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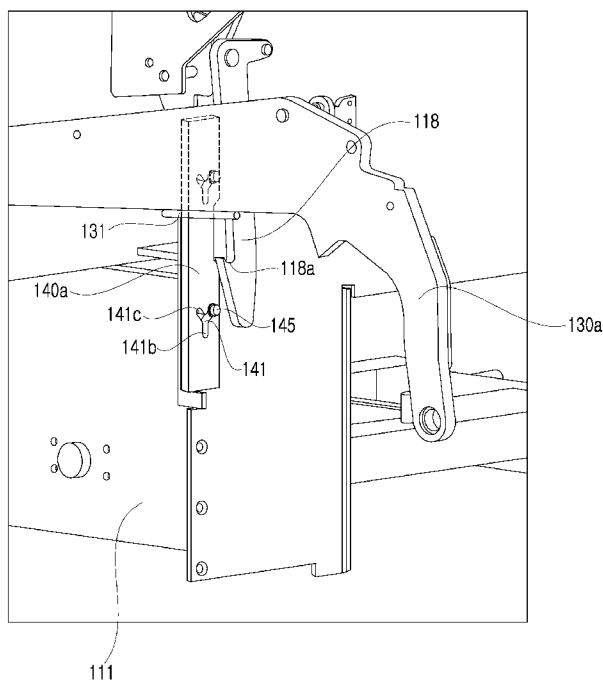
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- (54) **Title:** PAVER WITH SPACER FOR TOW ARM



(57) **Abstract:** The present disclosure relates to a road paver including a spacer, in which the spacer is fastened to a rear surface of the tractor unit, which perpendicularly intersects the side surface of the tractor unit, which corresponds to the inner surfaces of the left and right tow arms, in which the spacer has gap adjustment fastening holes penetratingly formed therein, respectively to have a plurality of fastening holes, respectively, arranged at different positions in a width direction so as to be connected to each other so that a degree of protrusion of the spacers to the side surface of the tractor unit can be adjusted through the selection of the fastening hole corresponding to the crown angle, in which when the spacers are fastened to the tractor unit, access to the spacers is easy as well as the fastening member can be moved to another fastening hole and can be fastened to the other fastening hole in a state in which the fastening member is not completely separated from the spacers.

Description

Title of Invention: PAVER WITH SPACER FOR TOW ARM

Technical Field

- [1] The present disclosure relates to a road construction machine, and more particularly, to a road paver which has a tow arm for connecting a screed unit to a tractor unit.

Background Art

- [2] Typically, a road paver includes a tractor unit, a screed unit, and left and right tow arms that interconnect the tractor unit and the screed unit.
- [3] The tractor unit includes a main body having a built-in engine that generates a driving power, wheels or a caterpillar track for travelling, and a cab that forms a space for an operator to get on and off. In addition, the tractor unit includes a receiving hopper having a road paving material (HMA) loaded therein, a conveyor (not shown) that transfers the road paving material, and a spreading auger that evenly discharges the transferred road paving material onto a road surface.
- [4] The screed unit is a unit that widely disperses the road paving material discharged from the tractor unit onto the road surface while being towed by the tractor unit. The screed unit includes left and right screed plates having facing corresponding surfaces that are hinge-coupled at the lower ends of thereof to each other, and a crowning mechanism 123 that is hinge-coupled to the left and right screen plates and is configured to adjust the crown angle by the length adjustment according to expansion and contraction thereof.
- [5] Typically, the top surface of a paved road, i.e., the paved road surface is formed to be flat, but needs to be formed such that a given area thereof is gradually increased in thickness as it goes toward the centre of the paved road surface or is gradually increased in thickness as it goes toward both edges thereof in the width direction of the road surface depending on the required conditions of the paved road surface.
- [6] When the length of the crowning mechanism is expanded, the left and right screed plates are pivotally rotated downwardly about a hinge coupling part of the lower ends of the facing corresponding surfaces thereof so that the left and right screed plates are maintained in a state of being inclined upwardly as it goes toward the centre thereof in their entirety. The screed unit enables the paved road surface to be formed thicker toward the centre of the paved road surface. In this case, the left and right screed plates have a positive crown angle with respect to the road surface.
- [7] In addition, when the length of the crowning mechanism 123 is contracted, the left and right screed plates are pivotally rotated upwardly about the hinge coupling part of the lower ends of the facing corresponding surfaces of the left and right screed plates

so that the left and right screed plates are maintained in a state of being inclined upwardly as it goes toward the both edges thereof in their entirety. The screed unit enables the paved road surface to be formed thicker toward the edges of the paved road surface. In this case, the left and right screed plates 121a and 121b have the negative crown angle with respect to the road surface.

- [8] The left and right tow arms 130a and 130b are units that towably connect the screed unit to the tractor unit.
- [9] The left tow arm is pivot-connected at one end thereof to a left side surface of the tractor unit, and is connected at the other end thereof to a left side of the screed unit. In addition, the right tow arm is pivot-connected at one end thereof to a right side surface of the tractor unit, and is connected at the other end thereof to a right side of the screed unit.
- [10] The crown angle of the left and right screed plates is adjusted by the crowning mechanism, and thus the width between both sides of the screed unit is changed. Therefore, the width between the left and right tow arms connected to both sides of the screed unit is also changed. Consequently, a gap between the tractor unit and the left and right tow arms is also changed.
- [11] In the case where the crown angle of the left and right screed plates is excessively adjusted by the crowning mechanism, the inner side surfaces of the left and right tow arms may be pressed against the side surface of the tractor unit, thereby causing a mechanical damage. Spacers typically are mounted to the side surface of the tractor unit corresponding to the tow arms to prevent a direct contact between the left and right tow arms and the tractor unit.
- [12] As a representative example of the spacer, a spacer is applied to the road paver by a bolt fastening method in the form of a single spacer block. But the spacer in the form of a single spacer block entails a problem in that when it maintains the same thickness, it is difficult to adjust a gap between the tow arms and the tractor unit depending on a degree of adjustment of the crown angle.
- [13] As another example of the spacers, a spacer may be applied to the road paver in the form of several spacer blocks laminated by the same bolt fastening method. The entire thickness of the spacer can be changed by adjusting the number of the spacer blocks depending on a degree of adjustment of the crown angle. Thus, in case of applying the spacer, a gap between the tow arms and the tractor unit can be adjusted depending on a degree of the crown angle.
- [14] Such a spacer, however, encounters a problem in that for example, it is fastened to the tractor unit by a fastening member such as a bolt in a direction oriented toward the side surface of the tractor unit corresponding to the tow arms similarly to the spacer in the form of a single spacer block, so that when it is desired to adjust the number of the

single spacer blocks, the fastening member is hidden by the two arms, thus making it difficult to access the fastening member. Therefore, there is caused a problem in that after an operator suffers from an inconvenience of having to loosening the fastening bolt to increase/reduce the number of the spacer blocks, and then tightening the fastening bolt again.

Disclosure of Invention

Technical Problem

- [15] The present disclosure has been made to solve the above-mentioned problems.

Solution to Problem

- [16] The present disclosure is directed to a road paver including a spacer, in which the spacer is fastened to a rear surface of the tractor unit, which perpendicularly intersects the side surface of the tractor unit, which corresponds to the inner surfaces of the left and right tow arms, in which the spacer has gap adjustment fastening holes penetratingly formed therein, respectively to have a plurality of fastening holes, respectively, arranged at different positions in a width direction so as to be connected to each other so that a degree of protrusion of the spacers to the side surface of the tractor unit can be adjusted through the selection of the fastening hole corresponding to the crown angle, and in which when the spacers are fastened to the tractor unit, access to the spacers is easy as well as the fastening member can be moved to another fastening hole and can be fastened to the other fastening hole in a state in which the fastening member is not completely separated from the spacers.
- [17] In accordance with a preferred embodiment of the present disclosure, the gap adjustment fastening hole of the spacer may be formed in a “Y” shape, and one fastening hole is respectively formed at a right upper end, at a middle lower end, and at a left upper end of the Y-shaped gap adjustment fastening hole.
- [18] In accordance with a preferred embodiment of the present disclosure, in the case where the crown angle is set to 0 degree, the spacer may be fastened to the rear surface of the tractor unit through the fastening hole formed at the right upper end of the Y-shaped gap adjustment fastening hole, in the case where the crown angle is set to be small, the spacer may be fastened to the rear surface of the tractor unit through the fastening hole formed at the middle lower end of the Y-shaped gap adjustment fastening hole, and in the case where the crown angle is set to be large, the spacer may be fastened to the rear surface of the tractor unit through the fastening hole formed at the left upper end of the Y-shaped gap adjustment fastening hole.
- [19] In accordance with a preferred embodiment of the present disclosure, the gap adjustment fastening hole of the spacer may be formed in an “m” shape, and three fastening holes are formed at a lower end of the m-shaped gap adjustment fastening

hole.

[20] In accordance with a preferred embodiment of the present disclosure, the gap adjustment fastening hole of the spacer may be formed in an arrow shape whose apex is directed to the top, and one fastening hole is respectively formed at a right end, at a middle lower end, and at a left end of the arrow-shaped gap adjustment fastening hole.

[21] In accordance with a preferred embodiment of the present disclosure, the gap adjustment fastening hole of the spacer may be formed in an X shape, and one fastening hole is respectively formed at a right upper end, right lower end, left upper end, and left lower end of the X-shaped gap adjustment fastening hole.

[22] In accordance with a preferred embodiment of the present disclosure, two or more gap adjustment fastening holes provided so as to be spaced apart from each other along the longitudinal direction of the spacer.

[23] In accordance with a preferred embodiment of the present disclosure, each of the left and right tow arms may be connected to a main body of the tractor unit by means a leveling cylinder and a transport cylinder, the main body of the tractor unit including a locking plate having a hook-shaped seating groove formed thereon so as to allow the lower ends of the left and right tow arms to be seated therein in a transport state in which the leveling cylinders and the transport are maintained in a state of being contracted, and each of the left and right tow arms may include a damage prevention lining at a lower end thereof, the damage prevention lining configured to protect the left and right tow arms when the left and right tow arms are seated in the seating groove of the locking plate.

[24] In accordance with a preferred embodiment of the present disclosure, the damage prevention lining is joined into a predetermined length to a position where the damage prevention lining is seated in the seating groove of the locking plate at the lower end of the left and right tow arms.

Advantageous Effects of Invention

[25] The present disclosure is advantageous in that a degree of protrusion of the spacers to the side surface of the tractor unit can be adjusted through the selection of the fastening hole corresponding to the crown angle.

[26] The present disclosure is advantageous in that access to the spacers is easy when the spacers are fastened to the tractor unit.

[27] The present disclosure is advantageous in that the fastening member can be moved to another fastening hole and can be fastened to the other fastening hole in a state in which the fastening member is not completely separated from the spacers.

Brief Description of Drawings

[28] FIG. 1 shows the entire perspective view of a road paver in accordance with an em-

bodiment of the present disclosure.

- [29] FIG. 2a schematically shows a screed unit in a state in which the crown angle is 0 degree in a road paver in accordance with an embodiment of the present disclosure.
- [30] FIG. 2b schematically shows a screed unit in a positive crown angle state in a road paver in accordance with an embodiment of the present disclosure.
- [31] FIG. 2c schematically shows a screed unit in a negative crown angle state in a road paver in accordance with an embodiment of the present disclosure.
- [32] FIG. 3 shows a connection structure of the left and right tow arms in a road paver in accordance with an embodiment of the present disclosure.
- [33] FIG. 4a shows a normal state in which the left and right tow arms are maintained in parallel with the road surface in a road paver in accordance with an embodiment of the present disclosure.
- [34] FIG. 4b shows a state in which the left and right tow arms are maintained inclinedly with respect to the road surface in a road paver in accordance with an embodiment of the present disclosure.
- [35] FIG. 4c shows a transport state in which the left and right tow arms are maintained in parallel with the road surface in a state of being lifted from road surface in a road paver in accordance with an embodiment of the present disclosure.
- [36] FIG. 5 shows a mounting structure of a spacer in a road paver in accordance with an embodiment of the present disclosure.
- [37] FIG. 6a is a perspective view showing a spacer having a Y-shaped gap adjustment fastening hole formed therein in a road paver in accordance with an embodiment of the present disclosure.
- [38] FIG. 6b is a front view showing a spacer having an m-shaped gap adjustment fastening hole formed therein in a road paver in accordance with an embodiment of the present disclosure.
- [39] FIG. 6c is a front view showing a spacer having an arrow-shaped gap adjustment fastening hole penetratingly formed therein in such a manner that the apex of the arrow is directed to the top in a road paver in accordance with an embodiment of the present disclosure.
- [40] FIG. 6d is a front view showing a spacer having an X-shaped gap adjustment fastening hole penetratingly formed therein in a road paver in accordance with an embodiment of the present disclosure.
- [41] FIG. 7a shows a state in which a fastening member is fastened to the fastening hole formed at the right upper end in a spacer having a Y-shaped gap adjustment fastening hole formed therein.
- [42] FIG. 7b shows a state in which a fastening member is fastened to the fastening hole formed at the middle lower end in a spacer having a Y-shaped gap adjustment

fastening hole formed therein.

- [43] FIG. 7c shows a state in which a fastening member is fastened to the fastening hole formed at the left upper end in a spacer having a Y-shaped gap adjustment fastening hole formed therein.

Mode for the Invention

- [44] Reference will now be made in detail to embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings. While the present disclosure will be described in conjunction with the following embodiments, it will be understood that they are not intended to limit the present disclosure to these embodiments alone. On the contrary, the present disclosure is intended to cover alternatives, modifications, and equivalents which may be included within the spirit and scope of the present disclosure as defined by the appended claims. Furthermore, in the following detailed description of the present disclosure, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. However, embodiments of the present disclosure may be practiced without these specific details.

- [45] FIG. 1 shows the entire perspective view of a road paver in accordance with an embodiment of the present disclosure.

- [46] As shown in FIG.1, the road paver in accordance with an embodiment of the present disclosure includes a tractor unit 110, a screed unit 120, a left tow arm 130b, and a right tow arm (not shown).

- [47] The tractor unit 110 includes a main body 111 having a built-in engine (not shown) that generates a driving power, a caterpillar track 112 for travelling, and a cab 113 which an operator gets on and off. In addition, the tractor unit 110 includes a receiving hopper 114 having a road paving material (HMA) loaded therein, a conveyer (not shown) that transfers the road paving material, and a spreading auger 115 that evenly discharges the transferred road paving material onto a road surface.

- [48] The road paving material (HMA) stored in the receiving hopper 114 is moved to the rear of the tractor unit 110 through the conveyer so as to be supplied to the top of the spreading auger 115, which in turn evenly discharges the road paving material onto the road surface by its own rotation.

- [49] The screed unit 120 is a unit that widely disperses the road paving material discharged from the tractor unit 110 onto the road surface while being towed by the tractor unit 110.

- [50] FIG. 2a schematically shows a screed unit in a state in which the crown angle is 0 degree, FIG. 2b schematically shows a screed unit in a positive crown angle state, and FIG. 2c schematically shows a screed unit in a negative crown angle state.

- [51] As shown in FIGs. 2a to 2c, the screed unit 120 includes left and right screed plates 121a and 121b having facing corresponding surfaces that are hinge-coupled at the lower ends of thereof to each other, and a crowning mechanism 123 that is hinge-coupled at one end thereof to the left screen plate 121a and is hinge-coupled at the other end thereof to the right screed plate 121b, the crowning mechanism 123 being configured to adjust the crown angle by the length adjustment according to expansion and contraction thereof.
- [52] The crowning mechanism 123 includes a first insertion part 123a that is high-coupled to the left screed plate 121a, a second insertion part 123b that is hinge-coupled to the right screed plate 121b, a rod member 123c that is screw-coupled at both ends thereof to the first and second insertion parts 123a and 123b, and a forcible rotation means 123d that rotatably drives the rod member 123c.
- [53] The crowning mechanism 123 adjusts a degree of insertion of the rod member 123c into the first and second insertion parts 123a and 123b according to the rotation direction of the rod member 123c by the forcible rotation means 123d to adjust a distance between the first and second insertion parts 123a and 123b so that the crown angle of the left and right screed plates 121a and 121b with respect to the road surface is changed.
- [54] In the case where it is desired to simply level or flatten the top surface of a paved road, i.e., the paved road surface, as shown in FIG. 2a, the crowning mechanism 123 is adjusted to allow the left and right screed plates 121a and 121b to be arranged in parallel with the road surface.
- [55] In addition, in the case where it is desired to form the paved road surface such that the paved road surface is gradually increased in thickness as it goes toward the centre thereof, as shown in FIG. 2b, the length of the crowning mechanism 123 is expanded to cause the left and right screed plates 121a and 121b to be pivotally rotated downwardly about a hinge coupling part of the lower ends of the facing corresponding surfaces of the left and right screed plates 121a and 121b so that the left and right screed plates 121a and 121b are maintained in a state of being inclined upwardly as it goes toward the centre thereof in their entireties. In this case, the left and right screed plates 121a and 121b have the positive crown angle with respect to the road surface.
- [56] Further, In the case where it is desired to form the paved road surface such that the paved road surface is gradually increased in thickness as it goes toward the left and right edges thereof, as shown in FIG. 2c, the length of the crowning mechanism 123 is contracted to cause the left and right screed plates 121a and 121b to be pivotally rotated upwardly about the hinge coupling part of the lower ends of the facing corresponding surfaces of the left and right screed plates 121a and 121b so that the left and right screed plates 121a and 121b are maintained in a state of being inclined upwardly

as it goes toward the left and right edges thereof in their entireties. In this case, the left and right screed plates 121a and 121b have the negative crown angle with respect to the road surface.

- [57] The left and right tow arms 130a and 130b are units that towably connect the screed unit 120 to the tractor unit 110.
- [58] FIG. 3 shows a structure in which the left and right tow arms 130a and 130b are connected to a main body of the tractor unit 110.
- [59] As shown in FIGs. 1 and 3, the left tow arm 130a is pivot-connected at one end thereof to a left side surface of the main body 111 of the tractor unit 110, and is connected at the other end thereof to a left side of the screed unit 130. In addition, the right tow arm 130b is pivot-connected at one end thereof to a right side surface of the main body 111 of the tractor unit 110, and is connected at the other end thereof to a right side of the screed unit 130.
- [60] Moreover, the left and right tow arms 130a and 130b are mounted to both side surfaces of the main body 111 of the tractor unit 110 by means of leveling cylinders 116a and 116b and transport cylinders 117a and 117b. The upper ends of the leveling cylinders 116a and 116b and the transport cylinders 117a and 117b are respectively pivot-connected to both sides of the main body 111 of the tractor unit 110, and the lower ends of the leveling cylinders 116a and 116b and the transport cylinders 117a and 117b are respectively pivot-connected to the left and right tow arms 130a and 130b.
- [61] The left and right tow arms 130a and 130b are adjusted to various operating states depending on the length adjustment of the leveling cylinders 116a and 116b and the transport cylinders 117a and 117b.
- [62] FIG. 4a shows a normal state in which the left and right tow arms 130a and 130b are maintained in parallel with the road surface. In this normal state, the leveling cylinders 116a and 116b and the transport cylinders 117a and 117b are maintained in a state of being expanded, respectively. Thus, the left and right tow arms 130a and 130b are maintained in parallel with the road surface in a state of being the closest to the road surface. A road paving operation of the tractor unit 110 is performed in the above-mentioned normal state of the left and right tow arms 130a and 130b.
- [63] FIG. 4b shows a state in which the left and right tow arms 130a and 130b are maintained inclinedly with respect to the road surface. In this state, the leveling cylinders 116a and 116b are maintained in a state of being expanded, respectively whereas the transport cylinders 117a and 117b are maintained in a state being contracted, respectively. Thus, the left and right tow arms 130a and 130b are maintained inclinedly with respect to the road surface in a state of being lifted at a rear side thereof.

- [64] FIG. 4c shows a transport state in which the left and right tow arms 130a and 130b are maintained in parallel with the road surface in a state of being lifted from road surface. In this transport state, the leveling cylinders 116a and 116b and the transport cylinders 117a and 117b are maintained in a stated of being contracted. Thus, the left and right tow arms 130a and 130b are maintained in parallel with the road surface in a state of being lifted by the leveling cylinders 116a and 116b at a front side thereof, and simultaneously are lifted by the transport cylinders 117a and 117b at a rear side thereof. A travelling operation of the tractor unit 110 is performed in the above-mentioned transport state of the left and right tow arms 130a and 130b.
- [65] The crown angle of the left and right screed plates 121a and 121b is adjusted by the crowning mechanism 123, and thus the width between both sides of the screed unit 120 is changed. Therefore, the width between the left and right tow arms 130a and 130b connected to both sides of the screed unit 120 is also changed. Consequently, a gap between the tractor unit 10 and the left and right tow arms 130a and 130b is also changed.
- [66] In the case where the crown angle of the left and right screed plates 121a and 121b is excessively adjusted by the crowning mechanism 123, the inner side surfaces of the left and right tow arms 130a and 130b may be pressed against the side surface of the main body 111 of the tractor unit 110, thereby causing a mechanical damage. Spacers 140a, 140b, 140c and 140d are mounted to the tractor unit 110 to prevent a direct contact between the left and right tow arms 130a and 130b and the tractor unit 110.
- [67] FIG. 5 shows a mounting structure of a spacer 140a, FIGs. 6a to 6d show various modifications of spacers 140a, 140b, 140c and 140d, and FIGs. 7a to 7c show a configuration in which a degree of protrusion of the spacers to the side surface of the tractor unit 110 varies depending on the selection of fastening holes 141a, 141b and 141c in a spacer 140a formed with a Y-shaped gap adjustment fastening hole 141.
- [68] The spacers 140a, 140b, 140c and 140d have a rectangular shape formed with a cut portion at one side thereof as shown in FIGs. 6a to 6d.
- [69] In addition, as derived from FIG. 5, the spacers 140a, 140b, 140c and 140d are not fasteningly fixed to the side surface of the tractor unit 110, which corresponds to the inner surfaces of the left and right tow arms 130a and 130b, respectively, but are fastened to a rear surface of the tractor unit 110, which perpendicularly intersects the side surface of the tractor unit 110, which corresponds to the inner surfaces of the left and right tow arms 130a and 130b, respectively.
- [70] The spacers 140a, 140b, 140c and 140d are fasteningly fixed to the rear surface of the tractor unit 110, which is not affected by any interference of the left and right tow arms 130a and 130b during the fastening of the spacers by the tightening of the fastening member 145 or the release of the fastening member so that an operator can

very easily access the spacers during the fastening of the spacers 140a, 140b, 140c and 140d and can work in a rapid and easy manner.

[71] In addition, as shown in FIGs. 6a to 6d, the spacers 140a, 140b, 140c and 140d have a plurality of gap adjustment fastening holes 141, 142, 143 and 144 penetratingly formed therein, respectively. The gap adjustment fastening holes 141, 142, 143 and 144 have a plurality of fastening holes 141a to 141c, 142a to 142c, 143a to 143c, and 144a to 144d, respectively, arranged at different positions in a width direction so as to be connected to each other.

[72] When the spacers 140a, 140b, 140c and 140d are fasteningly fixed to the rear surface of the tractor unit 110, the fastening holes 141a to 141c, 142a to 142c, 143a to 143c, and 144a to 144d are selected and fastened depending on a degree of adjustment of the crown angle of the left and right screed plates 121a and 121b by the crowning mechanism 123 so that a degree of protrusion of the spacers to the side surface of the tractor unit 110 can be adjusted.

[73] A detailed configuration of the spacers 140a, 140b, 140c and 140d including the gap adjustment fastening holes 141, 142, 143 and 144 having various shapes and a method for adjusting a degree of protrusion of spacers 140a, 140b, 140c and 140d according to the various modifications will be described with reference to FIGs. 5, 6a to 6d and 7a to 7c.

[74] As shown in FIGs. 5 and 6a, the spacer 140a in accordance with a first embodiment includes a Y-shaped gap adjustment fastening hole 141 penetratingly formed therein. Three fastening holes 141a, 141b and 141c to which the fastening member 145 can be fastened are respectively formed at a right upper end, at a middle lower end, and at a left upper end of the Y-shaped gap adjustment fastening hole 141.

[75] In the case where the crown angle is set to 0 degree, as shown in FIG. 7a, the spacer 140a in accordance with a first embodiment is fastened to the rear surface of the tractor unit 110 by means of the fastening member 145 through the fastening hole 141a formed at the right upper end of the Y-shaped gap adjustment fastening hole 141. In this case, a gap between the inner side surfaces of the left and right tow arms 130a and 130b and the side surface of the main body 111 becomes maximum, and the spacer 140a in accordance with a first embodiment can be maximally protruded to the side surface of the tractor unit 110.

[76] In the case where the positive or negative crown angle is set to be small, as shown in FIG. 7b, the spacer 140a in accordance with a first embodiment is fastened to the rear surface of the tractor unit 110 by means of the fastening member 145 through the fastening hole 141b formed at the middle lower end of the Y-shaped gap adjustment fastening hole 141. In this case, the gap between the inner side surfaces of the left and right tow arms 130a and 130b and the side surface of the main body 111 of the tractor

unit 110 is reduced, and a degree of protrusion of the spacer 140a to the side surface of the tractor unit 110 is also reduced. Thus, a gap between the inner side surfaces of the left and right tow arms 130a and 130b and the spacer 140a can be maintained constantly.

[77] In the case where the positive or negative crown angle is set to be large, as shown in FIG. 7c, the spacer 140a in accordance with a first embodiment is fastened to the rear surface of the tractor unit 110 by means of the fastening member 145 through the fastening hole 141c formed at the left upper end of the Y-shaped gap adjustment fastening hole 141. In this case, the gap between the inner side surfaces of the left and right tow arms 130a and 130b and the side surface of the main body 111 of the tractor unit 110 is further reduced, and a degree of protrusion of the spacer 140a to the side surface of the tractor unit 110 is also further reduced. Thus, a gap between the inner side surfaces of the left and right tow arms 130a and 130b and the spacer 140a can be maintained constantly.

[78] As shown in FIG. 6b, the spacer 140b in accordance with a second embodiment includes an m-shaped gap adjustment fastening hole 142 penetratingly formed therein. Three fastening holes 142a, 142b and 142c to which the fastening member 145 can be fastened are juxtaposedly formed at a lower end of the m-shaped gap adjustment fastening hole 142. In other words, the fastening holes 142a, 142b and 142c are respectively formed at a right lower end, at a middle lower end, and at a left lower end of the m-shaped gap adjustment fastening hole 142.

[79] In the case where the crown angle is set to 0 degree, the spacer 140b in accordance with a second embodiment is fastened to the rear surface of the tractor unit 110 by means of the fastening member 145 through the fastening hole 142a formed at the right lower end of the m-shaped gap adjustment fastening hole 142. In this case, a gap between the inner side surfaces of the left and right tow arms 130a and 130b and the side surface of the main body 111 of the tractor unit 110 becomes maximum, and the spacer 140b in accordance with a second embodiment can be maximally protruded to the side surface of the tractor unit 110.

[80] In the case where the positive or negative crown angle is set to be small, the spacer 140b in accordance with a second embodiment is fastened to the rear surface of the tractor unit 110 by means of the fastening member 145 through the fastening hole 142b formed at the middle lower end of the m-shaped gap adjustment fastening hole 142. In this case, the gap between the inner side surfaces of the left and right tow arms 130a and 130b and the side surface of the main body 111 of the tractor unit 110 is reduced, and a degree of protrusion of the spacer 140b to the side surface of the tractor unit 110 is also reduced. Thus, a gap between the inner side surfaces of the left and right tow arms 130a and 130b and the spacer 140a can be maintained constantly.

- [81] In the case where the positive or negative crown angle is set to be large, the spacer 140b in accordance with a second embodiment is fastened to the rear surface of the tractor unit 110 by means of the fastening member 145 through the fastening hole 142c formed at the left lower end of the m-shaped gap adjustment fastening hole 142. In this case, the gap between the inner side surfaces of the left and right tow arms 130a and 130b and the side surface of the main body 111 of the tractor unit 110 is further reduced, and a degree of protrusion of the spacer 140b to the side surface of the tractor unit 110 is also further reduced. Thus, a gap between the inner side surfaces of the left and right tow arms 130a and 130b and the spacer 140b can be maintained constantly.
- [82] As shown in FIG. 6c, the spacer 140c in accordance with a third embodiment includes an arrow-shaped gap adjustment fastening hole 141 penetratingly formed therein in such a manner that the apex of the arrow is directed to the top. Three fastening holes 143a, 143b and 143c to which the fastening member 145 can be fastened are respectively formed at a right end, at a middle lower end, and at a left end of the arrow-shaped gap adjustment fastening hole 143.
- [83] In the case where the crown angle is set to 0 degree, the spacer 140c in accordance with a second embodiment is fastened to the rear surface of the tractor unit 110 by means of the fastening member 145 through the fastening hole 143a formed at the right end of the arrow-shaped gap adjustment fastening hole 143. In this case, a gap between the inner side surfaces of the left and right tow arms 130a and 130b and the side surface of the main body 111 of the tractor unit 110 becomes maximum, and the spacer 140c in accordance with a third embodiment can be maximally protruded to the side surface of the tractor unit 110.
- [84] In the case where the positive or negative crown angle is set to be small, the spacer 140c in accordance with a third embodiment is fastened to the rear surface of the tractor unit 110 by means of the fastening member 145 through the fastening hole 143b formed at the middle lower end of the arrow-shaped gap adjustment fastening hole 143. In this case, the gap between the inner side surfaces of the left and right tow arms 130a and 130b and the side surface of the main body 111 of the tractor unit 110 is reduced, and a degree of protrusion of the spacer 140c to the side surface of the tractor unit 110 is also reduced. Thus, a gap between the inner side surfaces of the left and right tow arms 130a and 130b and the spacer 140a can be maintained constantly.
- [85] In the case where the positive or negative crown angle is set to be large, the spacer 140c in accordance with a third embodiment is fastened to the rear surface of the tractor unit 110 by means of the fastening member 145 through the fastening hole 143c formed at the left end of the arrow-shaped gap adjustment fastening hole 142. In this case, the gap between the inner side surfaces of the left and right tow arms 130a and 130b and the side surface of the main body 111 of the tractor unit 110 is further

reduced, and a degree of protrusion of the spacer 140c to the side surface of the tractor unit 110 is also further reduced. Thus, a gap between the inner side surfaces of the left and right tow arms 130a and 130b and the spacer 140c can be maintained constantly.

[86] As shown in FIG. 6d, the spacer 140d in accordance with a fourth embodiment includes an X-shaped gap adjustment fastening hole 144 penetratingly formed therein. Four fastening holes 144a, 144b, 144c and 144d to which the fastening member 145 can be fastened are respectively formed at different positions in the width direction of the spacer 140d, i.e., at a right upper end, right lower end, left upper end, and left lower end of the X-shaped gap adjustment fastening hole 144.

[87] The spacer 140d in accordance with the fourth embodiment is fastened to the rear surface of the tractor unit 110 by means of the fastening member 145 through one selected from the fastening holes 144a, 144b, 144c and 144d of the X-shaped gap adjustment fastening hole 144 so that a gap between the inner side surfaces of the left and right tow arms 130a and 130b and the spacer 140c can be maintained constantly.

[88] The gap adjustment fastening holes 141, 142, 143 and 144 of the spacers 140a, 140b, 140c and 140d may be formed in various shapes besides the above-mentioned shapes. In this case, the gap adjustment fastening holes 141, 142, 143 and 144 are preferably formed are not connected in a horizontal or vertical direction with respect to the fastening holes 141a to 141c, 142a to 142c, 143a to 143c, and 144a to 144d to prevent the fastening position of the spacers 140a, 140b, 140c and 140d by the fastening member 145 from being displaced in a horizontal or vertical direction.

[89] Although it has been shown in the drawings that each of the gap adjustment fastening holes 141, 142, 143 and 144 is provided in pair so as to be spaced apart from each other along the longitudinal direction of the spacers 140a, 140b, 140c and 140d, three or more gap adjustment fastening holes may be preferably provided so as to be spaced apart from each other along the longitudinal direction of the spacers 140a, 140b, 140c and 140d. In the case where the number of each of the gap adjustment fastening holes 141, 142, 143 and 144 formed on each of the spacers 140a, 140b, 140c and 140d is one, the spacers 140a, 140b, 140c and 140d can be rotated about a fastening point. Thus, in case of the gap adjustment fastening holes 141, 142, 143 and 144, for the purpose of the complete fastening of the spacers 140a, 140b, 140c and 140d, two or more gap adjustment fastening holes are preferably provided so as to be spaced apart from each other along the longitudinal direction of the spacers 140a, 140b, 140c and 140d.

[90] In addition, the main body of the tractor unit 110 includes a locking plate 118 having a hook-shaped seating groove 118a formed thereon so as to allow the lower ends of the left and right tow arms 130a and 130b to be seated therein as shown in FIG. 5 in a transport state in which the leveling cylinders 116a and 116b and the transport

cylinders 117a and 117b are maintained in a state of being contracted as shown in FIG. 4c. The configuration and operation of the locking plate 118 is already well-known in the art, and thus the detailed description of the locking plate 118 will be omitted for the sake of simplicity of explanation.

[91] As shown in FIG. 5, each of the left and right tow arms 130a and 130b includes a damage prevention lining 131 at a lower end thereof. The damage prevention lining 131, as shown in FIG. 4c, serves to reduce a friction or impact to protect the left and right tow arms 130a and 130b and the locking plate 18 when the left and right tow arms 130a and 130b are seated in the seating groove 118a of the locking plate 118 in the transport state in which the leveling cylinders 116a and 116b and the transport cylinders 117a and 117b are maintained in a contracted state.

[92] The damage prevention lining 118 may be joined to the lower ends of the left and right tow arms 130a and 130b over the entire length thereof, but is preferably joined into a predetermined length to a position where the damage prevention lining 118 is seated in the seating groove 118a of the locking plate 118 at the lower end of the left and right tow arms 130a and 130b.

[93] Although the invention has been described with reference to the preferred embodiments in the attached figures, it is noted that equivalents may be employed and substitutions made herein without departing from the scope of the invention as recited in the claims.

Industrial Applicability

[94] The present disclosure is applicable to a road paver which has a tow arm for connecting a screed unit to a tractor unit.

Claims

- [Claim 1] A road paver configured to pave a road surface and including a spacer for a tow arm, the road paver comprising:
a tractor unit disposed at the front thereof and having a road paving material (HMA) loaded therein;
a screed unit disposed at the rear thereof and configured to evenly disperse the road paving material discharged from the tractor unit onto a road surface;
left and right tow arms configured to towably connect the screed unit to the tractor unit; and
a spacer configured to be protruded to the side surface of the tractor unit, which corresponds to the inner side surfaces of the left and right tow arms so that the inner side surfaces of the left and right tow arms is prevented from coming into close contact with the side surface of the tractor unit,
wherein the spacer is fastened to a rear surface of the tractor unit, which perpendicularly intersects the side surface of the tractor unit, which corresponds to the inner surfaces of the left and right tow arms, respectively,
wherein the spacer has gap adjustment fastening holes penetratingly formed therein, respectively to have a plurality of fastening holes, respectively, arranged at different positions in a width direction so as to be connected to each other so that a degree of protrusion of the spacers to the side surface of the tractor unit can be adjusted depending on the position of the fastening hole selected for fastening
- [Claim 2] The road paver according to claim 1, wherein the gap adjustment fastening hole of the spacer is formed in a “Y” shape, and one fastening hole is respectively formed at a right upper end, at a middle lower end, and at a left upper end of the Y-shaped gap adjustment fastening hole.
- [Claim 3] The road paver according to claim 2, wherein in the case where the crown angle is set to 0 degree, the spacer is fastened to the rear surface of the tractor unit through the fastening hole formed at the right upper end of the Y-shaped gap adjustment fastening hole, in the case where the crown angle is set to be small, the spacer is fastened to the rear surface of the tractor unit through the fastening hole formed at the middle lower end of the Y-shaped gap adjustment fastening hole, and in the case where the crown angle is set to be large, the spacer is

fastened to the rear surface of the tractor unit through the fastening hole formed at the left upper end of the Y-shaped gap adjustment fastening hole.

[Claim 4] The road paver according to claim 1, wherein the gap adjustment fastening hole of the spacer is formed in an “m” shape, and three fastening holes are formed at a lower end of the m-shaped gap adjustment fastening hole.

[Claim 5] The road paver according to claim 1, wherein the gap adjustment fastening hole of the spacer is formed in an arrow shape whose apex is directed to the top, and one fastening hole is respectively formed at a right end, at a middle lower end, and at a left end of the arrow-shaped gap adjustment fastening hole.

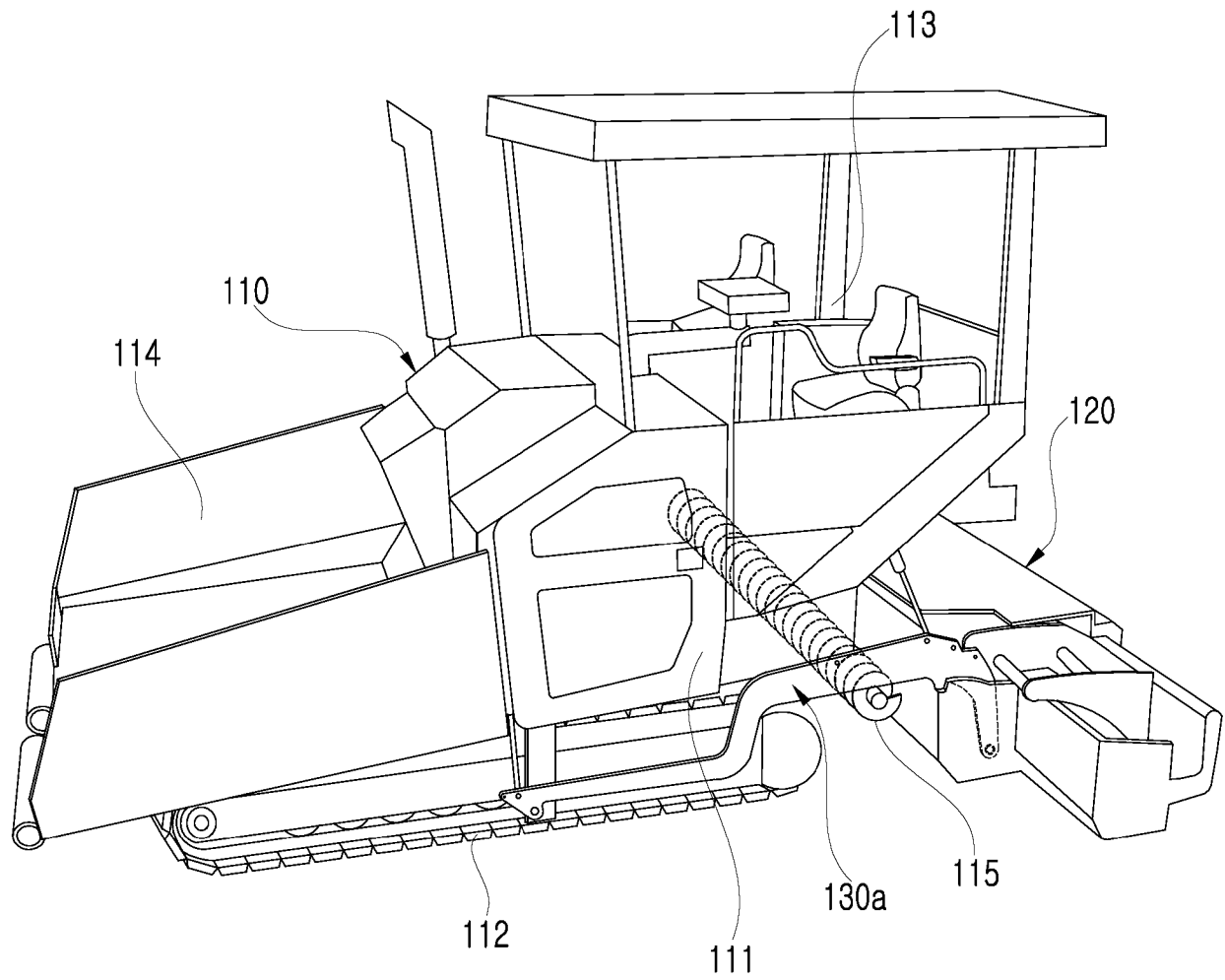
[Claim 6] The road paver according to claim 1, wherein the gap adjustment fastening hole of the spacer is formed in an X shape, and one fastening hole is respectively formed at a right upper end, right lower end, left upper end, and left lower end of the X-shaped gap adjustment fastening hole.

[Claim 7] The road paver according to any one of claims 1 to 6, wherein two or more gap adjustment fastening holes provided so as to be spaced apart from each other along the longitudinal direction of the spacer.

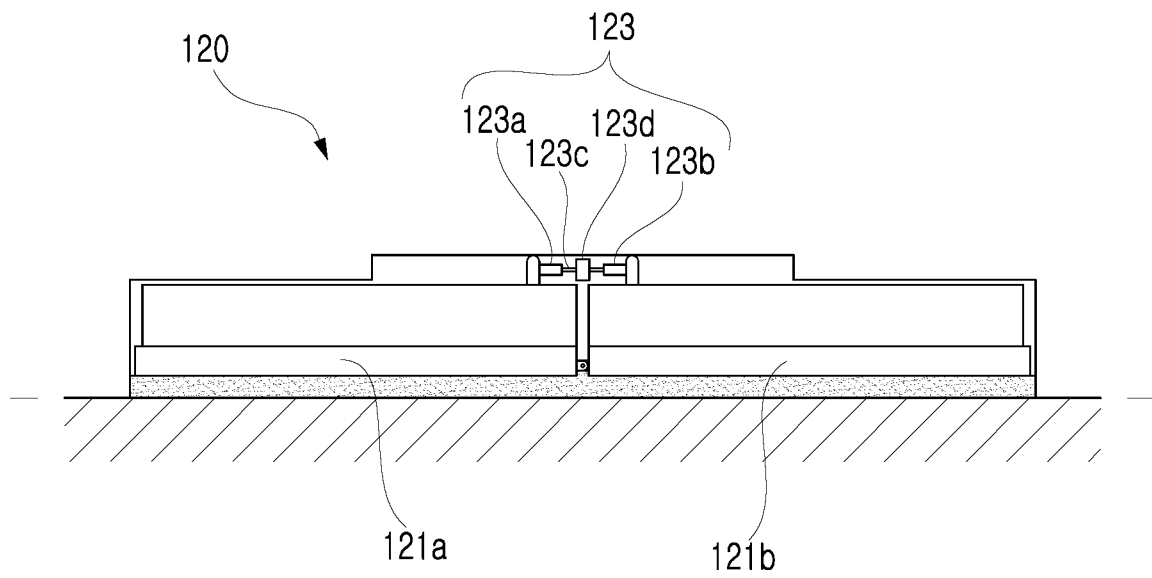
[Claim 8] The road paver according to claim 1, wherein each of the left and right tow arms are connected to a main body of the tractor unit by means a leveling cylinder and a transport cylinder, the main body of the tractor unit including a locking plate having a hook-shaped seating groove formed thereon so as to allow the lower ends of the left and right tow arms to be seated therein in a transport state in which the leveling cylinders and the transport are maintained in a state of being contracted, and each of the left and right tow arms includes a damage prevention lining at a lower end thereof, the damage prevention lining configured to protect the left and right tow arms when the left and right tow arms are seated in the seating groove of the locking plate.

[Claim 9] The road paver according to claim 1, wherein the damage prevention lining is joined into a predetermined length to a position where the damage prevention lining is seated in the seating groove of the locking plate at the lower end of the left and right tow arms.

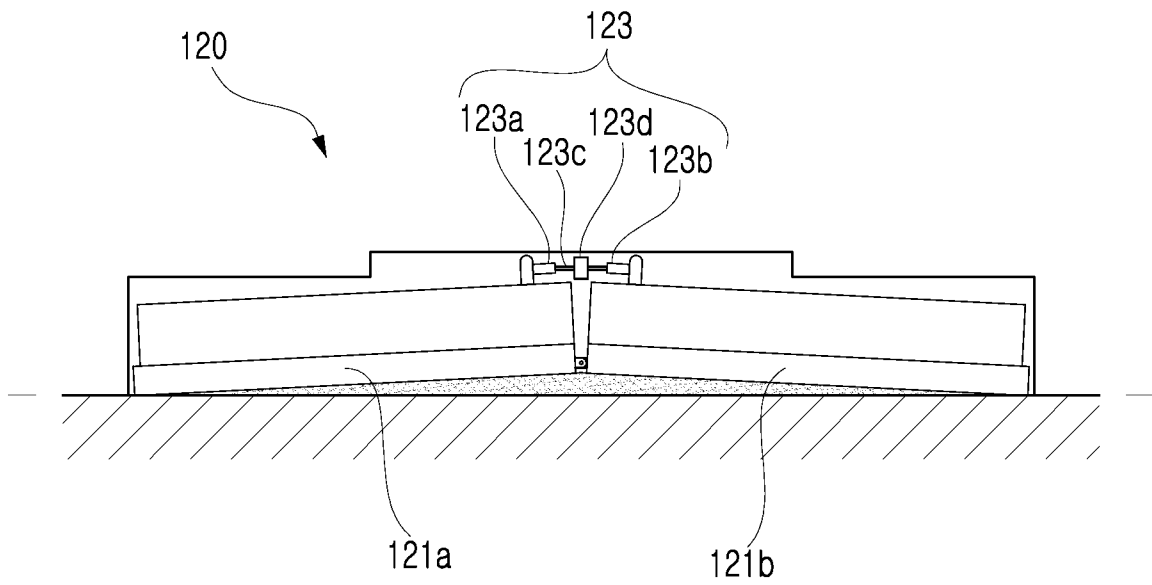
[Fig. 1]



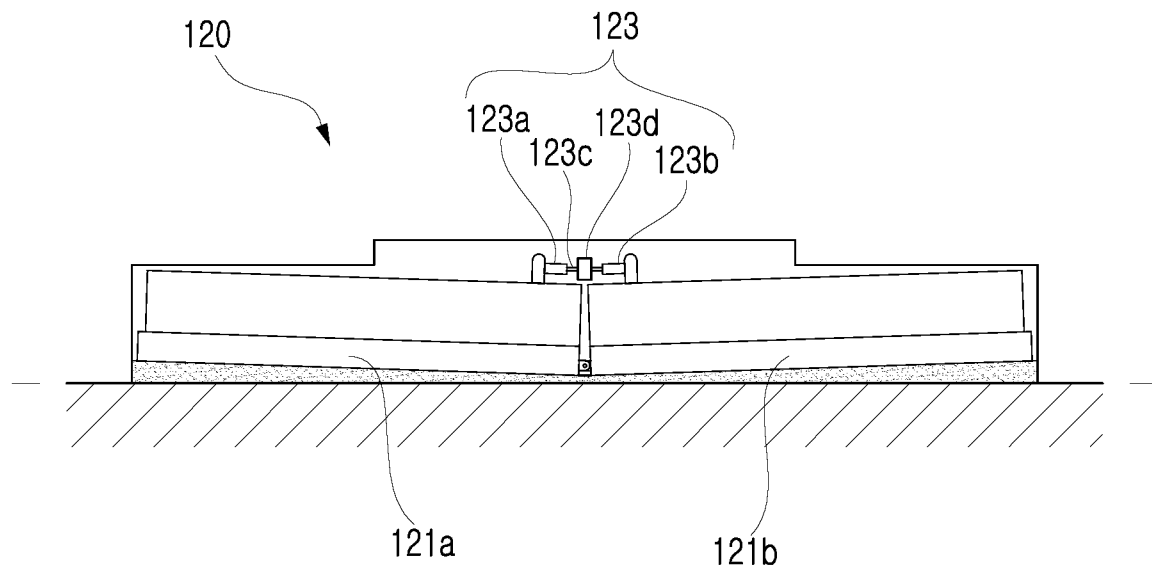
[Fig. 2a]



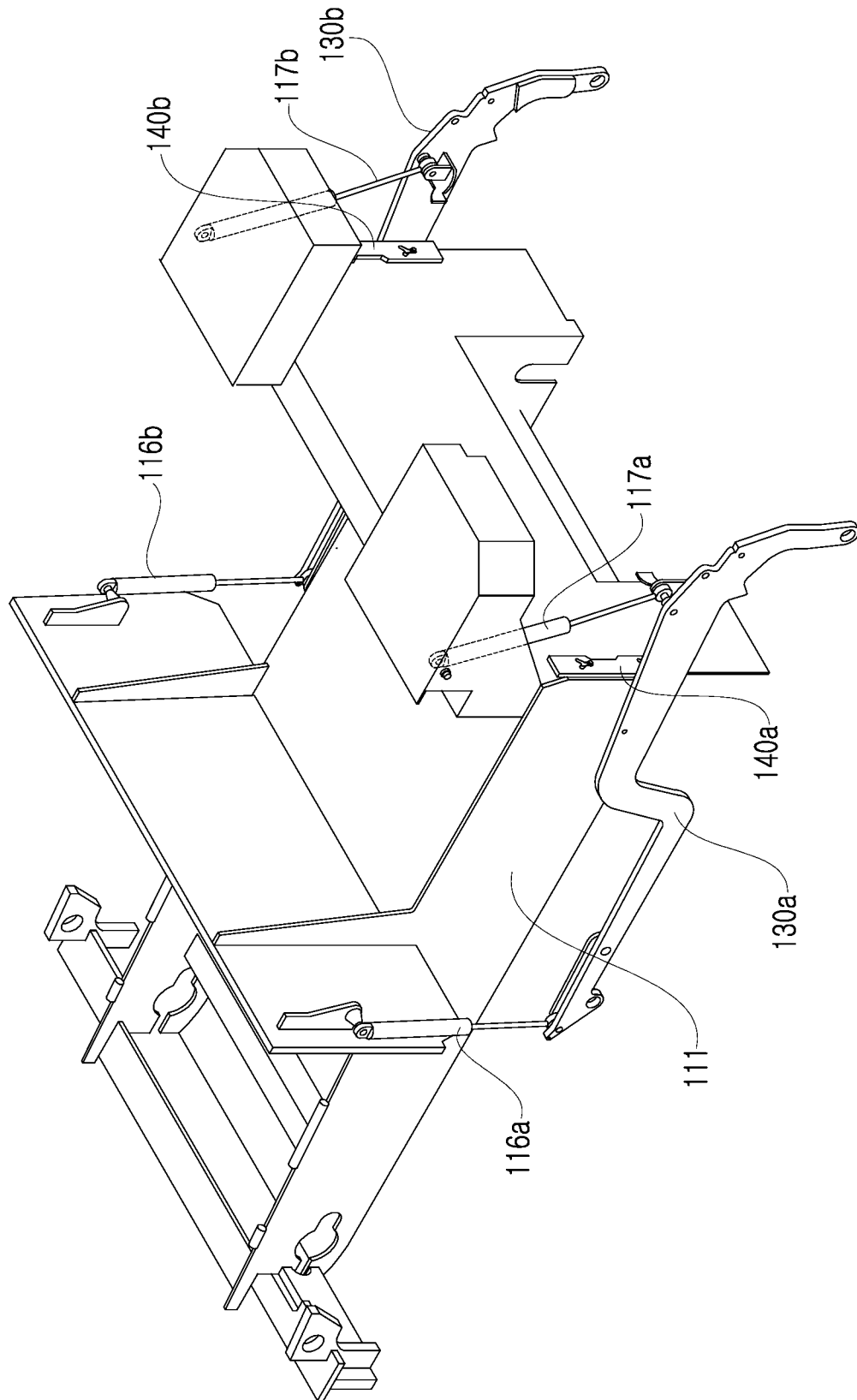
[Fig. 2b]



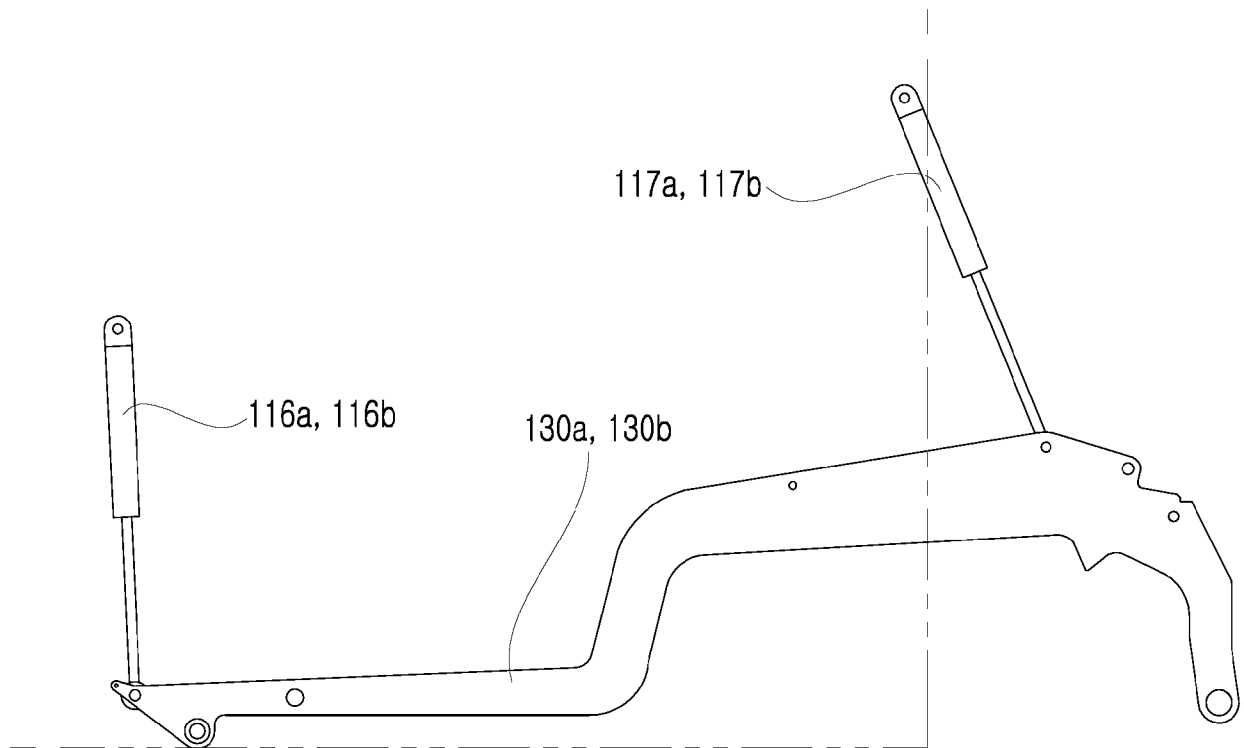
[Fig. 2c]



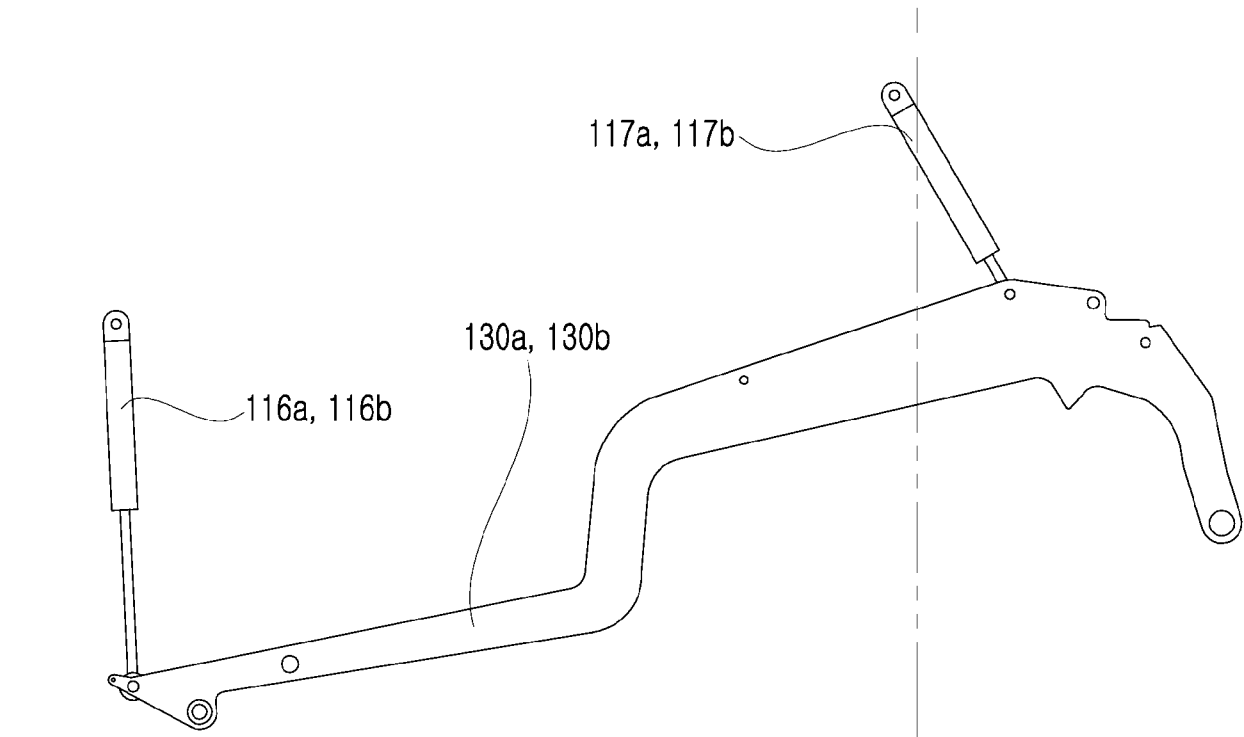
[Fig. 3]



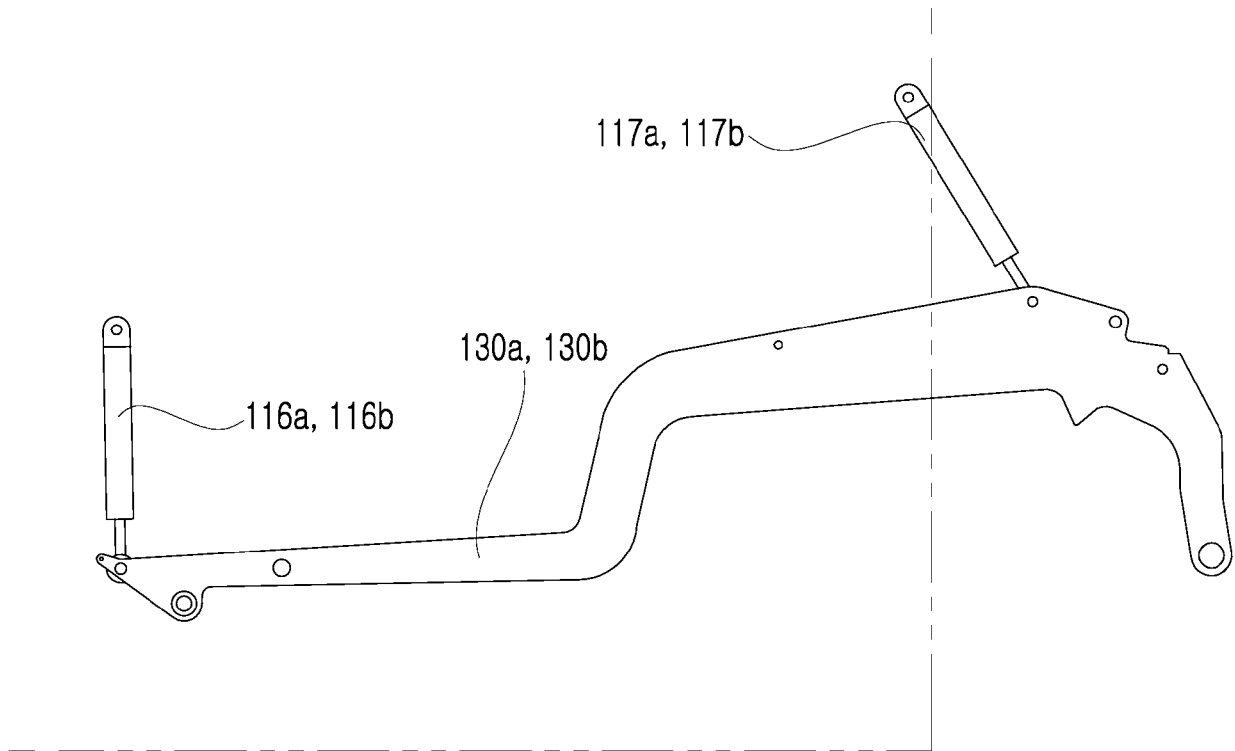
[Fig. 4a]



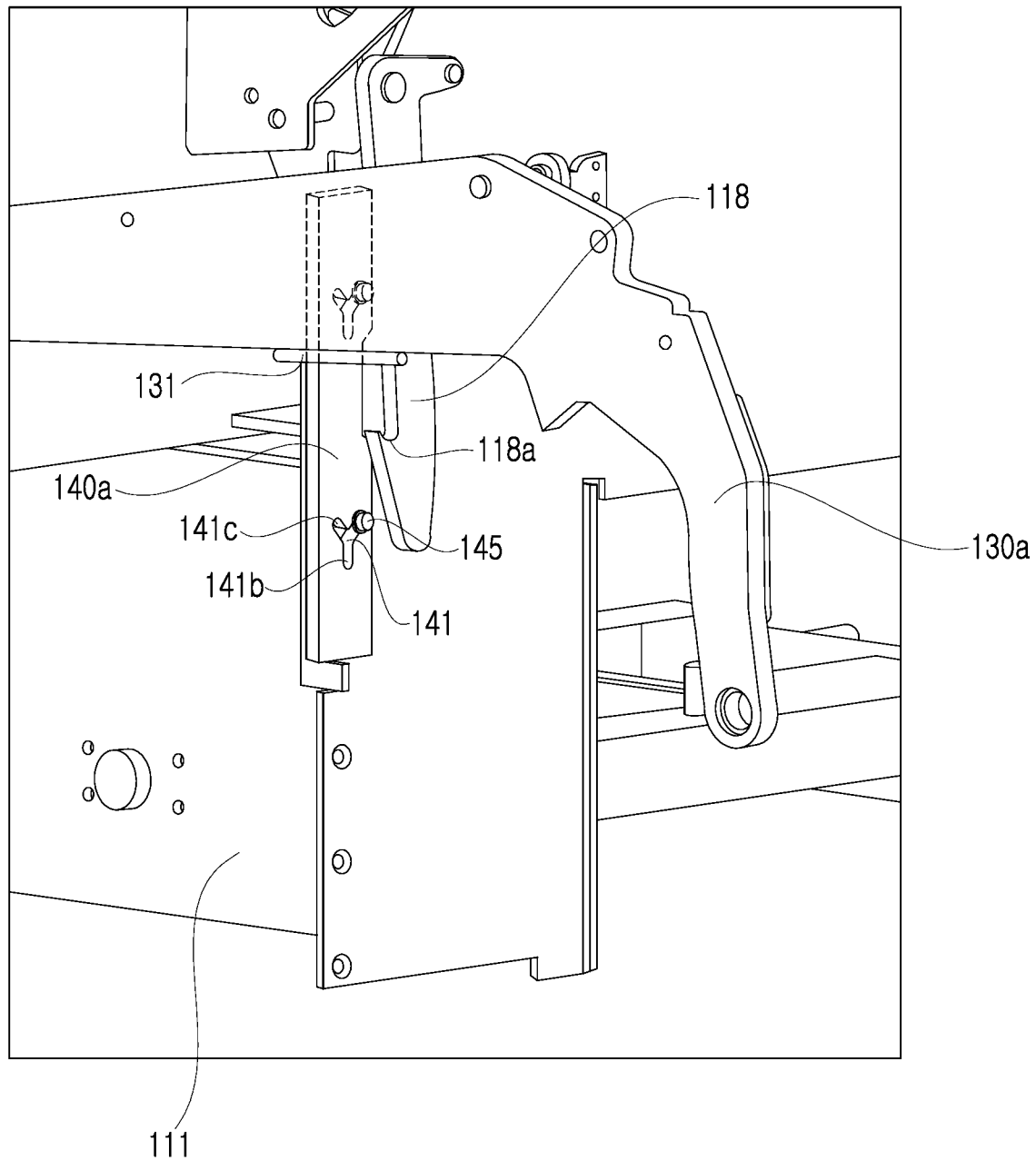
[Fig. 4b]



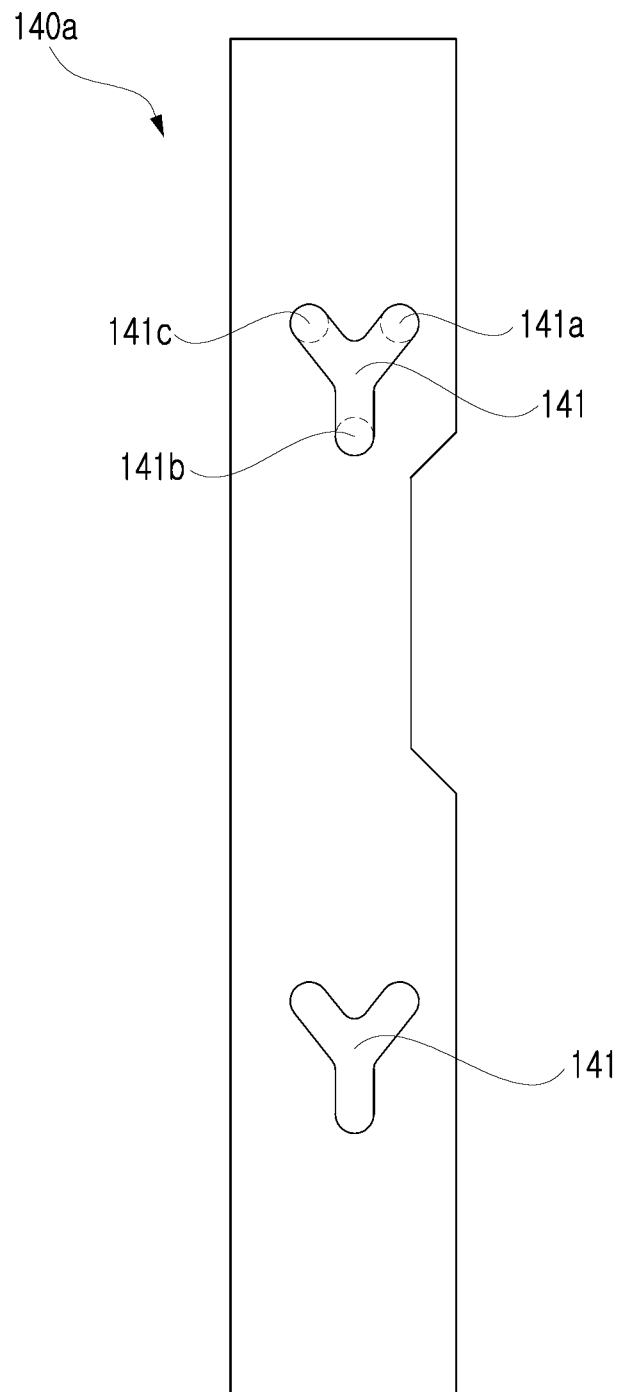
[Fig. 4c]



[Fig. 5]

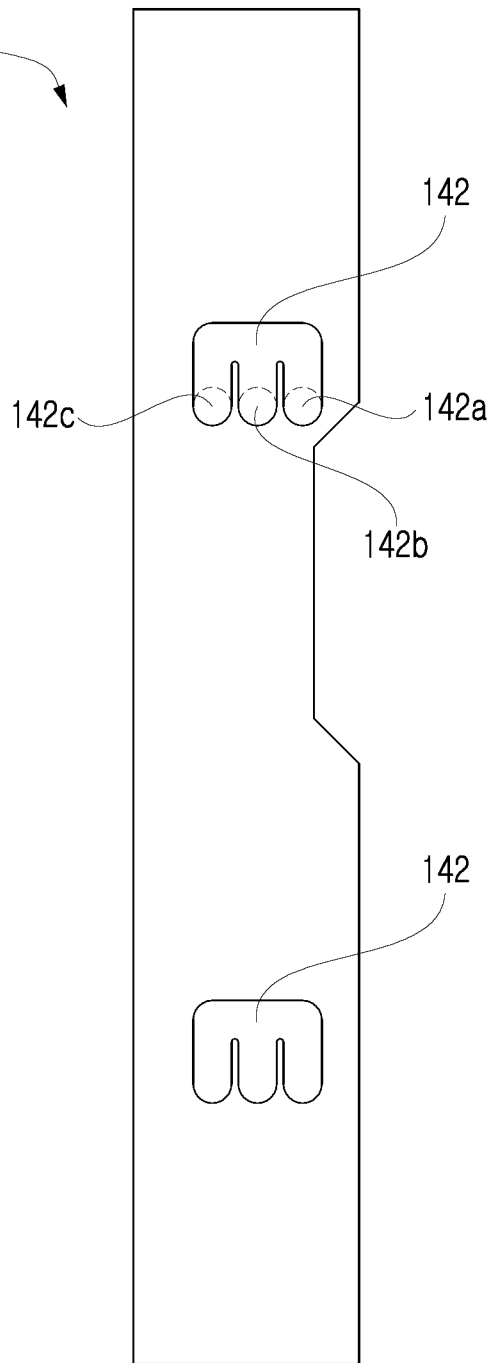


[Fig. 6a]

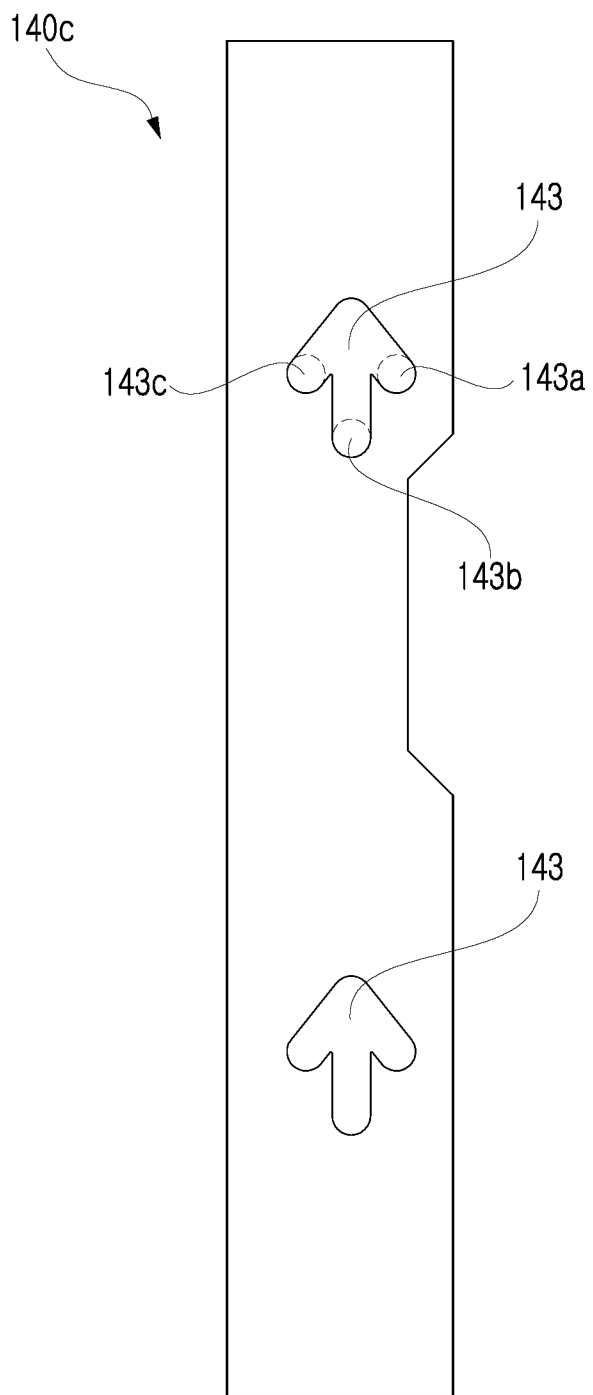


[Fig. 6b]

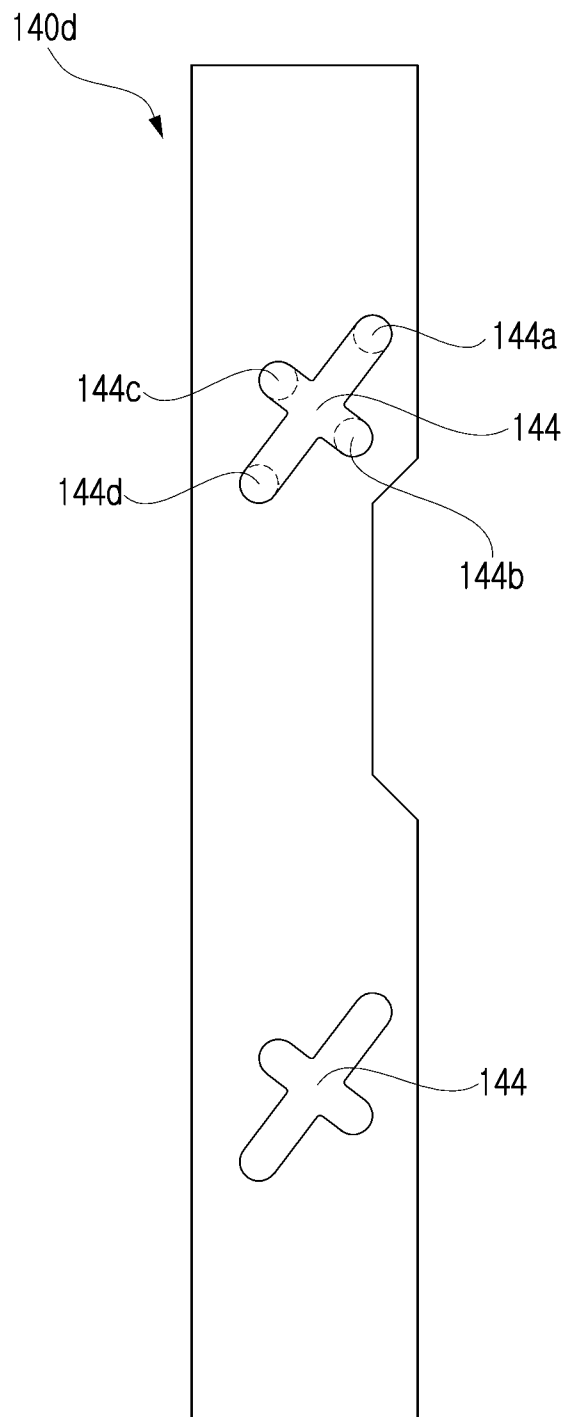
140b



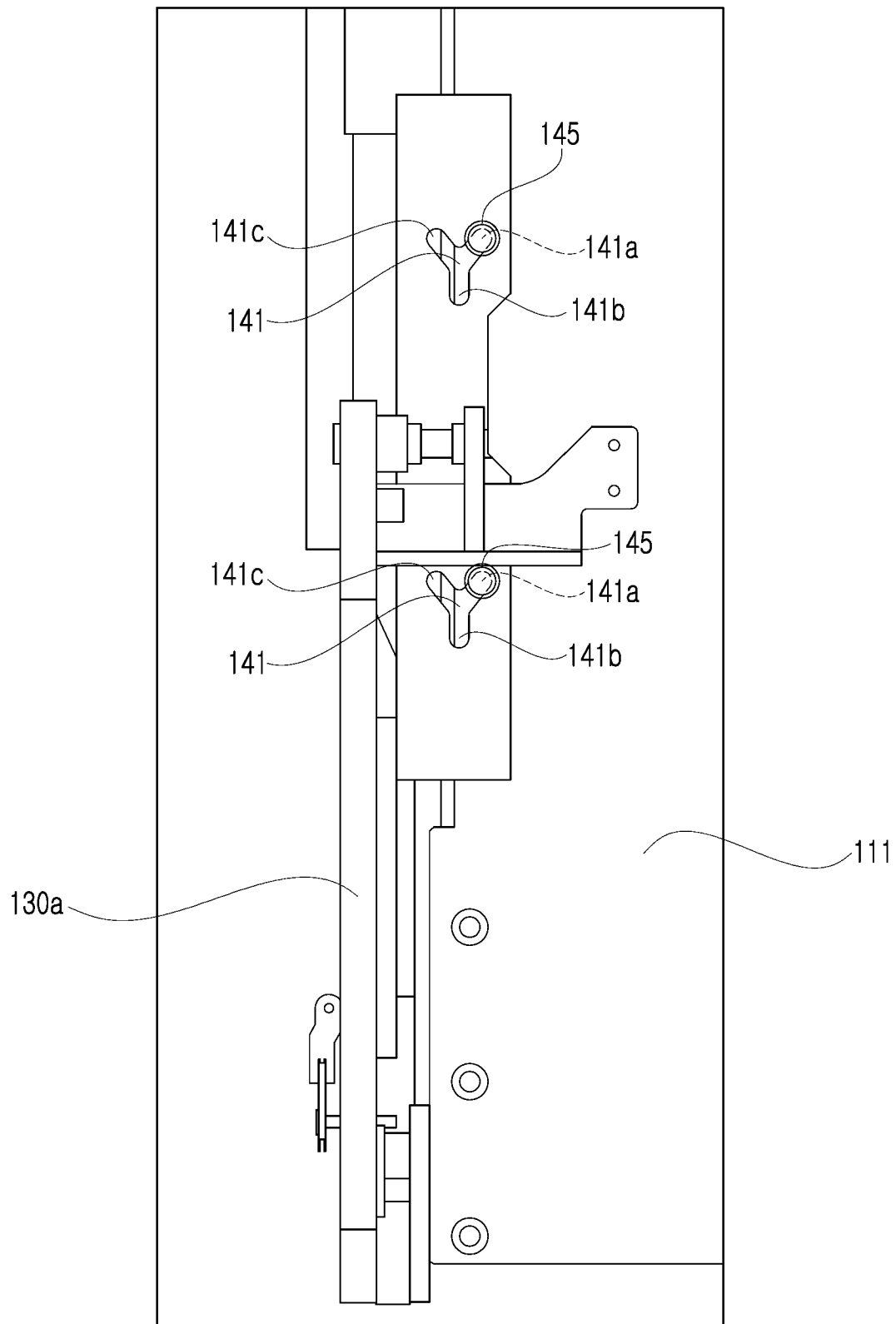
[Fig. 6c]



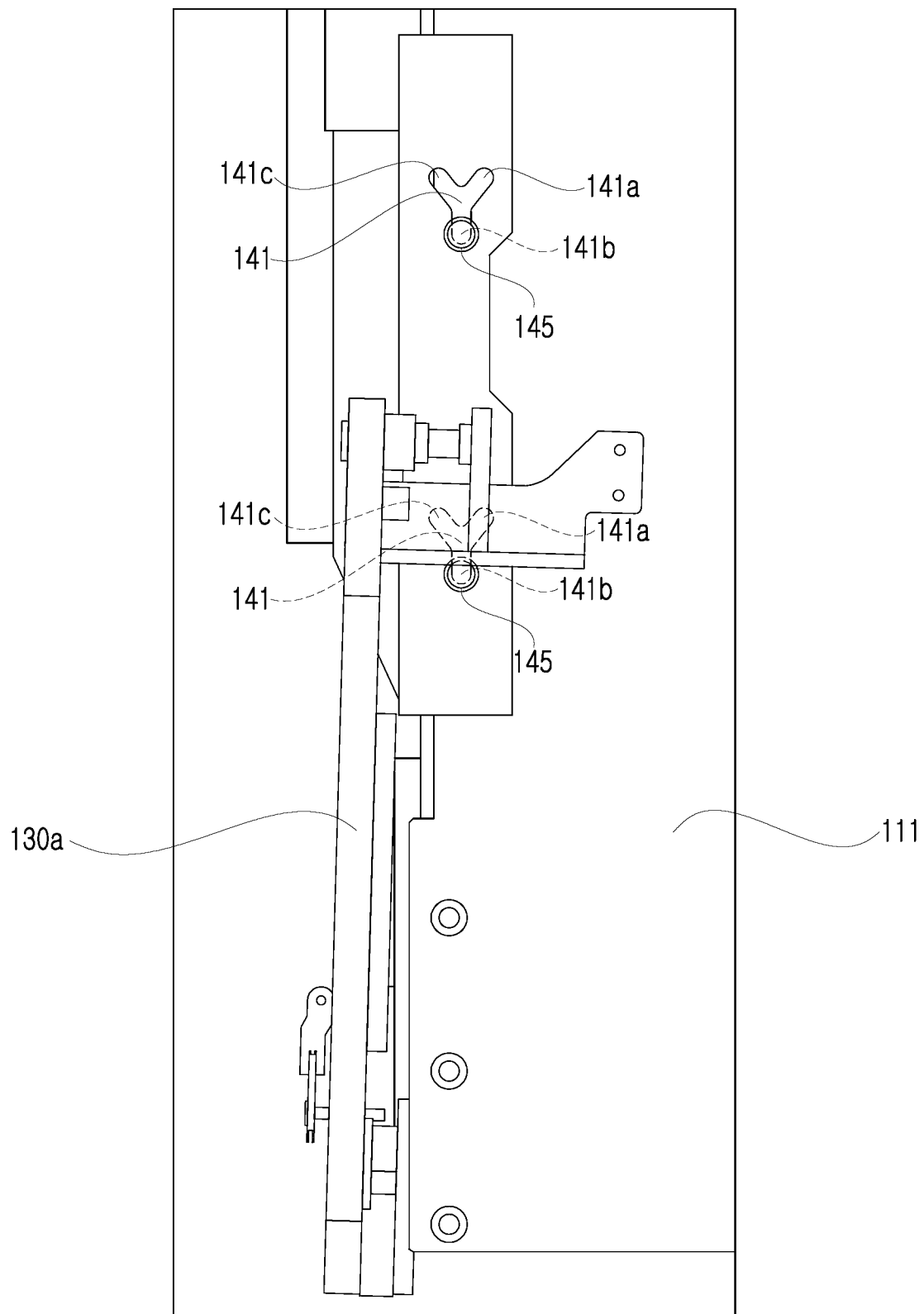
[Fig. 6d]



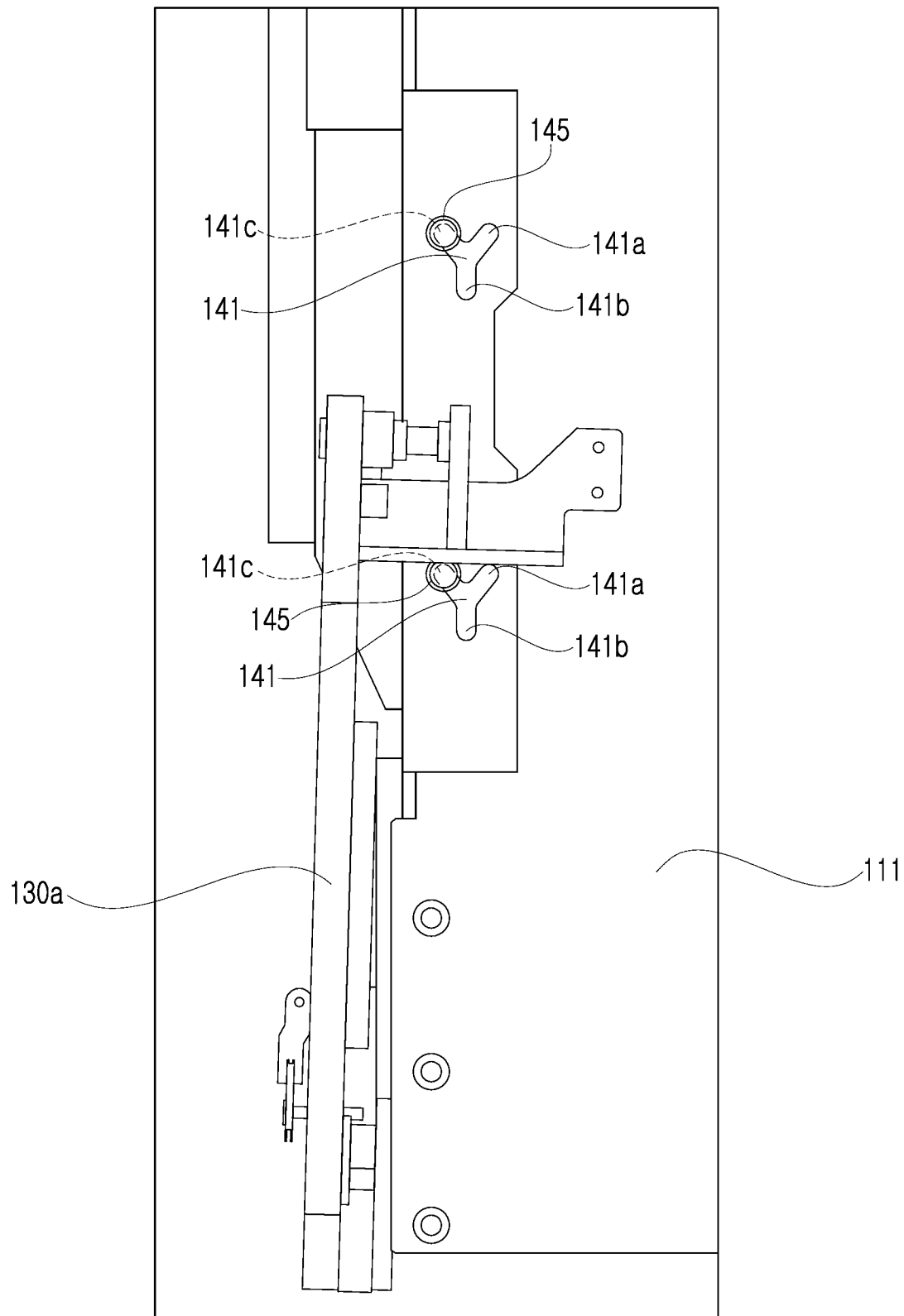
[Fig. 7a]



[Fig. 7b]



[Fig. 7c]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2014/006766**A. CLASSIFICATION OF SUBJECT MATTER****E01C 19/22(2006.01)i, E01C 19/48(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E01C 19/22; E01C 19/00; E01C 19/48

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & keywords: road paver, tractor unit, screed, tow arm, spacer, gap adjustment fastening hole, and mechanical damage

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002-0141824 A (WELLS, JAMES R.) 03 October 2002 See paragraphs [0030]–[0044] and figures 1–7.	1–9
A	US 5401115 A (MUSIL et al.) 28 March 1995 See column 7, lines 30–52, column 9, line 43 – column 10, line 56, and figures 1–3.	1–9
A	US 2010-0209190 A1 (MUNZ et al.) 19 August 2010 See paragraphs [0053], [0080]–[0081] and figures 1–2, 10.	1–9
A	US 5201603 A (BASSETT et al.) 13 April 1993 See column 3, line 23 – column 5, line 68 and figures 1–2, 5–10.	1–9
A	US 2014-0186115 A1 (GRAHAM et al.) 03 July 2014 See paragraphs [0015], [0025] and figures 1–3.	1–9



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

24 April 2015 (24.04.2015)

Date of mailing of the international search report

24 April 2015 (24.04.2015)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2014/006766

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002-0141824 A1	03/10/2002	US 6543962 B2 WO 02-079576 A1	08/04/2003 10/10/2002
US 05401115 A	28/03/1995	US 05356238 A	18/10/1994
US 2010-0209190 A1	19/08/2010	CN 101806030 A CN 101806030 B EP 2218824 A1 EP 2218824 B1 JP 2010-190031 A US 8221026 B2	18/08/2010 17/12/2014 18/08/2010 26/12/2012 02/09/2010 17/07/2012
US 5201603 A	13/04/1993	EP 0540725 A1 EP 0540725 A4 EP 0540725 B1 JP 02997314 B2 WO 92-20870 A1	12/05/1993 13/10/1993 28/06/1995 11/01/2000 26/11/1992
US 2014-0186115 A1	03/07/2014	None	