

CLAIMS

1. A cleaning device comprising:

a plurality of rollers that hold a peripheral edge part of a substrate;

a rotation driving unit that rotates the substrate by rotationally driving the plurality of rollers;

a cleaning member that abuts on the substrate and cleans the substrate;

a cleaning liquid supply nozzle that supplies a cleaning liquid to the substrate;

a microphone that detects a sound generated when a notch of the peripheral edge part of the substrate hits the plurality of rollers; ~~and~~

a rotation speed calculation unit that calculates a rotation speed of the substrate on a basis of the sound detected by the microphone; and

~~2. The cleaning device according to claim 1, further comprising~~

a housing that defines a cleaning space in which the substrate is cleaned, wherein

the plurality of rollers, the cleaning member, and the cleaning liquid supply nozzle are disposed inside the housing, and

at least one microphone is disposed outside the

housing.

2. A cleaning device comprising:

a plurality of rollers that hold a peripheral edge part of a substrate;

a rotation driving unit that rotates the substrate by rotationally driving the plurality of rollers;

a cleaning member that abuts on the substrate and cleans the substrate;

a cleaning liquid supply nozzle that supplies a cleaning liquid to the substrate;

a microphone that detects a sound generated when a notch of the peripheral edge part of the substrate hits the plurality of rollers;

a rotation speed calculation unit that calculates a rotation speed of the substrate on a basis of the sound detected by the microphone;

~~3. The cleaning device according to claim 1, further comprising~~

~~a housing that defines a cleaning space in which the substrate is cleaned; , wherein and~~

~~the plurality of rollers, the cleaning member, and the cleaning liquid supply nozzle are disposed inside the housing, and~~

~~the microphone is disposed only inside the housing.~~

~~4. The cleaning device according to any one of claims 1 to 3, wherein~~

~~—— the rotation speed calculation unit calculates a rotation speed of the substrate on a basis of a fundamental wave and a harmonic of the sound.~~

~~5. The cleaning device according to any one of claims 1 to 4, further comprising~~

~~—— a vibration sensor that detects a vibration generated when the notch of the peripheral edge part of the substrate hits one of the plurality of rollers, wherein~~

~~—— the rotation speed calculation unit calculates the rotation speed of the substrate on a basis of the sound detected by the microphone and the vibration detected by the vibration sensor.~~

~~6. The cleaning device according to any one of claims 1 to 4, further comprising~~

~~—— a second microphone that detects a sound generated from the rotation driving unit, wherein~~

~~—— the rotation speed calculation unit calculates the rotation speed of the substrate on a basis of the sound detected by the microphone and the sound detected by the second microphone.~~

~~7. The cleaning device according to any one of claims 1 to 6, further comprising~~

~~—— a rotation speed setting unit that sets a set value of the rotation speed of the substrate in the rotation driving unit, wherein~~

~~—— the rotation speed calculation unit calculates the rotation speed of the substrate in consideration of the set value acquired from the rotation speed setting unit.~~

~~8. The cleaning device according to any one of claims 1 to 7, further comprising~~

~~—— a display control unit that controls a display to display the rotation speed calculated by the rotation speed calculation unit.~~

~~9. The cleaning device according to claim 8, wherein~~

~~—— the display control unit averages a plurality of past rotation speeds calculated by the rotation speed calculation unit and controls the display to display the average.~~

~~10. The cleaning device according to any one of claims 1 to 9, further comprising~~

~~—— an abnormality determination unit that determines a~~

~~presence or absence of an abnormality on a basis of the rotation speed calculated by the rotation speed calculation unit.~~

~~11. The cleaning device according to claim 10, wherein
— the abnormality determination unit determines the presence or absence of an abnormality on a basis of an average value of the plurality of past rotation speeds calculated by the rotation speed calculation unit.~~

~~12. The cleaning device according to claim 10 or 11,
further comprising
— an abnormality reporting unit that reports the abnormality and/or instructs the rotation driving unit to stop in a case where the abnormality determination unit determines that there is an abnormality.~~

~~13. The cleaning device according to any one of claims 10 to 12, wherein
— the abnormality determination unit calculates a difference or a ratio between the rotation speed calculated by the rotation speed calculation unit and the set value acquired from the rotation speed setting unit, and determines that there is an abnormality in a case where the difference or the ratio exceeds a predetermined threshold.~~

~~14. The cleaning device according to any one of claims 10 to 13, wherein~~

~~—— the abnormality determination unit determines that there is an abnormality in a case where the rotation speed calculated by the rotation speed calculation unit is zero and the set value acquired from the rotation speed setting unit is not zero or in a case where an abnormal sound is detected by the microphone.~~

~~15. The cleaning device according to any one of claims 10 to 14, wherein~~

~~—— the abnormality determination unit determines the presence or absence of an abnormality in consideration of a fluctuation of a current flowing through a motor that rotates the cleaning member.~~

~~16. The cleaning device according to any one of claims 10 to 15, wherein~~

~~—— the abnormality determination unit determines the presence or absence of an abnormality in consideration of a fluctuation of an internal air pressure of the housing.~~

~~17. The cleaning device according to claim 2, wherein~~

~~—— the microphone collects a sound generated inside the~~

~~housing from a ventilation gap provided in the housing.~~

an abnormality determination unit that determines a presence or absence of an abnormality on a basis of the rotation speed calculated by the rotation speed calculation unit, wherein

the abnormality determination unit determines the presence or absence of an abnormality in consideration of a fluctuation of an internal air pressure of the housing.

3. The cleaning device according to claim 2, wherein

the abnormality determination unit determines the presence or absence of an abnormality on a basis of an average value of the plurality of past rotation speeds calculated by the rotation speed calculation unit.

4. The cleaning device according to claim 2 or 3, further comprising

an abnormality reporting unit that reports the abnormality and/or instructs the rotation driving unit to stop in a case where the abnormality determination unit determines that there is an abnormality.

5. The cleaning device according to any one of claims 2 to 4, wherein

the abnormality determination unit calculates a

difference or a ratio between the rotation speed calculated by the rotation speed calculation unit and the set value acquired from a rotation speed setting unit that sets a set value of the rotation speed of the substrate in the rotation driving unit, and determines that there is an abnormality in a case where the difference or the ratio exceeds a predetermined threshold.

6. The cleaning device according to any one of claims 2 to 5, wherein

the abnormality determination unit determines that there is an abnormality in a case where the rotation speed calculated by the rotation speed calculation unit is zero and the set value acquired from a rotation speed setting unit that sets a set value of the rotation speed of the substrate in the rotation driving unit is not zero or in a case where an abnormal sound is detected by the microphone.

7. The cleaning device according to any one of claims 2 to 6, wherein

the abnormality determination unit determines the presence or absence of an abnormality in consideration of a fluctuation of a current flowing through a motor that rotates the cleaning member.

8. The cleaning device according to claim 1, wherein
the microphone collects a sound generated inside the
housing from a ventilation gap provided in the housing.

9. The cleaning device according to any one of claims 2 to
7, wherein
the plurality of rollers, the cleaning member, and the
cleaning liquid supply nozzle are disposed inside the
housing, and
the microphone is disposed only inside the housing.

10. The cleaning device according to any one of claims 1 to
9, wherein
the rotation speed calculation unit calculates a
rotation speed of the substrate on a basis of a fundamental
wave and a harmonic of the sound.

11. The cleaning device according to any one of claims 1 to
10, further comprising
a vibration sensor that detects a vibration generated
when the notch of the peripheral edge part of the substrate
hits one of the plurality of rollers, wherein
the rotation speed calculation unit calculates the
rotation speed of the substrate on a basis of the sound
detected by the microphone and the vibration detected by

the vibration sensor.

12. The cleaning device according to any one of claims 1 to 10, further comprising

a second microphone that detects a sound generated from the rotation driving unit, wherein

the rotation speed calculation unit calculates the rotation speed of the substrate on a basis of the sound detected by the microphone and the sound detected by the second microphone.

13. The cleaning device according to any one of claims 1 to 12, wherein

the rotation speed calculation unit calculates the rotation speed of the substrate in consideration of the set value acquired from a rotation speed setting unit that sets a set value of the rotation speed of the substrate in the rotation driving unit.

14. The cleaning device according to any one of claims 1 to 13, further comprising

a display control unit that controls a display to display the rotation speed calculated by the rotation speed calculation unit.

15. The cleaning device according to claim 14, wherein
the display control unit averages a plurality of past
rotation speeds calculated by the rotation speed
calculation unit and controls the display to display the
average.

~~18~~16. The cleaning device according to claim ~~7~~13, wherein
the rotation speed calculation unit changes a cutoff
frequency of a filter applied to a signal of the sound
according to the set value.

~~19~~17. A polishing device comprising:
a polishing unit that polishes a substrate; and
a cleaning unit that cleans the substrate after
polishing, wherein
the cleaning unit has
a plurality of rollers that hold a peripheral edge part
of the substrate,
a rotation driving unit that rotates the substrate by
rotationally driving the plurality of rollers,
a cleaning member that abuts on the substrate and
cleans the substrate,
a cleaning liquid supply nozzle that supplies a
cleaning liquid to the substrate,
a microphone that detects a sound generated when a

notch of the peripheral edge part of the substrate hits the plurality of rollers, ~~and~~

a rotation speed calculation unit that calculates a rotation speed of the substrate on a basis of the sound detected by the microphone, and-

a housing that defines a cleaning space in which the substrate is cleaned, and wherein

the plurality of rollers, the cleaning member, and the cleaning liquid supply nozzle are disposed inside the housing, and

at least one microphone is disposed outside the housing.

18. A polishing device comprising:

a polishing unit that polishes a substrate; and

a cleaning unit that cleans the substrate after polishing, wherein

the cleaning unit has

a plurality of rollers that hold a peripheral edge part of the substrate,

a rotation driving unit that rotates the substrate by rotationally driving the plurality of rollers,

a cleaning member that abuts on the substrate and cleans the substrate,

a cleaning liquid supply nozzle that supplies a

cleaning liquid to the substrate,

a microphone that detects a sound generated when a notch of the peripheral edge part of the substrate hits the plurality of rollers,

a rotation speed calculation unit that calculates a rotation speed of the substrate on a basis of the sound detected by the microphone,

a housing that defines a cleaning space in which the substrate is cleaned, and

an abnormality determination unit that determines a presence or absence of an abnormality on a basis of the rotation speed calculated by the rotation speed calculation unit, and wherein

the abnormality determination unit determines the presence or absence of an abnormality in consideration of a fluctuation of an internal air pressure of the housing.

2019. A device that calculates a rotation speed of a substrate in a cleaning device including

a plurality of rollers that hold a peripheral edge part of the substrate,

a rotation driving unit that rotates the substrate by rotationally driving the plurality of rollers,

a cleaning member that abuts on the substrate and cleans the substrate, and

a cleaning liquid supply nozzle that supplies a cleaning liquid to the substrate, and
a housing that defines a cleaning space in which the substrate is cleaned,

the device comprising:

a microphone that detects a sound generated when a notch of a peripheral edge part of the substrate hits the plurality of rollers; and

a rotation speed calculation unit that calculates the rotation speed of the substrate on a basis of the sound detected by the microphone, wherein-

the plurality of rollers, the cleaning member, and the cleaning liquid supply nozzle are disposed inside the housing, and

at least one microphone is disposed outside the housing.

20. A device that calculates a rotation speed of a substrate in a cleaning device including

a plurality of rollers that hold a peripheral edge part of the substrate,

a rotation driving unit that rotates the substrate by rotationally driving the plurality of rollers,

a cleaning member that abuts on the substrate and

cleans the substrate,

a cleaning liquid supply nozzle that supplies a
cleaning liquid to the substrate, and

a housing that defines a cleaning space in which the
substrate is cleaned,

the device comprising:

a microphone that detects a sound generated when a
notch of a peripheral edge part of the substrate hits the
plurality of rollers;

a rotation speed calculation unit that calculates the
rotation speed of the substrate on a basis of the sound
detected by the microphone; and

an abnormality determination unit that determines a
presence or absence of an abnormality on a basis of the
rotation speed calculated by the rotation speed calculation
unit, wherein

the abnormality determination unit determines the
presence or absence of an abnormality in consideration of a
fluctuation of an internal air pressure of the housing.

21. A method that calculates a rotation speed of a
substrate in a cleaning device including

a plurality of rollers that hold a peripheral edge part
of the substrate,

a rotation driving unit that rotates the substrate by
rotationally driving the plurality of rollers,

a cleaning member that abuts on the substrate and
cleans the substrate, ~~and~~

a cleaning liquid supply nozzle that supplies a
cleaning liquid to the substrate, and

a housing that defines a cleaning space in which the
substrate is cleaned,

the method comprising steps of:

detecting, by a microphone, a sound generated when a
notch of a peripheral edge part of the substrate hits the
plurality of rollers; ~~and,~~ wherein the plurality of
rollers, the cleaning member, and the cleaning liquid
supply nozzle are disposed inside the housing, and at least
one microphone is disposed outside the housing; and

calculating the rotation speed of the substrate on a
basis of the sound detected by the microphone.

22. A method that calculates a rotation speed of a
substrate in a cleaning device including

a plurality of rollers that hold a peripheral edge part
of the substrate,

a rotation driving unit that rotates the substrate by
rotationally driving the plurality of rollers,

a cleaning member that abuts on the substrate and
cleans the substrate,

a cleaning liquid supply nozzle that supplies a
cleaning liquid to the substrate, and

a housing that defines a cleaning space in which the
substrate is cleaned,
the method comprising steps of:
detecting, by a microphone, a sound generated when a
notch of a peripheral edge part of the substrate hits the
plurality of rollers;
calculating the rotation speed of the substrate on a
basis of the sound detected by the microphone; and
determining a presence or absence of an abnormality on
a basis of the calculated rotation speed, wherein the
presence or absence of an abnormality is determined in
consideration of a fluctuation of an internal air pressure
of the housing.