document 1, or a required thickness is created by cutting out from engineering plastics such as PEEK (polyetheretherketone) resin, and the material cost and manufacturing cost are high, and it was an expensive part as a consumable part.

(4) The carrier main body surrounding the outer circumference of the workpiece W is a split structure consisting of a plurality of fixed and movable carrier bodies c, d, …, and each plate is likely to be distorted, deflected, or deformed, which caused adverse effects on the workpiece W in the grinding process, and it was hard to enhance the grinding precision.

(5) Or, as disclosed in Japanese Patent Laid-Open Publication No. H11-333707, in the structure forming the carrier bodies c, d, … and the notch trigger g as an integral piece, if the notch trigger portion heavy in abrasion is worn first, all of the integrally formed carrier main body and the notch trigger must be replaced in batch, or in order extend the life of the integral piece, the constituent material must be changed to a material suited to the notch trigger, and it adds to the material cost.

BRIEF SUMMARY OF THE INVENTION

Embodiments~~It is hence a primary object~~ of the present invention ~~to~~ present a novel carrier apparatus of a thin disk-shaped workpiece capable of successfully solving these conventional

problems.

Embodiments~~It is other object~~ of the present invention ~~to~~ present a carrier apparatus simple and inexpensive in structure, and capable of processing at high efficiency and high precision, in machining of surface side and/or reverse side of a thin disk-shaped workpiece such as semiconductor wafer.

Embodiments~~It is another object~~ of the present invention ~~to~~ present a method of manufacturing a carrier apparatus capable of manufacturing the carrier apparatus at low cost.

Embodiments~~It is one other object~~ of the present invention ~~to~~ present a both-side grinding machine having such carrier apparatus as a constituent device, and capable of grinding the surface and reverse sides of a thin disk-shaped workpiece such as a semiconductor wafer at high efficiency and high precision.

According to an aspect of the invention, there is provided a~~The configuration of the~~ carrier apparatus of a thin disk-shaped workpiece ~~of the present invention relates to an apparatus of grinding or polishing at least one side of a workpiece while supporting and rotating a thin disk-shaped workpiece, more specifically a carrier apparatus~~for constituting a rotation supporting device for rotating and driving a workpiece while supporting the circular outer circumference of the workpiece, including an annular carrier main body having a circular inner peripheral edge surrounding closely the whole circumference of the workpiece, and a notch trigger having a pointed end engaging part to be engaged with a cut portion

provided in the circular outer peripheral edge of the workpiece, being formed as an integral piece, in which the notch trigger is a separate part from the carrier main body, so as to be exchangeable and joined and fixed integrally, and the pointed end engaging part has a mounting structure of projecting inward in a radial direction from a part of the circular inner peripheral edge of the carrier main body.

~~Preferred embodiments include the following configurations.~~

~~(1) The~~In an embodiment, thickness of the carrier main body and the notch trigger is set thinner than the finishing thickness of the workpiece, and joining and fixing of the notch trigger and the carrier main body is realized by an adhesive that can be fixed and released.

~~(2) The~~In an embodiment, notch trigger mounting part on the carrier main body is cut and formed in a shape corresponding to the outer contour shape of the junction part of the notch trigger, and the adhesive is applied on the junction surface of the notch trigger mounting part.

~~(3) The~~In an embodiment, notch trigger is composed of thin plate members having a triangular contour having one peak formed as the pointed end engaging part to be engaged with the cut part of the workpiece, and in the notch trigger mounting part of the carrier main body, circular grooves for avoiding concentration of stress are formed at positions corresponding to remaining

two peaks of the triangular contour of the notch trigger.

~~(4) The~~In an embodiment, pointed end engaging part of the notch trigger has an arc contour shape, and its section is set corresponding to the sectional shape of the cut part of the workpiece.

According to a second aspect, there is provided a~~The~~ method of manufacturing a carrier apparatus of a thin disk-shaped workpiece ~~of the present invention is a method suited to manufacturing of the carrier apparatus~~, and includes the following steps (a) to (c).

(a) A cleaning step of cleaning and degreasing junction surfaces of notch trigger mounting part of the carrier main body and junction surfaces of junction parts of the notch trigger;

(b) A joining step of positioning and holding the parallelism of the carrier main body and the notch trigger, and adhering and joining the junction surfaces of notch trigger mounting part of the carrier main body and junction surfaces of junction parts of the notch trigger while applying the adhesive; and

(c) A finishing step of removing the excess adhesive coming out from the junction parts of the carrier main body and the notch trigger integrally joined at the joining step.

According to a third aspect, there is provided a~~The~~ both-side grinding machine of a thin disk-shaped workpiece of the present invention is a machine for rotating and supporting a thin disk-shaped workpiece, feeding a pair of grinding wheels rotating at high speed in the grinding wheel

axial direction, and grinding the surface and reverse sides of the workpiece simultaneously by the grinding surfaces of these two grinding wheels, including a pair of grinding wheels disposed so that the grinding surfaces may be opposite to each other, and workpiece rotation supporting means for supporting and rotating the workpiece, in a state of the surface and reverse sides of the workpiece opposite to these two grinding surfaces between the grinding surfaces of the pair of grinding wheels, in which the workpiece rotation supporting means has axial direction supporting means for positioning and supporting the workpiece in an axial direction, and radial direction supporting means for positioning, rotating and supporting the workpiece in a radial direction, and this radial direction supporting means has the above carrier apparatus.

The carrier apparatus as per embodiments of the present invention is an apparatus for supporting and rotating a thin disk-shaped workpiece, and grinding or polishing at least one side of the workpiece, and is more specifically a carrier apparatus constituting a workpiece rotation supporting apparatus for rotating and driving while positioning and supporting the circular outer circumference of the workpiece, including an annular carrier main body having a circular inner peripheral edge surrounding closely the whole circumference of the workpiece, and a notch trigger having a pointed end engaging part to be engaged with a cut part provided in the circular

materials.

(viii) Moreover, since the notch trigger is joined and fixed to the carrier main body, its shape can be simplified, so that the processing cost of the notch trigger can be saved, and further as compared with the conventional notch trigger, the material consumption is saved, and the cost is lowered also in this respect.

According to the manufacturing method of the carrier apparatus of embodiments of the present invention, the carrier apparatus performing these effects effectively can be manufactured easily and at low cost.

According to the both-side grinding machine of embodiments of the present invention, since such carrier apparatus is provided, the above effects can be effectively displayed, and the surface and reverse sides of a thin disk-shaped workpiece can be ground simultaneously at high efficiency and high precision.

These and other embodiments~~objects~~ and features of the present invention will be more clearly appreciated and understood by reading the detailed description based on the accompanying drawings and novel facts disclosed in the claims thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view showing a configuration of principal parts of a horizontal both-side grinding machine in an exemplary embodiment of the present invention.

workpiece, feeding a pair of grinding wheels rotating at high speed in the grinding wheel axial direction, and grinding the surface and reverse sides of the workpiece simultaneously by the grinding surfaces of these two grinding wheels, comprising:

a pair of grinding wheels disposed so that the grinding surfaces may be opposite to each other, and

workpiece rotation supporting means for supporting and rotating the workpiece, in a state of the surface and reverse sides of the workpiece opposite to these two grinding surfaces between the grinding surfaces of the pair of grinding wheels,

wherein the workpiece rotation supporting means has axial direction supporting means for positioning and supporting the workpiece in an axial direction, and radial direction supporting means for positioning, rotating and supporting the workpiece in a radial direction, and

this radial direction supporting means has the carrier apparatus as set forth in any one of claims 1 to 5~~7~~.