CLAIMS

1. A cutting apparatus, comprising:

a table to be mounted with the article to be cut;

a cutting mechanism that cuts the article to be cut; and

a moving mechanism that relatively moves the table and the cutting mechanism,

the cutting apparatus being for use in cutting the article to be cut along a cutting line into separate pieces to provide a plurality of individual products, the cutting apparatus further comprising:

a rotating shaft installed in the cutting mechanism;

a driving mechanism installed in the cutting mechanism to drive the rotating shaft to rotate;

a cooling water passage formed in the cutting mechanism around the rotating shaft;

a rotary blade attached to an edge of the rotating shaft;

a first fixture disposed on the edge of the rotating shaft;

a second fixture disposed on the edge of the rotating shaft;

the first fixture is at a position closer to the cutting mechanism than the second fixture;

the first fixture and ~~a second fixture disposed at a position closer to the edge in view from the first fixture,~~ the second fixture fixing the rotary blade to the rotating shaft being sandwiched between the first fixture and the second fixture;

an electric current supply mechanism that supplies the driving mechanism with electric current to rotate the rotating shaft;

a measurement unit that measures a physical quantity associated with the cutting mechanism while the rotating shaft is rotating;

a flow rate regulating unit connected to the cooling water passage to regulate a flow rate of cooling water supplied to flow in the cooling water passage;

a cooling water delivery mechanism that delivers the cooling water to the flow rate regulating unit; and

a controller connected to at least the flow rate regulating unit, wherein

the controller compares a measured value of the physical quantity measured by the measurement unit while the rotating shaft is rotating to a prestored value of the physical quantity, and

~~changes~~ the flow rate of the cooling water supplied to flow in the cooling water passage is changed based on a result of the comparison~~.~~

~~2. The cutting apparatus as claimed in claim 1~~, wherein

the physical quantity is the electric current,

the measurement unit is an electric current measurement unit for constantly measuring the electric current supplied from the electric current supply mechanism~~connected~~ to the driving mechanism while the rotating shaft is rotating~~to measure the electric current~~,

~~the physical quantity is the electric current,~~

the controller is connected to the electric current measurement unit, and

the controller detects variations of the electric current based on the result of the comparison, and increases or decreases the flow rate of the cooling water in accordance with a result of the detection.

23. A~~The~~ cutting apparatus ~~as claimed in claim 1 or 2~~, comprising:

a table to be mounted with the article to be cut;

a cutting mechanism that cuts the article to be cut; and

a moving mechanism that relatively moves the table and the cutting mechanism,

the cutting apparatus being for use in cutting the article to be cut along a cutting line into separate pieces to provide a plurality of individual products, the cutting apparatus further comprising:

a rotating shaft installed in the cutting mechanism;

a driving mechanism installed in the cutting mechanism to drive the rotating shaft to rotate;

a cooling water passage formed in the cutting mechanism around the rotating shaft;

a rotary blade attached to an edge of the rotating shaft;

a first fixture disposed on the edge of the rotating shaft;

a second fixture disposed on the edge of the rotating shaft;

the first fixture is at a position closer to the cutting mechanism than the second fixture;

the first fixture and the second fixture fixing the rotary blade to the rotating shaft being sandwiched between the first fixture and the second fixture;

an electric current supply mechanism that supplies the driving mechanism with electric current to rotate the rotating shaft;

a measurement unit that measures a physical quantity associated with the cutting mechanism while the rotating shaft is rotating;

a flow rate regulating unit connected to the cooling water passage to regulate a flow rate of cooling water supplied to flow in the cooling water passage;

a cooling water delivery mechanism that delivers the cooling water to the flow rate regulating unit; and

a controller connected to at least the flow rate regulating unit, wherein

the controller compares a measured value of the physical quantity measured by the measurement unit while the rotating shaft is rotating to a prestored value of the physical quantity, and

the flow rate of the cooling water supplied to flow in the cooling water passage is changed based on a result of the comparison, wherein

the physical quantity is the distance,

the measurement unit is a distance measurement unit installed in the cutting mechanism to measure a distance between the cutting mechanism and the first fixture,

~~the physical quantity is the distance,~~

the controller is connected to the distance measurement unit, and

the controller detects variations of the distance based on the result of the comparison, and increases or decreases the flow rate of the cooling water in accordance with a result of the detection.

34. The cutting apparatus as claimed in claim 23, wherein

the controller calculates a difference between a measured value and a prestored value of the distance between the cutting mechanism and the fixture, and aligns a position of the rotary blade to a position of the cutting line based on the difference.

45. The cutting apparatus as claimed in claim 23, wherein

the distance measurement unit includes at least an eddy current displacement sensor or an optical displacement sensor.

56. The cutting apparatus as claimed in claim 1 ~~or 2~~, wherein

the prestored value is a plurality of prestored values,

the plurality of prestored values are respectively associated with a plurality of flow rate values of the cooling water, and

the measured value is compared to the plurality of prestored values to regulate the flow rate of the cooling water supplied to flow in the cooling water passage to be any one of the plurality of flow rate values.

6~~7~~. The cutting apparatus as claimed in claim 1~~ or 2~~, wherein

the article to be cut is a sealed substrate.

7~~8~~. The cutting apparatus as claimed in claim 1~~ or 2~~, wherein

the article to be cut is a substrate embedded with functional elements in a plurality of regions respectively corresponding to the plurality of products.

8. The cutting apparatus as claimed in claim 1, further comprising:

a distance measurement unit installed in the cutting mechanism to measure a distance between the cutting mechanism and the first fixture, wherein

the controller calculates a difference between a measurement value measured by the distance measurement unit and a prestored value of the distance between the cutting mechanism and the first fixture, and aligns a position of the rotary blade to a position of the cutting line based on the difference.

9. A cutting method, comprising steps of:

mounting an article to be cut on a table;

relatively moving the table and a cutting mechanism;

cutting the article to be cut along a cutting line using the cutting mechanism by way of the relative movement between the table and the cutting mechanism;

supplying a driving mechanism installed in the cutting mechanism with electric current to rotate the rotating shaft;

rotating, using the driving mechanism, a rotating shaft and a rotary blade fixed~~ly~~ to the rotating shaft being sandwiched between a first fixture disposed on an edge of the rotating shaft ~~at a position closer to the cutting mechanism~~ and a second fixture disposed on an edge of the rotating shaft, the first fixture is at a position closer to the cutting mechanism than~~edge in view from~~ the second~~first~~ fixture;

delivering cooling water from a cooling water delivery mechanism to a flow rate regulating unit;

supplying a cooling water passage arranged around the rotating shaft with the cooling water from the flow rate regulating unit;

measuring a physical quantity associated with the cutting mechanism while the rotating shaft is rotating;

comparing a measured value of the physical quantity measured while the rotating shaft is rotating to a prestored value of the physical quantity; and

changing a flow rate of the cooling water supplied to flow in the cooling water passage based on a result of the comparison in the comparing step~~.~~

~~10. The cutting method as claimed in claim 9~~, wherein

the physical quantity is the electric current,

the step of measuring unit the physical quantity constantly measures the electric current supplied to the driving mechanism while the rotating shaft is rotating, and

the step of changing the flow rate includes detecting variations of the electric current based on the result of the comparison and further includes increasing or decreasing the flow rate of the cooling water in accordance with a result of the detection.

10~~11~~. A~~The~~ cutting method ~~as claimed in claim 9 or 10~~, comprising steps of:

mounting an article to be cut on a table;

relatively moving the table and a cutting mechanism;

cutting the article to be cut along a cutting line using the cutting mechanism by way of the relative movement between the table and the cutting mechanism;

supplying a driving mechanism installed in the cutting mechanism with electric current to rotate the rotating shaft;

rotating, using the driving mechanism, a rotating shaft and a rotary blade fixed to the rotating shaft being sandwiched between a first fixture disposed on an edge of the rotating shaft and a second fixture disposed on an edge of the rotating shaft, the first fixture is at a position closer to the cutting mechanism than the second fixture;

delivering cooling water from a cooling water delivery mechanism to a flow rate regulating unit;

supplying a cooling water passage arranged around the rotating shaft with the cooling water from the flow rate regulating unit;

measuring a physical quantity associated with the cutting mechanism while the rotating shaft is rotating;

comparing a measured value of the physical quantity measured while the rotating shaft is rotating to a prestored value of the physical quantity; and

changing a flow rate of the cooling water supplied to flow in the cooling water passage based on a result of the comparison in the comparing step, wherein

the physical quantity is a distance between the cutting mechanism and the first fixture, and

the step of changing the flow rate includes detecting variations of the distance based on the result of the comparison and further includes increasing or decreasing the flow rate of the cooling water in accordance with a result of the detection.

11~~12~~. The cutting method as claimed in claim 10~~11~~, further comprising steps of:

measuring the distance between the cutting mechanism and the fixture using a distance measurement unit installed in the cutting mechanism;

calculating a difference between a measured value and a prestored value of the distance; and

aligning a position of the rotary blade to a position of the cutting line based on the difference.

12~~13~~. The cutting method as claimed in claim 10~~11~~, wherein

the distance measurement unit includes at least an eddy current displacement sensor or an optical displacement sensor.

13~~14~~. The cutting method as claimed in claim 9~~ or 10~~, wherein

the prestored value is a plurality of prestored values,

the plurality of prestored values are respectively associated with a plurality of flow rate values of the cooling water, and

the measured value is compared to the plurality of prestored values to regulate the flow rate of the cooling water supplied to flow in the cooling water passage to be any one of the plurality of flow rate values.

14~~15~~. The cutting method as claimed in claim 9~~ or 10~~, wherein

the article to be cut is a sealed substrate.

15~~16~~. The cutting method as claimed in claim 9~~ or 10~~, wherein

the article to be cut is a substrate embedded with functional elements in a plurality of regions respectively corresponding to the plurality of products.

16. The cutting method as claimed in claim 9, further comprising steps of:

measuring the distance between the cutting mechanism and the first fixture using a distance measurement unit installed in the cutting mechanism;

calculating a difference between a measurement value measured by the distance measurement unit and a prestored

value of the distance between the cutting mechanism and the first fixture; and

aligning a position of the rotary blade to a position of the cutting line based on the difference.