Claims

[Claim 1]

A gripping device comprising:

an upper-surface grip portion having a first suction surface that is capable of holding an upper surface of an article by suction;

a side-surface grip portion having a second suction surface that is capable of holding a side surface of the article by suction; and

a flip-up mechanism that is capable of switching between a first state where the side-surface grip portion is positioned below a lower end of the upper-surface grip portion and a second state where the side-surface grip portion is positioned above the lower end of the upper-surface grip portion,

wherein the flip-up mechanism has a lock mechanism that positions the side-surface grip portion at a position in the second state.

[Claim 2]

The gripping device according to claim 1, further comprising:

a first suction mechanism that operates the suction in the first suction surface in a state where the first suction surface is in contact with the upper surface of the article; and

a second suction mechanism that operates the suction in the second suction surface in a state where the second suction surface is in contact with the side surface of the article.

[Claim 3]

The gripping device according to claim 1,

wherein the flip-up mechanism causes the side-surface grip portion to rotate around a first rotary shaft that is parallel to the first suction surface and the second suction surface and that is located above the side-surface grip portion in the first state.

[Claim 4]

The gripping device according to claim 3, further comprising:

a first arm portion that has one end side connected to the side-surface grip portion and that is expandable and contractable in a first direction perpendicular to the second suction surface; and

a second arm portion that has one end side connected to the other end side of the first arm portion, that has the other end side connected to the upper-surface grip portion via the flip-up mechanism, and that is expandable and contractable in a second direction parallel to the second suction surface and orthogonal to the first rotary shaft.

[Claim 5]

The gripping device according to claim 1,

wherein the flip-up mechanism causes the side-surface grip portion to be translationally moved in a direction perpendicular to the first suction surface.

[Claim 6]

The gripping device according to claim 1, further comprising:

a turning mechanism that causes the upper-surface grip portion and the side-surface grip portion to rotate around a perpendicular second rotary shaft.

[Claim 7]

A control method for the gripping device according to any one of claims 1 to 6, the control method comprising:

a transport target data acquisition step of acquiring transport target data indicating data relating to an article to be transported by the gripping device;

a captured image data acquisition step of acquiring captured image data in which a predetermined region including an article to be unloaded or a region on which an article is loaded is imaged;

a determination step of determining, based on the transport target data, whether or not side-surface gripping of the article by the side-surface grip portion is required for the transport of the article;

a switching step of switching the side-surface grip portion to the second state in a case where it is determined in the determination step that the side-surface gripping is not required; and

a transport step of supporting and transporting the article with at least the upper-surface grip portion.

[Claim 8]

The control method for the gripping device according to claim 7,

wherein in the switching step, based on the captured image data, presence or absence of an obstacle that may interfere with the side-surface grip portion around the article is determined, and in a case where the obstacle is present, the side-surface grip portion is caused to move relative to the upper-surface grip portion to a position where the side-surface grip portion is capable of avoiding the obstacle.

[Claim 9]

The control method for the gripping device according to claim 7,

wherein the transport target data includes the number of articles, a position of each article to be loaded or a position of each article to be unloaded, and an order in which each article is loaded or an order in which each article is unloaded, and

the captured image data acquisition step, the determination step, the switching step, and the transport step are repeatedly executed after the transport target data acquisition step.