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(54) **On-deck container lashing equipment**

(57) One end (upper end) of a tightening member consisting of a lashing rod (6) and a turnbuckle (7) is attached to a lashing eye plate (4) on a lashing bridge pillar (8) erected on the deck of a ship, the tightening member extends slantwise downward, and the other end (lower end) thereof is attached to a corner metal (5) of a container (2).

FIG. 2(a)

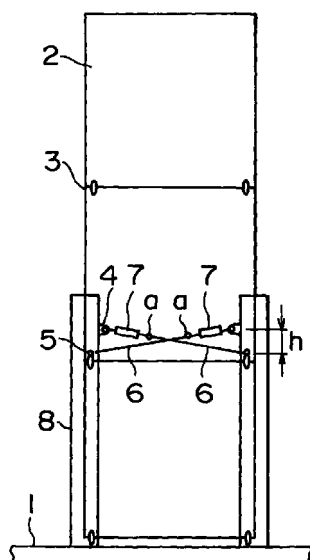
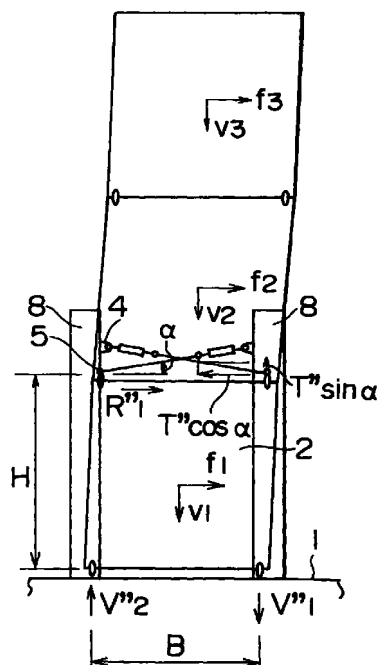


FIG. 2(b)



Description**BACKGROUND OF THE INVENTION AND RELATED ART STATEMENT**

1. Field of the Invention

[0001] The present invention relates to an equipment for lashing containers stacked on the deck of a ship.

2. Description of the Related Art

[0002] Generally, on a container ship, not only containers are stowed in a hold, but also containers 2 are stacked on a hatch cover top face 1 etc. as shown in FIG. 5(a).

[0003] These stacked containers 2 may shift due to the rolling of the ship as shown in FIG. 5(b). Therefore, the containers 2 are lashed as shown in FIGS. 6(a) and 7. When it is assumed that the containers 2 are not lashed as shown in FIG. 5(a) to explain the principle of strength calculation on the lashing of container, each of the containers 2 is subjected to a horizontal force f_1 , f_2 , f_3 and a vertical force v_1 , v_2 , v_3 by the oscillation (rolling) of the ship as shown in FIG. 5(b).

[0004] At this time, a racking force R_1 expressed by Eq. 1 is created on top of the lowest-tier container by the horizontal forces f_1 , f_2 and f_3 . Accordingly, the container is deformed into a diamond shape, and if the deformation exceeds an allowable strength of the container itself, the container is crushed.

$$R_1 = f_1 + f_2 + (1/2)f_3 \quad (1)$$

[0005] The aforementioned horizontal forces f_1 , f_2 and f_3 develop an overturning force V_2 at a corner of the container, and if the overturning force V_2 exceeds an allowable strength of container corner and an allowable tensile strength of an automatic twist lock 3, a breaking accident occurs.

[0006] Also, the vertical forces v_1 , v_2 and v_3 develop a compressive force V_1 at a corner of the container, and if compressive force V_1 exceeds an allowable compressive strength of the container body, the container is crushed.

[0007] Therefore, as shown in FIG. 6, a lashing rod 6 and a turnbuckle 7 connected to the rod 6 via a joint a are installed between a lashing eye plate 4 on the hatch cover top face 1 and a container corner metal 5, which are located on a diagonal line, by which the container 2 is lashed. Thereby, the aforementioned racking force R_1 is reduced to R_1' expressed by Eq. 2 by the horizontal component $T\cos\theta$ of a tension T created on the lashing rod 6 and the turnbuckle 7, by which the container is prevented from being crushed.

$$R_1' = R_1 - T\cos\theta \quad (2)$$

where θ is a tension angle of the turnbuckle 7 (lashing angle) shown in FIG. 6(b).

[0008] The horizontal component $T\cos\theta$ of the tension T also acts in the direction such as to reduce the aforementioned container overturning force V_2 , by which the container overturning force V_2 is decreased. The decreased container overturning force V_2' is given by Eq. 3 according to the ratio of a container height H to a container width B .

$$V_2' = V_2 - T\cos\theta \cdot (H/B) \quad (3)$$

[0009] Also, the container compressive force V_1 is reduced to V_1' given by Eq. 4 by the tension T on the aforementioned lashing means.

$$V_1' = V_1 - T\cos\theta \cdot (H/B) + T\sin\theta \quad (4)$$

[0010] Therefore, in multi-tier stacking and heavy stacking of containers, the tension T of the rod 6 is increased, or container lashing bridge pillars 8 must be installed to raise the lashing positions of the containers 2 as shown in FIGS. 8 and 9.

[0011] If the lashing tension T is increased, however, the container compressive force V_1' tends to be increased by an increase in the vertical component $T\sin\theta$ of the tension T .

[0012] The results of calculation on the lashing means shown in FIGS. 8 and 9 are given in Table 1.

[0013] In this table, case A shows the results of calculation on the second-tier container lashing means shown in FIG. 8, and case B shows the results of calculation on the third-tier container lashing means shown in FIG. 9.

[0014] As can be seen from these calculation results, the stowage weight in case A is 111.0 tons (five tier stowage) and 92.75 tons (six tier stowage), and the stowage weight in case B is 133.6 tons (five tier stowage) and 111.5 tons (six

tier stowage).

Table 1

Roll Condition

GW=0.5 m

		Case A	Case B	Case C
5th tier stow Container Weight(LT)	1st tier	26.75	32.4	39.3
	2nd tier	26.75	32.4	39.3
	3rd tier	26.75	32.4	39.3
	4th tier	26.75	32.4	39.3
	5th tier	4	4	4
	Total	111	133.6	161.2
Lashing tention: T		26.94ton	28.43ton	28.63ton
Racking Force: R1		10.98ton	13.75ton	15.18t(Limit)
V.comp.:V1		82.09t(Limit)	82.19t(Limit)	76.37ton

6th tier stow Container Weight(LT)	1st tier	17.75	21.5	23.5
	2nd tier	17.75	21.5	23.5
	3rd tier	17.75	21.5	23.5
	4th tier	17.75	21.5	23.5
	5th tier	17.75	21.5	23.5
	6th tier	4	4	4
	Total	92.75	111.5	121.5
Lashing tention: T	24.07ton	11.71ton	26.61ton	23.1ton
Racking Force: R1		11.71ton	10.76ton	15.19t(Limit)
V.comp.:V1		82.02t(Limit)	82.13t(Limit)	72.82 ton

OBJECT AND SUMMARY OF THE INVENTION

[0015] The present invention has been made to solve the above problems with the conventional on-deck container lashing equipment. Accordingly, an object of the present invention is to provide an on-deck container lashing equipment in which in lashing containers stacked on the deck of a ship, the arrangement of tightening means is contrived so that a force component in the direction such as to pull up the container is created, whereby the container can be prevented from being crushed, and the tightening means can be made small in size and light in weight.

[0016] To achieve the above object, the on-deck container lashing equipment in accordance with the present invention is characterized by comprising a plurality of lashing bridge pillars erected on the deck of a ship to lash containers stacked on the deck, an attachment member for lashing mounted on the lashing bridge pillar, and a tightening member one end of which is attached to the attachment member, extending slantwise downward, and the other end of which is attached to a corner metal of a container stowed between the lashing bridge pillars.

[0017] Also, the on-deck container lashing equipment in accordance with the present invention is characterized in that a lashing angle that the tightening direction of the tightening member makes with the horizontal plane is set in the range of 5 to 35 degrees.

[0018] Further, the on-deck container lashing equipment in accordance with the present invention is characterized in that the tightening member is composed of a turnbuckle only.

[0019] In the above-described on-deck container lashing equipment in accordance with the present invention, the tightening member whose one end (upper end) is attached to the attachment member for lashing mounted on the lashing bridge pillar erected on the deck of the ship extends slantwise downward, and the other end (lower end) of the tightening member is attached to the corner metal of the container. Therefore, due to the tightening action caused by the shrinkage of the tightening member, an upward component of the tightening force acts in the direction such as to pull up the container, so that the compressive force at the container corner, which has so far presented a problem, can be decreased, thereby preventing the container from being crushed.

[0020] If the lashing angle that the tightening direction of the tightening member makes with the horizontal plane is set in the range of 5 to 35 degrees, the length of the tightening member can be decreased significantly as compared with the case of the lashing angle of 45 degrees and larger of the conventional tightening member, by which a small-sized, lightweight tightening member can be provided.

[0021] Also, as the length of the tightening member is decreased as described above, the tightening member is composed of the turnbuckle only, and the lashing rod connected to the conventional turnbuckle via the joint is omitted. Thereby, the number of required parts is decreased, and the construction is simplified, so that lowered cost and reduced maintenance can be achieved.

[0022] As described above in detail, the on-deck container lashing equipment in accordance with the present invention achieves the following effects.

(1) The tightening member whose one end (upper end) is attached to the attachment member for lashing mounted on the lashing bridge pillar erected on the deck of the ship extends slantwise downward, and the other end (lower end) of the tightening member is attached to the corner metal of the container. Therefore, due to the tightening action caused by the shrinkage of the tightening member, an upward component of the tightening force acts in the direction such as to pull up the container, so that the compressive force at the container corner, which has so far presented a problem, can be decreased, thereby preventing the container from being crushed.

(2) If the lashing angle that the tightening direction of the tightening member makes with the horizontal plane is set in the range of 5 to 35 degrees, the length of the tightening member can be decreased significantly as compared with the case of the lashing angle of 45 degrees and larger of the conventional tightening member, by which a small-sized, lightweight tightening member can be provided.

(3) As the length of the tightening member is decreased as described above, the tightening member is composed of the turnbuckle only, and the lashing rod connected to the conventional turnbuckle via the joint is omitted. Thereby, the number of required parts is decreased, and the construction is simplified, so that lowered cost and reduced maintenance can be achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

FIG. 1 is a front view of an on-deck container lashing equipment in accordance with a first embodiment of the present invention;

FIG. 2 is a front view showing a modification of the on-deck container lashing equipment shown in FIG. 1, FIG. 2(a) showing a state before containers are subjected to ship oscillation, and FIG. 2(b) showing a state after containers have been subjected to ship oscillation;

FIG. 3 is a front view of an on-deck container lashing equipment in accordance with a second embodiment of the present invention;

FIG. 4 is a perspective view showing an essential part of the equipment shown in FIG. 3;

FIG. 5 is a front view showing a state in which containers are stacked on the deck of a ship, FIG. 5(a) showing a state before the containers are subjected to ship oscillation, and FIG. 5(b) showing a state after the containers have been subjected to ship oscillation;

FIG. 6 is a front view showing a state in which the container shown in FIG. 5 is provided with a conventional lashing equipment, FIG. 6(a) showing a state before containers are subjected to ship oscillation, and FIG. 6(b) showing a state after containers have been subjected to ship oscillation;

FIG. 7 is a perspective view of a container provided with the conventional lashing equipment shown in FIG. 6;

FIG. 8 is a front view showing an example of a conventional on-deck container lashing equipment; and

FIG. 9 is a front view showing another example of a conventional on-deck container lashing equipment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

5 **[0024]** Embodiments of the present invention will now be described with reference to the accompanying drawings. FIG. 1 is a front view of an on-deck container lashing equipment in accordance with a first embodiment of the present invention, FIG. 2(a) is a front view showing a case where the equipment shown in FIG. 1 is applied to containers stacked on a hatch cover top face, and FIG. 2(b) is a front view schematically showing a state in which the containers shown in FIG. 2(a) are subjected to ship oscillation. FIG. 3 is a front view of an on-deck container lashing equipment in accordance with a second embodiment of the present invention, and FIG. 4 is an enlarged perspective view showing an essential part of the equipment shown in FIG. 3.

[0025] First, the first embodiment of the present invention will be described. As shown in FIG. 1, in order to lash containers 2 stacked on the deck of a ship, a plurality of lashing bridge pillars 8 are erected on the deck of the ship, and a lashing eye plate 4 is mounted on the pillar 8 as an attachment member for lashing.

15 **[0026]** To the lashing eye plate 4 is attached one end (upper end) of a lashing rod 6 and a turnbuckle 7, which constitute a tightening member extending slantwise downward, and the other end (lower end) of the lashing rod 6 and the turnbuckle 7 is attached to a corner metal 5 of the container 2 stowed between the lashing bridge pillars 8.

[0027] A lashing angle α , which the tightening direction of the turnbuckle 7 constituting the tightening member makes with the horizontal plane, is set in the range of 5 to 35 degrees, preferably in the range of 25 to 35 degrees. The lashing rod 6 and the turnbuckle 7, constituting the tightening member, are connected to one another via a joint a.

[0028] FIG. 2(a) shows the case where the above-described on-deck container lashing equipment is used to lash the containers 2 stacked on a hatch cover top face 1. The symbols in FIG. 2(a) are used as in the case of FIG. 1.

25 **[0029]** FIG. 2(b) shows the state in which the containers 2 shown in FIG. 2(a) are subjected to ship oscillation (rolling). In FIG. 2(b), the vertical component $T \sin \alpha$ of the tension T acts advantageously on a compressive force V_1 as is expressed by Eq. 5.

$$V_1'' = V_1 - T \cos \alpha \cdot (H/B) - T \sin \alpha \quad (5)$$

[0030] Since the lashing angle α is set in the range of 5 to 35 degrees, which is far smaller than the conventional case of 45 degrees and larger, the horizontal component $T \cos \alpha$ of the tension T can be increased, so that the racking force R_1 and the overturning force V_2 can be reduced to R_1'' and V_2'' , respectively, expressed by Eq. 6.

$$R_1'' = R_1 - T \cos \alpha$$

$$35 \quad V_2'' = V_2 - T \cos \alpha \cdot (H/B) \quad (6)$$

[0031] An increase in container stowing weight due to the above-described lashing equipment is shown as case c in Table 1.

40 **[0032]** As a result, the stowage weight is 161.2 tons for five tier stowage and 121.5 tons for six tier stowage. That is, the lashing means shown in FIG. 1 can ensure a stowage weight 30% or more heavier than that of the conventional second-tier lashing means shown in FIG. 8.

[0033] In the on-deck container lashing equipment of the above-described first embodiment, the lashing rod 6 and the turnbuckle 7, which serve as the tightening member whose one end (upper end) is attached to the lashing eye plate 4 serving as the attachment member for lashing on the lashing bridge pillar 8 erected on the deck of the ship, extend slantwise downward, and the other end (lower end) of the tightening member is attached to the corner metal 5 of the container 2. Therefore, due to the tightening action caused by the shrinkage of the tightening member, an upward component of the tightening force acts in the direction such as to pull up the container 2, so that the compressive force at the container corner, which has so far presented a problem, can be decreased, thereby preventing the container 2 from being crashed.

50 **[0034]** Since the lashing angle that the tightening direction of the tightening member makes with the horizontal plane is set in the range of 5 to 35 degrees, the length of the tightening member can be decreased significantly as compared with the case of the lashing angle of 45 degrees and larger of the conventional tightening member, by which a small-sized, lightweight tightening member can be provided.

55 **[0035]** The following is a description of an on-deck container lashing equipment in accordance with a second embodiment of the present invention. FIG. 3 is a front view thereof, and FIG. 4 is a perspective view thereof. In this second embodiment as well, in order to lash containers 2 stacked on the deck of a ship, the plurality of lashing bridge pillars 8 are erected on the deck of the ship, and the lashing eye plate 4 is mounted on the pillar 8 as an attachment member for lashing.

[0036] To the lashing eye plate 4 is attached one end (upper end) of the turnbuckle 7 serving as a tightening member, which extends slantwise downward and the other end (lower end) of which is attached to the corner metal 5 of the container 2 stowed between the lashing bridge pillars 8. The lashing rod 6 and the joint a in the above-described first embodiment are omitted. That is, since the length of the tightening member is decreased significantly as compared with the conventional tightening member by setting the lashing angle in the range of 5 to 35 degrees, it is necessary only that a rod portion of the turnbuckle 7 be lengthened slightly.

[0037] Thus, the second embodiment also achieves the same operation and effects as those of the above-described first embodiment. Further, since the tightening member is composed of only the turnbuckle owing to the decreased length of the tightening member, the number of required parts is decreased, and the construction is simplified, so that lowered cost and reduced maintenance can be achieved.

Claims

1. An on-deck container lashing equipment comprising: a plurality of lashing bridge pillars erected on the deck of a ship to lash containers stacked on the deck; an attachment member for lashing mounted on said lashing bridge pillar; and a tightening member one end of which is attached to said attachment member, extending slantwise downward, and the other end of which is attached to a corner metal of a container stowed between said lashing bridge pillars.
2. The on-deck container lashing equipment according to claim 1, wherein a lashing angle that the tightening direction of said tightening member makes with the horizontal plane is set in the range of 5 to 35 degrees.
3. The on-deck container lashing equipment according to claim 2, wherein said tightening member is composed of a turnbuckle only.

FIG. 1

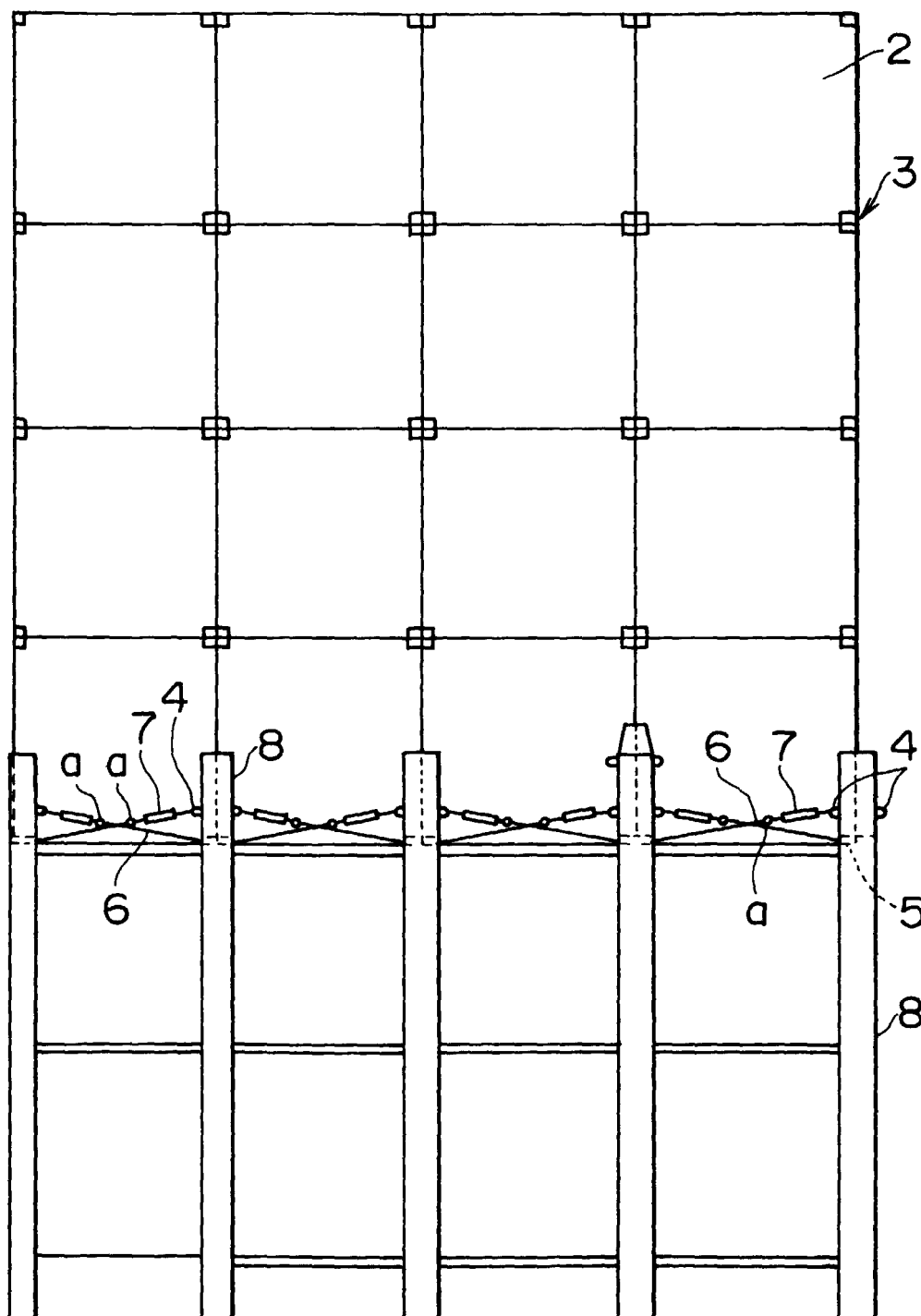


FIG. 2(a)

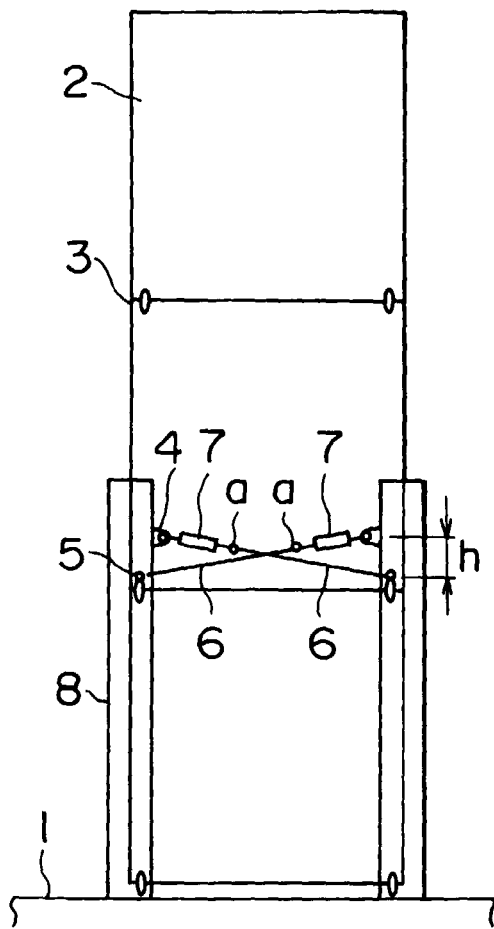


FIG. 2(b)

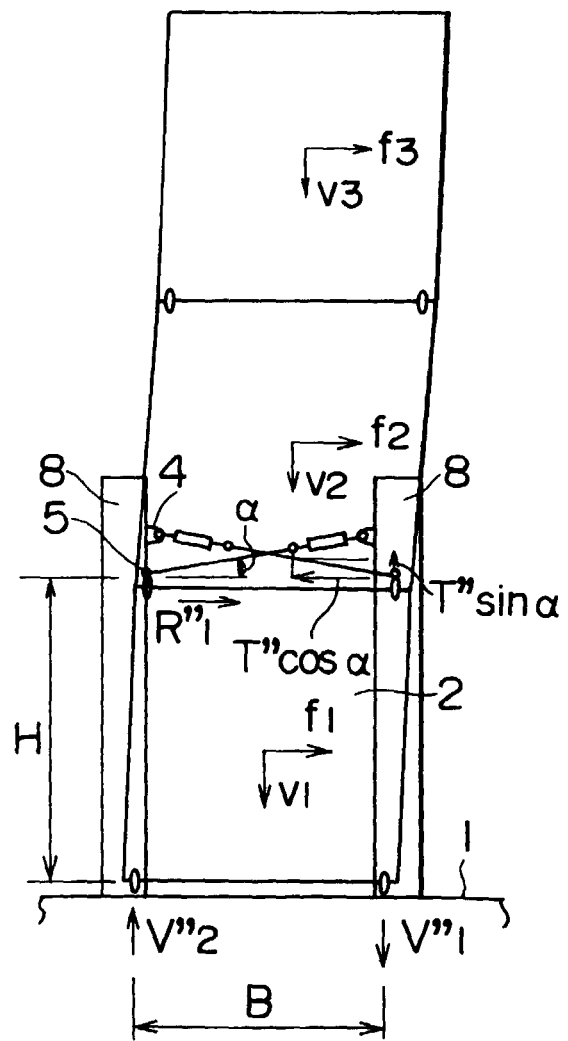


FIG. 3

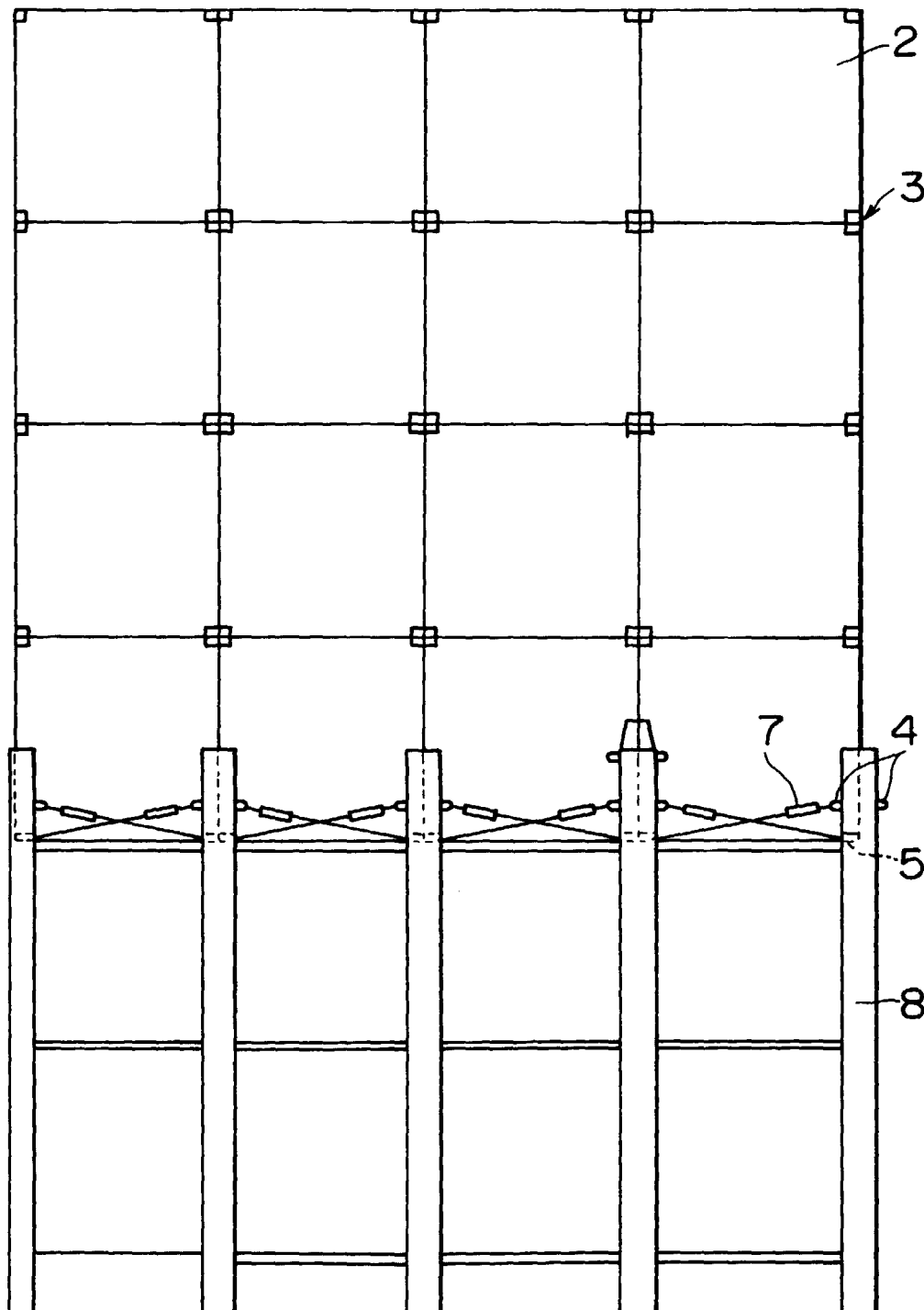


FIG. 4

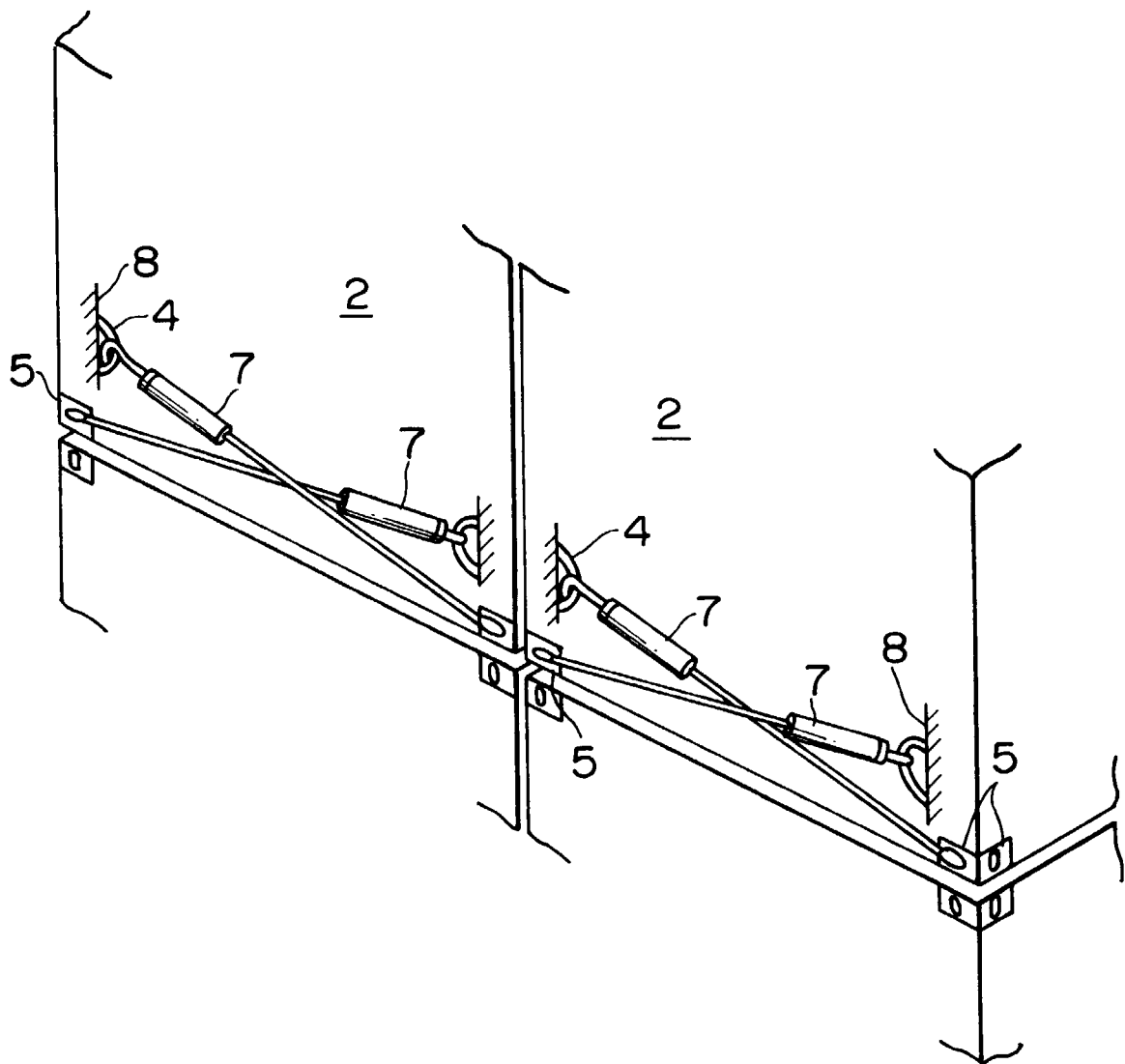


FIG. 5(a)

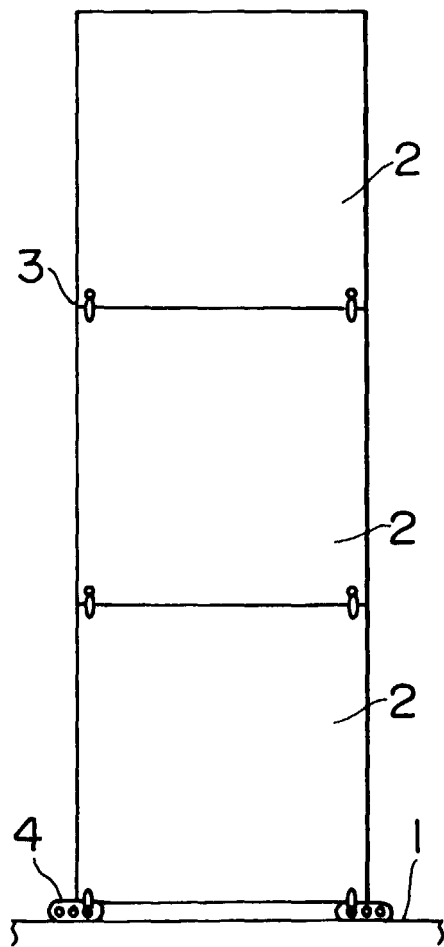


FIG. 5(b)

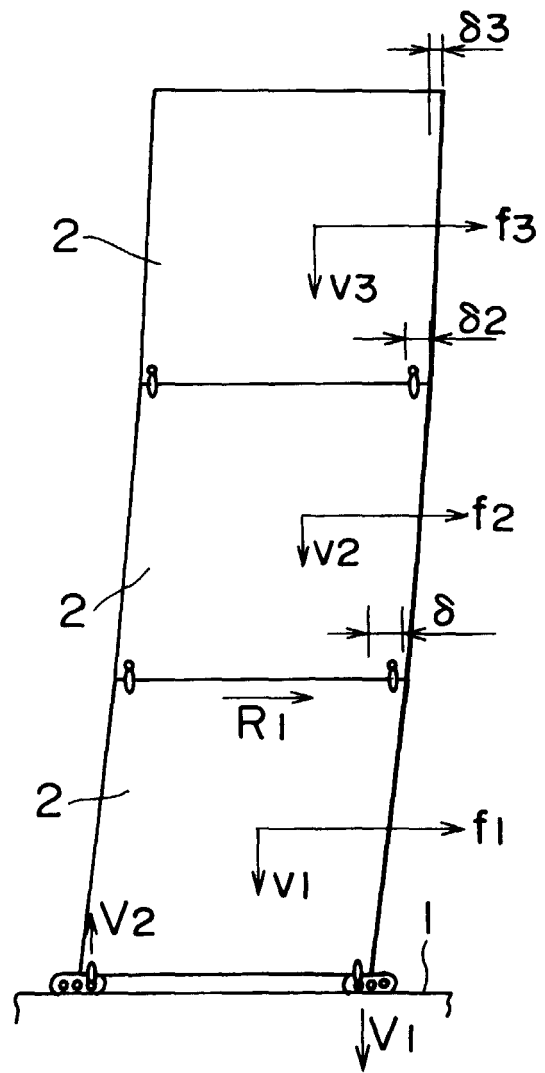


FIG. 6(a)

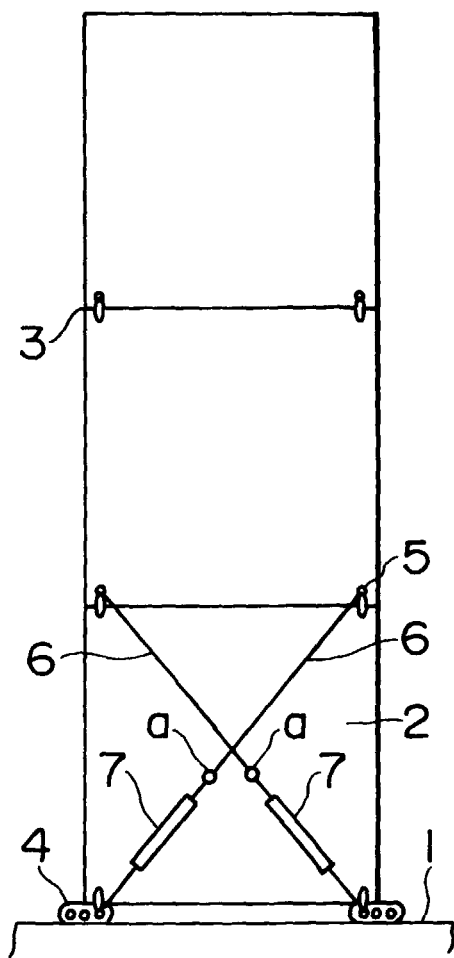


FIG. 6(b)

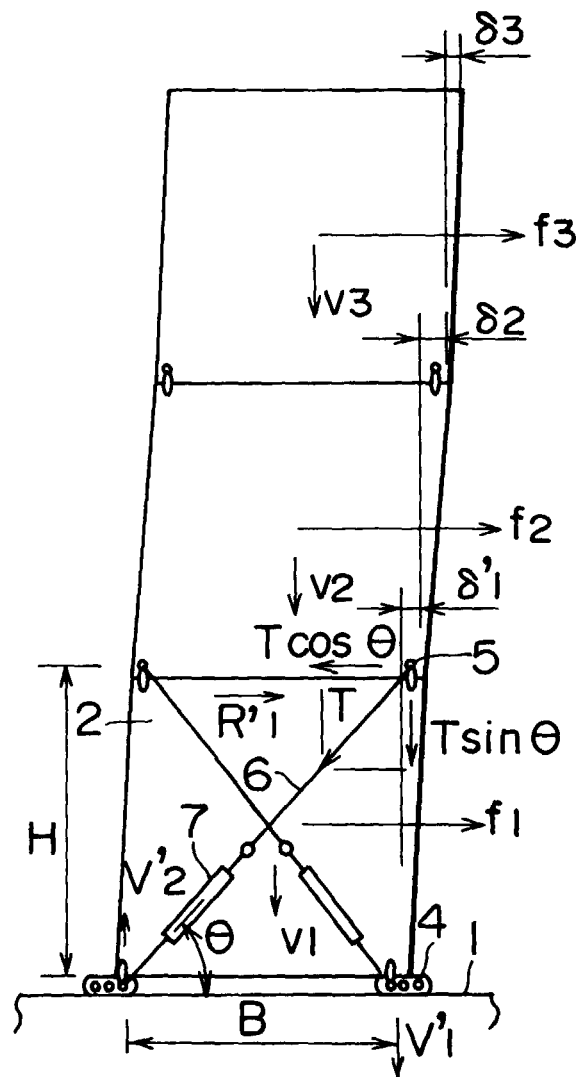


FIG. 7

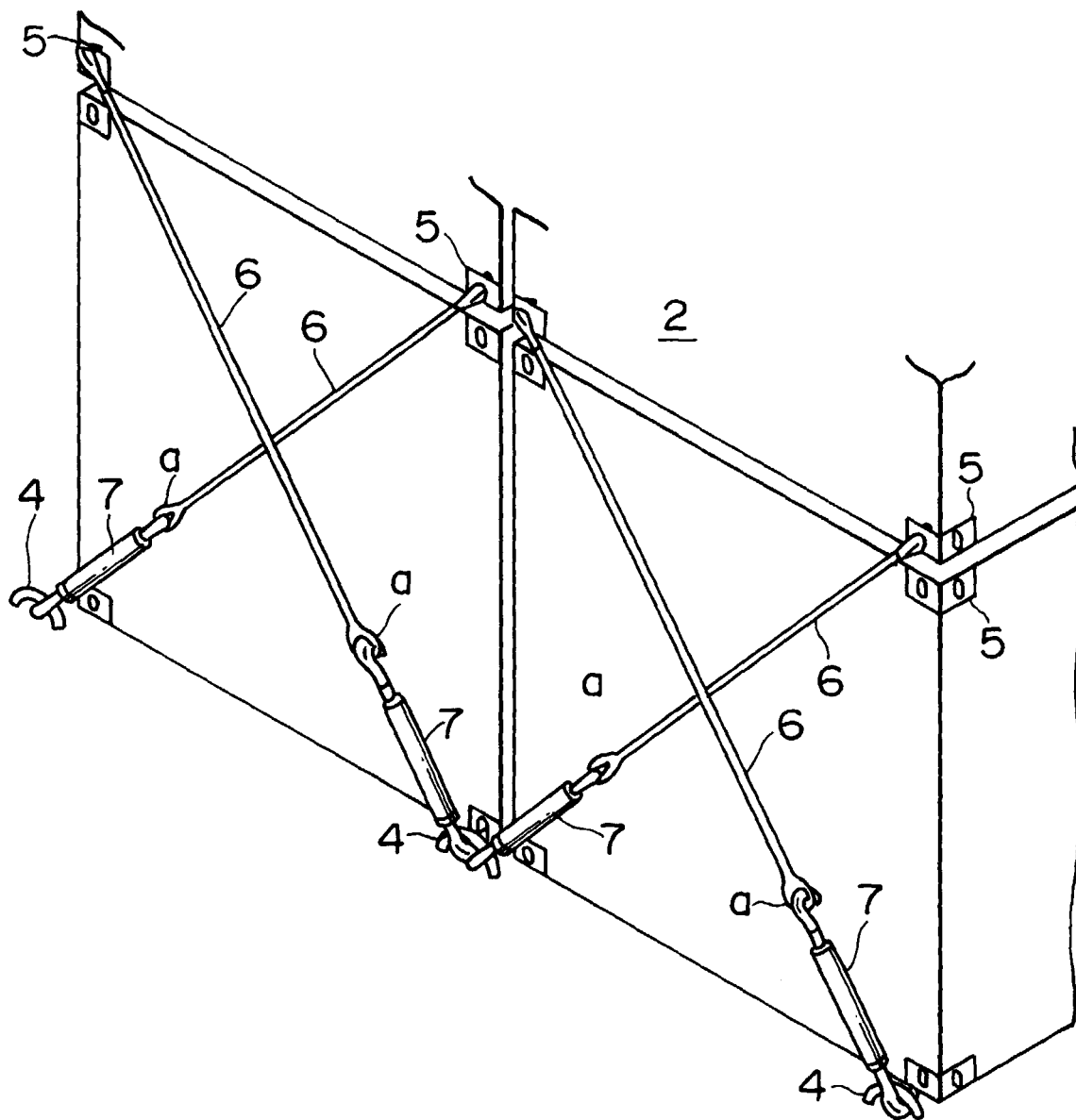


FIG. 8

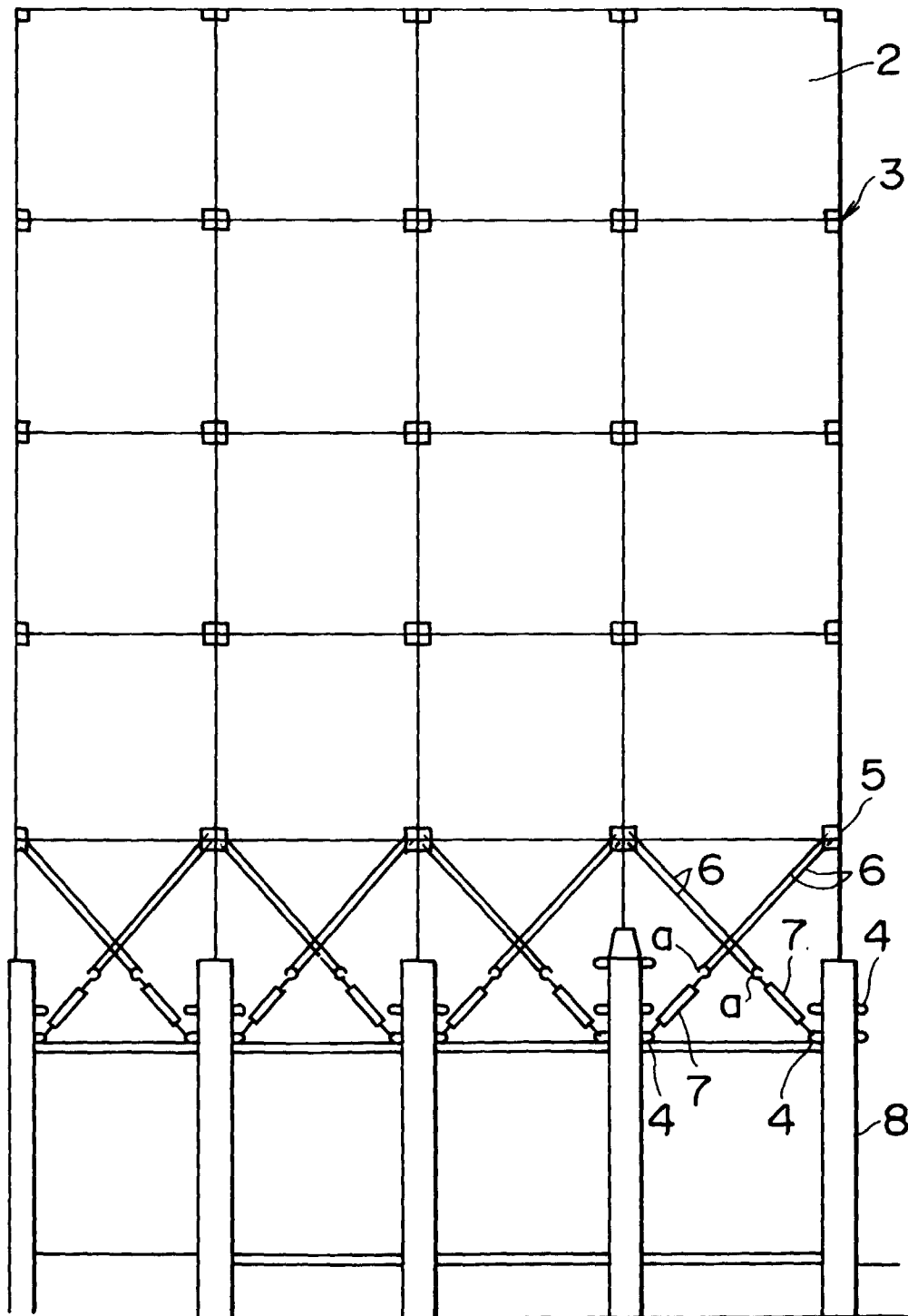


FIG. 9

