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(54) SCISSORS-TYPE RETRACTABLE STRUCTURE

EINZIEHBARE STRUKTUR VOM SCHERENTYP

STRUCTURE RÉTRACTABLE DE TYPE CISEAUX

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Description

TECHNICAL FIELD

[0001] The present invention relates to a scissors-type retractable structure including a scissors structure.

BACKGROUND ART

[0002] We have experienced many times a phenomenon in which a bridge is washed away due to a typhoon, heavy rain in the rainy season, localized torrential rain, tsunami, and other flood disasters, or in which a bridge is damaged by an earthquake or a tremor. There is accordingly an increasing demand for a technique to restore bridges that have been washed away or damaged. It is also important to shorten the construction period of even a small bridge to reduce the construction cost.

[0003] In a spot struck by a disaster, a temporary bridge of known art is provided to allow passage of private construction vehicles. Construction of such a temporary bridge is achieved by transporting parts of a temporary girder bridge or a truss bridge made of heavy steel, and assembling these parts according to a method suitable for the spot. Construction methods such as the cantilever method, the bent support method, and the incremental launching method are commonly used to construct structures not only in such a spot struck by a disaster but also in other places. The construction according to these methods takes at least several days.

[0004] Meanwhile, an expandable scissors link for shear reinforcement is known from, for example, Patent Document 1. This scissors link is configured to occupy a small space when it is transported or stored, and to be extended to achieve desired structure and length when it is used.

CITATION LIST

PATENT DOCUMENT

[0005] Patent Document 1: Japanese Unexamined Patent Publication No. H11-210161. GB 1 068 155, GB 2 161 573 and WO 2010/127894 disclose scissors-type retractable structures.

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0006] A scissors mechanism as described in Patent Document 1 has been difficult to apply to a large structure such as a bridge. This may be because, for example: the scissors mechanism provides few advantages when used as a bridge; it includes a controller, which increases the cost; if no control member is incorporated, it may come to be an instable structure; and while having a high stiffness in one direction, it tends to have a low stiffness in another direction. Further, stress concentration and wear which may occur due to the presence of hinges (pivots) at intersection points of parts make it difficult for the bridge design to ensure structural strength.

[0007] To address this problem, deck plates may be provided to stabilize the scissors mechanism in an extended state, and to allow automobiles and other vehicles to pass across the mechanism. However, provision of the deck plates results in an increase in the number of parts. Further, for folding the scissors mechanism again, it requires huge force to erect the deck plates laying horizontally by applying the force in the horizontal direction. Furthermore, the increase in the number of the parts by the number of the deck plates complicates the configuration and the mechanism.

[0008] In view of the foregoing background, it is therefore an object of the present invention to provide a scissors-type retractable structure which has a simple configuration, and is easy to transport, retract, and extend.

SOLUTION TO THE PROBLEM

[0009] To achieve the above object, the scissors-type retractable structure of the present invention is configured to form a substantially flat surface when the retractable structure is in a fully extended state, without using deck plates.

[0010] Specifically, a first aspect of the present invention relates to a scissors-type retractable bridge which is extendable in an extension direction.

[0011] The scissors-type retractable bridge includes: at least one scissors frame including a plurality of frame elements each consisting of two frame members pin-connected to each other at central portions of the frame members, the plurality of frame elements pin-connected to each other at end portions of the frame members, each frame member including a frame body having a pin-insertion central hole formed in a central portion of the frame body, and a deck member provided on an upper side of the frame body.

[0012] When the scissors frame is in an extended state, part of the frame members forming the frame elements and positioned on a near side in the width direction of the retractable bridge are linearly coupled to each other, and the other part of the frame members forming the frame elements and positioned on a far side in the width direction of the retractable bridge are linearly coupled to each other, thereby causing upper surfaces of the frame members to form a continuous flat surface, the deck members being configured to form part of the flat surface, whereby the frame member functions as a scissors structure and as a deck plate structure as well, so that stabilization is achieved without using separate deck plate members.

[0013] With this configuration, when the scissors frames are in a fully extended state, the upper surfaces of the frame members form a flat surface. Therefore, stabilization is achieved without using separate deck plate

members, and the upper surfaces of the frame members function as deck plates to allow pedestrians and vehicles to pass over the frame members. Thanks to the absence of deck plate members, unlike a structure including deck plate members, it does not need huge force to erect the scissors-type retractable structure of the present invention being in its horizontal position and to bring the retractable structure into a standby state. The absence of deck plate members may result in a decrease in the number of parts, simplification of the configuration, and weight reduction. Note that the "flat surface" as used herein refers to not only a completely flat surface, but also a surface which is uneven to the extent that pedestrians and vehicles are allowed to pass. Further, a plate-like member may be placed on, and integrally and firmly secured to, the upper surfaces of the frame members in an extended state, with bolts or other fasteners.

[0014] A second aspect of the present invention is an embodiment of the scissors-type retractable bridge according to the first aspect, in which
the at least one scissors frame includes a plurality of scissors frames arranged side by side toward the far side, and the plurality of scissors frames in the extended state form a girder.

[0015] With this configuration, when the retractable structure is used as a girder, the width of the girder may be increased by arranging the plurality of scissors frames side by side toward the far side.

[0016] A fourth aspect of the present invention is an embodiment of the scissors-type retractable bridge according to one of the first to third aspects, in which
in plan view of the at least one scissors frame, junctions between adjacent ones of the frame members positioned on the near side are not aligned with junctions between adjacent ones of the frame members positioned on the far side.

[0017] With this configuration, the junctions that are not aligned with each other distribute stress applied when a heavy object passes, and avoid stress concentration.

[0018] A fifth aspect of the present invention is an embodiment of the scissors-type retractable bridge according to one of the first to fourth aspects, in which
lower end portions of the at least one scissors frame are supported on a plurality of pontoons, and the at least one scissors frame is extended by increasing a distance between adjacent ones of the plurality of pontoons.

[0019] With this configuration, the pontoons coupled to each other are towed over a water surface, and the distances between the pontoons are increased in a desired spot. In this manner, a temporary bridge of which the lower end portions are supported on the pontoons may be easily provided over the water surface.

[0020] A sixth aspect of the present invention is an embodiment of the scissors-type retractable bridge according to one of the first to fourth aspects, in which
the retractable bridge is able to be placed on a trailer of a trailer truck, and further includes an outrigger provided outside relative to the trailer and extends in a vertical direction to support a weight of the retractable bridge.

[0021] With this configuration, the scissors-type retractable structure in a standby state may be transported on the trailer of the trailer truck, and may be placed on the ground or other planes by using the outrigger in a desired spot. Thereafter, the trailer tuck is moved, and the retractable structure is extended. In this manner, a temporary bridge or structure may be provided quite quickly and easily. For removal, the retractable structure, which has been retracted, may be placed on the trailer of the trailer truck by the outrigger, without having to use a crane to raise the retractable structure. Thus, the use of the outrigger enables the scissors-type retractable structure to be loaded and unloaded quite easily, without having to use a special machine such as a crane.

ADVANTAGES OF THE INVENTION

[0022] As can be seen from the foregoing, the scissors-type retractable bridge of the present invention is configured such that the upper surfaces of the scissors frames in an extended state form a flat surface. Thus, the scissors-type retractable structure of the present invention has a simple configuration, is easy to transport, retract, and extend, and forms a stable structure when in an extended state.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

FIG. 1 is a front view of a scissors-type retractable bridge according to an embodiment of the present invention, which is in the course of extension.

FIG. 2 corresponds to FIG. 1 and shows the scissors-type retractable bridge in a standby state.

FIG. 3 corresponds to FIG. 1 and shows the scissors-type retractable bridge in an erected state before being extended.

FIG. 4 is a front view of a scissors linkage in the course of extension.

FIGS. 5A-5C show the scissors linkage in an extended state, where FIG. 5A is a front view, FIG. 5B is a plan view, and FIG. 5C is a perspective view.

FIGS. 6A-6D show a frame member on an enlarged scale, where FIG. 6A is a front view, FIG. 6B is a plan view, FIG. 6C is a bottom view, and FIG. 6D is a perspective view.

FIGS. 7A and 7B show three scissors linkages coupled to one another in a width direction, where FIG. 7A is a plan view and FIG. 7B is a perspective view.

FIG. 8 is a front view schematically showing a scissors-type retractable bridge according to a first variation, which is being extended between suspension bridge towers, as an example application.

FIGS. 9A and 9B schematically show a scissors-type retractable bridge according to a second variation, which is used together with pontoons, as an example

application, where FIG. 9A is a front view of the retractable bridge in a standby state and FIG. 9B is a front view of the retractable bridge in an extended state.

FIG. 10 is a front view of a scissors-type retractable bridge according to a third variation, which is on the trailer of a trailer truck.

DESCRIPTION OF EMBODIMENTS

[0024] An embodiment of the present invention will be described below with reference to the drawings.

[0025] FIG. 1 shows a scissors-type retractable structure according to the embodiment of the present invention and configured as scissors-type retractable bridge 1, which is in the course of extension. FIG. 2 shows the scissors-type retractable bridge 1 in a standby state. FIG. 3 shows the scissors-type retractable bridge 1 which has been brought into an erected state from the state shown in FIG. 2. This scissors-type retractable bridge 1 is extendable and retractable in an extension direction, and configured to become flat in a fully extended state. Specifically, this scissors-type retractable bridge 1 includes at least one scissors frame 4. As also shown in FIGS. 4-6D, the scissors frame 4 includes a plurality of frame elements 3 (four frame elements 3 in FIG. 4) each of which is comprised of two frame members 2 (see FIGS. 6A-7B) pin-connected to each other at pin-insertion central holes 2a (shown in FIGS. 6A-6D) formed in central portions of the frame members 2. The plurality of frame elements 3 are pin-connected to each other at end portions of the frame members 2. Each frame member 2 includes a frame body 7 which has pin-insertion end holes 2d in both end portions and plurality of through holes 2b for weight reduction, and a deck member 8 provided on the upper side of the frame body 7 and configured to form part of a flat surface. The frame member 2 may be made of, for example, a single integral extrusion member of an aluminum alloy which includes a hollow and has a small weight and high stiffness, or a three-dimensionally optimally shaped built member. Alternatively, the frame member 2 may be configured as an assembly of the frame body 7 and the deck member 8 made of different materials. The frame member 2, which functions as a scissors structure and as a deck plate structure as well, leads to a decrease in the number of parts, eases the assembly, and reduces resistance caused by the geometrical structure of deck plates.

[0026] As shown in detail in FIGS. 6A-6D, the frame body 7 has a support notch 7a formed at its base end, and a mating support notch 7b formed at its tip end. The mating support notch 7b is brought into contact with, and supported on, the support notch 7a of an adjacent frame body 7. The support notch 7a and the mating support notch 7b need to be shaped such that the notches 7a and 7b interfere with each other only after the scissors-type retractable bridge 1 is fully extended, stabilize once the retractable bridge 1 is fully extended and positioned horizontally, and enable the retractable bridge 1 to support the weights of pedestrians and automobiles passing over the deck members 8.

[0027] As shown in FIG. 4, one frame element 3 includes two frame members 2. These two frame members 2 are connected to each other via a center shaft 2c which penetrates, and extends in parallel to, the pin-insertion central holes 2a formed in the central portions of the two frame members 2. This allows the two frame members 2 to pivot about the center shaft 2c just like a pair of scissors. When the scissors frame 4 is in an extended state, part of the frame members 2 forming the frame elements 3 and positioned on a near side are linearly coupled to each other, and the other part of the frame members 2 forming the frame elements 3 and positioned on a far side are linearly coupled to each other. Consequently, the upper surfaces of the frame members 2 form a continuous flat surface shown in FIG. 5A. As shown in FIG. 5B, in the scissors frame 4 in the extended state, junction lines A between the frame members 2 on the near side are not aligned with junction lines B between the frame members 2 on the far side, in plan view. Causing the junctions not to be aligned with each other in this manner may avoid stress concentration. Note that for the sake of simplification, FIGS. 1-7B show a small number of the frame members 2 and other components, and that the number of these components is not particularly limited to this.

[0028] As shown in, for example, FIGS. 7A and 7B, it is suitable to arrange three scissors frames 4 side by side in the width direction to increase the width of the retractable bridge 1. The number of the scissors frames 4 to be arranged may be suitably determined according to the relation between the width of the deck member 8 and the width of a girder which is needed to allow pedestrians or vehicles to cross the retractable bridge 1.

[0029] Further, horizontal shafts 2e extending in the width direction of the scissors-type retractable bridge 1 are coupled respectively to the pin-insertion end holes 2d positioned above, and the pin-insertion end holes 2d positioned below. As a result, the frame elements 3 adjacent in the extension direction are coupled to each other. Long horizontal shafts 2e extending in the width direction may be used at appropriate intervals to couple the frame elements 3 arranged in the width direction to one another, which may increase the strength. Although it is ideal that all of the deck members 8 form a flat surface when the scissors frames 4 are in an extended state, the resultant deck surface may be uneven to the extent that pedestrians and vehicles are allowed to pass. For example, arranging a pair of scissors frames 4 in the width direction with a spacing provided therebetween and corresponding to the distance between the wheels of an automobile (the vehicle width) allows the automobile to run on the scissors frames 4. Note that a scissors linkage 6 which includes the plurality of scissors frames 4 arranged side by side toward the far side may be increased in the width to allow ordinary automobiles of different

types to pass at the same time. In this case, it is suitable to arrange two or more scissors frames 4 in parallel to each other such that the scissors frames 4 at least correspond to the wheels of the ordinary automobiles.

[0030] The scissors-type retractable bridge 1 includes the plurality of frame elements 3 each including the frame members 2 and coupled to each other such that the resultant girder has a length desired in a spot where the retractable bridge 1 is provided. As shown in FIG. 1 and other drawings, the scissors linkage 6 including these frame elements 3 each comprised of the frame members 2 has an end secured to a pedestal frame 10. This pedestal frame 10 is installed on an installation plane P where the scissors-type retractable bridge 1 is provided, and made of, for example, a welded structure having an L shape as viewed from a side. The pedestal frame 10 includes, on its portion which is positioned vertically in an extended state, a guide member 11 having the shape of a gutter and determining a direction in which the frame members 2 are extended. Although the details are not shown in the drawings, a roller 11a provided to the frame member 2 closest to the counter-extension direction side moves vertically in this vertical guide member 11, thereby controlling the direction in which the frame elements 3 are extended.

[0031] The pedestal frame 10 is coupled to a base 12 having a rectangular frame shape of which the long sides extend in the extension direction such that the pedestal frame 10 may be erected and laid down. Specifically, a pedestal frame control cylinder 13 is provided which has an end coupled to a counter-extension direction side end of the base 12, and the other end coupled to the pedestal frame 10. The pedestal frame 10 has its counter-extension direction side end pivotably coupled to a pivot 12a of the base 12. This configuration allows the pedestal frame 10 to be erected and laid down with respect the base 12 according to extension and retraction of the pedestal frame control cylinder 13.

[0032] For example, the base 12 has, at its extension direction side end, an anchor 18 to which the pedestal frame 10 is coupled and anchored. The anchor 18 may be omitted, and its shape is not particularly limited.

[0033] The scissors-type retractable bridge 1 further includes an extension assistance mechanism 23 which assists the scissors linkage 6 in extending and retracting. Specifically, the pedestal frame 10 is provided with, on both its sides in the width direction, extension speed-regulating cylinders 14 functioning as means for regulating an extension speed. These extension speed-regulating cylinders 14 assist the scissors linkage 6 in extending and retracting. For example, a first sprocket 15 is attached to an end of each extension speed-regulating cylinder 14. Extending and retracting each extension speed-regulating cylinder 14 may vary a distance between the first sprocket 15 and a second sprocket 16 which is fixed to a lower portion of the pedestal frame 10. An extension chain 17 is wrapped around each pair of the first and second sprockets 15 and 16. Each extension chain 17 has an end secured to the pedestal frame 10 and the other end coupled to an end of the second frame member 2 from the counter-extension direction side.

[0034] The extension assistance mechanism 23 includes, for example, an extension cylinder 19. The extension cylinder 19 has a cylinder tube fixed to the base 12 and a vertical arm 19a projecting from the end of its rod. When the extension cylinder 19 retracts, this arm 19a pushes, for example, the second horizontal shaft 2e from the counter-extension direction side, causing the scissors linkage 6 to start extending. The scissors linkage 6 then continues extending due to its own weight.

[0035] During the extension of the scissors linkage 6 due to its own weight, the extension chains 17 are pulled and the extension speed-regulating cylinders 14 extend, which allows the scissors frames 4 to open. At this time, a hydraulic device (not shown) controls a flow rate of hydraulic fluid from the extension speed-regulating cylinders 14 to regulate the extension speed (a so-called meter-out control). The retraction may be performed in such a manner that the extension speed-regulating cylinders 14 are forced to retract by receiving supply of the hydraulic fluid so as to pull back the extension chains 17, thereby closing the opened frame members 2. Adjustment of the number of falls of the extension chains 17 enables regulation of the speed and distance of the movement of the extension chains 17 even if strokes of the extension speed-regulating cylinders 14 are restricted.

[0036] It is suitable, for example, to provide a separate electric hydraulic unit (not shown) functioning as a hydraulic source for the pedestal frame control cylinder 13, the extension speed-regulating cylinders 14, and the extension cylinder 19.

[0037] An extension sheave 20 is provided at the top end of the pedestal frame 10. A wire 22 of a hand-operated winch 21 installed on the installation plane P is wrapped around the extension sheave 20, and an end of this wire 22 is coupled to an end of the frame member 2 at the forefront in the extension direction. For example, if the extension is performed by the own weight of the scissors linkage 6, the extension speed of the scissors linkage 6 may be regulated by manipulating the hand-operated winch 21. Thus, the winch 21 may be used as a means for regulating the extension speed. Although the hand-operated winch 21 may be replaced with a hydraulic winch or an electric winch, the hand-operated winch 21 has an advantage that the extension may be performed with human power. An electric winch may be actuated using a battery of an automobile, if applicable.

[0038] Next, it will be described how the scissors-type retractable bridge 1 according to this embodiment operates.

[0039] First, in the standby state shown in FIG. 2, the pedestal frame 10 is secured to the counter-extension direction side end portion of the base 12. The pedestal frame control cylinder 13, the extension speed-regulating cylinders 14, and the extension cylinder 19 are all in the

retracted state. Holding these cylinders in the retracted state enables the retractable bridge 1 to be maintained the standby state. Note that a lock device may be separately provided to maintain in the retractable bridge 1 in the standby state. The retractable bridge 1 retracted into the compact standby state may be transported by trailer truck, boat, ship, large helicopter, or other means.

[0040] Next, a separately provided hydraulic unit is connected to the pedestal frame control cylinder 13, extension speed-regulating cylinders 14, and the extension cylinder 19.

[0041] The pedestal frame control cylinder 13 is then extended gradually until the pedestal frame 10 enters the erected state shown in FIG. 3. In this state, the scissors linkage 6 is still in the retracted state.

[0042] Next, the extension cylinder 19 is supplied with the hydraulic fluid and extended gradually. Consequently, the arm 19a of the extension cylinder 19 forces the horizontal shaft 2e extending in the width direction to slide and move, and the extension chains 17 are fed. At the same time, the hand-operated winch 21 feeds the wire 22. The extension speed is controlled by adjusting the amount of the hydraulic fluid discharged from the tube-rod side of the extension speed-regulating cylinders 14. Consequently, the intervals between all the frame members 2 are increased gradually. In this manner, the scissors frames 4 are extended not at once, but gradually and stably.

[0043] When each support notch 7a and the associated mating support notch 7b come into contact with each other to form a flat surface, the extension is stopped and the retractable bridge 1 stabilizes as shown in FIGS. 5A-5C. A locking means may be provided to stabilize the retractable bridge 1 in this state. Alternatively, a plate-like member may be placed on, and integrally and firmly secured to, the upper surfaces of the deck members 8 with bolts or other fasteners. In this manner, a temporary bridge is formed. As a result, the deck members 8 form a stable girder which allows passage of ordinary automobiles and pedestrians. Thus, the retractable bridge 1 may be transported to a spot struck by a disaster, and used to restore a damaged or washed away bridge quickly.

[0044] Conversely, retraction of the retractable bridge 1 is suitably performed by, for example, manually operating the hand-operated winch 21 or forcing the extension speed-regulating cylinders 14 to retract to fold the deck members 8 together with the scissors frames 4. As can be seen, the retractable bridge 1 may be extended and retracted without difficulty, and removal of the retractable bridge 1 may be performed quite easily as well. The use of the hand-operated winch 21 enables the extension and retraction to be performed with human power.

[0045] The frame members 2 of this embodiment are made of an aluminum alloy or a magnesium alloy and have a structure with a small weight and a high stiffness. Therefore, the retractable bridge 1 may be transported easily, and the strength is also ensured without difficulty.

[0046] According to this embodiment, when the scissors frames 4 are in a fully extended state, the upper surfaces of the frame members 2 form a flat surface. Therefore, stabilization may be achieved without using separate deck plate members. The upper surfaces of the frame members 2 function also as deck plates to allow pedestrians and automobiles to pass over the frame members 2. Thanks to the absence of deck plate members, unlike a bridge including deck plate members, it does not need huge force to erect the scissors-type retractable bridge 1 of this embodiment being in the horizontal position, and to bring the retractable bridge 1 into the standby state. The absence of deck plate members may result in a decrease in the number of parts, simplification of the configuration, and weight reduction.

[0047] The plurality of scissors frames 4 arranged toward a far side form a girder when the scissors frames 4 are in the extended state. Thus, the width of the girder may be increased easily when the scissors frames 4 are used as the girder.

[0048] As can be seen, the scissors-type retractable bridge 1 according to this embodiment is configured such that the upper surfaces of the scissors frames 4 in the extension state form a flat surface. Thus, the scissors-type retractable bridge 1 has a simple configuration, is easy to transport, retract, and extend, and forms a stable structure in the extended state.

[0049] Since the scissors-type retractable bridge 1 of this embodiment is prefabricated in, for example, a factory, the retractable bridge 1 has a high quality and a high degree of perfection. Transportation and dealing of the retractable bridge 1, which can be folded compactly, may be performed quite easily.

[0050] Further, the retractable bridge 1 may increase choices of countermeasures against difficult restoration work in a spot struck by a disaster, and improve conformability with the spot.

[0051] In a situation where an aging bridge is repaired to extend its life and the main truss such as the main girder is subjected to the repair work, a problem is usually caused: the bridge has to be closed. The scissors-type retractable bridge 1 of this embodiment including the scissors linkage 6 may be used to address this problem. Specifically, with restriction of passage of vehicles, the retractable structure of the retractable bridge 1 is secured to portions receiving reaction force, on the bridge piers or bridge abutments, thereby provisionally reinforcing the aging bridge. Thus, the retractable bridge 1 may advantageously enable the repair of the aging bridge to be performed, while reducing burden on the aging bridge.

[0052] Further, this embodiment is of high utility value for landing piers of fishing ports or harbors. Specifically, the retractable bridge 1 of this embodiment may be temporarily provided only when needed, which may avoid restriction of use of a landing pier, and damage caused by a typhoon, a storm surge, or other disasters. Thus, the retractable bridge 1 of this embodiment provides convenience to the users and administrator.

[0053] Further, the retractable bridge 1 of this embodiment may be used as an escape bridge for a middle-to-low building. For example, in case of fire, an escape route may be ensured by extending the retractable bridge 1 to an adjacent building. Thus, the retractable bridge 1 of this embodiment may provide a great advantage in case of emergency.

- First Variation -

[0054] FIG. 8 is a front view schematically showing a scissors-type retractable bridge 101 according to a first variation of this embodiment, which is being extended between suspension bridge towers 130, as an example application. Note that in the following variations, components that are the same as those shown in FIGS. 1-7B will be denoted by the corresponding reference characters, and detailed description thereof will be omitted herein.

[0055] In this variation, for example, the scissors linkage 6 has an end secured to one of the suspension bridge towers 130, and the other end provided with an extension sheave 120 around which a wire 122 is wrapped. The wire 122 has an end wrapped around another extension sheave 120 provided to the other tower 130. The scissors linkage 6 is extended by pulling the end of the wire 122 with a crane or a winch, and the other end of the scissors linkage 6 is then secured to the latter tower 130, thereby providing a temporary scissors-type retractable bridge 101.

[0056] Note that the wire 122 may be pulled directly with a crane or other apparatus, without being wrapped around the extension sheave 120 provided to the latter tower 130.

[0057] This configuration eliminates conventional problems which have occurred in construction sites: It is no longer needed to assemble a bridge body temporarily and to ensure a temporary work site or space having a length equivalent to that of the bridge. This configuration enables the main body of a temporary bridge to be provided in a short time by using a crane, while eliminating need for a special device or need for taking great care for maintaining balance, which is required in, for example, the incremental launching method.

- Second Variation -

[0058] FIGS. 9A and 9B schematically show a scissors-type retractable bridge 201 according to a second variation of this embodiment, which is used together with pontoons 230, as an example application. FIG. 9A is a front view of the retractable bridge in a standby state, and FIG. 9B is a front view of the retractable bridge in a fully extended state.

[0059] The lower end portions of scissors frames 4 are supported on the plurality of pontoons 230. A pontoon is a boat having a flat bottom, which is also called "flat-bottomed boat" or "ponton." Extension of the retractable bridge 201 is performed by increasing the distance between adjacent ones of the pontoons 230 to extend the scissors linkage 6.

[0060] In this variation, as shown in FIG. 9A, the pontoons 230 coupled to each other are towed over a water surface 231 by, for example, a tugboat. In a desired spot, the pontoons 230 on which the lower end portions of the scissors linkage 6 are supported are separated from each other to increase the distance therebetween until the deck members 8 become positioned horizontally and coupled to each other, thereby easily providing the temporary bridge over the water surface 231, as shown in FIG. 9B. No bridge piers are needed in this case.

[0061] As can be seen, the present invention also makes it possible to easily construct, in a river or a harbor, a bridging system in which a plurality of pontoons 230 are linked via a scissors linkage 6. Gathering several pontoons 230 compactly enables a pontoon bridge system which has, by nature, a large size to be constructed easily. This system may also ensure an escape route in case of a disastrous flood.

[0062] This variation may be applied to a case where a "gangplank" for allowing passengers of a boat to land on a shore is needed (in particular, to a conceivable situation where harbor facilities are also damaged seriously by an earthquake). Specifically, a compact scissors linkage 6 with which a boat is equipped may be utilized flexibly, and may enable passengers of the boat to transfer safely from the boat to another boat.

- Third Variation -

[0063] FIG. 10 is a front view of a scissors-type retractable bridge 1 according to a third variation of this embodiment, which is placed on the trailer 331 of a trailer truck 330.

[0064] In this variation, the base 12 including the pedestal frame 10 is placed on the trailer 331 of the trailer truck 330. The trailer 331 is towed by the trailer truck 330 to a work site, where the scissors-type retractable bridge 1 is unloaded and its scissors linkage 6 is extended.

[0065] Specifically, the scissors-type retractable bridge 1 in the standby state is transported on the trailer 331 of the trailer truck 330. In the work site, outriggers 332 provided to the retractable bridge 1 are extended to raise the retractable bridge 1, and the trailer truck 330 is then moved forward to place the retractable bridge 1 on the ground or any other plane.

[0066] After the placement, the scissors linkage 6 may be extended while the outriggers 332 remain extended or after the outriggers 332 are retracted. Performing the extension after placing the retractable bridge 1 on the ground or any other plane in the work site by using the outriggers 332 in this manner may enable a temporary bridge to be provided quite quickly and easily.

[0067] Conversely, to perform the removal, after the scissors linkage 6 is retracted, the trailer 331 of the trailer truck 330 is moved to be stopped under the retractable

bridge 1 held raised by the outriggers 332. Thereafter, the outriggers 332 are retracted, thereby placing the retractable bridge 1 on the trailer 331 for removal, without having to use a crane to raise the retractable bridge 1.

[0068] In this variation, the use of the outriggers 332 enables the scissors-type retractable bridge 1 to be loaded and unloaded quite easily, without having to use a special machine such as a crane.

- Fourth Variation -

[0069] A fourth variation, which is not shown in the drawings in detail, is configured as follows: The scissors-type retractable bridges 1 each of which is able to extend by itself in a cantilevered state are allowed to extend from opposite banks. A bent or any other support is provided at the middle between the banks to support the retractable bridges 1. The scissors linkages 6 of both retractable bridges 1 are coupled to each other at the middle between the banks. Thereafter, the bent or the support is removed. In this manner, a desired bridge may be constructed quickly.

- Fifth Variation -

[0070] A fifth variation, which is not shown in the drawings in detail, is configured as follows: A plurality of bents functioning as supports are arranged. Two scissors-type retractable bridges 1 are extended over a predetermined span in the opposite directions from an associated one of the plurality of bents. Couplings are provided between the scissors linkages 6 extending in the opposite directions and joining with each other, and the bents provided as supports are then removed. In this manner, a desired bridge may be constructed quickly.

(Other Embodiments)

[0071] The embodiment of the present invention described above may be modified as follows.

[0072] The embodiment described above includes the extension speed-regulating cylinders 14 including the extension chains 17 and functioning as the extension assistance mechanism 23. However, in particular, if the scissors-type retractable bridge 1 has a small size, the retractable bridge 1 may be extended and retracted using a hand-operated winch 21 alone, without having to include the extension chains 17 and the extension speed-regulating cylinders 14.

[0073] A wheel attached to the horizontal shaft 2e that is positioned toward the extension direction side may beneficially allow the scissors linkage 6 to extend smoothly.

[0074] Note that the embodiments described above are merely preferred examples in nature, and are not intended to limit the scope, application, or uses of the present invention as defined in the appendent claims.

INDUSTRIAL APPLICABILITY

[0075] As described above, the present invention is useful for a scissors-type retractable bridge.

DESCRIPTION OF REFERENCE CHARACTERS

[0076]

1	Scissors-type Retractable Bridge (Scissors-type Retractable Structure)
2	Frame Member
2a	Pin-insertion Central Hole
2b	Through Hole
2c	Center Shaft
2d	Pin-insertion End Hole
2e	Horizontal Shaft
3	Frame Element
4	Scissors Frame
6	Scissors Linkage
7	Frame Body
8	Deck Member
10	Pedestal Frame
11	Guide Member
11a	Roller
12	Base
12a	Pivot
13	Pedestal Frame Control Cylinder
14	Extension Speed-regulating Cylinder
15	First Sprocket
16	Second Sprocket
17	Extension Chain
18	Anchor
19	Extension Cylinder
19a	Arm
20	Extension Sheave
21	Hand-operated Winch
22	Wire
23	Extension Assistance Mechanism
101	Scissors-type Retractable Bridge (Scissors-type Retractable Structure)
120	Extension Sheave
122	Wire
130	Suspension Bridge Tower
201	Scissors-type Retractable Bridge (Scissors-type Retractable Structure)
230	Pontoon
231	Water Surface
330	Trailer Truck
331	Trailer
332	Outrigger

Claims

1. A scissors-type retractable bridge (1) extendable in an extension direction, the retractable bridge (1) comprising at least one scissors frame (4) including

a plurality of frame elements (3) each including two frame members (2) pin-connected to each other at central portions of the frame members (2), the plurality of frame elements (3) pin-connected to each other at end portions of the frame members (2), **characterized in that** each frame element (3) consists of two frame members (2) and **in that** each frame member (2) includes a frame body (7) having a pin-insertion central hole (2a) formed in a central portion of the frame body (7), and a deck member (8) provided on an upper side of the frame body (7), wherein, when the scissors frame (4) is in an extended state, part of the frame members (2) forming the frame elements (3) and positioned on a near side in the width direction of the retractable bridge (1) are linearly coupled to each other, and the other part of the frame members (2) forming the frame elements (3) and positioned on a far side in the width direction of the retractable bridge (1) are linearly coupled to each other, thereby causing upper surfaces of the frame members (2) to form a continuous flat surface, the deck members (8) being configured to form part of the flat surface, whereby the frame member functions as a scissors structure and as a deck plate structure as well, so that stabilization is achieved without using separate deck plate members.

2. The scissors-type retractable bridge of claim 1, wherein
the at least one scissors frame (4) comprises a plurality of scissors frames (4) arranged side by side toward the far side in the width direction of the retractable bridge (1), and
the plurality of scissors frames (4) in the extended state form a girder.

3. The scissors-type retractable bridge of claim 1 or 2, wherein
in plan view of the at least one scissors frame (4), junctions (A) between adjacent ones of the frame members (2) positioned on the near side in the width direction of the retractable bridge (1) are not aligned with junctions (B) between adjacent ones of the frame members (2) positioned on the far side in the width direction of the retractable bridge (1).

4. The scissors-type retractable bridge of any one of claims 1 to 3, wherein
lower end portions of the at least one scissors frame (4) are supported on a plurality of pontoons (230), and the at least one scissors frame (4) is extended by increasing a distance between adjacent ones of the plurality of pontoons (230).

5. The scissors-type retractable bridge of any one of claims 1 to 3, wherein
the retractable bridge (1) is able to be placed on a trailer (331) of a trailer truck (330), and further includes an outrigger (332) provided outside relative to the trailer (331) and extends in a vertical direction to support a weight of the retractable bridge (1).

Patentansprüche

1. Einziehbare Brücke (1) vom Scherentyp, die in eine Ausfahrrichtung ausfahrbar ist, wobei die einziehbare Brücke (1) mindestens einen Scherenrahmen (4) umfasst, der eine Vielzahl von Rahmenelementen (3) beinhaltet, von denen jedes zwei Rahmenglieder (2) beinhaltet, die an zentralen Abschnitten der Rahmenglieder (2) miteinander verstiftet sind, wobei die Vielzahl von Rahmenelementen (3) an Endabschnitten der Rahmenglieder (2) miteinander verstiftet sind,
dadurch gekennzeichnet, dass jedes Rahmenelement (3) aus zwei Rahmengliedern (2) besteht, und dadurch, dass jedes Rahmenglied (2) einen Rahmenkörper (7) beinhaltet, der ein zentrales Stifteinführungsloch (2a) aufweist, das in einem zentralen Abschnitt des Rahmenkörpers (7) gebildet ist, und ein Deckglied (8), das auf einer Oberseite des Rahmenkörpers (7) bereitgestellt ist,
wobei, wenn der Scherenrahmen (4) in einem ausgefahrenen Zustand ist, ein Teil der Rahmenglieder (2), die die Rahmenelemente (3) bilden und an einer nahen Seite in der Breitenrichtung der einziehbaren Brücke (1) positioniert sind, linear miteinander gekoppelt sind, und der andere Teil der Rahmenglieder (2), die die Rahmenelemente (3) bilden und an einer entfernten Seite in der Breitenrichtung der einziehbaren Brücke (1) positioniert sind, linear miteinander gekoppelt sind, wodurch bewirkt wird, dass obere Oberflächen der Rahmenglieder (2) eine durchgehende flache Oberfläche bilden, wobei die Deckglieder (8) konfiguriert sind, um einen Teil der flachen Oberfläche zu bilden, wodurch das Rahmenglied als eine Scherenstruktur und ebenfalls als eine Deckplattenstruktur funktioniert, sodass eine Stabilisierung ohne Verwendung eigener Deckplattenglieder erreicht wird.

2. Einziehbare Brücke vom Scherentyp nach Anspruch 1, wobei
der mindestens eine Scherenrahmen (4) eine Vielzahl von Scherenrahmen (4) umfasst, die Seite an Seite zur entfernten Seite in der Breitenrichtung der einziehbaren Brücke (1) angeordnet sind, und
die Vielzahl von Scherenrahmen (4) in dem ausgefahrenen Zustand einen Träger bilden.

3. Einziehbare Brücke vom Scherentyp nach Anspruch 1 oder 2, wobei
in Draufsicht auf den mindestens einen Scherenrahmen (4) Verbindungen (A) zwischen angrenzenden der Rahmenglieder (2), die an der nahen Seite in der

Breitenrichtung der einziehbaren Brücke (1) positioniert sind, nicht mit den Verbindungen (B) zwischen angrenzenden der Rahmenglieder (2), die an der entfernten Seite in der Breitenrichtung der einziehbaren Brücke (1) positioniert sind, ausgerichtet sind.

4. Einziehbare Brücke vom Scherentyp nach einem der Ansprüche 1 bis 3, wobei
untere Endabschnitte des mindestens einen Scherenrahmens (4) auf einer Vielzahl von Pontons (230) getragen werden, und der mindestens eine Scherenrahmen (4) durch Erhöhen eines Abstands zwischen benachbarten der Vielzahl von Pontons (230) ausgefahren wird.

5. Einziehbare Brücke vom Scherentyp nach einem der Ansprüche 1 bis 3, wobei
die einziehbare Brücke (1) imstande ist, auf einem Anhänger (331) eines Anhänger-LKW (330) platziert zu werden, und weiter einen Ausleger (332) beinhaltet, der außerhalb relativ zu dem Anhänger (331) bereitgestellt ist, und sich in eine vertikale Richtung erstreckt, um ein Gewicht der einziehbaren Brücke (1) zu tragen.

Revendications

1. Pont rétractable de type ciseaux (1) extensible dans une direction d'extension, le pont rétractable (1) comprenant au moins un cadre de ciseaux (4) comportant une pluralité d'éléments de cadre (3) comportant chacun deux éléments de cadre (2) reliés par une broche l'un à l'autre au niveau de parties centrales des éléments de cadre (2), la pluralité d'éléments de cadre (3) étant reliés par une broche les uns aux autres au niveau de parties d'extrémité des éléments de cadre (2),
caractérisé en ce que chaque élément de cadre (3) est constitué de deux éléments de cadre (2) et **en ce que** chaque élément de cadre (2) comporte un corps de cadre (7) ayant un trou central d'insertion de broche (2a) formé dans une partie centrale du corps de cadre (7), et un élément de tablier (8) prévu sur un côté supérieur du corps de cadre (7),
dans lequel, lorsque le cadre de ciseaux (4) est dans un état étendu, certains des éléments de cadre (2) formant les éléments de cadre (3) et positionnés sur un côté proche dans la direction de la largeur du pont rétractable (1) sont couplés linéairement les uns aux autres, et les autres des éléments de cadre (2) formant les éléments de cadre (3) et positionnés sur un côté éloigné dans la direction de la largeur du pont rétractable (1) sont couplés linéairement les uns aux autres, amenant ainsi des surfaces supérieures des éléments de cadre (2) à former une surface plane continue, les éléments de tablier (8) étant configurés pour faire partie de la surface plane, moyennant quoi l'élément de cadre sert à la fois de structure de ciseaux et de structure de plancher de tablier, de sorte que la stabilisation soit obtenue sans utiliser d'éléments de plancher de tablier séparés.

2. Pont rétractable de type ciseaux de la revendication 1, dans lequel
l'au moins un cadre de ciseaux (4) comprend une pluralité de cadres de ciseaux (4) agencés côte à côte vers le côté éloigné dans la direction de la largeur du pont rétractable (1), et
la pluralité de cadres de ciseaux (4) dans l'état étendu forment une poutre.

3. Pont rétractable de type ciseaux de la revendication 1 ou 2, dans lequel
en vue en plan de l'au moins un cadre de ciseaux (4), des jonctions (A) entre des éléments adjacents des éléments de cadre (2) positionnés sur le côté proche dans la direction de la largeur du pont rétractable (1) ne sont pas alignées avec des jonctions (B) entre des éléments adjacents des éléments de cadre (2) positionnés sur le côté éloigné dans la direction de la largeur du pont rétractable (1).

4. Pont rétractable de type ciseaux de l'une quelconque des revendications 1 à 3, dans lequel
des parties d'extrémité inférieure de l'au moins un cadre de ciseaux (4) sont supportées sur une pluralité de pontons (230), et l'au moins un cadre de ciseaux (4) s'étend en augmentant une distance entre des pontons adjacents de la pluralité de pontons (230).

5. Pont rétractable de type ciseaux de l'une quelconque des revendications 1 à 3, dans lequel
le pont rétractable (1) peut être placé sur une remorque (331) d'un camion remorque (330), et comporte en outre un stabilisateur (332) prévu à l'extérieur par rapport à la remorque (331) et s'étend dans une direction verticale pour supporter le poids du pont rétractable (1).

FIG.1

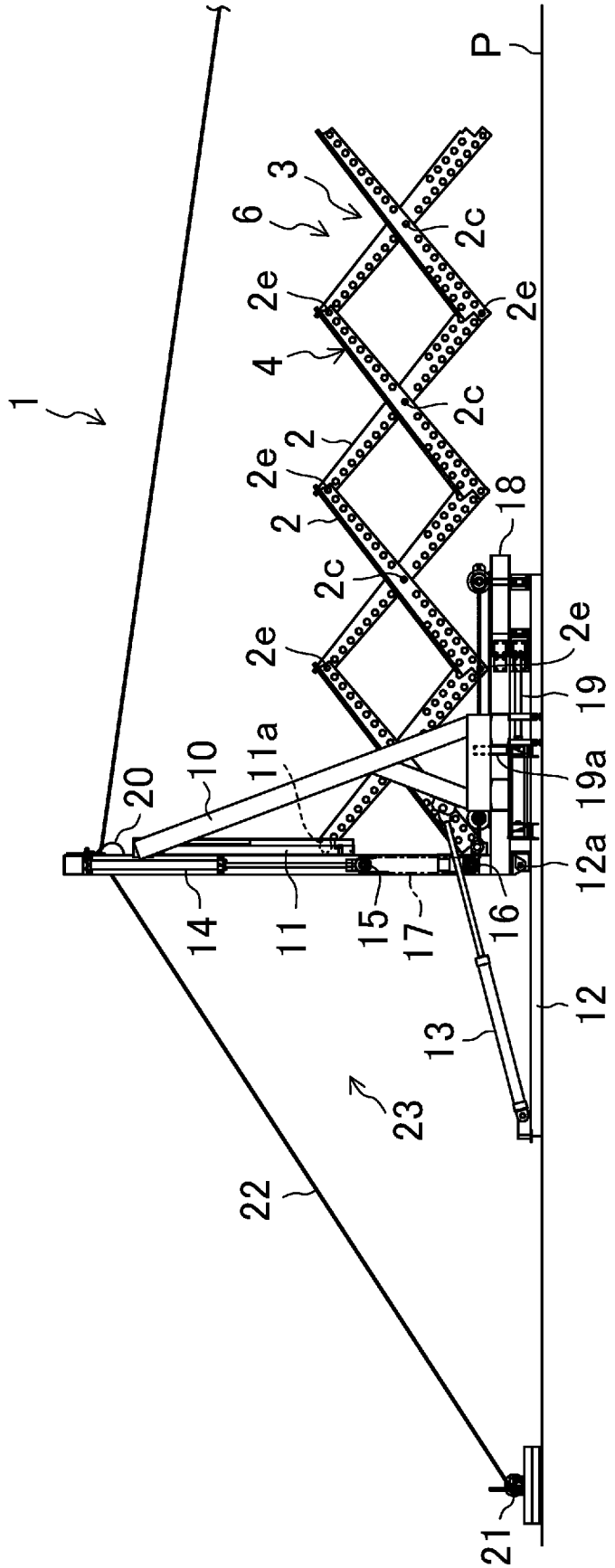
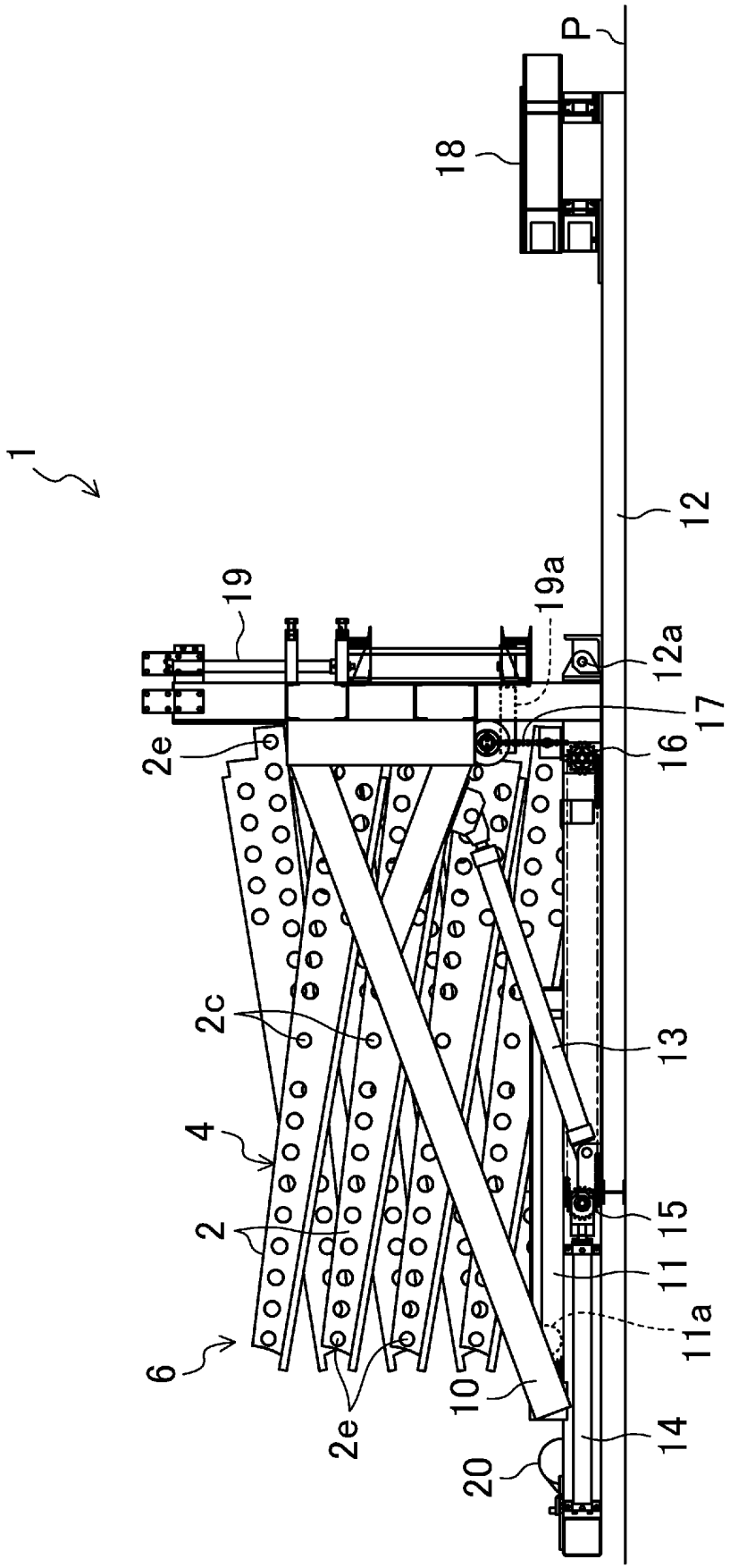


FIG.2



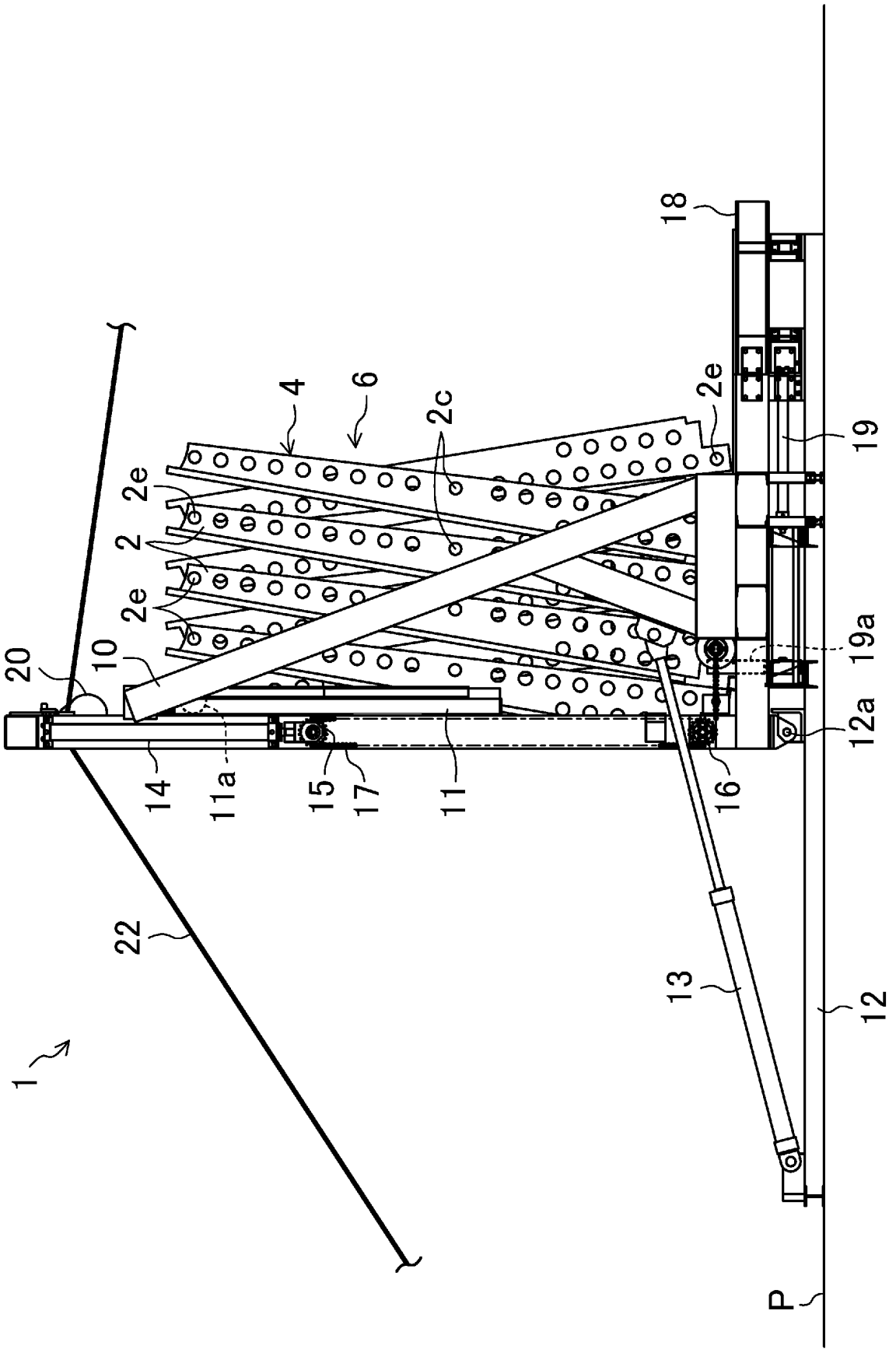
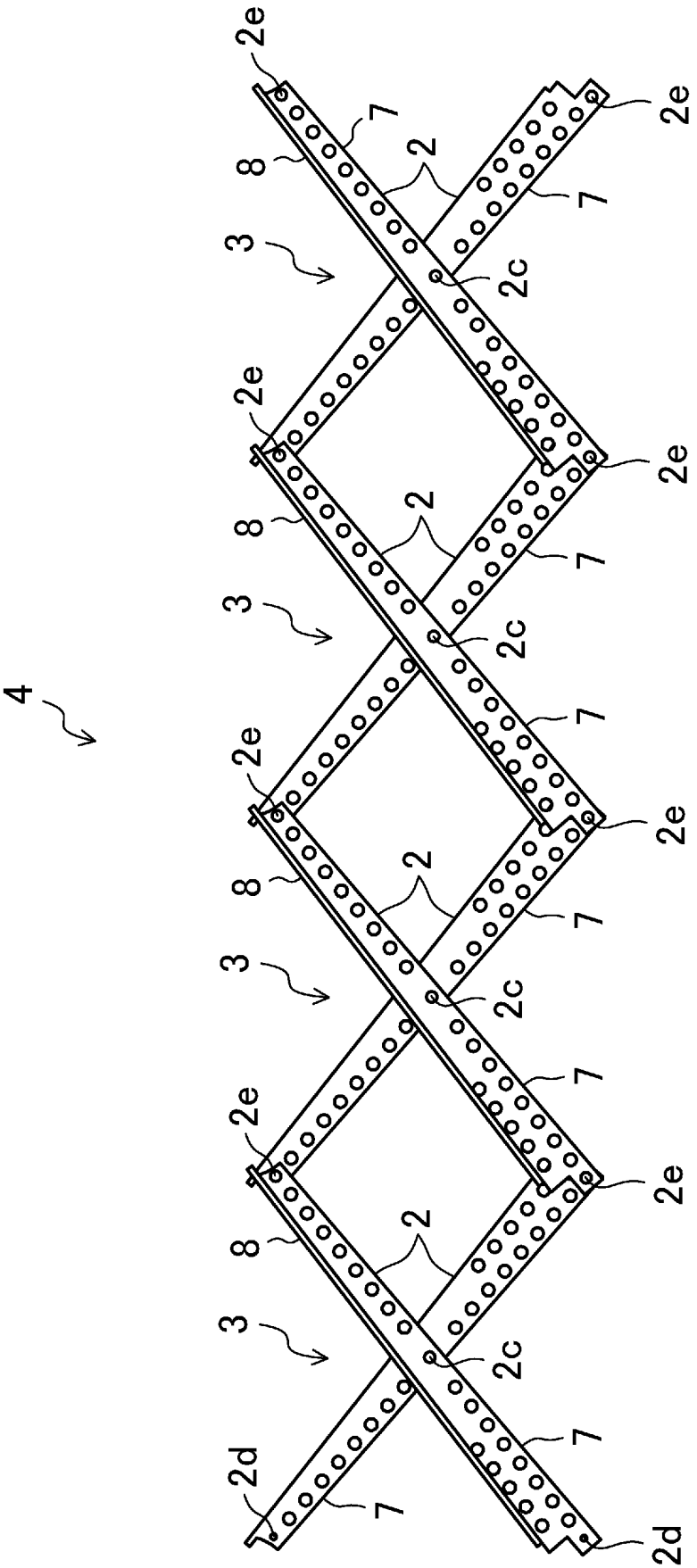


FIG.3

FIG.4



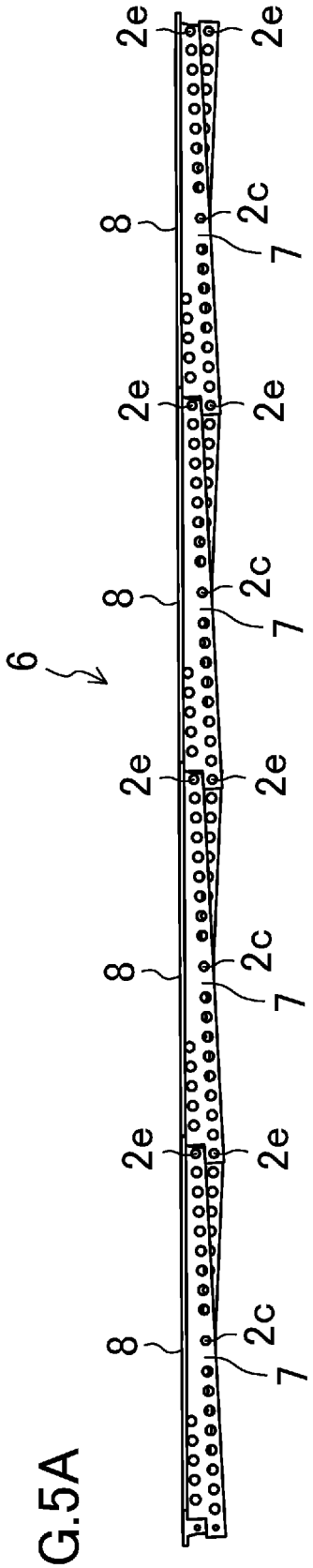


FIG.5A

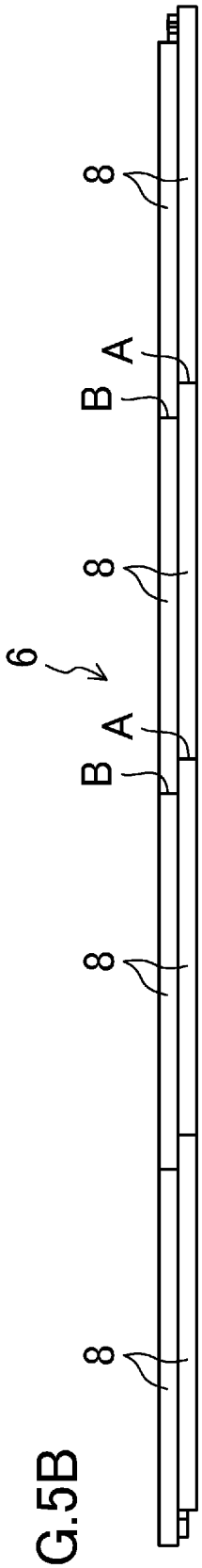


FIG.5B

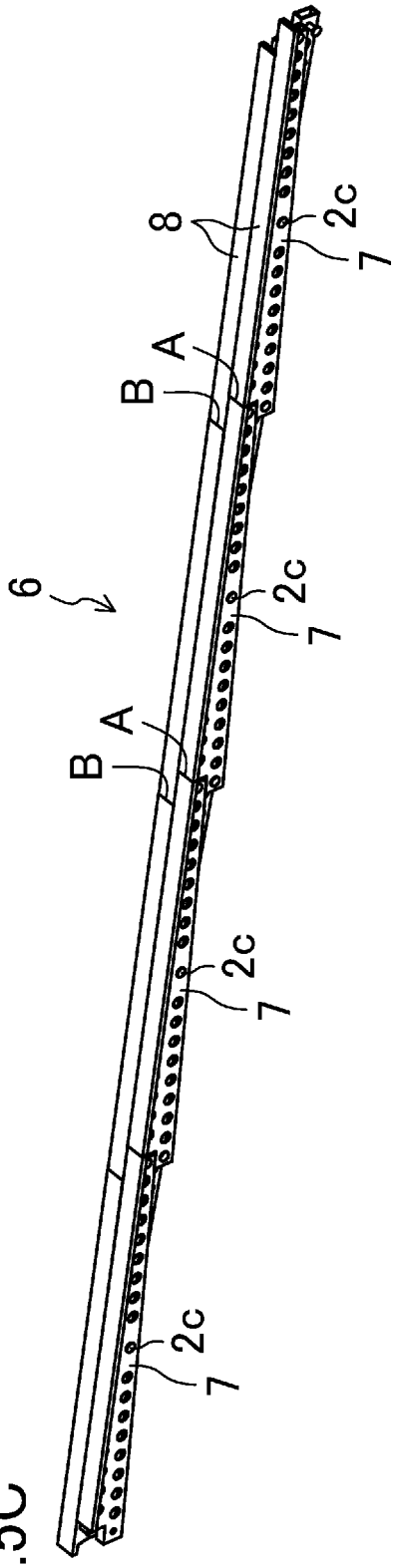


FIG.5C

FIG.6A

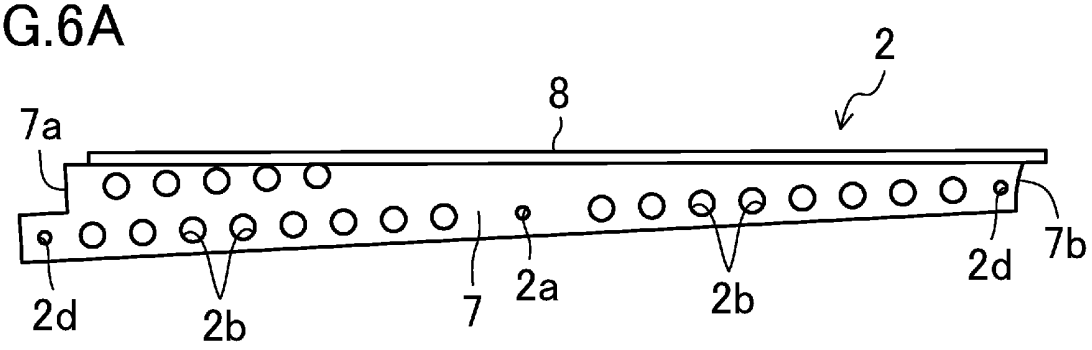


FIG.6B

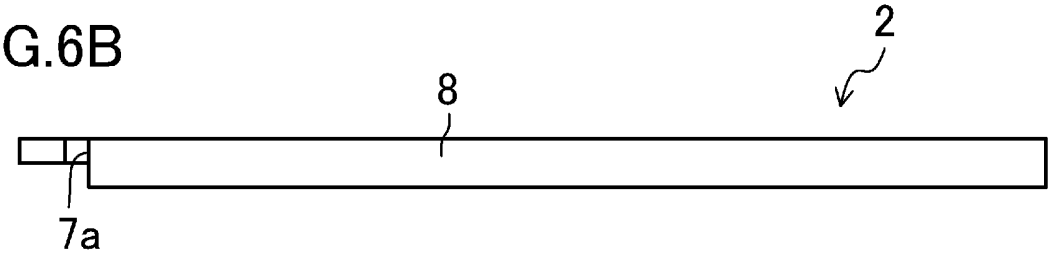


FIG.6C

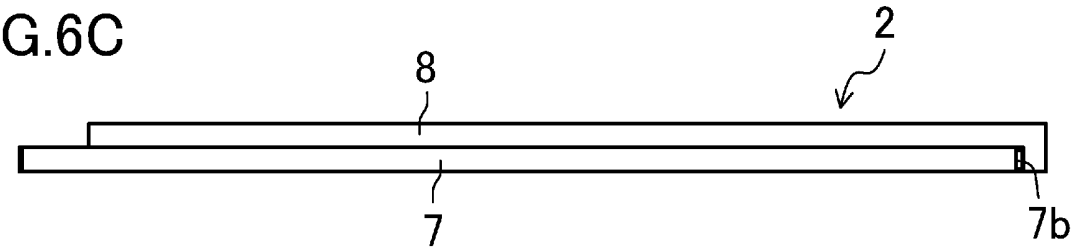


FIG.6D

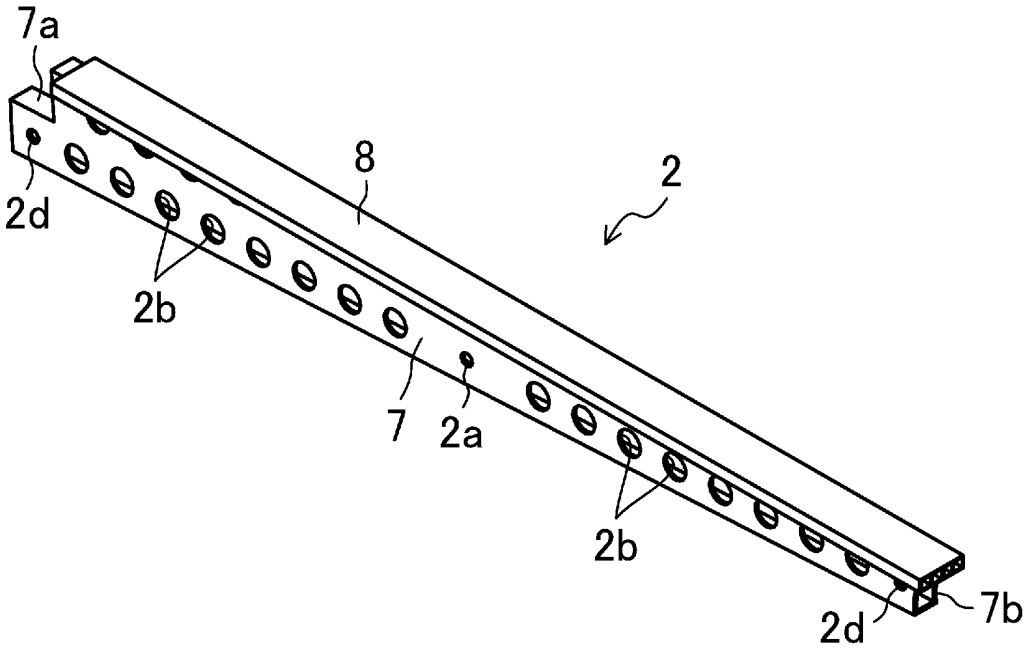


FIG.7A

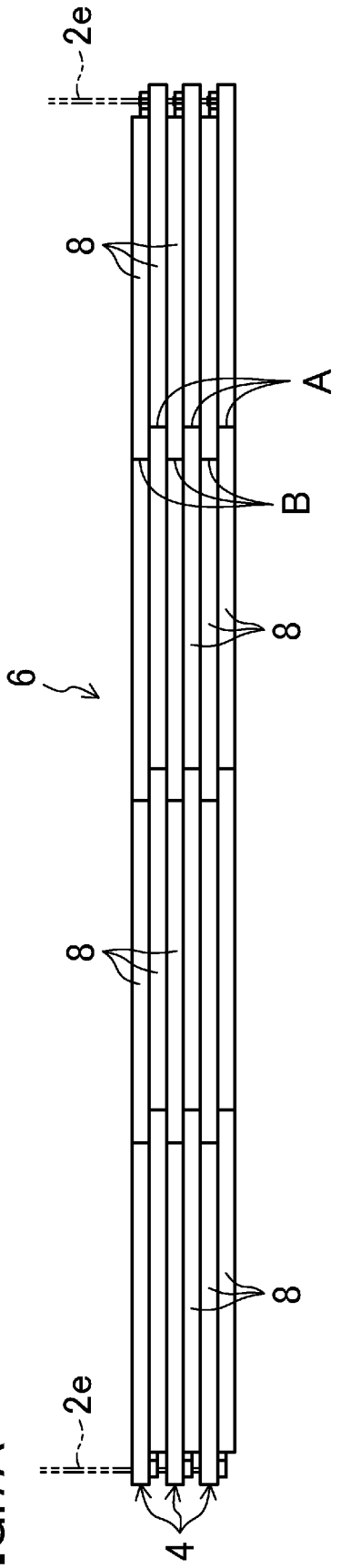

2e
8
A
B
8
6
8
8
2e
4

FIG.7B

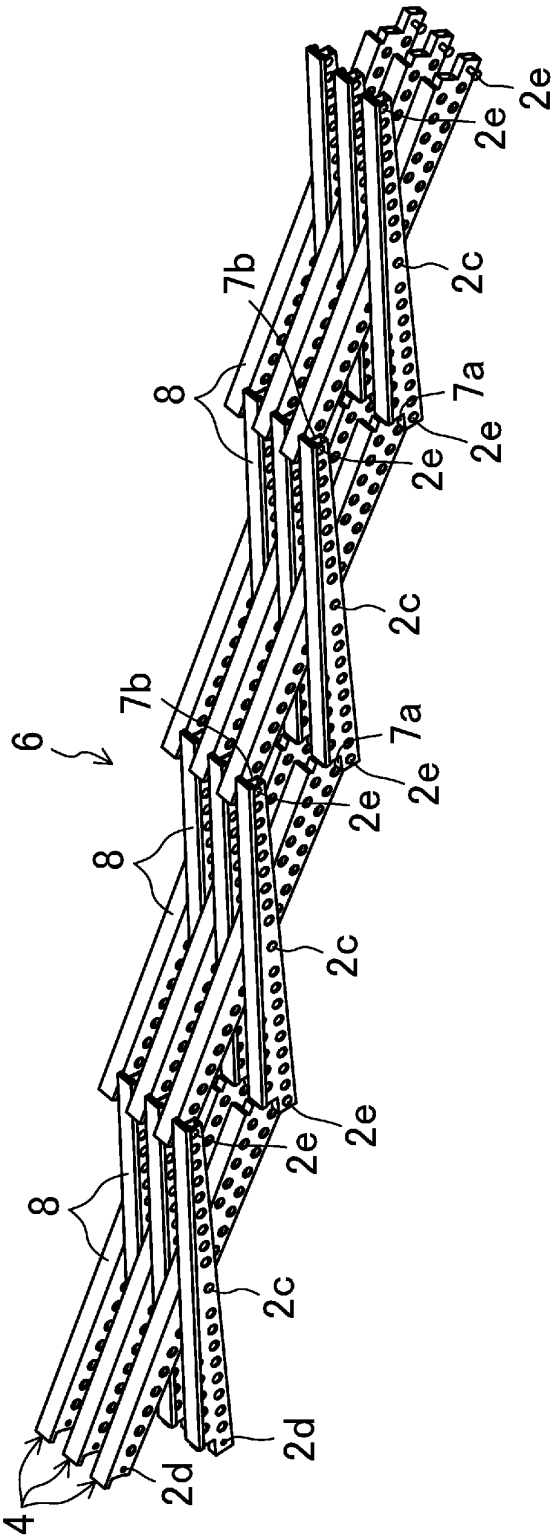

2e
2e
2e
7b
2c
8
7a
2e
2e
2c
7b
6
7a
2e
2e
8
2c
2e
2e
8
2c
2d
2d
4

FIG.8

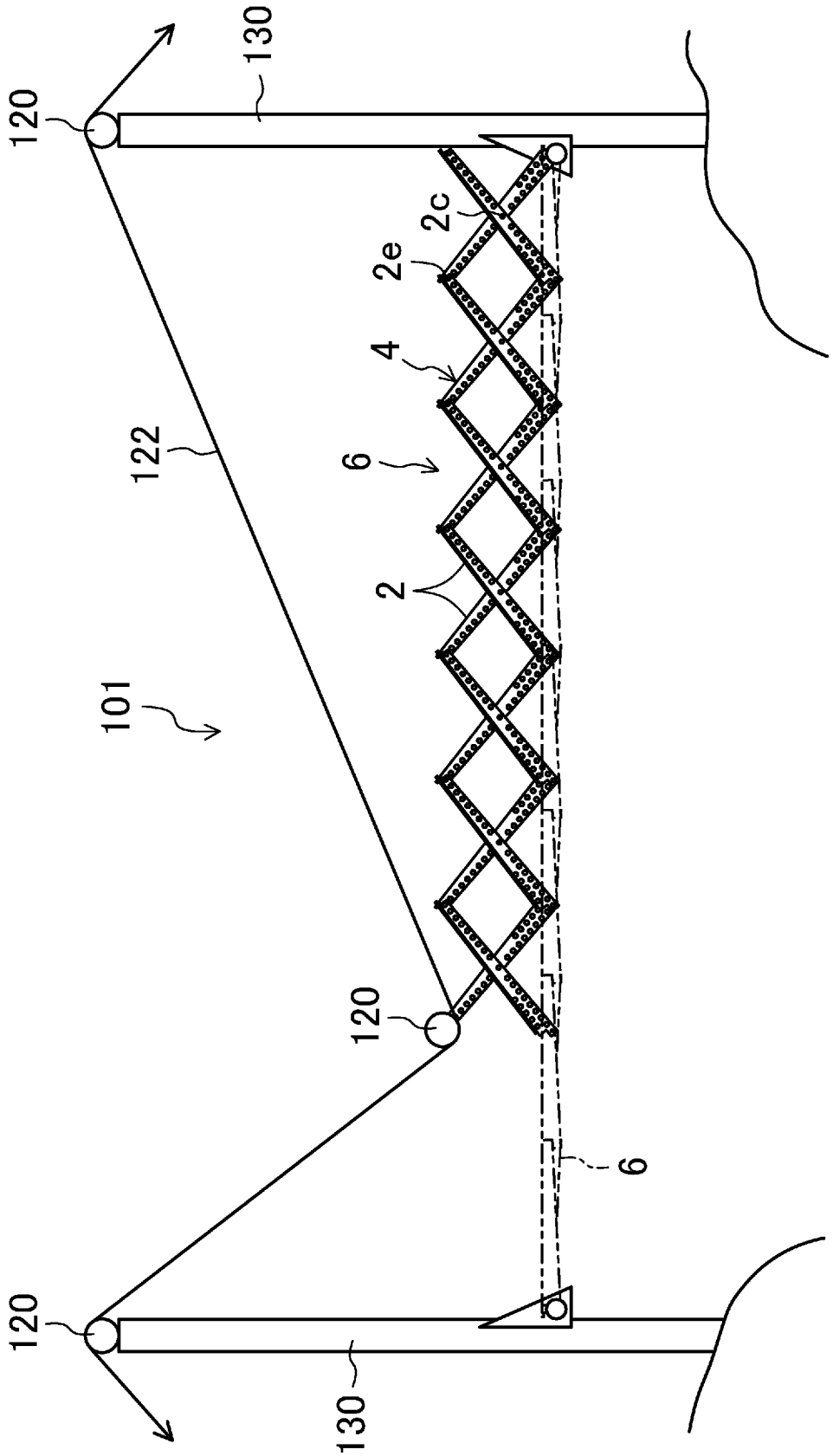


FIG.9A

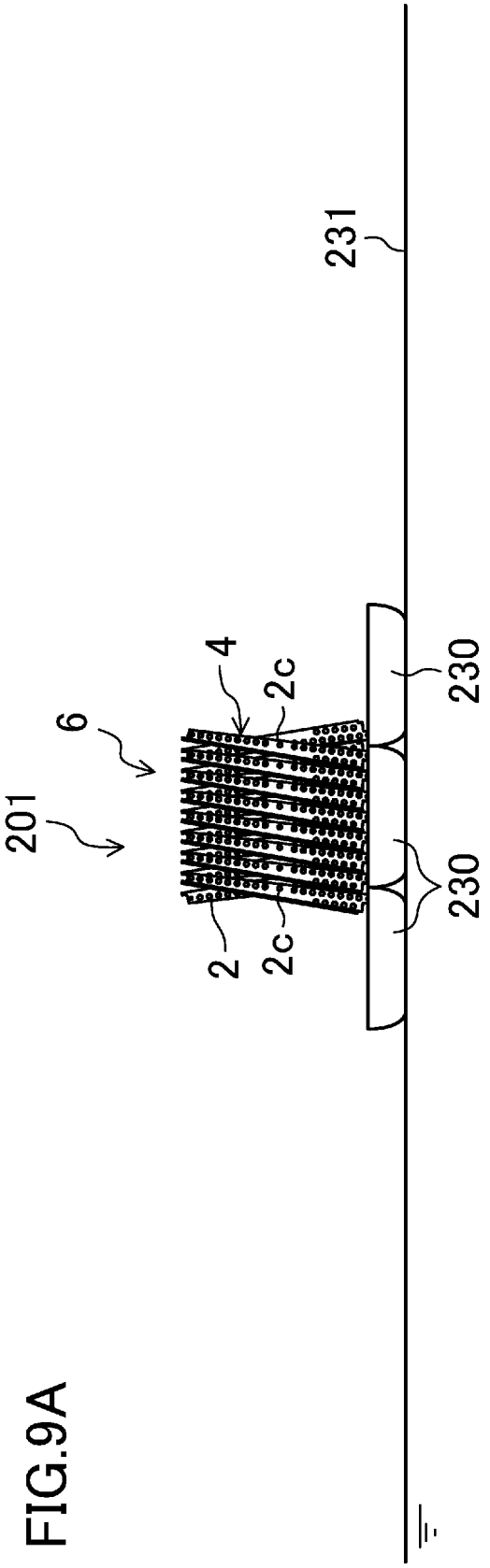

231
201
6
4
2c
230
2
2c
230

FIG.9B

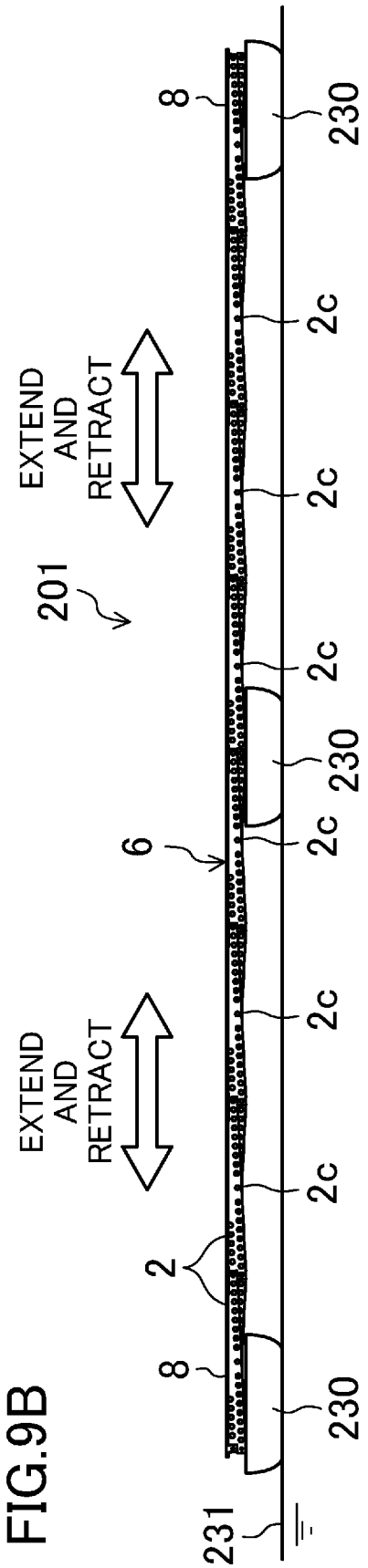
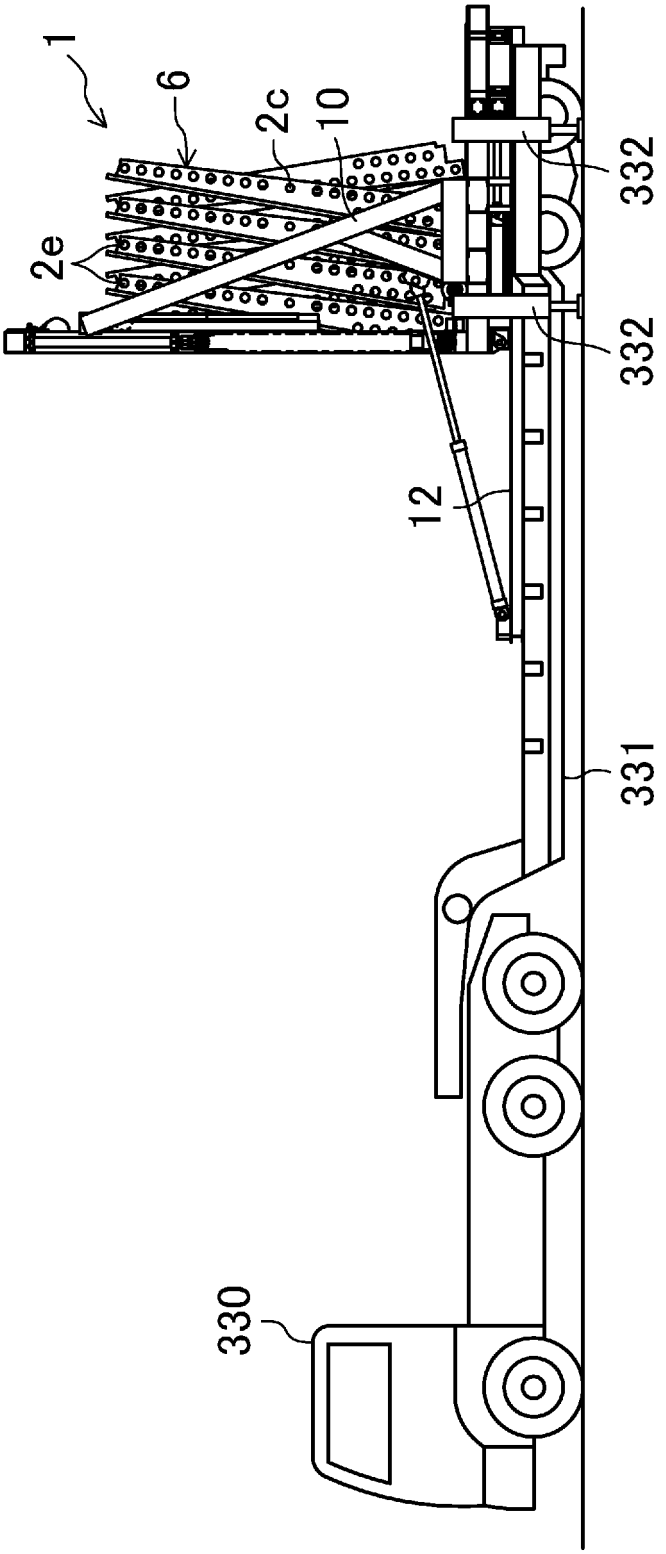

8
230
2c
EXTEND AND RETRACT
201
2c
2c
230
6
2c
EXTEND AND RETRACT
2c
2
8
230
231

FIG.10



REFERENCES CITED IN THE DESCRIPTION

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