WHAT IS CLAIMED IS:

1. A processing apparatus that removes a beveled part formed in an outer circumferential surplus region from a wafer in a ring manner, the processing apparatus comprising:

a wafer cassette table on which a wafer cassette in which a plurality of wafers are housed is placed;

a wafer carrying-out unit that carries out the wafer from the wafer cassette placed on the wafer cassette table;

a wafer table that supports the wafer carried out by the wafer carrying-out unit;

a frame housing unit that houses a plurality of annular frames in which an opening part that houses the wafer is formed;

a frame carrying-out unit that carries out an annular frame from the plurality of frames in the frame housing unit;

a frame table that supports the annular frame carried out by the frame carrying-out unit;

a tape sticking unit that is disposed over the frame table and sticks a tape to the annular frame;

a tape-attached frame conveying unit that conveys the annular frame to which the tape is stuck to the wafer

table and positions the opening part of the annular frame to one surface of the wafer supported by the wafer table and places a tape-attached frame on the wafer table;

a tape pressure bonding unit that executes pressure bonding of the tape of the tape-attached frame to the one surface of the wafer;

frame unit carrying-out means that carries out a frame unit in which the tape of the tape-attached frame and the one surface of the wafer are pressure-bonded by the tape pressure bonding unit from the wafer table;

a beveled part removing unit that cuts and removes, in the ring manner, the beveled part formed in the outer circumferential surplus region from the wafer of the frame unit carried out by the frame unit carrying-out means;

beveled-part-free unit carrying-out means that carries out a beveled-part-free unit resulting from the removal of the beveled part in the ring manner from the beveled part removing unit; and

a frame cassette table on which a frame cassette that houses the beveled-part-free unit carried out by the beveled-part-free unit carrying-out means is placed, wherein

the beveled part removing unit includes a removal

detecting unit that detects whether or not the beveled part has been removed.

2. The processing apparatus according to claim 1, wherein

the wafer carrying-out unit includes a conveying arm, and a hand that is disposed at a tip of the conveying arm and supports the wafer housed in the wafer cassette.

3. The processing apparatus according to claim 2, wherein

the hand is a Bernoulli pad on which a negative pressure is generated by a jet of air and that supports the wafer in a contactless manner.

4. The processing apparatus according to claim 1, wherein

the wafer table includes an annular support part that supports the outer circumferential surplus region of the wafer and causes a part on an inside relative to the outer circumferential surplus region to be contactless, and a frame support part that is disposed around an outer circumference of the annular support part and supports the annular frame.

5. The processing apparatus according to claim 1, wherein

the tape sticking unit includes a roll tape support part that supports a roll tape into which the tape before use is wound, a tape take-up part that takes up the tape used, a tape pull-out part that pulls out the tape from the roll tape, a pressure bonding part that executes pressure bonding of the tape pulled out to the annular frame, and a cutting part that cuts the tape protruding to an outer circumference of the annular frame along the annular frame.

6. The processing apparatus according to claim 1, wherein

the tape pressure bonding unit includes an upper chamber disposed over the wafer table, a lower chamber in which the wafer table is housed, a raising-lowering mechanism that raises and lowers the upper chamber and generates a closed state in which the upper chamber is brought into contact with the lower chamber and an opened state in which the upper chamber is separated from the lower chamber, a vacuum part that sets the upper chamber and the lower chamber to a vacuum state in the closed state, and an opening-to-atmosphere part that opens the upper chamber and the lower chamber to atmosphere, and

in a state in which the tape of the tape-attached frame is positioned to the one surface of the wafer

supported by the wafer table, the upper chamber and the lower chamber are set to the vacuum state while the raising-lowering mechanism is actuated to keep the closed state, and the pressure bonding of the tape of the tape-attached frame to the one surface of the wafer is executed by a pressing roller disposed in the upper chamber.

7. The processing apparatus according to claim 1, wherein

the frame unit carrying-out means includes a frame unit holding part having a wafer holding part that holds the wafer and a frame holding part that holds the annular frame and a conveying part that conveys the frame unit holding part to a temporary placement table.

8. The processing apparatus according to claim 7, wherein

the frame unit carrying-out means includes a two-dimensional movement mechanism that two-dimensionally moves the frame unit holding part in a horizontal direction and an imaging part that images an outer circumference of the wafer of the frame unit held by the frame unit holding part, and

the two-dimensional movement mechanism is actuated to image at least three places at the outer circumference

of the wafer by the imaging part, and center coordinates of the wafer are obtained to make a center of the wafer correspond with a center of the temporary placement table.

9. The processing apparatus according to claim 7, wherein

the beveled part removing unit includes a laser beam irradiation unit that irradiates a base part of the beveled part formed at the outer circumference of the wafer with a laser beam to form a cut groove or form a modified layer inside the wafer, a first raising-lowering table that holds and raises the frame unit temporarily placed on the temporary placement table and positions the frame unit to the laser beam irradiation unit, and a separating part that separates the beveled part from the cut groove or the modified layer in the ring manner,

the separating part includes an ultraviolet irradiation part that irradiates the tape corresponding to the beveled part with ultraviolet to reduce an adhesive force of the tape, a second raising-lowering table that sucks and holds an inside of the wafer in such a manner that the beveled part is exposed from the outer circumference, and supports the annular frame, a separator that acts on the beveled part and separates the

beveled part in the ring manner, and a discard part by which the beveled part separated is discarded, and

the first raising-lowering table temporarily places the frame unit in which the cut groove or the modified layer is formed on the temporary placement table, and the temporary placement table is positioned to the separating part by a temporary placement table conveying part, and the second raising-lowering table supports the frame unit temporarily placed on the temporary placement table.

10. The processing apparatus according to claim 9, wherein

the temporary placement table has a heater and the first raising-lowering table holds, from the temporary placement table, the frame unit in which the tape has been heated by the heater and the tape is in close contact with a root of the beveled part.

11. The processing apparatus according to claim 9, wherein

the temporary placement table includes an annular support part that supports the outer circumferential surplus region of the wafer and causes a part on an inside relative to the outer circumferential surplus region to be contactless, and a frame support part that is disposed around an outer circumference of the annular

support part and supports the annular frame.

12. The processing apparatus according to claim 10, wherein

the beveled-part-free unit carrying-out means includes an inversion mechanism that has a frame holding part that faces the beveled-part-free unit supported by the second raising-lowering table and holds the annular frame and moves toward the frame cassette table and inverts the frame holding part, a beveled-part-free unit support part that supports the beveled-part-free unit that is inverted by the inversion mechanism and in which another surface of the wafer is oriented upward, and a pushing part that causes the beveled-part-free unit supported by the beveled-part-free unit support part to enter the frame cassette placed on the frame cassette table and be housed in the frame cassette.

13. The processing apparatus according to claim 9, wherein

the beveled part removing unit includes a cut groove detecting unit that detects the cut groove.