It is therefore desirable to provide an improved hairstyling device and/or improved methods of operating a hairstyling device.

Summary

According to an aspect of the present disclosure, there is provided a hairstyling device comprising: a heatable hair contact member having a hair-contactable surface, the hair contact member being operable to apply heat to a tress of hair of a user via the hair-contactable surface; and a controller configured to: determine that the hair contact member is moving along the tress from a first end of the tress towards a second end of the tress; and based on the determining, control heating of the hair contact member to cause the operating temperature of the hair contact member to change as the hair contact member moves along the tress from the first end of the tress towards the second end of the tress.

By adapting and/or modulating the delivery of heat to hair along the tress, the heat distribution across the tress can be controlled.

In ~~embodiment~~examples, the first end of the tress comprises a hair-root end of the tress. In ~~embodiment~~examples, the second end of the tress comprises a hair-tip end of the tress. In ~~embodiment~~examples, the controller is configured to cause the operating temperature of the hair contact member to increase as the hair contact member moves along the tress from the hair-root end of the tress towards the hair-tip end of the tress.

The temperature of the hair may be higher at the hair-root end of a tress compared to the hair-tip end of the tress. However, hair at the hair-tip end may require a greater amount of heat to be applied than hair at the hair-root end in order to be styled in a desired manner (e.g. straightened). Hair at the hair-tip end is older than hair at the hair-root end, and older hair may require more heat in order to be styled in the desired manner. Using a constant operating temperature of the hair contact member along the tress may therefore result in thermal damage to hair at the hair-root end of the tress (due to too much heat being delivered at the hair-root end), and/or may prevent the desired style from being achieved (due to too little heat being delivered at the hair-tip end). Providing a heat delivery profile that increases from the hair-root end towards the hair-tip end of the tress thus reduces the likelihood of thermal damage (particularly protecting the younger hair at the hair-root end), whilst ensuring that sufficiently high temperatures are delivered to hair at the hair-tip end to achieve the desired style.

In ~~embodiment~~examples, the hairstyling device comprises sensor equipment configured to generate a sensor output dependent on movement of the hair contact member. In such ~~embodiment~~examples, the controller is configured to receive the sensor output from the sensor equipment, and process the sensor output to determine that the hair contact member is moving along the tress. Therefore, the determination that the hair contact member is moving along the tress may be made without user input and/or intervention.

In ~~embodiment~~examples, the controller is configured to determine, based on the sensor output, a displacement of the hair contact member from the first end of the tress, and control heating of the hair contact member based on the determined displacement. In ~~embodiment~~examples, the controller is configured to control heating of the hair contact member based on a predetermined operating temperature of the hair contact member. The predetermined threshold operating temperature is dependent on the determined displacement of the hair contact member from the first end of the tress. Controlling heating of the hair contact member based on the determined displacement enables a finer control of heat distribution along the tress.

In ~~embodiment~~examples, the controller is configured to determine, based on the sensor output, a speed of the hair contact member, and control heating of the hair contact member based on the determined speed. This allows for a finer control of the heat distribution along the tress, and/or enables the hairstyling device to adapt to the user's behaviour. In ~~embodiment~~examples, the controller is configured to cause the operating temperature of the hair contact member to increase at a rate dependent on the determined speed.

In ~~embodiment~~examples, the sensor equipment comprises an inertial measurement unit, IMU. In ~~embodiment~~examples, the sensor equipment comprises a Hall effect sensor.

In ~~embodiment~~examples, the controller is configured to process the sensor output using a velocity and/or position estimation algorithm. In ~~embodiment~~examples, the velocity and/or position estimation algorithm comprises a Madgwick filter. In ~~embodiment~~examples, the velocity and/or position estimation algorithm comprises a machine learning model.

In ~~embodiment~~examples, causing the operating temperature to increase comprises adjusting an amount of energy used to heat the hair contact member as the hair contact member moves along the tress from the first end of the tress towards the second end of the tress.

In ~~embodiment~~examples, the controller is configured to cause the operating temperature of the hair contact member to increase at a predetermined rate as the hair contact member moves along the tress from the first end towards the second end.

In ~~embodiment~~examples, the controller is configured to cause the operating temperature of the hair contact member when the hair contact member is at the second end to be between 40 and 80 degrees higher than the operating temperature of the hair contact member when the hair contact member is at the first end. Such a difference in operating temperature between the first end and the second end enables the entire tress to achieve a desired style (e.g. to be straightened or curled), thereby reducing a styling time, whilst reducing the likelihood of thermal damage to the hair.

In ~~embodiment~~examples, the controller is configured to determine whether the hairstyling device is being used according to a first styling behaviour or a second, different styling behaviour. In such ~~embodiment~~examples, the controller is configured to control heating of the hair contact member in dependence on whether the hairstyling device is being used according to the first styling behaviour or the second styling behaviour. In ~~embodiment~~examples, the controller is configured to cause the operating temperature of the hair contact member to increase at a rate that is dependent on the whether the hairstyling device is being used according to the first styling behaviour or the second styling behaviour. As such, a distinct temperature delivery profile may be used for different activities. This enables different styles to be achieved by the same hairstyling device, thereby improving the versatility of the hairstyling device, whilst reducing the likelihood of thermal damage, and reducing the styling time.

In ~~embodiment~~examples, the hairstyling device comprises a heating element operable to heat the hair contact member. In such ~~embodiment~~examples, the controller is configured to control the heating element to cause the operating temperature of the hair contact member to change as the hair contact member moves along the tress from the first end towards the second end.

In ~~embodiment~~examples, the hairstyling device comprises a hair straightening device and/or a hair curling device.

According to an ~~aspect~~ example of the present disclosure, there is provided a method of operating a hairstyling device, the hairstyling device comprising a heatable hair contact member having a hair-contactable surface, the hair contact member being operable to apply heat to a tress of hair of a user via the hair-contactable surface, the method comprising: determining that the hair contact member is moving along the tress from a first end of the tress towards a second end of the tress; and based on the determining, controlling heating of the hair contact member to cause the operating temperature of the hair contact member to increase as the hair contact member moves along the tress from the first end of the tress towards the second end of the tress.

According to another aspect of the present disclosure, there is provided a method of operating a hairstyling device, the hairstyling device comprising a heatable hair contact member having a hair-contactable surface, the hair contact member being operable to apply heat to a tress of hair of a user via the hair-contactable surface, the method comprising: determining that the hair contact member is moving along the tress from a first end of the tress towards a second end of the tress; and based on the determining, controlling heating of the hair contact member to cause the operating temperature of the hair contact member to change as the hair contact member moves along the tress from the first end of the tress towards the second end of the tress.

According to an ~~aspect~~ example of the present disclosure, there is provided a computer program comprising a set of instructions which, when executed by a computerised device, cause the computerised device to perform a method of operating a hairstyling device, the hairstyling device comprising a heatable hair contact member having a hair-contactable surface, the hair contact member being operable to apply heat to a tress of hair of a user via the hair-contactable surface, the method comprising: determining that the hair contact member is moving along the tress from a first end of the tress towards a second end of the tress; and based on the determining, controlling heating of the hair contact member to cause the operating temperature of the hair contact member to increase as the hair contact member moves along the tress from the first end of the tress towards the second end of the tress.

According to another aspect of the present disclosure, there is provided a computer program comprising a set of instructions which, when executed by a computerised device, cause the computerised device to perform a method of operating a hairstyling device, the hairstyling device comprising a heatable hair contact member having a hair-contactable surface, the hair contact member being operable to apply heat to a tress of hair of a user via the hair-contactable surface, the method comprising: determining that the hair contact member is moving along the tress from a first end of the tress towards a second end of the tress; and based on the determining, controlling heating of the hair contact member to cause the operating temperature of the hair contact member to change as the hair contact member moves along the tress from the first end of the tress towards the second end of the tress.

It will of course be appreciated that features described in relation to one aspect of the present ~~invention~~disclosure may be incorporated into other aspects of the present ~~invention~~disclosure. For example, a method of the ~~invention~~disclosure may incorporate any of the features described with reference to an apparatus of the ~~invention~~disclosure and *vice versa*.

Brief description of the drawings

Embodiments of the present disclosure will now be described by way of example only with reference to the accompanying drawings, of which:

Figures 1A and 1B are perspective views of a hairstyling device according to embodiments;

Figure 2 is a schematic diagram of a hairstyling device according to embodiments;

Figure 3 is a flow diagram showing a method of operating a hairstyling device according to embodiments;

Figure 4 is a flow diagram showing a method of operating a hairstyling device according to embodiments;

Figure 5 is a flow diagram showing a method of operating a hairstyling device according to embodiments;

Figure 6 is a flow diagram showing a method of operating a hairstyling device according to embodiments;

Figure 7 is a flow diagram showing a method of operating a hairstyling device according to embodiments;

Figure 8 is a flow diagram showing a method of operating a hairstyling device according to embodiments;