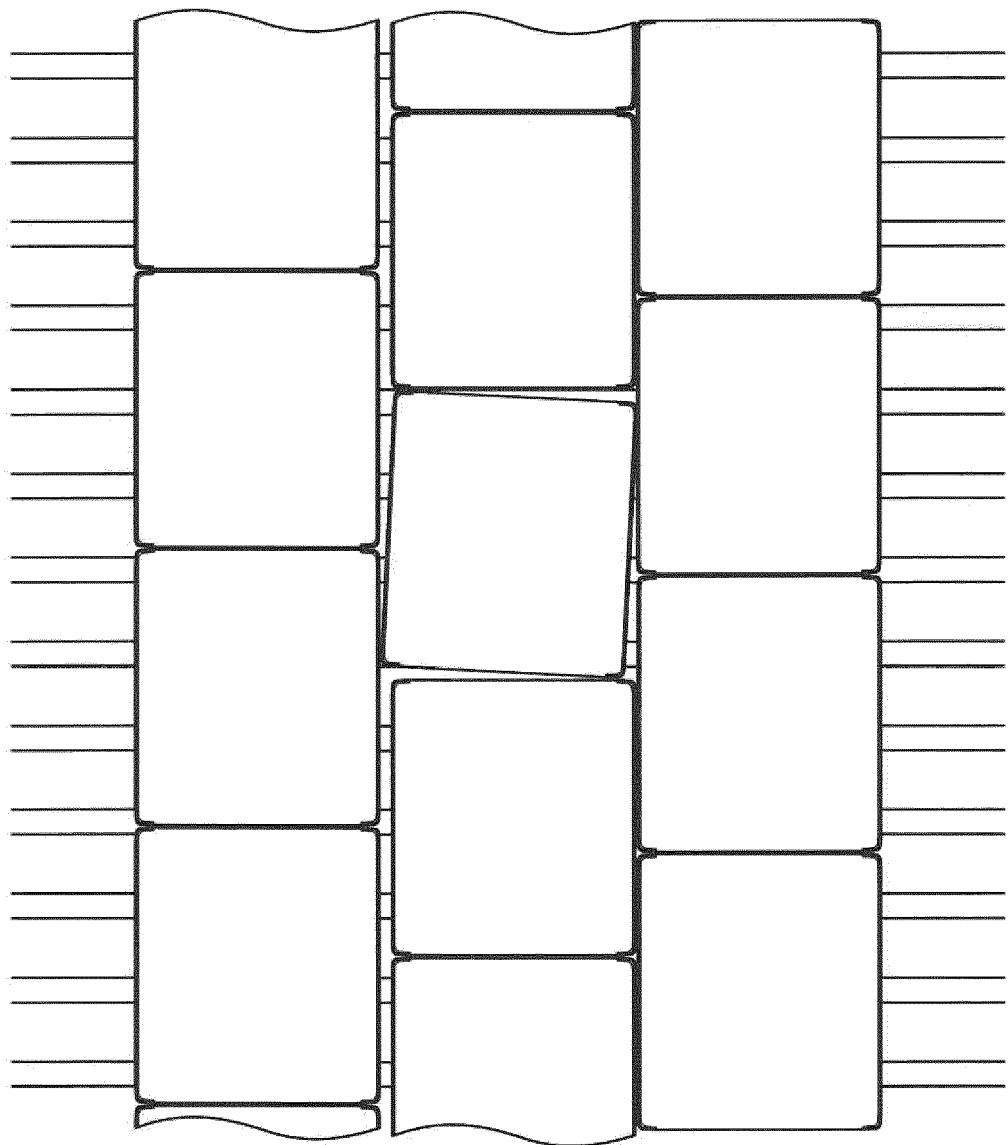


Fig. 3

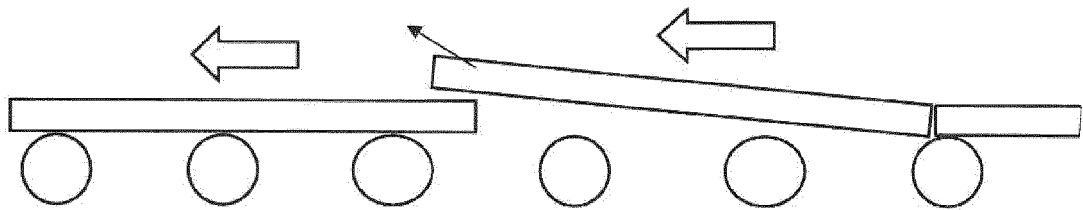


Fig. 4

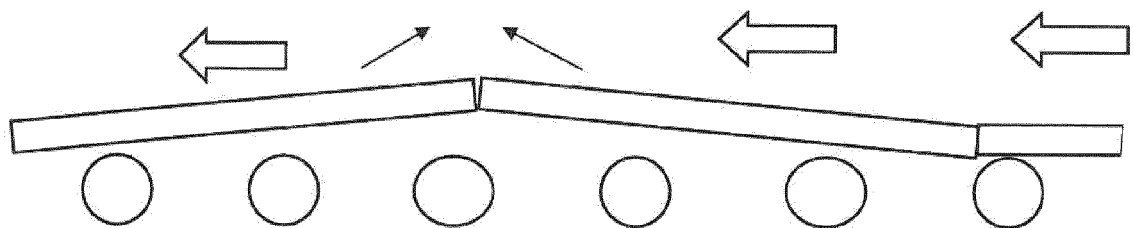


Fig. 5

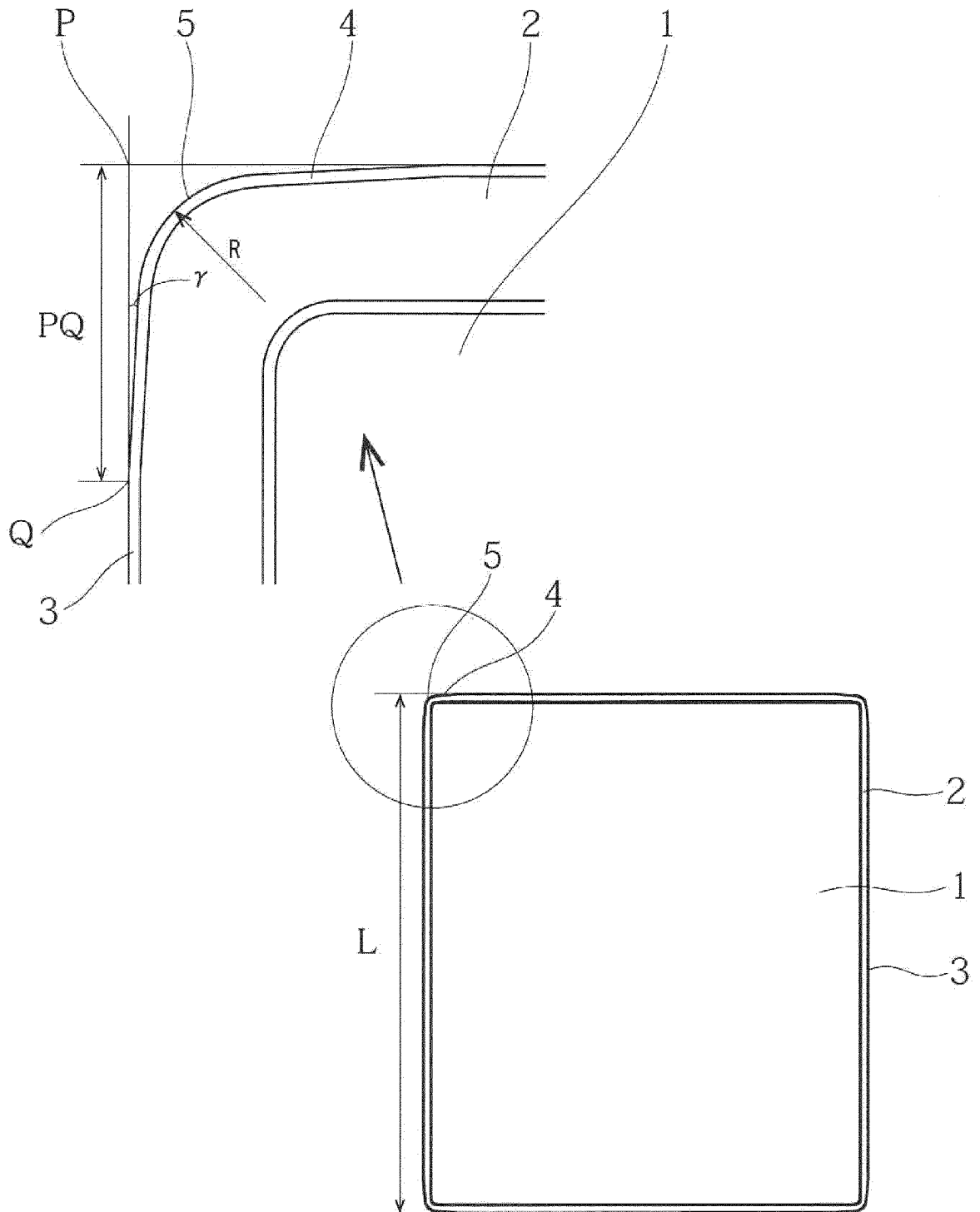


Fig. 6

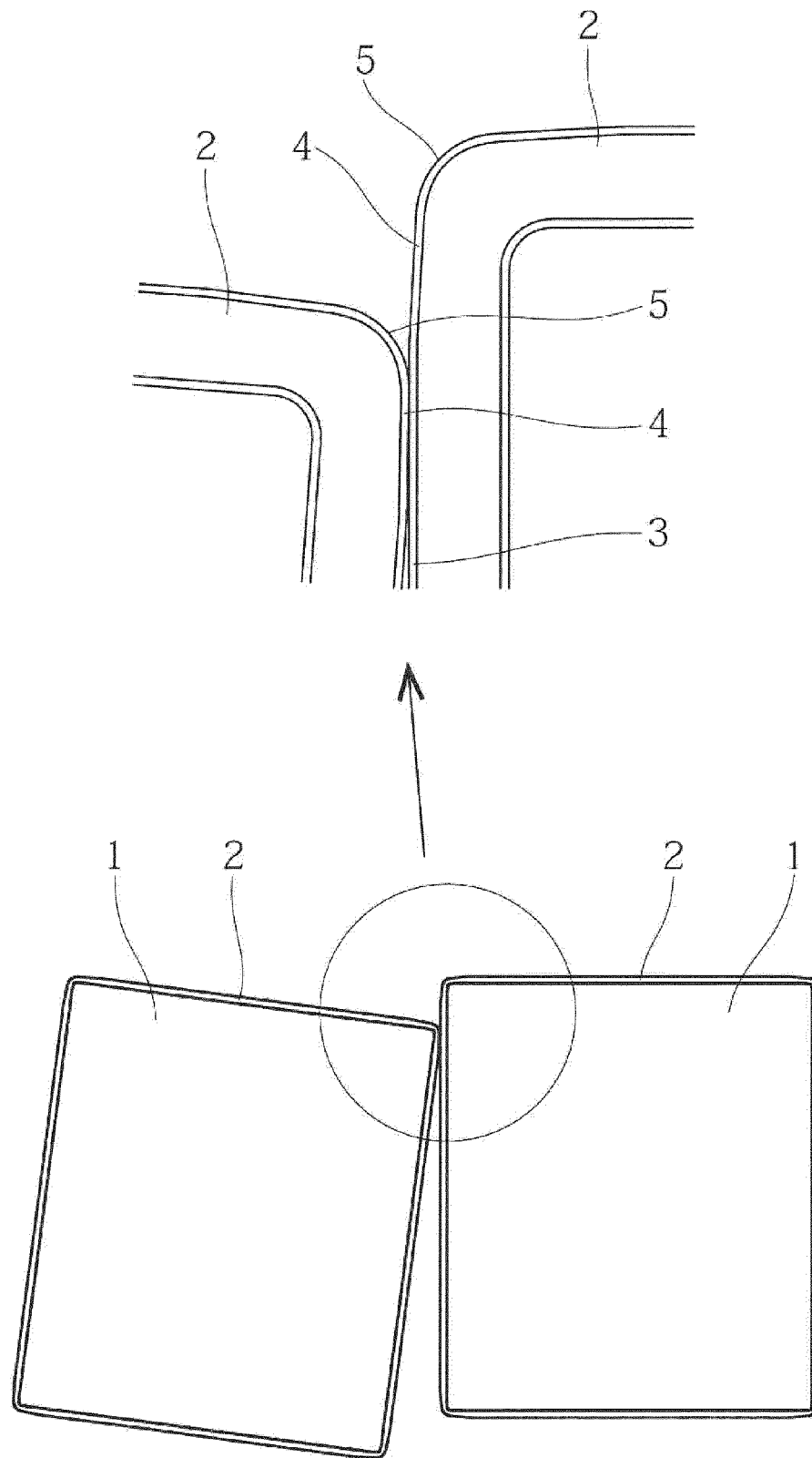


Fig. 7

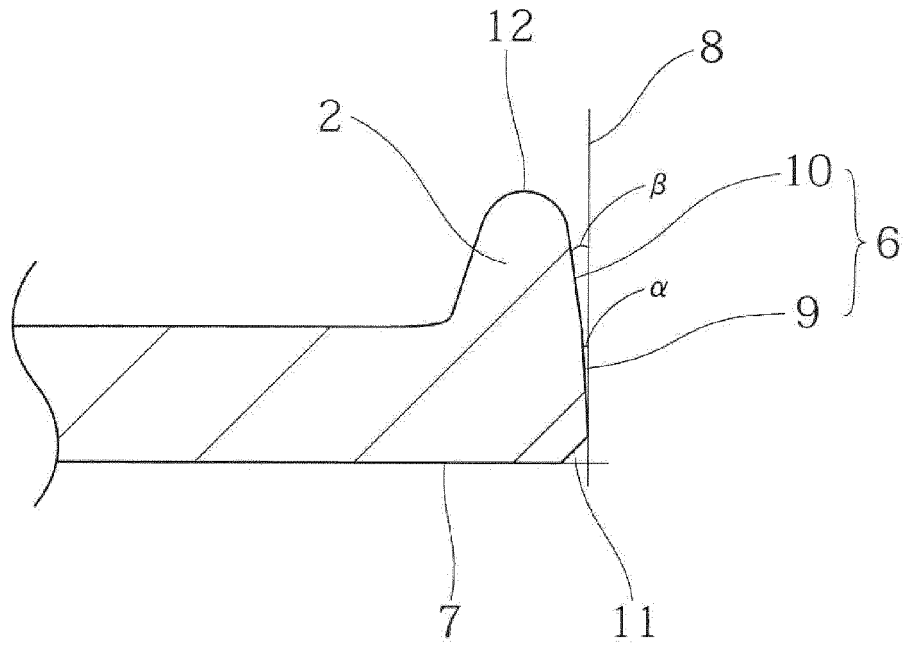


Fig. 8

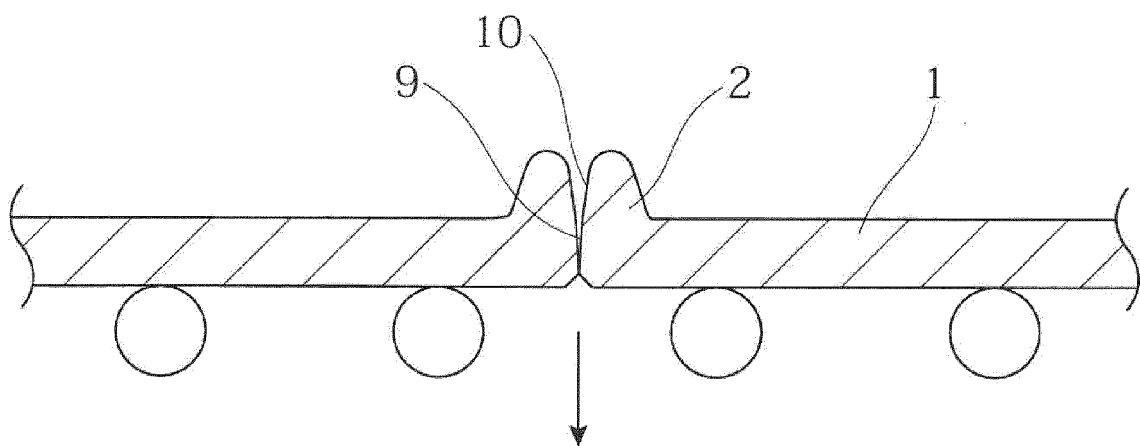


Fig.10

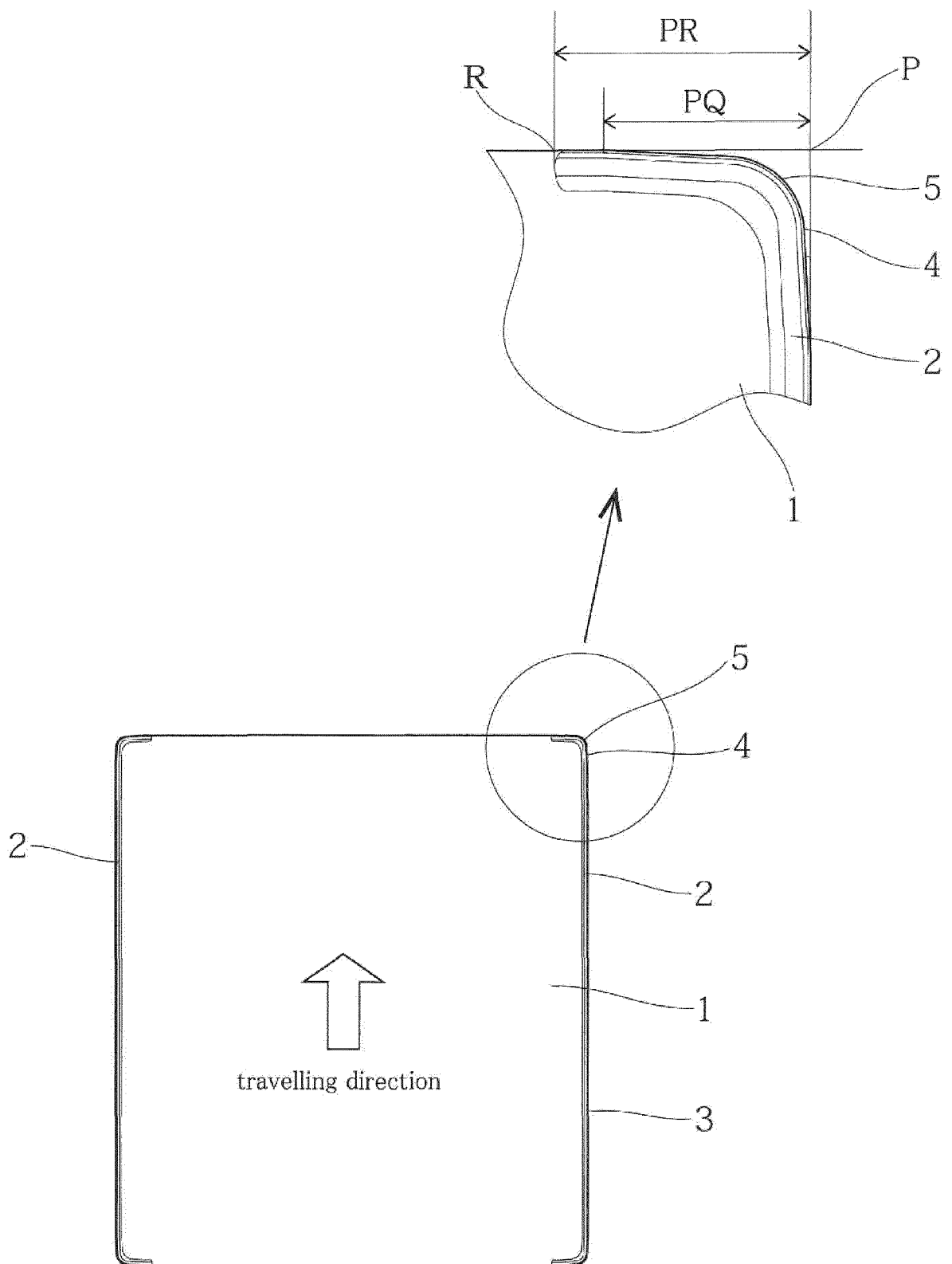


Fig.11

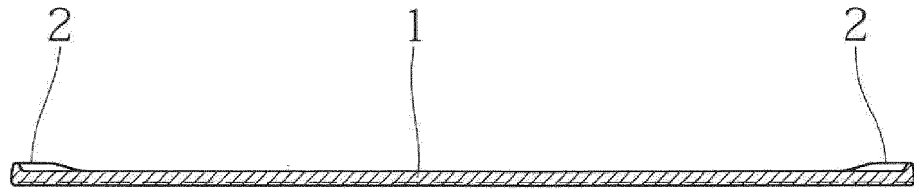
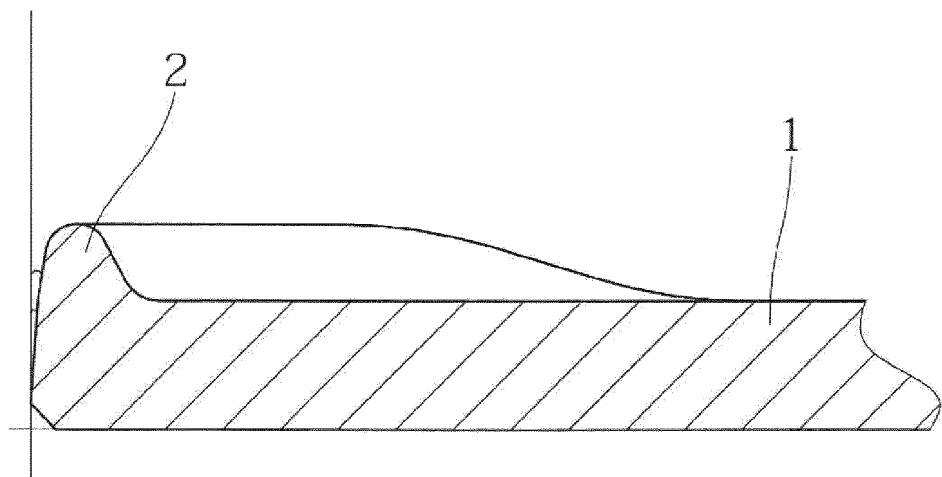


Fig.12



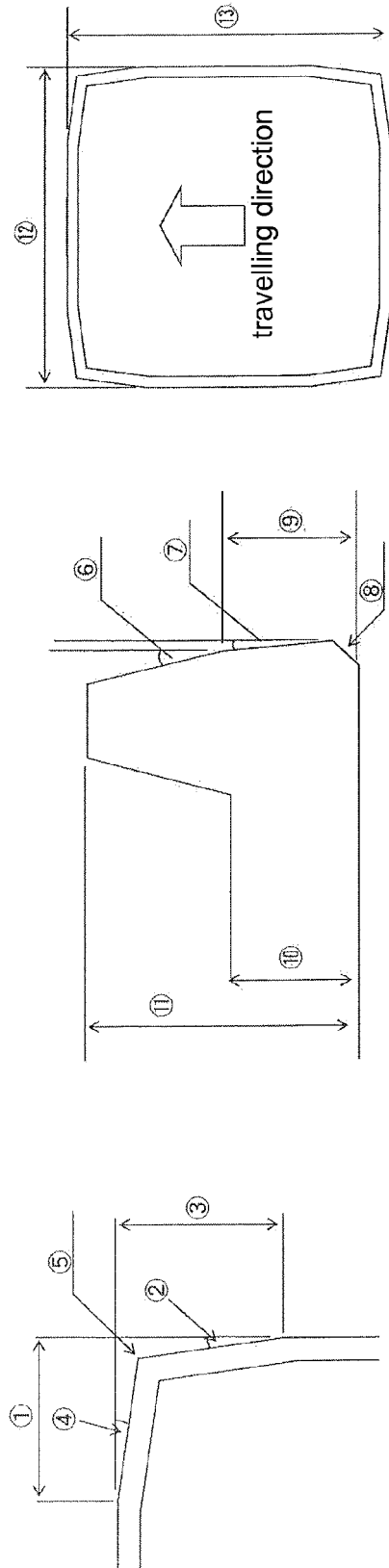


Fig. 9



EUROPEAN SEARCH REPORT

 Application Number
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Place of search		Date of completion of the search	Examiner
Munich		4 February 2015	Gavriliu, Alexandru
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