CLAIMS

~~1. A cleaning device for a wire in a cutting machine, the cleaning device comprising:~~

~~a through hole configured to allow passage of the wire therethrough; and~~

~~a conically shaped annular gap configured to focus an annular air jet onto the wire passing through the cleaning device for cleaning and drying the wire, the conically shaped annular gap being in fluid communication and co-axial with the through hole.~~

~~2. The cleaning device of claim 1, further comprising an air inlet configured to direct compressed dry air into the conically shaped annular gap.~~

~~3. The cleaning device of claim 1 or claim 2, wherein the cleaning device comprises at least two portions, a first portion comprising a central recess having a conical base, and a second portion comprising a central shaft having a conical end, wherein the conically shaped annular gap is formed by spacing the conical end from the conical base.~~

~~4. The cleaning device of claim 3 when dependent on claim 2, wherein the air inlet is provided in the first portion.~~

~~5. The cleaning device of any preceding claim, further comprising a conical depression at one end of the through hole into which the annular air jet is focused.~~

~~6.~~ 1. A cutting machine for cutting an ingot; the cutting machine comprising:

a carrier configured to attach the ingot thereonto;

a plurality of wires configured to cut the ingot; and

a container configured to flow water onto the plurality of wires and the ingot during cutting and to submerge cut portions of the ingot in water in the container without submerging the plurality of wires.

~~7.~~2. The cutting machine of claim ~~6~~1, further comprising at least one dancer configured to control wire tension during operation.

~~8.~~3. The cutting machine of claim ~~7~~2, wherein the dancer is configured to be moveable to increase total distance travelled by a wire to increase wire tension, and to decrease total distance travelled by the wire to decrease the tension.

~~9.~~4. The cutting machine of claim ~~8~~3, further comprising at least one wire tension sensor configured to detect wire tension, wherein movement of the dancer is in response to the detected wire tension.

~~10.~~5. The cutting machine of any one of claims ~~6~~ 1 to ~~9~~4, further comprising a wire positioner configured to position a wire relative to a wire drum when winding the wire onto the wire drum and when unwinding the cutting wire from the wire drum, the plurality of wires being formed from the wire, the wire positioner further comprising a wire displacement sensor configured to detect the position of the wire relative to the wire drum.

~~11.~~6. The cutting machine of claim ~~10~~5, further comprising a control system configured to control movement of the wire positioner in response to the detected position of the wire.

~~12.~~7. The cutting machine of claim ~~11~~ 6 when dependent on claim ~~9~~4, wherein the control system is further configured to control movement of the dancer in response to the detected wire tension.

~~13.~~8. The cutting machine of any one of claims ~~6~~ 1 to ~~12~~7, further comprising ~~the~~ a cleaning device for the plurality of wires, the plurality of wires being formed from a wire, the cleaning device comprising: ~~of any one of claims 1 to 5.~~

a through hole configured to allow passage of the wire therethrough; and

a conically shaped annular gap configured to focus an annular air jet onto the wire passing through the cleaning device for cleaning and drying the wire, the conically shaped annular gap being in fluid communication and co-axial with the through hole.

9. The cutting machine of claim 8, further comprising an air inlet configured to direct compressed dry air into the conically shaped annular gap.

10. The cutting machine of claim 8 or 9, wherein the cleaning device comprises at least two portions, a first portion comprising a central recess having a conical base, and a second portion comprising a central shaft having a conical end, wherein the conically shaped annular gap is formed by spacing the conical end from the conical base.

11. The cutting machine of claim 10 when dependent on claim 9, wherein the air inlet is provided in the first portion.

12. The cutting machine of any one of claims 8 to 11, further comprising a conical depression at one end of the through hole into which the annular air jet is focused.

~~14.~~13. A method of cutting an ingot, the method comprising:

a. attaching an ingot onto a carrier;

b. lowering the ingot to contact a plurality of wires;

c. flowing water onto the plurality of wires and the ingot during cutting; and

d. submerging cut portions of the ingot in water without submerging the plurality of wires.

~~15.~~14. The method of claim ~~14~~13, further comprising periodically raising the ingot during

operation such that the plurality of wires are run against the cut portions of the ingot during the raising, thereby improving surface quality of the cut portions of the ingot.

~~16.~~15. The method of claim ~~14~~13 or ~~15~~14, wherein the plurality of wires are formed from a wire, and further comprising cleaning the wire after cutting by passing the wire through a wire cleaning device prior to winding the wire onto a wire receiver drum.

~~17.~~16. The method of claim ~~16~~15, further comprising positioning the wire with respect to the wire receiver drum by passing the wire through a wire displacement sensor after cleaning the wire and prior to winding the wire onto the wire receiver drum.

~~18.~~17. The method of claim ~~16~~15 or ~~17~~16, further comprising, before cutting, positioning the wire relative to a wire feeder drum by passing the wire through a wire displacement sensor after unwinding the wire from a wire feeder drum.

~~19.~~18. The method of claim ~~17~~16, further comprising controlling tension of the wire by controlling movement of a dancer around which the wire is passed, wherein movement of the dancer is in response to wire tension detected by a wire tension sensor.

~~20.~~19. The method of claim ~~18~~17, wherein controlling tension of the wire comprises moving the dancer to increase total distance travelled by the wire to increase wire tension when the detected wire tension is lower than a predetermined wire tension, and moving the dancer to decrease total distance travelled by the wire to decrease wire tension when the detected wire tension is higher than the predetermined wire tension.