heating profile is produced along most of the specimen-bearing surface of the slide. The substantially uniform temperature profile has less than a 5° temperature variation across the specimen-bearing area of the slide. Additionally or alternatively, the conductive heater can be configured to produce a central low temperature heating zone along the support element and a peripheral high temperature heating zone along the support element. Additionally or alternatively, the conductive heater is positioned underneath the support element and defines an opening through which a convective flow is capable of passing to cool the support element.

The system for heating a specimen-bearing slide, in some embodiments, includes a convection cooling device coupled to the controller and configured to deliver a convective flow into the opening based on a signal from the controller. In certain embodiments, the convection cooling device includes at least one fan capable of producing the convective flow. In some embodiments, compressed air or motive air can be used.

The support element, in some embodiments, comprises stainless steel. In some embodiments, a portion of the support element between the support surface for carrying the slide and the conductive heater has a thermal conductivity equal to or less than about 20 W/m*K.

In view of the above, in accordance with a first aspect, there is provided a slide processing apparatus, comprising:

a slide holder platen having a receiving region configured to receive a slide with a first side of the slide facing the receiving region and a second side facing away from the receiving region; and

an opposable actuator positioned to hold an opposable element to define a capillary gap between the opposable element and the slide located at the receiving region, the opposable actuator being configured to move the opposable element along the slide in a first direction to move the capillary gap in the first direction along the slide to move a band of liquid along the second side of the slide from a first

position to a second position, to vary a width of the band of liquid in a direction substantially parallel to the first direction by varying a height of the capillary gap along the first direction,

wherein the opposable actuator is configured to move the opposable element to displace the band of liquid between the first position and the second position while maintaining the width of the band of liquid or increasing or decreasing the width of the band of liquid less than 5% while displacing the band of liquid across the specimen.

~~a slide holder platen having a receiving region configured to receive a slide with a first side of the slide facing the receiving region and a second side facing away from the receiving region; and an opposable actuator positioned to hold an opposable element to define a capillary gap between the opposable element and a slide located at the receiving region, the opposable actuator being configured to move the capillary gap in a first direction along the slide to move a band of liquid along the second side of the slide from a first position to a second position and to decrease a width of the band of liquid in a direction substantially parallel to the first direction.~~

In accordance with a second aspect, there is provided ~~a slide processing apparatus, comprising: a slide holder platen; and an opposable actuator including an opposable receiver and a drive mechanism, the opposable receiver being positioned to hold an opposable element to form a capillary gap between the opposable element and a slide held by the slide holder platen, the drive mechanism having a rolling state for rolling the opposable element in a first direction along the slide to move a band of liquid to an end of a space between the opposable element and the slide, the drive mechanism having an over-rolling state for rolling the opposable element in the first direction to decrease a width of the band of liquid in a direction substantially parallel to the first direction captivated at the end of the space.~~

~~In accordance with a third aspect, there is provided~~ a method for processing a specimen carried by a slide, comprising:

delivering a slide and an opposable element to a staining module;

positioning the opposable element held by the staining module relative to the slide held by the staining module to from a band of liquid in a capillary gap between the slide and the opposable element, the band of liquid showing a first narrowed width W_{N1}, the width of the band of liquid being parallel to the longitudinal axis of the slide;

moving the opposable element relative to the slide to displace the liquid in a first direction that is parallel to a longitudinal axis of the slide, thereby spreading the band of liquid to increase the width of the band of liquid to a spread width W_S, and moving the spread band of liquid across the specimen displaced on the slide, whereby the spread width W_S is maintained or increased or decreased less than 5% while displacing the band of liquid across the specimen, towards an end of an opening between the slide and the opposable element; and

further moving the opposable element relative to the slide in the first direction and decreasing the width of the band of liquid to a second narrowed width W_{N2}, and captivating the band of liquid at the end of the opening.

~~delivering a slide and an opposable element to a staining module; positioning the opposable element held by the staining module relative to the slide held by the staining module to hold a liquid in a capillary gap between the slide and the opposable element; moving the opposable element relative to the slide to displace the liquid in a first direction that is substantially parallel to a longitudinal axis of the slide and towards an end of an opening between the slide and the opposable element; and moving the opposable element relative to the slide to decrease a~~

~~width of a band of the liquid in the first direction while the band is captivated at the end of the opening.~~

BRIEF DESCRIPTION OF THE DRAWINGS

Non-limiting and non-exhaustive embodiments are described with reference to the following drawings. The same reference numerals refer to like parts or acts throughout the various views, unless otherwise specified.

Figure 1 is an isometric view of a specimen processing system in accordance with an embodiment of the disclosed technology.

Figure 2 is an exploded isometric view of the specimen processing system of Figure 1. Portions of a protective housing are shown removed.

Figure 3 is a detailed view of a portion of the specimen processing system of Figure 2.

PATENT CLAIMS

1. A slide processing apparatus, comprising:

a slide holder platen having a receiving region configured to receive a slide with a first side of the slide facing the receiving region and a second side facing away from the receiving region; and

an opposable actuator positioned to hold an opposable element to define a capillary gap between the opposable element and ~~a~~ the slide located at the receiving region, the opposable actuator being configured to move the opposable element along the slide in a first direction to move the capillary gap in ~~a~~ the first direction along the slide to move a band of liquid along the second side of the slide from a first position to a second position, ~~and~~ to ~~decrease~~ vary a width of the band of liquid in a direction substantially parallel to the first direction by varying a height of the capillary gap along the first direction,

characterized in that the opposable actuator is configured to move the opposable element to displace the band of liquid between the first position and the second position while maintaining the width of the band of liquid or increasing or decreasing the width of the band of liquid less than 5% while displacing the band of liquid across the specimen.

2. The slide processing apparatus of claim 1, wherein the opposable actuator is configured to alternatingly roll the opposable element along the slide in the first direction and a second direction opposite the first direction to move the band of liquid between the first position and the second position, the band of liquid at the first position is located between an end of the opposable element and the slide, and the band of liquid at the second position is located between the opposable element and an end of the slide, wherein, in the first configuration, the band of liquid is narrowed at the first end of an opening between the opposable element and

the slide and, in the second configuration, the band of liquid is narrowed at a second end of the opening between the opposable element and the slide.

~~3. The slide processing apparatus of claim 2, further comprising decreasing the width of the band of liquid at each of the first position and the second position prior to moving the band of liquid to the other of the first position and the second position.~~

43. The slide processing apparatus of claim 1, wherein the opposable actuator is configured to move the opposable element relative to the slide to decrease the width of the band of liquid at an end of an opening defined by an end of at least one of the slide and/or the opposable element by at least 50%.

~~5. The slide processing apparatus of claim 1, wherein the opposable actuator is configured to move the opposable element to displace the band of liquid between the first position and the second position while maintaining the width of the band of liquid.~~

~~6. The slide processing apparatus of claim 1, wherein the opposable actuator is moveable between a first configuration in which the band of liquid is narrowed at a first end of an opening between the opposable element and the slide and a second configuration in which the band of liquid is narrowed at a second end of the opening.~~

~~7~~4. The slide processing apparatus of claim 1, wherein the opposable actuator is movable ~~to an over-roll configuration~~ to move a first side of the band of liquid towards a second side of the band of liquid to decrease the width of the band of liquid while the second side of the band of liquid is held ~~substantially~~ stationary at an end of one of the opposable element and the slide.

~~8~~5. The slide processing apparatus of claim 1, further comprising:

a staining module comprising the slide holder platen and the opposable actuator; and

a controller communicatively coupled to the staining module, the controller being programmed to command the staining module to move the opposable element to move the capillary gap.

~~96~~. The slide processing apparatus of claim 1, further comprising:

~~an opposable element including a mounting end held by an opposable receiver of the opposable actuator, a captivating end opposite the mounting end, and a main body between the mounting end and the captivating end, wherein the captivating end cooperates with the slide to accumulate the liquid at an end of a mounting surface of the slide which is proximate to~~ a label on the slide being adapted to help captivating the band of liquid, wherein the label is made, in whole or in part, of a hydrophobic material~~as the mounting end is moved away from the slide~~.

~~107~~. The slide processing apparatus of claim 1, further comprising:

~~an~~ the opposable element having a tapered end facing the receiving region, the tapered end being positioned to contact and captivate the band of liquid.

~~118~~. The slide processing apparatus of claim ~~107~~, wherein the tapered end includes a rounded region extending between opposite longitudinally extending edges of the opposable element.

~~12. The slide processing apparatus of claim 1, wherein the opposable actuator has a rolling state to roll the opposable element along the slide to move the band of liquid between a first location an end of an opening defined by an end of the slide and the opposable element and a second location an opposing end of the opening.~~

~~13. The slide processing apparatus of claim 1, further comprising:~~

~~a slide supported by a contact surface of the receiving region such that the slide extends laterally outward past opposing edges of the contact surface.~~

~~14~~9. The slide processing apparatus of claim 1, further comprising:

~~an~~ the opposable element held by the opposable actuator, the opposable element having a curved captivation end with a radius of curvature equal to or less than about ~~0.08 inch~~2 mm.

~~15~~10. The slide processing apparatus of claim 1, further comprising ~~an~~ the opposable element having an arcuate body for rolling along the slide at the receiving region.

~~16. A slide processing apparatus, comprising:~~

~~a slide holder platen; and~~

~~an opposable actuator including an opposable receiver and a drive mechanism, the opposable receiver being positioned to hold an opposable element to form a capillary gap between the opposable element and a slide held by the slide holder platen, the drive mechanism having a rolling state for rolling the opposable element in a first direction along the slide to move a band of liquid to an end of a space between the opposable element and the slide, the drive mechanism having an over-rolling state for rolling the opposable element in the first direction to decrease a width of the band of liquid in a direction substantially parallel to the first direction captivated at the end of the space.~~

~~17. The slide processing apparatus of claim 16, wherein the opposable actuator is configured to move the opposable element to move the band of liquid across at least most of a mounting surface of the slide.~~

~~18. The slide processing apparatus of claim 16, wherein the opposable actuator is configured to decrease the width of the band of liquid by moving at least a portion of the opposable element away from the slide, and the width of the band of liquid is in a direction substantially parallel to a longitudinal axis of the slide.~~

~~19~~11. A method for processing a specimen carried by a slide, comprising:

delivering a slide and an opposable element to a staining module;

positioning the opposable element held by the staining module relative to the slide held by the staining module to ~~hold~~ from a band of liquid in a capillary gap between the slide and the opposable element, the band of liquid showing a first narrowed width W_{N1}, the width of the band of liquid being parallel to the longitudinal axis of the slide;

moving the opposable element relative to the slide to displace the liquid in a first direction that is ~~substantially~~ parallel to a longitudinal axis of the slide, thereby spreading the band of liquid to increase the width of the band of liquid to a spread width W_S, and moving the spread band of liquid across the specimen displaced on the slide, whereby the spread width W_S is maintained or increased or decreased less than 5% while displacing the band of liquid across the specimen, towards an end of an opening between the slide and the opposable element; and

further moving the opposable element relative to the slide in the first direction ~~to~~ and ~~decrease~~ decreasing ~~a~~ the width of ~~a~~ the band of ~~the~~ liquid to a second narrowed width W_{N2}, ~~in the first direction~~ and captivating ~~while~~ the band of liquid ~~is captivated~~ at the end of the opening.

~~20~~12. The method of claim ~~19~~11, further comprising alternatingly moving the band of liquid between the end of the opening and an opposing end of the opening by rolling the opposable element along the slide in the first direction and a

second direction opposite the first direction, thereby, in a first configuration, narrowing the band of liquid at the first end of the opening and, in a second configuration, narrowing the band of liquid at the second end of the opening.

~~21. The method of claim 19, further comprising:~~

~~spreading the band to increase the width of the band of liquid; and~~

~~moving the spread band across a specimen on the slide.~~

~~22. The method of claim 21, further comprising decreasing the width of the band at one end of the capillary gap prior to moving the band to the other end of the gap.~~

~~23. The method of claim 19, further comprising captivating substantially all of the liquid at the end of the capillary gap while decreasing the width of the band.~~

~~24. The method of claim 19, further comprising displacing the band across a specimen on the slide while maintaining the width of the band of liquid.~~

~~25. The method of claim 19, further comprising decreasing the width of the band by at least 50% by moving the opposable element relative to the slide, wherein a volume of the liquid is equal to or greater than about 30 µL.~~

~~26. The method of claim 19, wherein the width of the band is less than a length of the band, the width of the band is substantially parallel to the longitudinal axis of the slide, and the length of the band is substantially perpendicular to the longitudinal axis of the slide.~~

13. The method of claim 11, wherein the entire narrowed band of liquid is spaced apart from the specimen.

14. The method of claim 11, wherein the first narrowed width W_{N1} and/or the second narrowed width W_{N2} of the band of liquid is equal or less than 50% of the spread width W_S of the band of liquid.

15. The method of claim 11, wherein a label on the slide helps captivating the band of liquid, wherein the label is made, in whole or in part, of a hydrophobic material.