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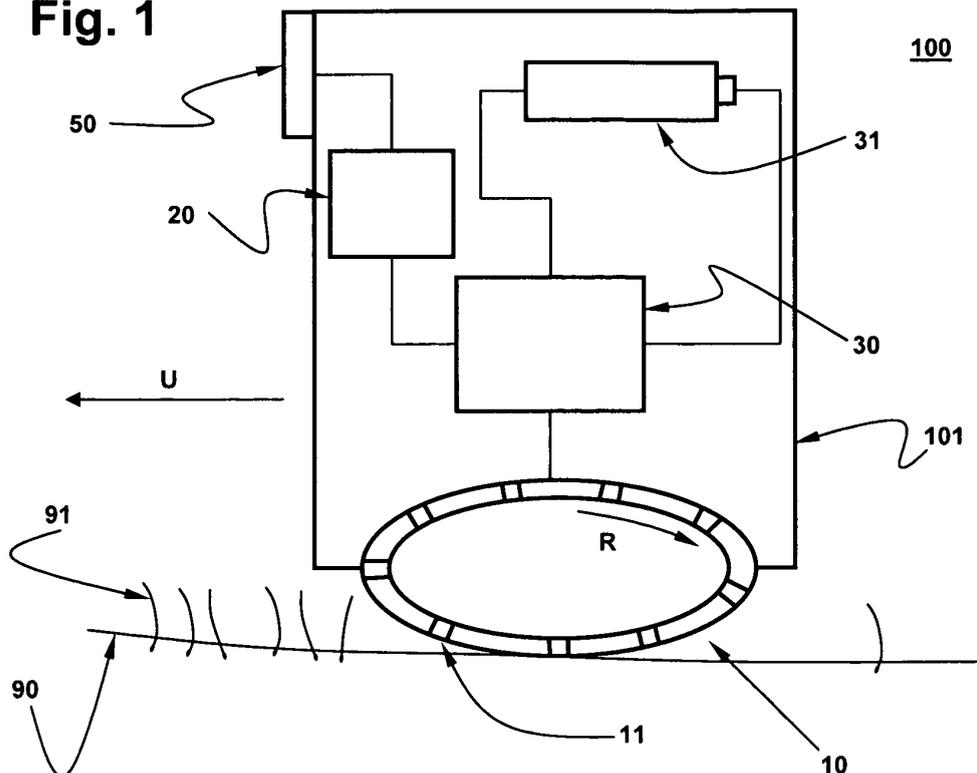
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 Amended claims in accordance with Rule 137(2)
 EPC.

(54) Epilation device

(57) An epilation device (100) is proposed that has a housing (101), a roll-like epilation implement (10) mounted at the housing (101), which epilation implement (10) has clamping units (11) for successively clamping and plucking hairs, and the epilation device (100) has further a powered motor (30) operatively coupled to the epilation implement (10), and a motor control (20, 21, 22). The proposed epilation device (100) is arranged to

have at least a fast operation mode in which the motor (30) is controlled by the motor control (20, 21, 22) such that the clamping units (11) move with a circumferential speed of more than 2.5 meters per second relative to the housing (101). This serves to e.g. achieve a gap-less clamping and plucking in a use direction (U) even if the epilation device (100) is drawn over the skin with a relatively high speed.

Fig. 1



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to epilation devices and in particular to epilation devices that have a housing, a roll-like epilation implement having clamping units for successively clamping and plucking hair, a powered motor coupled to the epilation implement, and a motor control.

BACKGROUND OF THE INVENTION

[0002] Epilation devices according to the previous paragraph are known. DE 10 2004 013 755 A1 describes a device in which a roll-like epilation implement is rotated with a circumferential speed of 0.6 meters per second or lower relative to the housing and in particular with a circumferential speed of 0.15 meters per second or lower. DE 10 2004 013 755 A1 also refers to EP 0 532 106 A1, in which an epilation device is described that is rotated with a circumferential speed of about 2 meters per second. The low speed of the epilation implement as described by DE 10 2004 013 755 A1 serves to increase the amount of epilated hairs that are epilated with the hair root so that a more enduring hair removal effect is achieved in contrast to epilation devices that rotate with a higher circumferential speed such as 2 meters per second.

SUMMARY OF THE INVENTION

[0003] It is desirable to provide an epilation device that is improved over the known epilation devices.

[0004] The object of the invention is solved by an epilation device according to claim 1. Additional embodiments are given by the dependent claims.

[0005] The epilation device according to claim 1 has a housing, a roll-like epilation implement having clamping units for successively clamping and plucking hair, which roll-like epilation implement is mounted to the housing, a powered motor operatively coupled to the roll-like epilation implement, and a motor control. The epilation device further has at least a fast operation mode in which the motor is controlled by the motor control such that the clamping units are moved with a circumferential speed of more than 2.5 meters per second relative to the housing and in particular with a circumferential speed of about 3.0 meters per second relative to the housing or more.

[0006] A roll-like epilation implement in particular means a cylindrical epilation implement that has on its surface openings, where through each opening at least a movable clamping element extends so that a clamping unit is formed by the opening and the clamping element. The epilation implement is rotated around its longitudinal centre axis and the clamping element is concurrently moved in succession from an open position to a clamping position in which hairs are clamped between the movable

clamping element and e.g. a sidewall of the opening. Such an epilation implement is e.g. described in international patent application WO 2006/037392 A1, the content of which is included into the present description by reference. The roll-like epilation implement could also be a deformed or a curved cylindrical epilation implement, one example for a bent cylindrical epilation implement is described in US 2007/093853 A1. But the roll-like epilation implement should not be confined to implements having essentially a cylindrical cross-section. A roll-like epilation implement is also given by rod-like elements that are arranged one after the other on a base body having a non-cylindrical cross section and where the rod-like elements form a closed chain that is continuously moved along the outer surface of the base body as is e.g. described in WO 01/95758 A1.

[0007] Circumferential speed means the speed of the clamping units at the surface of the roll-like epilation implement in use direction relative to the housing.

[0008] In an embodiment, the epilation device has a sensor that is arranged to measure the speed of the epilation device relative to a surface over which the epilation device is drawn. In a refinement, the motor control is arranged to vary the circumferential speed of the clamping units in dependence on a speed signal provided by the sensor. In one embodiment, the circumferential speed is varied such that the clamping units clamp and pluck hairs in an essentially gap-less manner in a use direction of the epilation device and in another embodiment, the circumferential speed is varied such that a preset plucking efficiency is steadily achieved.

[0009] In another embodiment, at least a clamping unit comprises a clamping element that is made at least partially from an elastomeric material or has a coating of an elastomeric material covering the surface of the clamping element at least partially.

[0010] In a further embodiment, the epilation device is provided with a switch for selectively switching into the fast operation mode.

[0011] In an even further embodiment, the motor control is arranged to automatically switch to the fast operation mode if the load of the motor rises above a threshold value.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The present invention will further be described by detailed explanation of exemplary embodiments and by reference to figures.

Fig. 1 is a schematic depiction of a first embodiment of an epilation device as proposed and
 Fig. 2 is a schematic depiction of a second embodiment of an epilation device as proposed.

DETAILED DESCRIPTION OF THE INVENTION

[0013] It was found that current epilation devices such

as, e.g., the Braun Silk-épil Xelle®, are often intuitively drawn over the skin in a use direction with a speed that coincides with the speed a user would draw a wet shaver over the skin, that is up to about 20 centimetres per second (cm/s). At such a speed, successive plucking events performed by the clamping units arranged at the circumference of the roll-like epilation implement occur with a gap in the use direction. The actual width of the gap in use direction depends on the width of the clamping units in use direction. As a result, hairs are not clamped and plucked that lie in these gaps and the plucking efficiency per stroke is reduced. Gaps between plucking events can be avoided by either using the epilation device at a lower drawing speed in use direction or with a higher circumferential speed of the clamping units that are arranged on the surface of the roll-like epilation implement.

[0014] In the past, the plucking speed of an epilation device (which is the circumferential speed of the clamping units relative to the housing; the drawing speed of the epilation device is not taken into account) was in the order of about 2 meters per second (m/s). Additionally it was described in DE 10 2004 013 755 A1 that it would be advantageous to reduce the plucking speed to about 0.6 m/s or even lower to a plucking speed of 0.15 m/s to achieve optimal efficiency and enduring hair removal results as the percentage of roots that are plucked together with the hair is increased by the low plucking speed.

[0015] It was now found, in contrast to the teachings and beliefs of the past, that the plucking pain is reduced at higher plucking speed and that also the efficiency of the epilation device concerning plucking of hairs together with their roots when compared to regular plucking speeds of about 2 m/s is only marginally reduced when increasing the plucking speed above the usual plucking speed of 2 m/s. In conclusion, it was now found that increasing the plucking speed leads to less plucking pain and to an improved efficiency at the intuitively used drawing speed, while the root plucking efficiency is only marginally reduced. Circumferential speeds of the clamping units that allow this improved usage lie above 2.5 m/s and in particular lie at about 3 m/s or even higher speeds. An epilation device as proposed has thus at least a fast operation mode in which the motor control controls the powered motor to move the clamping units of the roll-like epilation implement such that the circumferential speed of the clamping units relative to the housing of the epilation device lies above 2.5 m/s and in particular at least about 3 m/s.

[0016] Fig. 1 is a schematic depiction of an epilation device 100 as proposed. The epilation device 100 has a roll-like epilation implement 10 that has clamping units 11 arranged on its circumference. The roll-like epilation implement 10 is operatively coupled to a motor 30, which motor 30 is energized by an accumulator 31. Instead of an accumulator 31, the motor 30 may alternatively (or additionally) be energized by a power cable (not shown) that can be connected to mains voltage. The motor 30 is controlled by a motor control 20. A switch element 50 is

arranged on the housing 101 of the epilation device 100 to allow a user to selectively switch the device on or off or to selectively switch from a low speed mode to a fast speed mode, in which the circumferential speed of the clamping units 11 relative to the housing 101 of the epilation device 100 is above 2.5 m/s, in particular where the circumferential speed of the clamping units 11 relative to the housing of the epilation device 100 is about 3.0 m/s or even faster.

[0017] During operation, the epilation device 100 is brought into contact with a subject's skin 90 and is moved over the skin 90 in a use direction U as is schematically shown in Fig. 1. The clamping units 11 arranged on the circumference of the roll-like epilation implement 10 are moved along the circumference of the roll-like epilation implement 10 in a direction R, e.g. by rotating the whole roll-like epilation implement 100, which in particular can be realized in the form of an epilation cylinder, as is generally known in the art. Hairs 91 growing on the skin will eventually be clamped by the clamping units 11 and plucked from the skin. A long lasting hair removal is achieved by plucking out the hairs together with the respective root section of the hair. The roll-like epilation implement could be realized as an epilation cylinder as is known in the art and is described e.g. in WO 2006/037392 A1. Instead of a rotating cylinder, the clamping units 11 may be arranged on a chain as is described e.g. in WO 01/95758 A1 so that also non-cylindrical roll-like epilation implements 10 can be realised.

[0018] Fig. 2 is a schematic depiction of another embodiment of an epilation device 100 as proposed. Most features of the epilation device in Fig. 2 are the same as in Fig. 1 and will not be described again. The epilation device 100 according to Fig. 2 has an additional sensor 40 that is arranged to measure the speed of the device relative to the subject's skin. The sensor 40 could be realised as an optical speed sensor as is known from a computer mouse. The sensor 40 could alternatively be realised as a mechanical speed sensor such as a roll that is in frictional contact with the skin and translates its movement into a speed signal. The sensor 40 is connected with the motor control 20 so that a speed signal determined by the sensor 40 can be transmitted to the motor control 20.

[0019] The epilation device 100 also has a memory unit 21 for storing e.g. a preset efficiency value. In one embodiment, the efficiency value can be set by the user through a selection knob 51, which may be arranged at the housing 101 of the epilation device 100. The switching element 50 as depicted in Fig. 1 may be arranged to also fulfil the functionality of the selection knob 51 or the selection knob 51 is additionally or alternatively provided to the switching element 50 arranged at the housing 101 of the epilation device 100. A certain efficiency of the epilation device 100 is given by the density of the plucking events in the use direction U. If an efficiency value is preset, then the motor control 20 can vary the circumferential speed of the clamping units in dependence on the

speed of the device in the use direction U, which speed is derived from the speed signal delivered by the sensor 40. The higher the speed of the device in the use direction U, the higher the circumferential speed of the clamping elements 11 so that a constant density of plucking events and hence a preset efficiency value is achieved.

[0020] The epilation device 100 further has a motor load determination unit 22 that in the shown embodiment determines the motor load from the current the motor 30 requires driving the roll-like epilation implement 10. The motor load determination unit 22 is connected to the motor control 20 so that the determined motor load value can be transmitted to the motor control 20. If the epilation device 100 is brought into contact with the skin 90, then the load rises due to the friction between roll-like epilation implement 10 and the skin 90 and due to the plucking events. The motor control 20 compares the motor load value determined by the motor load determination unit 22 with a threshold value, which is e.g. chosen to lie between the load of motor if no additional external load such as the friction between device and skin is present (no-external-load operation load) and a previously measured load of the motor during a typical epilation procedure (usual operation load). If the motor load rises above the threshold, then the motor control 20 switches into the fast operation mode. In turn, if the motor load drops below the threshold, then the motor control switches back into a slow operation mode. The slow operation mode can be chosen so that the device makes only a low noise acceptable to a user.

[0021] It should be noted that the motor control 20 can be arranged to control the motor 30 in such way that a gapless plucking is achieved or so that a constant efficiency is achieved on basis of a speed signal delivered by a sensor provided to measure the speed with which the epilation device is drawn over a surface also independently from the existence of a fast operation mode of more than 2.5 m/s. Likewise, the switching of the motor between a slow mode (e.g. between 0.5 m/s - 1.5 m/s, in particular 1 m/s) and a faster or regular mode (e.g. between 1.5 m/s - 2.5 m/s, in particular 2 m/s) in case the motor load rises above a threshold as discussed can also be implemented without the faster or regular mode being necessarily a fast mode of more than 2.5 m/s. The advantages of these provisions are evidently the same as in case of a fast mode of more than 2.5 m/s. An epilation device would then comprise a housing, a roll-like epilation implement having clamping units for successively clamping and plucking hairs, the roll-like epilation implement being mounted to the housing, a powered motor operatively coupled to the roll-like epilation implement, a motor control, and a sensor arranged to measure the speed of the epilation device relative to a surface over which the epilation device is drawn during operation, whereas the motor control is arranged to vary the circumferential speed of the clamping element in dependence of a speed signal provided by the sensor. The motor control could then further be arranged to vary the circumfer-

ential speed of the clamping units either such that the clamping units clamp and pluck hairs in an essentially gap-less manner in a use direction of the epilation device or such that a preset plucking efficiency is steadily achieved.

[0022] An exemplary diameter of a roll-like epilation implement 10 realized as an epilation cylinder is about 2 cm and an exemplary circumferential width of a clamping unit 11 is about 4 mm. Due to mechanical restrictions and for efficiency reasons, each clamping unit 11 is often axially spaced to all other clamping units 11 of the roll-like epilation implement 10. Thus, only one clamping unit 11 is arranged at a given axial position with respect to the use direction U of the epilation device 100, which use direction U is perpendicular to the axial extension of the roll-like epilation implement 10. Given a circumferential speed of the clamping unit 11 relative to the housing 101 of the epilation device 100 of 2 m/s and assuming an intuitively chosen drawing speed of 20 cm/s of the epilation device 100 over the skin, the clamping unit 11 will clamp hairs at positions that are 6 mm apart from the respective previous clamping position. As the circumferential width of the exemplary clamping unit 11 in use direction is 4 mm, a gap of 2 mm remains that has not undergone a clamping and plucking event. In order to improve the efficiency of the epilation device 100 at the intuitively chosen drawing speed of about 20 cm/s, the circumferential speed of the clamping unit 11 is increased in the fast operation mode so that after a rotation of the roll-like epilation implement 10, the clamping unit 11 is clamping and plucking hairs at a distance of 4 mm with respect to the previous clamping and plucking position. As a result, this leads to an essentially gap-less clamping and plucking of hairs in the use direction U. For the given exemplary numbers this results in a circumferential speed of the clamping units 11 relative to the housing 101 of the epilation device 100 of 3 m/s. Generally, an improvement of the efficiency is achieved with a circumferential speed of the clamping units 11 with respect to the housing of 2.5 m/s or a larger circumferential speed such as 2.6 m/s, 2.7 m/s, 2.8 m/s or 2.9 m/s. For the exemplary geometrical dimensions of an epilation device 100 as used for the present computations, a circumferential speed of 3.2 m/s or even more, such as 3.4 m/s or 3.6 m/s would then allow to reduce the circumferential width of the clamping units 11 to still achieve an essentially gap-less clamping and plucking of hairs. A reduced circumferential width of the clamping units 11 leads to reduced surface areas of the clamping elements of a clamping unit 11 that are pinched together to clamp hairs, which in turn reduces the noise generated by the epilation device 100. As the noise is increased with increasing circumferential speed due to the increasing pinching speed at constant geometry of the clamping units 11, reduction of the width of the clamping unit is one measure to counteract noise increase. As another measure to reduce noise generated by the epilation device 100, the clamping elements of the clamping units 11 can be at

least partially made of an elastomeric material such as a synthetic elastomeric material or a natural elastomeric material such as rubber or can be at least partially coated by such a material.

[0023] The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm."

Claims

1. Epilation device (100) comprising:

a housing (101);
 a roll-like epilation implement (10) having clamping units (11) for successively clamping and plucking hairs, the roll-like epilation implement (10) being mounted to the housing;
 a powered motor (30) operatively coupled to the roll-like epilation implement (10); and
 a motor control (20, 21, 22);

wherein the epilation device (100) has at least a fast operation mode in which the motor (30) is controlled by the motor control (20, 21, 22) such that the clamping units (11) move with a circumferential speed of more than 2.5 meters per second relative to the housing (101).

2. Epilation device according to claim 1, wherein the motor (30) is controlled such that the clamping units (11) move with a circumferential speed of at least 3 meters per second relative to the housing (101).

3. Epilation device according to claim 1 or to claim 2 that further has a sensor (40) arranged to measure the speed of the epilation device (100) relative to a surface over which the epilation device (100) is drawn during operation.

4. Epilation device according to claim 3, wherein the motor control (20, 21, 22) is arranged to vary the circumferential speed of the clamping units (11) in dependence on a speed signal provided by the sensor (40).

5. Epilation device according to claim 4, wherein the motor control (20, 21, 22) is arranged to vary the circumferential speed such that the clamping units (11) clamp and pluck hairs in an essentially gap-less manner in a use direction (U) of the epilation device (100).

6. Epilation device according to claim 4, wherein the

motor control (20, 21, 22) is arranged to vary the circumferential speed so that a preset plucking efficiency is steadily achieved.

7. Epilation device according to claim 1, wherein a clamping unit (11) comprises at least a clamping element that is made at least partially from an elastomeric material or has a coating or covering layer of an elastomeric material covering its surface at least partially.

8. Epilation device according to claim 1, which has a switch element (50, 51) for selectively switching into the fast operation mode of the epilation device.

9. Epilation device according to claim 1, wherein the motor control (20, 21, 22) is arranged to automatically switch to the fast operation mode if the load of the motor (30) rises above a threshold value.

Amended claims in accordance with Rule 137(2) EPC.

1. Epilation device (100) comprising:

a housing (101);
 a roll-like epilation implement (10) having clamping units (11) for successively clamping and plucking hairs, the roll-like epilation implement (10) being mounted to the housing;
 a powered motor (30) operatively coupled to the roll-like epilation implement (10); and
 a motor control (20, 21, 22);

characterized in that the epilation device (100) has at least a fast operation mode in which the motor (30) is controlled by the motor control (20, 21, 22) such that the clamping units (11) move with a circumferential speed of more than 2.5 meters per second relative to the housing (101).

2. Epilation device according to claim 1, wherein the motor (30) is controlled such that the clamping units (11) move with a circumferential speed of at least 3 meters per second relative to the housing (101).

3. Epilation device according to claim 1 or to claim 2 that further has a sensor (40) arranged to measure the speed of the epilation device (100) relative to a surface over which the epilation device (100) is drawn during operation.

4. Epilation device according to claim 3, wherein the motor control (20, 21, 22) is arranged to vary the circumferential speed of the clamping units (11) in dependence on a speed signal provided by the sensor (40).

5. Epilation device according to claim 1, wherein a clamping unit (11) comprises at least a clamping element that is made at least partially from an elastomeric material or has a coating or covering layer of an elastomeric material covering its surface at least partially. 5

6. Epilation device according to claim 1, which has a switch element (50, 51) for selectively switching into the fast operation mode of the epilation device. 10

7. Epilation device according to claim 1, wherein the motor control (20, 21, 22) is arranged to automatically switch to the fast operation mode if the load of the motor (30) rises above a threshold value. 15

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Fig. 1

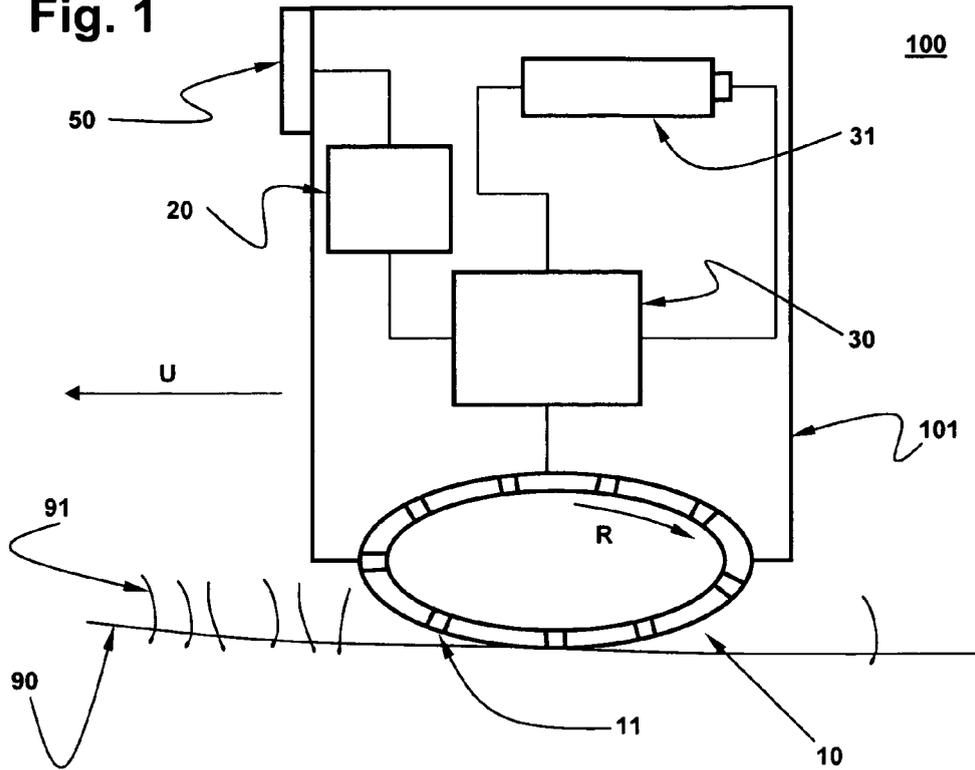
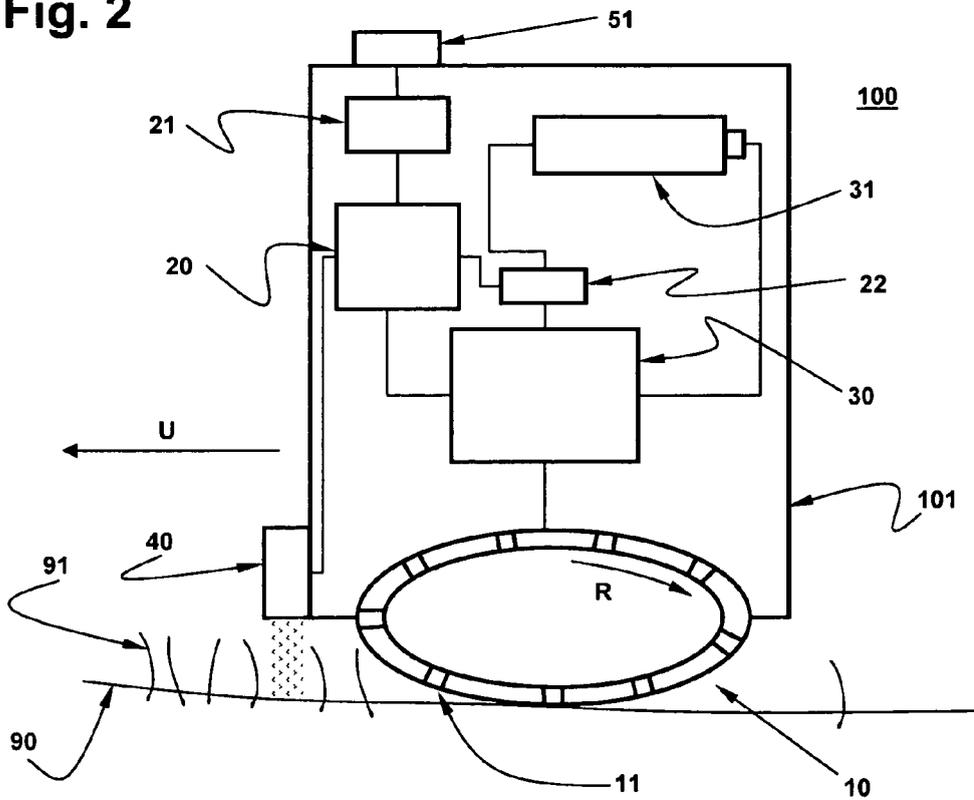


Fig. 2





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Application Number
EP 08 01 2880

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