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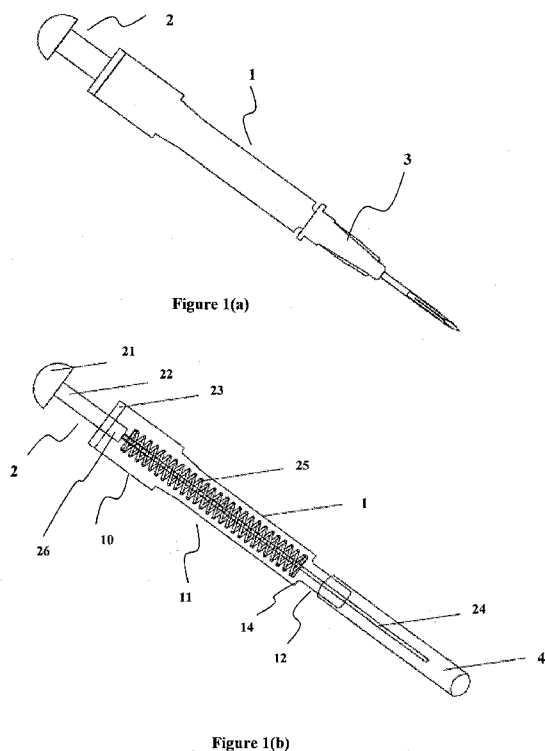
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(54) Title: IMPLANTATING DEVICE



(57) Abstract: The present invention relates to a planting device to plant plantable material in diverse substrates. The invention in particular relates to a hair plantation device capable of speedy, accurate and atraumatic plantation of hair follicle while maintaining follicular integrity resulting in better yield and method of its use in hair restoration process. The synergistic combination of the said housing, spring loaded plunger assembly, hub assembly of the present plantation device obviates need of a dedicated depth control mechanism and prevents blind grafting of the plantable material such as hair follicle in the substrate as the plunger of the present device aids appropriate positioning and controls plantation of the hair follicle with desired precision under observation of the user. This further enables multiple functions of a dissector, site creator, stopper, spiral cavity maker, stretcher, separator and slider maintaining plantable material integrity during plantation.

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IMPLANTATING DEVICE

Field of the Invention

5 The present invention relates to a planting device to plant plantable material in diverse substrates. The invention further relates to a hair plantation device capable of speedy, accurate and atraumatic plantation of hair follicle while maintaining follicular integrity resulting in better yield, and method of its use in hair restoration process.

Background of the Invention

10 The present invention generally relates to devices for hair follicle transplantation. A variety of restorative approaches have been used to deal with problems of baldness due to hair loss by processes such as using hair pieces, topical application, oral medication, scalp reduction, scalp flaps and hair transplantation. However the goal continues to be to provide affordable long
15 lasting or permanent solutions without side effect for natural looks with / without minimal maintenance.

Follicular hair transplantation is now widely accepted as the best restorative procedure as it fulfills most of the above criteria. Clinical study has revealed that when longer lasting hair from
20 back and side of scalp are transplanted over the area of baldness, hair continues to stay viable and grow.

Hair transplantation procedure comprises three steps wherein the first step involves the harvesting of hair roots from the permanent zone, the second step involving their separation and
25 the third step in which the individual roots are planted in the desired area.

The plantation process generally involves steps that include creation of an ideal recipient site, keeping the site open and placement of the graft into the site maintaining its integrity and
30 stability.

Sites created by punches (US Patents 5,895,403, US 5,922,000, US 5,792,163, US 5,611,810, US 5,693,064) and laser or radio frequency techniques (Bernstein RM, Rassman WR: Laser hair transplantation: Is it really a state of art? Lasers in Surgery and Medicine 1996; 19: 233-
35 235) were phased out as they did not produce desirable results.

Sites created by cold steel produce minimum damage by distracting tissue. Blades (number 11, 15) and trokars of different shape (triangular, mercedes, rectangular) and needles are used to

create slits in the skin. (Arnold James, Mini blades and mini blade handle for hair transplantation American journal of Cosmetic Surgery Vol. 14 no. 2 1997 195-200.)

Several methods are in use for placement / planting the hair grafts.

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In one of the method, multiple slits are created by one person as a first step followed by simultaneous placement of grafts is done by several persons. In another method, a slit is created by one person followed by placement of graft in the created site as a second step by the same person. In these methods grafts are picked and held by forceps or similar grasping
10 instruments and pushed into the recipient slit or hole. Such methods suffer from problems of drying of tissues, mechanical damage to the vital cells during holding, grabbing, pinching, dragging and pushing. Insertion of the graft by such techniques also have problems of crushing, squeezing, folding, distorting, jamming, distracting and bending of hair grafts. Further
15 in such methods, the separate step of "slits creation" is an additional step and at the same time increases the burden of counting and isolating grafts to match the number, size including width and depth of the slits. It is possible to miss sites, piggy backing (more than one graft in one cavity), hair under graft, slipping too deep and rough placing with multiple attempts. These consume additional time of the surgeon and impact the cost of the surgery.

20 In a significant improvement over the earlier methods, a transplanter device is first loaded with graft and the loaded transplanter is used to create the site and immediately place the graft in the created site in one single motion by one person.

Several methods and instruments are known in prior art to perform plantation

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The PCT Publication 2001/010307 provides a planter wherein the process involves the insertion of a needle into a scalp having a pointed end portion to reduce damage of the scalp, and a guide plate which is adhered to an end portion of a sliding unit reciprocating in the longitudinal direction of the needle outside the needle, prevents hair roots from being separated at the time
30 of the separation of the needle. As a result, the hair roots inserted into a needle insertion groove are not damaged and are naturally settled in the scalp without modification, thereby stably performing the hair transplantation. Though this instrument and method is a significant improvement over the earlier instruments and methods, it has several disadvantages. By the very nature of the instrument construction, it performs a "blind plantation", needing to align the
35 follicle, adjust the depth control every time the length of follicle changes and is severely limited to the use of stiff hair that is preferably 6 mm long and is not good for untrimmed harvested hair. Folding, bending, twisting and squashing of follicles are not visible / identified and even if

identified, it is difficult to take corrective action. The short beveled cannot create the desired spiral cavity on the scalp and also the follicle needs to be pushed with force causing faster blunting of the sharp end thereby requiring frequent changing of the needle resulting in longer time for completion of the procedure. This relatively large cross-section and heavy weight of the instrument with too many parts is difficult to rotate, maneuver and needs too much time to change the needles resulting in longer times for the entire plantation process. Further during the withdrawal motion of the plunger, the hair bends down to touch the skin surface at the junction of follicle which is not desirable. The instrument cannot be classed as truly disposable.

WO 2003/096906 A2 was a major improvement over the prior art in which the transplantation device has a longitudinal groove having a wider slot as a loading area and a narrower slot as a retaining area further developing into a tapered sharpened wedge with depth control performing desired multiple functions of a dissector, site creator, stopper, spiral cavity maker, stretcher, separator and slider capable of harvesting and planting. The device functions without electricity, suction or spring assistance having the advantages of being multifunctional, small, light weight, handy, autoclavable, sterilisable, disposable, having minimum joints and moving parts yet easily manufactured in wide range of sizes from various materials, with capability to harvest and plant wide range of plantable materials into diverse substrates at enhanced plantation speeds maintaining follicular integrity resulting in better yield. The device of this invention has an optional holder and a handle and is functionally cost effective with easy learning curve and versatile acceptability. This device though a distinct improvement over the prior art, is also not free from disadvantages. For example, this device requires two hands to conduct the procedure. As the two hands occupy most of the plantation area (recipient site) only one person can conduct the procedure thereby reducing speed of the plantation process and the plantation is possible only by standing behind the patient. Conducting the procedure by standing on front and side of the patient is not possible. The learning curve is slow for professionals with less surgical experience. The number of assistants required is high leading to a higher cost of the entire procedure.

WO 2013/015534 discloses a hair transplant device for transplanting hair onto a region of thinning hair. The hair transplant device is very useful in that during a hair implant operation the device can precisely adjust and set the length of an implanting needle in which a hair root is inserted and the depth of a spindle according to a thick layer of skin tissue found in the scalp of each person, thereby improving hair graft rates and hair transplant results.

WO 2010/126191 discloses a hair transplanting device which transplants the roots of hair in skin. The hair transplanting device comprises: a core shaft support case (100) which has a

hollow pen shape and has a guide hole formed in the longitudinal direction of a body; a core shaft fixer (300) which is inserted into the guide hole to enable linear movement along the guide hole, and has a cap fixing portion (305) protruded above the guide hole; a hair transplanting needle (310) which is adhered to and inserted into the core shaft fixer (300) in accordance with the vertical direction of the cap fixing portion (305) and the vertical direction of a slit; a cylindrical fixing case (200) which encompasses the body of the core shaft support case (100) and has a hole (205) corresponding to the cap fixing portion (305) at the central portion thereof; a core shaft unit (300) which is inserted into the support case (100) and has a core shaft cap at the end portion thereof; a spring (450) which enables linear movement through elastic force between the core shaft fixer (300) and the core shaft unit (300); and a core shaft fixing cap (350) which is inserted into the hole and the cap fixing portion (305) of the core shaft fixer (300) at the upper portion of the fixing case (200). The present invention provides advantages of remarkably reducing the assembling time for operation, making the assembling method more convenient and simple, and allowing easy use by an operator. Furthermore, the present invention has advantages of allowing an operator to find a slit direction easily, and providing easy maintenance because the fixing cap prevents a hair transplanting device from rolling around when an operator puts the hair transplanting device on an operating table.

United States Patent 5584851 discloses an instrument for transplanting a plurality of hair grafts into respective pre-formed holes in the skin of a patient, includes an elongate hollow tube having first and second ends, and an open channel extending along a length of the tube, the tube being adapted to hold a plurality of hair grafts, and a dilation device for dilating the pre-formed holes in the skin of the patient, including a spoon-shaped tip extending from the first end of the tube. Additionally, a method for transplanting hair grafts is provided, wherein the tube is loaded with a plurality of hair grafts, and the spoon-shaped tip is successively inserted into the pre-formed holes to dilate same, and sliding the hair grafts into respective, dilated pre-formed holes. In another aspect of the invention, the hair transplant instrument has a multiplicity of channels, each containing a hair graft.

United States Patent 5611811 discloses a device for automating hair transplant procedures. The device includes a part for puncturing the scalp, a part for containing the hair grafts to be transplanted, a part for ejecting the hair grafts from the containing means, a part for actuating the ejecting means and a part for delivering the hair grafts into the transplant site.

United States Patent 6572625 discloses harvesting of hair for a hair transplant procedure employs a hollow drill with an imaging system which permits alignment of center of the cutting edge of the needle with the axis of the follicular unit to be removed. The diameter of the needle

is chosen such that when properly aligned, a follicular unit is removed without damaging critical anatomical portions of the follicles. In one embodiment, fluid is introduced to separate adjacent follicles. In another embodiment, suction is applied to aid in the removal of the excised follicular unit. In still another embodiment, an x/y/z stabilizing gantry is employed to position the hollow
5 needle in each instance.

United States Patent 7144406 discloses a hair implantation instrument herein employs a simple means for capturing a hair graft in a needle in a position for implantation into a scalp and an escapement mechanism for withdrawing the needle in a manner to leave the graft in the scalp.

10 The needle is moved with respect to a rod which positions an implanted graft properly when the needle is withdrawn. The apparatus also defines a sheath over the needle for properly positioning a graft during a graft capture operation. The escapement mechanism is vacuum controlled in one embodiment and spring controlled in a second embodiment.

15 United States Patent application 2003/0097144 discloses hair transplant devices which comprises a cylindrical first cutting member having a bent blade, a cylindrical second cutting member moving forward/backward along the interior of the first cutting, an extrusion member moving forward/backward along the interior of the second cutting member, and a housing providing an induction road for the second cutting member and the extrusion member. According
20 to the hair transplant devices of the present invention, it is possible to execute a hair-transplanting procedure, i.e., harvesting a hair graft from a hairy area in a scalp and then implanting the hair graft into a bald area, in series without other devices. Also, it is not necessary to incise rather big size of the scalp for harvest of hair grafts, and only very small size of a perforation is required. Therefore, no scars are left on the perforated site of the hairy area.

25 United States Patent application 2006/0293703 discloses a hair implantation instrument herein employs a simple means for capturing a hair graft in a needle in a position for implantation into a scalp and an escapement mechanism for withdrawing the needle in a manner to leave the graft in the scalp. The needle is moved with respect to a rod which positions an implanted graft
30 properly when the needle is withdrawn. The apparatus also defines a sheath over the needle for properly positioning a graft during a graft capture operation. The escapement mechanism is vacuum controlled in one embodiment and spring controlled in a second embodiment.

WO 2009/083741 discloses a direct hair transplanting device enabling sequential harvesting of
35 single hair follicles from a donor region and implantation of the same at a recipient zone of the scalp comprising a tubular housing (30) with a forwardly projecting tubular needle (2) with an outermost end being formed with a conical obliquely cut knife edge cutting surface. A hair follicle

is extracted through rotation of the cutting surface of the needle around a selected hair follicle at the target donor region of the scalp and implantation of the same at a selected recipient locus of the scalp being effected through initiating a forward stroke of a push rod (7) slidable within the interior of tubular needle (2) to implant the hair follicle into the scalp. Appropriate regulation and fine adjustment of the depth of intrusion of needle (2) into the scalp is obtained through differentiated depth of screwing of an internally threaded tubular shaft (35) holding the needle around an externally threaded perimeter of a cylindrical member (34) detachably mounted onto the tubular housing (30).

10 United States Patent 5899916 discloses a dilator/hair implanter device comprising a wedge-shaped hollow body, said body having one end for engageably penetrating the scalp of a patient and wherein said body contains hair grafts for implantation into the scalp of said patient. Further provided is a dilator/hair implanter device comprising a body having at least two parts, said body having one end for engageably penetrating the scalp of a patient and wherein said body
15 contains hair grafts for implantation into the scalp of said patient. Also provided are various methods of transplanting hair.

Japanese Patent 10151134 discloses a hair implanting appliance having a hair implanting tissue sampling member 3 with a cylindrical cutter 2 on the end, a hair implanting member 5 with an
20 inclined cutter 4 on the end, a mandrel 6 and a hollow cylindrical body 7 for coaxially housing the members 3 and 5, and the mandrel 6. One of the hair implanting tissue sampling member 3 and the hair implanting member 5 is inserted in the other, and the mandrel 6 is thereby passed in such a state as embedded in an innermost layer. The appliance is equipped with an advance and retreat operation part 18 for causing one of the members 3 and 5 to independently come
25 out from and enter the end of the other, and an operation means 17 for causing the mandrel 6 to advance and project from the end of the hair implanting member 5. The advance and retreat operation part 18 is made of a cam 12 laid on the inner wall of the body 7 formed to be capable of freely turning, and an spring 11 for energizing one of the members 3 and 5 toward the rear end thereof and coming in contact with the cam 12

30 Japanese Patent 04152944 discloses a hair implantation appliance in which hair 18 having a supporting tissue 19 to be implanted is collected from the occiput and branched into threads. The hair 18 is matched with the slit 7 of an implanting needle 2, and the supporting tissue 19 is inserted into the needle 2. The implanting device is taken in hand, and the needle 2
35 is inserted into the implanting spot. Since the upper end of the supporting tissue 19 set in the needle 2 is supported by a supporting tissue fixing spindle 3, the needle 2 is inserted to a specified depth, the main body 1 is pulled up while pressing a pushing part 11, hence the tissue

19 is forced into the hole 20 formed by the needle 2 by the spindle 3, the needle 2 is detached from the skin, the hair 18 with the tissue 19 attached to it is transplanted into the skin. Consequently, the living hair with the supporting tissue attached to it is surely and easily implanted.

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Japanese Patent 10052429 discloses a hair planter in which a hair planting needle 1 with the sharp tip end 1a is attached protruded from a main body 3 of the hair planter. A core shaft 4 is inserted into the hair planting needle 1 and a spring 7 to energize the core shaft 4 toward the rear end of the main body 3 is mounted. An operation means 9 is set on the other end of the core shaft 4. A rod 5 inserted fit on the outside the core shaft 4 and synchronized to progress/regress with the core shaft 4 is inserted into the main body 3, and a skin pressing part 12 is equipped on the tip end of the rod 5. A window 6 is equipped on the rod 5, and a needle support member 3 to be fixed on the main body 3 is equipped crossing the window 6. The hair planting needle 1 is inserted by the core shaft 4 and inserted into the rod 5, and the core shaft 4 and the rod 5 are attached to the needle support member 2 so as to freely progress/regress. A tissue mounting jig for hair planting has a hole 71 on one end, and is equipped with a hole 72 bored through from the other end to the hole 71. An opening 73 is set on the hole 72. Slits 72a and 71a are formed on the hole 72 and the hole 71. A push rod 74 is equipped on the hole 72.

United States Patent Application 20040193203 discloses a hair implantation instrument that employs a simple means for capturing a hair graft in a needle in a position for implantation into a scalp and an escapement mechanism for withdrawing the needle in a manner to leave the graft in the scalp. The needle is moved with respect to a rod which positions an implanted graft properly when the needle is withdrawn. The apparatus also defines a sheath over the needle for properly positioning a graft during a graft capture operation. The escapement mechanism is vacuum controlled in one embodiment and spring controlled in a second embodiment.

Japanese Patent 10286257 discloses a hair transplantation implement that comprises a cylindrical grip part 11, a movable pressing element 13 accommodated in the grip part 11 so as to be extendable from the top thereof, a spring 16 incorporated in the grip part 11, for urging the pressing element 13 in a direction in which the pressing element 13 is extended from its latter, a pipe-like stationary needle 12 having a hole through which a hair can be inserted, and fixed to the grip part 11 so that its front part is projected from the lower end of the grip part 11, for accommodating a hair, and a movable needle 18 slidably inserted in the stationary needle, having a proximal end fixed to the pressing element 13 and adapted to be accommodated in the stationary needle 12 when the pressing element 13 is extended from the top end of the grip part 11, and to be projected at its distal end from the distal end of the stationary needle 12 when the

pressing element 13 is retracted into the grip part 11. It is preferably that the distal end part of the stationary needle 12 is formed to be oblique, and the distal end of the movable needle 18 is formed to be flat, and further, it is preferable that the diameter of the hole is set to be less than that of the hair roots.

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Japanese Patent 3590235 discloses a hair transplantation implement that comprises a cylindrical grip part 11, a movable pressing element 13 accommodated in the grip part 11 so as to be extendable from the top thereof, a spring 16 incorporated in the grip part 11, for urging the pressing element 13 in a direction in which the pressing element 13 is extended from its latter, a pipe-like stationary needle 12 having a hole through which a hair can be inserted, and fixed to the grip part 11 so that its front part is projected from the lower end of the grip part 11, for accommodating a hair, and a movable needle 18 slidably inserted in the stationary needle, having a proximal end fixed to the pressing element 13 and adapted to be accommodated in the stationary needle 12 when the pressing element 13 is extended from the top end of the grip part 11, and to be projected at its distal end from the distal end of the stationary needle 12 when the pressing element 13 is retracted into the grip part 11. It is preferably that the distal end part of the stationary needle 12 is formed to be oblique, and the distal end of the movable needle 18 is formed to be flat, and further, it is preferable that the diameter of the hole is set to be less than that of the hair roots.

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WO 2010/126191 discloses a hair transplanting device which transplants the roots of hair in skin. The hair transplanting device comprises: a core shaft support case (100) which has a hollow pen shape and has a guide hole formed in the longitudinal direction of a body; a core shaft fixer (300) which is inserted into the guide hole to enable linear movement along the guide hole, and has a cap fixing portion (305) protruded above the guide hole; a hair transplanting needle (310) which is adhered to and inserted into the core shaft fixer (300) in accordance with the vertical direction of the cap fixing portion (305) and the vertical direction of a slit; a cylindrical fixing case (200) which encompasses the body of the core shaft support case (100) and has a hole (205) corresponding to the cap fixing portion (305) at the central portion thereof; a core shaft unit (300) which is inserted into the support case (100) and has a core shaft cap at the end portion thereof; a spring (450) which enables linear movement through elastic force between the core shaft fixer (300) and the core shaft unit (300); and a core shaft fixing cap (350) which is inserted into the hole and the cap fixing portion (305) of the core shaft fixer (300) at the upper portion of the fixing case (200). The present invention provides advantages of remarkably reducing the assembling time for operation, making the assembling method more convenient and simple, and allowing easy use by an operator. Furthermore, the present invention has advantages of allowing an operator to find a slit direction easily, and providing easy

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maintenance because the fixing cap prevents a hair transplanting device from rolling around when an operator puts the hair transplanting device on an operating table.

Japanese Patent 11104138 discloses an inserting hair implanter that comprises a front end part 3 which connects with the front end of a cylindrical part 2, an expandable spring 12 which is to be stored in the cylindrical part 2, an insertable needle 4 which is to be stored in the cylindrical part 2, leaving a length from the tip to the engagement groove 4a of the needle 4 as it is by the working of the expandable spring 12 and a plunging piston rod 5 which compresses the expandable spring 12 to connect the insertable needle 4 with the tip integrally and regulates the extrusion length of the insertable needle 4 to a specified length without rotating the insertable needle 4 to the cylindrical part 2.

The devices disclosed in the prior art suffer from several drawbacks such as:

- 15 ✓ Blind plantation
Due to the lack of visualization of the movement of plantable material during plantation (placement)
- ✓ Undesirable positioning and fixation
Blind plantation leading to non-detection of folding, bending, twisting and squashing of plantable material during the plantation process
- 20 ✓ Repetition
Repetition of plantation is required due to inability to correct poor positioning and secure fixation of plantable material in the same step.
- ✓ Poor yield
25 Poor positioning and fixation leading to poor revival, survival and growth resulting in poor yield
- ✓ Variable depth control solution
Due to lack of intrinsic depth control in the implanting device additional mechanism for the depth control is required which demands adjustment of depth control mechanism for variable sized hair follicles.
- 30 ✓ Prolonged plantation time
Complex installation due to multiple parts interconnected with screw joint. Shorter beveled requires more force for site creation resulting in quicker blunting of point requiring frequent changeover of implanting parts.
- 35 Changeover of implanting device involves time consuming unscrewing and re-screwing of various parts thereby negatively impacting speed of the plantation procedure
Repetition of steps due to poor positioning and more pop outs as mentioned above.

Increased cleaning time required to clean the blood stained irregular outer surface of the body of the implanter.

✓ Poor Maneuverability

Due to substantial weight making difficult and tiresome handling

5 Due to substantial large diameter of the housing resulting in uncomfortable and inaccurate gripping

✓ Not truly disposable

Due to lack of disposability aspect of all the components wherein only implanting device is disposable.

10 ✓ Not versatile

Due to inability to plant follicles with soft hair or absence of projectile hair.

✓ High probability of graft damage

15 As the spring is compressed the plantation device is withdrawn but the plunger remains still and maintains pressure on the hair to prevent pop out resulting in bending of the hair leading to possible damage to the follicle

Thus, there is a need for a device capable of providing safe, speedy, atraumatic and yet accurate plantation maintaining follicular integrity providing superior results with minimal scar, bleeding and pop out from the substrate making less strenuous on the operator.

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The present invention overcomes the disadvantages of the prior art and provides a device for speedy, accurate, versatile and atraumatic transplantation of hair. This plantation device can plant a wide range of plantable materials into diverse substrates at enhanced plantation speed maintaining follicular integrity resulting in better yield.

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Summary of the Invention

30 The main object of the invention is to provide a plantation device that can plant a wide range of plantable materials into diverse substrates at enhanced plantation speed maintaining follicular integrity resulting in better yield.

Another object of the invention is to provide a device that allows plantation under direct vision.

35 Yet another object of the invention is to provide a device with minimum number of movable parts.

Yet another object of the invention is to provide a device that has the flexibility of using a range of plantable material especially without limitation of length, stiffness, diameter of hair.

5 Yet another object of the invention is to provide a disposable introducing device and planting device.

Yet another object of the invention is to provide a device with self depth control arrangement.

10 Yet another object of the invention is to provide a device to ensure use of minimum force for easy insertion with low pop out and less bleeding.

15 Yet another object of the invention is to provide a device in which the needle point retains its integrity for a longer period thereby enabling plantation of higher number of follicles with decreased frequency of needle replacement.

Yet another object of the invention is to provide a device in which replacement of planting device can be performed in minimal time.

20 Yet another object of the invention is to provide a device in which the planter point is robust and preserved while attaching it with the introducing device during replacement.

Yet another object of the invention is to provide a device which is capable of planting grafts harvested by open or close donor methods, trimmed or untrimmed.

25 Yet another object of the invention is to provide a device which is thinner for better grip and light weight to reduce muscle fatigue.

30 Yet another object of the invention is to provide a device that is capable of operating with direct force rather than using counter force to ensure pushing of the graft into the cavity for better alignment under direct vision rather than remaining still and thereby preventing graft pop out.

Yet another object of the invention is to provide a device in which plantation is possible with single hand with capability to reset misaligned grafts without aid of additional instruments.

35 Yet another object of the invention is to provide a device in which plantable material is made to slide down into the cavity as one piece without any bending force on the plantable material.

Yet another object of the invention is to provide a device in which learning curve to operate is fast.

Yet another object of the invention is to provide a device which can be used for plantation by
5 more assistants from different angles simultaneously on the scalp resulting in plantation of
higher number of grafts in shorter time.

Yet another object of the invention is to provide a device in which plantation is possible at very
narrow acute angle with the skin

10 Yet another object of the invention is to provide a device which is cost effective time, money and
human resource wise.

Yet another object of the invention is to obviate use of depth control mechanism.

15 Yet another object of the invention is to provide truly disposable implanting device.

Yet another object of the invention is to obviate contact of the sharp end of the planting device
with other components.

20 Yet another object of the invention is to enable transmission of the force and the linear
movement of the hair follicle enabled by plunger and spring.

Yet another object of the invention is to enable plantation on substantial substrate area with
25 substantially reduced number of plantation devices.

Yet another object of the invention is to obviate pressing and thereby damaging hair follicle due
to undesirable pressing of the follicle by the plunger.

30 Thus in accordance with the invention, the plantation device comprises
a housing (1), spring loaded plunger assembly (2), hub assembly (3), tube cover (4)
wherein the housing comprises of first portion (10), middle portion (11) and the third converged
portion (12)

wherein the said spring loaded plunger assembly (2) is adapted to be fitted inside the said
35 housing;

the hub assembly is removably fitted on the said third converged portion (12) of the housing;

the tube cover is removably fitted on the said hub assembly or the said the converged portion (12) of the housing.

Detailed Description of the Invention

5 Features and advantages of this invention will become apparent in the following detailed description and the preferred embodiments with reference to the accompanying drawings.

Fig. 1 Schematic of the plantation device (Sheet 1)

Fig. 2 Exploded view of the plantation device (Sheet 2)

10 Fig. 3 Schematic of the hub assembly (Sheet 3)

Fig. 4 Schematic of the stopper and planting means (Sheet 4)

Fig. 5 Schematic of exploded view of assembling of the hub assembly with plunger (Sheet 5)

Fig 6 Schematic of the use of the planting device (Sheet 6)

Fig. 7a,7b Schematic of the hair follicle loading in the planting device (Sheet 7)

15 Fig. 7c,7d Schematic of the loaded planting device with respect to substrate (Sheet 8)

Fig.8 Schematic of the use of the planting device (Sheet 9)

Fig. 9 Representation of plurality of planting device mounting (Sheet 10)

Definitions

- 20 ✓ "Transplant material" is a solid or semisolid material like fiber and its like, living or non-living that can be harvested from one site and planted onto another site.
- ✓ "Harvesting" means up-rooting a transplant material from a substrate preferably without damaging it.
- ✓ "Planting" means inserting transplant material into a suitable substrate without damaging
- 25 the material.
- ✓ "Transplanting" means harvesting from one site in a substrate and then planting it onto another site in the same or another substrate.
- ✓ "Introducing" means an action which helps insertion of the transplant material during planting.
- 30 ✓ "Stopper" is a device or body that can restrict the depth to which the planter can pierce the substrate.
- ✓ "Introducing assembly" means a device made up of multiple parts which when attached to the planting assembly facilitates insertion (placement) of graft into a predetermined plantation site.
- 35 ✓ "Planting assembly" means a device made up of multiple parts when loaded with plantable material is capable of plantation with or without an introducing assembly.

Figure 1 depicts schematic of the plantation device. It comprises of a housing **1**, spring loaded plunger assembly **2**, hub assembly **3**, tube cover **4**. The **Figure 1a** illustrates schematic depicting disposition of the said spring loaded plunger assembly **2** in the said housing **1** that comprises of a first portion **10**, second middle portion **11** and the third portion **12**. The diameter of the said first portion **10** is larger than that of the middle and converged portion as depicted in the **Figure 1a**. The said middle portion **11** is substantially cylindrical, further the said third portion **12** is substantially cylindrical having diameter less than that of the said middle portion **11** wherein an internal recess **14** is created on the junction of the said middle portion **11** and the third portion **12**. In one of the embodiments the diameters of the said first portion **10** and the second portion **11** are of same diameter. In yet another embodiment the said first, second and third portions are integrated. In yet another embodiment the said first, second and third portions are attached with each other.

As illustrated in **Figure 1b** and **Figure 2**, the said spring loaded plunger assembly **2** comprises of knob **21**, plunger holding sleeve **22**, cap **23**, plunger **24** and spring **25**. The knob **21** is press-fitted in the plunger holding sleeve **22** from one of the ends. The other end **26** of the said sleeve is substantially cylindrical provided with an internal cavity to receive the said plunger **24** inside. Further, the sleeve end **26** is adapted to receive/ mount one of the ends of the spring **25** on the outer cylindrical surface wherein the spring surrounds the plunger as depicted in **Figure 1b**. The other end of the spring rests on the said recesses **14** of the housing **1**. In one of the embodiments the said sleeve **22** and the knob **21** are integrated with each other. Further, the said sleeve **22** is slidably disposed with a clearance fit in the cap **23**. The said first portion **10** of the housing **1** is adapted to receive the said cap **23**. Further the said third portion **12** is adapted to removably receive the said hub assembly **3**.

Figure 3 depicts hub assembly **3**. It comprises of a substantially conical shaped / converging shaped hub **31**, stopper **32**, planting means **33**. The said hub **31** has annular longitudinally extending cavity / passage **37** adapted to reciprocatingly house the said plunger **24**. The said hub comprises of a substantially cylindrical first portion **34** that is adapted to be removably fitted on the surface of the said third portion **12** of the housing **1**. The said first portion **34** is followed by a substantially converging portion **35** provided with optional ribs. The end portion **36** is adapted to receive the said stopper **32** and the planting means **33** inside it. As illustrated in the **Figure 3b**, the stopper **32** comprises of substantially cylindrical portion **32a**. Further part of the said cylindrical surface portion is extended longitudinally to form a tongue like extended portion **32b** as illustrated in the **Figure 3b**. The width of the said tongue like extended portion **32b** is judiciously arrived at. The end **32c** of the this extended portion is in the form of a circular sector having thickness equal to the thickness of the said cylindrical portion. The length of the

said tongue like extended portion is judiciously arrived at with respect to the end of the said planting means 33 and end portion 36. The planting means 33 comprises of substantially cylindrical elongated hollow first portion 33a. Further the said portion is provided with a slotted groove 33b longitudinally to form the second portion 33c wherein the hollow portion of the cylinder enveloped below the said groove and cylindrical surface forms a retaining area 33e (Figure 4) for the plantable material such as hair follicle. The width of the said groove 33b is about one half to about one tenth the diameter of the planting material to facilitate the insertion and further locating / temporary retention of the plantable material in a predetermined position in the said groove ensuring its smooth loading, unloading and movement along longitudinal direction of the groove for subsequent operations. It is to be noted that the length of the said groove in the present invention provides flexibility of placing the follicle at appropriate distance and sliding it obviating need of a dedicated depth control mechanism as is the case in most of the prior art. The width of the said groove 33b is maintained / designed to prevent the plantable substance to pop out from the groove but at the same time allow easy passage to and from the groove to the tapered wedge shaped end. The said second portion 33c is further developed into a tapered wedged shaped end portion 33d as depicted in the Figure 3(b).

Figures 4a and 4b depict top view and front view respectively of the assembly of the said stopper 32 and planting means 33. As illustrated in Figure 4, the wedge shaped end portion 33d comprises of edges 40 and 41 converged to form needle like shape end 42 to enable piercing in a substrate. The length of the said wedged shaped end portion is arrived at judiciously. The said sharpened edges to enable piercing a substrate for harvesting and / or planting to appropriate (or predefined) depth that is controlled by the location of the said end 32c. This aspect is illustrated schematically in Figure 4a and 4b wherein the said planting means 33 is inserted into the stopper 32 to the extent to maintain a desired / predetermined distance between the said end 32c and the needle like shape end 42. The said edges 40 and 41 are sharp and tapered in a manner to allow easy passage into the substrate with flexibility of rotation when desired. As illustrated in Figure 4a, the width and shape of the said wedge shaped end is designed in a manner that during harvesting it enables creation of circumferential cut around the hair follicle and during plantation it enables the creation of an appropriate site for the plantation process by maintaining the opening of the cavity stretched and walls of the cavity dilated/separated to facilitate easy insertion of the said plantable material into the created site with the help of the said plunger 24. Further, as illustrated in Figure 4b (front view) the said edges 40 and 41 are contoured.

35

Figure 5 depicts the assembly of the said housing 1, spring loaded plunger assembly 2, hub assembly 3. The said spring loaded plunger assembly 2 is adapted to be fitted in the said

housing wherein the plunger 24 of the said assembly 2 extends longitudinally out from the said end portion 12 as depicted in the Figure 5a. As depicted in Figure 5b, assembly of the said plunger 24 is inserted / housed in the said passage 37 of the said hub assembly 3. Figure 5c depicts the extension of the said plunger 24 into the hollow cylindrical portion 33c of the said planting means 33. It is to be noted that in operation the knob 21 is pressed (numeral 100 in Figure 5c represents reciprocation of the said knob) against spring force to push / extend the said plunger 24 into the said portion 33c and further extending it beyond the said needle like shape end 42. Upon release of the knob 21, the plunger is retracted by spring force to its original position. The plunger 24 is thus reciprocated in the said planting means 33. It is evident that this synergistic combination enables user to control travel of the longitudinal distance of the said plunger as desired using one hand with perfect visual observation of the plunger travel while the said needle like shape end 42 is pierced in the substrate obviating in the blind grafting of the plantable material such as hair follicle.

In one of the embodiments the width of the said groove 33b is about one half to about one tenth the diameter of the planting material to facilitate the disposition of the planting material, ensuring its smooth loading, unloading and movement along the groove for subsequent operations. In yet another embodiment the length of the groove is one to three times the length of the planting material.

It is to be noted that the synergistic combination of the said housing 1, spring loaded plunger assembly 2, hub assembly 3, of the present device obviates need of a dedicated depth control mechanism and prevents blind grafting of the plantable material such as hair follicle in the substrate as the plunger of the present device aids appropriate location and controls plantation of the hair follicle with desired precision under observation of the user. This synergistic combination enables multiple functions of a dissector, site creator, stopper, spiral cavity maker, stretcher, separator and slider maintaining plantable material integrity during plantation. The said hub assembly 3 can be easily press fitted on the said end portion of the housing 12 obviating the clumsy and time consuming change over.

The method of plantation of the said plantable material such as hair follicle 101 using the plantation device is illustrated in Figures 6, Figure 7 and Figure 8. The method comprises steps of:

✓ **Figure 6** is a representation of the loaded plantable material **101** such as hair follicle in the said groove **33b** and disposition of the said planting device with respect to the substrate **200** wherein the said needle like shape end **42** and the tapered wedged shaped portion **33d** is shown in contact with the substrate surface. As in **Figure 7a** the said hair follicle is

loaded first in the said wedge **33d**. With the help of forceps or other suitable means **300** the said hair follicle is held by the hair nearer to the tip. The held hair follicle **101** (**Fig. 7a and Fig. 7b**) from the wedge **33d** is slid in the direction indicated by numeral **500** using means such as forceps **300** to the said groove **33b** in such a way that the tip of the hair slides into the groove of the said planting means **33** while the actual follicle slides inside the said retaining portion **33e** of the planting means. This is illustrated in **Fig. 7b** wherein the shaded area **550** indicates the portion of the said follicle retained / residing in the said retaining portion **33e**. Part of the hair continues to project outside the said groove and remains visible as illustrated by numeral **70** in **Figure 7c**;

✓ holding the said plantation device loaded with hair follicle by either hand (dominant or non-dominant) and bringing the said needle like shape end **42** close to the selected site on the substrate for plantation wherein desired angle, direction and orientation of plantation is decided by the operator (**Figure 6**);

✓ applying downward pressure on the said housing in such a way that the said wedge shaped end portion **33d** penetrates the substrate such as skin to create the site for plantation (**Figure 7c**);

✓ continuing the pressure and insertion of the said portion **33d** in the skin till the said end **32c** of the said stopper **32** touches the skin and prevents further penetration (**Figure 7c**);

✓ applying downward pressure with same hand index finger on the said knob **21**

so that the said plunger **24** is provided with the force for linear movement to push the said hair follicle residing in the said retaining portion **33e**. It is to be underlined that the synergistic combination of the said plunger **24**, retaining portion and the said wedge shaped end portion of the present invention enables visual observation (under direct vision) the linear movement / displacement of hair follicle through the said groove **33b** and also the part of the hair projected out from the said groove (as illustrated in **Figure 7d**) and stopped as soon as the hair touches the skin (indicated by numeral **71**). At this stage the said plunger **24** substantially at the skin level. This unique aspect prevents the blind grafting of the hair follicle. It is to be noted that the depth control is achieved by the disposition of the said stopper and in turn the said end **32c** of the stopper obviating need of a dedicated mechanism that makes the device complex, adds weight due to additional components and is cumbersome to operate;

✓ applying further downward pressure on the said knob **21** so that it almost touches the cap **23** and further displacement of the cap is restricted wherein the said plunger **24** enters the created cavity and irons out the follicle correcting its folds, bends or twist created at the time of insertion. This completes the fixation of hair follicle into the site cavity as illustrated in **Figure 8a**;

- ✓ keeping the said knob **21** pressed and withdrawing the housing **1** outwards from the plantation site as illustrated in **Figure 8b** and maintaining the fixation of hair follicle into the site wherein the hair follicle remains fixed in to the created site at desired angle, direction and orientation and plantation is completed.

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In one of the embodiments the material of construction of the said hub assembly **3**, spring loaded plunger assembly **2** and housing **1** is selected from metal, alloy, polymer based material or combination thereof.

- 10 In yet another embodiment the said spring **25** is integrated in the said housing. In yet another variant of this embodiment the said spring **25** is integrated or affixed with the said sleeve **22**. In yet another variant of this embodiment the said spring **25** is a separate component that is assembled with the said housing and the said sleeve.

- 15 It is evident that the plantation device of the present invention is characterized in providing a truly disposable construction wherein both implanting device and introducing device are disposable. During change over the said end **42** does not get blunt as sharp point does not come in contact with any other parts. The compression of the said spring results in the movement of the follicle as well as the said end **42** of the plantation device remains inside the
- 20 substrate providing appropriate and desired control preventing follicle damage. The synergistic configuration obviates the need of changing the depth control with variable size follicles. The design of the contoured end **42** (beveled) requires substantially reduced force resulting in enhancing plantation effectiveness. Further substantially increased number of sites in the substrate can be created with one device as it does not get blunt quickly due to longer beveled.
- 25 Reduced number of the planting devices required for larger sessions results in reducing change over time. The device of the present invention is easy to clean, in particular the blood stained outer surface of the body in case of reuse.

- It is to be noted that the in the present plantation device at the end of plantation as the device is
- 30 withdrawn the said plunger **24** does not need to press on projectile part of the hair resulting in obviating bend down of the hair and damage. As the said plunger **24** pushes the follicle in the cavity during plantation, follicle with soft hair or even without projectile hair are easily planted using the plantation device of the present invention.

- 35 It is to be noted that the description and method of using the said plantation device is not merely limited to hair follicle. For purposes of explanation, this embodiment with hair follicle is elaborated in order to provide a thorough understanding of the embodiments. A person skilled

in art can contemplate diverse applications such as but not limited to creating near periodic structures by grafting elements in substrate wherein the process of harvesting of a plantable material and planting it in diverse substrate is performed with the aid of the plantation device of the present invention. Accordingly, in some instances, features are omitted and/or simplified in order to not obscure the disclosed embodiments. Furthermore, it is understood that the
5 embodiments shown in the Figures are illustrative representation and are not necessarily drawn to scale.

In yet another embodiment plurality of planting devices or part thereof are arranged in
10 combination of rows and / or columns or other configuration as schematically depicted in **Figure 9**. Plurality of the plantation device **91** of the present invention is mounted on a common member **90** that is operably configured with a positioning means **89** operationally connected with the said knobs. The said positioning means is configured with the actuating means **88**
15 (under the direction of force indicated by arrow **700**) of the plantation device to enable plantation of one or plurality of (many) plantable material into plantable substrate in one stroke / single process step.

In another embodiment the said plunger **24** is integrated or affixed with the said sleeve **22**.

20 In another embodiment the said plunger **24** is a separate component that is assembled with the said sleeve **22**.

In yet another embodiment the geometry of the said first portion **10**, middle portion **11** and third converged portion **12** is in the form of triangular, quadrangular, pentagonal, hexagonal,
25 polygonal cross section or combination thereof.

In yet another embodiment the geometry of the said plunger is in the form of cylindrical, triangular, quadrangular, hexagonal, polygonal cross section or combination thereof.

30 In yet another embodiment the upper surface of the knob **21** is in the form of substantially convex, flat, concave, contoured or combination thereof.

In yet another variant of this embodiment the cap **23** and housing **1** are integrated. In yet another variant of this embodiment the cap **23** and housing **1** are operably connected by press
35 fitting, by connector, by attaching or combination thereof.

In another embodiment, the plantation device and the method are capable of being employed in diverse plantation applications for example in agriculture, surgical procedures, electronics and materials engineering.

- 5 In one of the embodiments the plantation device of the present invention is used to graft / root fins in a solid and /or flexible substrate that is used for enhancing heat transfer.

CLAIMS

- 5 1. A plantation device comprising
a housing (1), spring loaded plunger assembly (2), hub assembly (3), tube cover (4)
wherein the housing comprises of first portion (10), middle portion (11) and the third
converged portion (12)
wherein the said spring loaded plunger assembly (2) is adapted to be fitted inside the
10 said housing;
the hub assembly (3) is removably fitted on the said third converged portion (12) of the
housing;
the tube cover is removably fitted on the said hub assembly or the said the converged
portion (12) of the housing.
- 15 2. A plantation device as claimed in claim 1 wherein the said housing comprises of a first
portion (10), second middle portion (11) and the third portion (12);
the said first portion (10) is substantially cylindrical;
the diameter of the said first portion (10) is larger than that of the middle portion (11)and
20 the third converged portion (12);;
the said middle portion (11) is substantially cylindrical, the said third portion (12) is
substantially cylindrical having diameter less than that of the said middle portion (11)
wherein an internal recess (14) is created on the junction of the said middle portion (11)
and the third portion (12).
- 25 3. A plantation device as claimed in claim 2 wherein the diameters of the said first portion
(10) and the second portion (11) are equal.
4. A plantation device as claimed in claim 2 wherein the said first (10), second (11) and
30 third portions (12) are integrated.
5. A plantation device as claimed in claim 2 wherein the said first (10), second (11) and
third portions (12) are attached with each other.
- 35 6. A plantation device as claimed in claim 1 wherein the said spring loaded plunger
assembly (2) comprises of knob (21), plunger holding sleeve (22), cap (23), plunger (24)
and spring (25)
wherein

the knob (21) is press-fitted in the plunger holding sleeve (22) from one of the ends, the other end (26) of the said sleeve is substantially cylindrical, it is provided with an internal cavity to receive the said plunger (24) inside;

the sleeve end (26) is adapted to receive one of the ends of the spring (25) on the outer cylindrical surface wherein the spring surrounds the plunger;

the other end of the spring rests on the said recesses (14) of the housing (1);

the said sleeve (22) is slidably disposed with a clearance fit in the cap (23)

wherein the said first portion (10) of the housing (1) is adapted to receive the said cap (23),

the said third portion (12) is adapted to removably receive the said hub assembly (3).

7. A plantation device as claimed in claim 6 wherein the said sleeve (22) and the knob (21) are integrated with each other.

8. A plantation device as claimed in claim 1 wherein hub assembly (3) comprises of a substantially conical shaped / converging shaped hub (31), stopper (32), planting means (33);

the said hub (31) has annular longitudinally extending passage (37) adapted to reciprocatingly house the said plunger (24), substantially cylindrical first portion (34) that is adapted to be removably fitted on the surface of the said third portion (12) of the housing (1);

the said first portion (34) is followed by a substantially converging portion (35) provided with optional ribs;

the end portion (36) is adapted to receive the said stopper (32) and the planting means (33) inside it;

the stopper (32) comprises of substantially cylindrical portion (32a), part of the said cylindrical surface portion is extended longitudinally to form a tongue like extended portion (32b),

the end (32c) of the this extended portion is in the form of a circular sector having thickness equal to the thickness of the said cylindrical portion;

the planting means (33) comprises of substantially cylindrical elongated hollow first portion (33a), the said portion is provided with a slotted groove (33b) longitudinally to form the second portion (33c) wherein the hollow portion of the cylinder enveloped below the said groove and cylindrical surface forms a retaining area (33e) for the plantable material such as hair follicle;

the said second portion (33c) is further developed into a tapered wedged shaped end portion (33d).

9. A plantation device as claimed in claim 8 wherein the width of the said groove (33b) is one half to one tenth the diameter of the planting material such as hair follicle to facilitate insertion and further temporary retention of the plantable material in a predetermined position in the said groove ensuring its smooth loading, unloading and movement along longitudinal direction of the groove for subsequent operations.
10. A plantation device as claimed in claims 1, 7,8 wherein the length of the said groove (33b) that provides flexibility of placing the plantable material such as the hair follicle at desired distance and sliding it obviating need of a dedicated depth control mechanism.
11. A plantation device as claimed in claims 1, 8-10 wherein the said wedge shaped end portion (33d) comprises of edges (40) and (41) converged to form needle like shape end (42) to enable piercing in a substrate for planting the plantable material such as hair follicle to predetermined depth that is controlled by the location of the said end (32c) of the extended portion (32b) of the said stopper (32).
12. A plantation device as claimed in claim 11 wherein the said planting means (33) is inserted into the cylindrical portion (32a) of stopper (32) to the extent to maintain a predetermined distance between the said end (32c) of the extended portion (32b) of the said stopper (32) and the needle like shape end (42).
13. A plantation device as claimed in claim 11 wherein the said edges (40) and (41) of the said wedge shaped end (33d) are contoured.
14. A plantation device as claimed in claims 1, 7, 8, 9 wherein the length of the groove (33b) is one to three times the length of the planting material such as hair follicle.
15. A plantation device as claimed in claims 1- 14 wherein the said spring loaded plunger assembly (2) is adapted to be fitted in the said housing wherein the plunger (24) of the said assembly (2) extends longitudinally out from the said end portion (12); assembly of the said plunger (24) is inserted / housed in the said passage (37) of the said hub assembly (3) wherein in operation the knob (21) is pressed against spring force to push / extend the said plunger (24) into the said portion (33c) and further extending it up to the said needle like shape end (42) , upon release of the knob (21), the plunger is retracted by spring force to its original position, the plunger (24) is reciprocated in the said planting means (33).

16. A plantation device as claimed in claims 1- 15 wherein method of plantation of the said plantable material such as hair follicle comprise steps of:
- ✓ optionally assembling the housing (1) and spring loaded plunger assembly (2), hub assembly in such a way that hub (3) fits over third
5 converged portion (12) of housing (1) with plunger (24) passing through predetermined cavity (37) of hub (3) occupying the cavity space of portion 33a and 33c of planting means (33);
 - ✓ loading plantable material (101) such as hair follicle in the device;
 - ✓ holding the said plantation device loaded with hair follicle by either hand
10 (dominant or non-dominant) and bringing the said needle like shape end (42) close to the selected site on the substrate for plantation wherein desired angle, direction and orientation of plantation is decided by the operator;
 - ✓ applying downward pressure on the said housing in such a way that the said wedge shaped end portion (33d) penetrates the substrate such as skin to create
15 the site for plantation;
 - ✓ continuing the pressure on housing (1) and insertion of the said portion (33d) in the skin till the said end (32c) of the said stopper (32) touches the skin and prevents further penetration;
 - ✓ controlling the desired depth by the disposition of the said stopper and in turn the
20 said end (32c);
 - ✓ keeping the housing (1) in situ applying downward pressure on the said knob (21) with same hand index finger so that the said plunger (24) is provided with the force for linear movement to push the said hair follicle residing in the said retaining portion (33e);
 - ✓ visually observing the linear displacement of the hair follicle through the said
25 groove (33b) and also the part of the hair projected out from the said groove;
 - ✓ under direct vision stopping the displacement on complete disappearance of plantable material in to substrate also observed by the projected hair as the hair touches the substrate surface such as skin wherein the said plunger (24) is
30 substantially at the skin level;
 - ✓ applying further downward pressure on the said knob (21) so that it almost touches the cap (23) and further downward displacement of the plunger is restricted wherein the said plunger (24) enters beyond substrate surface deep
35 into the created cavity and reaches up to the end (42) to iron out the follicle correcting its folds, bends or twist created at the time of insertion to complete fixation of hair follicle into the created site cavity;

- ✓ keeping the said knob (21) pressed and withdrawing the housing (1) outwards from the plantation site and maintaining the fixation of hair follicle into the site wherein the hair follicle remains fixed in to the created site at desired angle, direction and orientation and plantation is completed.

5

17. A plantation device as claimed in claim 16 wherein loading of plantable material comprises steps of:

- ✓ loading the said hair follicle in the said wedge (33d);
- ✓ holding the said hair follicle with the help of forceps or other suitable means (300) the said hair follicle is held by the hair nearer to the tip;
- ✓ sliding the held hair follicle (101) from the wedge (33d) using forceps (300) to the said groove (33b) in such a way that the tip of the hair slides into the groove of the said planting means (33) while the actual follicle slides inside the said retaining portion (33e) of the planting means.

10

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18. A plantation device as claimed in claims 1- 17 wherein the material of construction of the housing (1) spring loaded plunger assembly (2), said hub assembly (3), and the tube cover (4) is selected from metal, alloy, polymer based material or combination thereof.

20

19. A plantation device as claimed in claim 6 wherein the said spring (25) is integrated or affixed with the said sleeve (22).

20. A plantation device as claimed in claim 19 wherein the said spring (25) is a separate component that is assembled with the said housing (1) and / or the said sleeve.

25

21. A plantation device as claimed in claim 20 wherein the said plunger (24) is integrated or affixed with the said sleeve (22).

22. A plantation device as claimed in claim 20 wherein the said plunger (24) is a separate component that is assembled with the said sleeve (22).

30

23. A plantation device as claimed in claims 1-22 wherein the plantable material is hair follicle.

35

24. A plantation device as claimed in claims 1-23 wherein the plantable material is selected from biological material, agriculture (botanical), electronic, engineering (physical) material including fins for heat exchange purpose.

25. A plantation device as claimed in claims 1-24 wherein planting devices or part thereof are arranged in combination of rows and / or columns wherein plurality of the plantation device (91) is mounted on a common member (90) that is operably configured with a positioning means (89) operationally connected with the said knobs;
- 5 the positioning means is configured with the actuating means (88) of the plantation device to enable plantation of one or plurality of plantable material into substrate in one stroke / single process step.
- 10 26. A plantation device as claimed in claim 2 wherein the geometry of the said first portion (10), middle portion (11) and third converged portion (12) is in the form of triangular, quadrangular, pentagonal, hexagonal, polygonal cross section or combination thereof.
- 15 27. A plantation device as claimed in claim 6 wherein the geometry of the said plunger is in the form of cylindrical, triangular, quadrangular, hexagonal, polygonal cross section or combination thereof.
- 20 28. A plantation device as claimed in claim 6 wherein the upper surface of the knob (21) is in the form of substantially convex, flat, concave, contoured or combination thereof.
29. A plantation device as claimed in claim 6 wherein the cap (23) and housing (1) are integrated.
- 25 30. A plantation device as claimed in claim 6 wherein the cap (23) and housing (1) are operably connected by press fitting, by connector, by attaching or combination thereof.

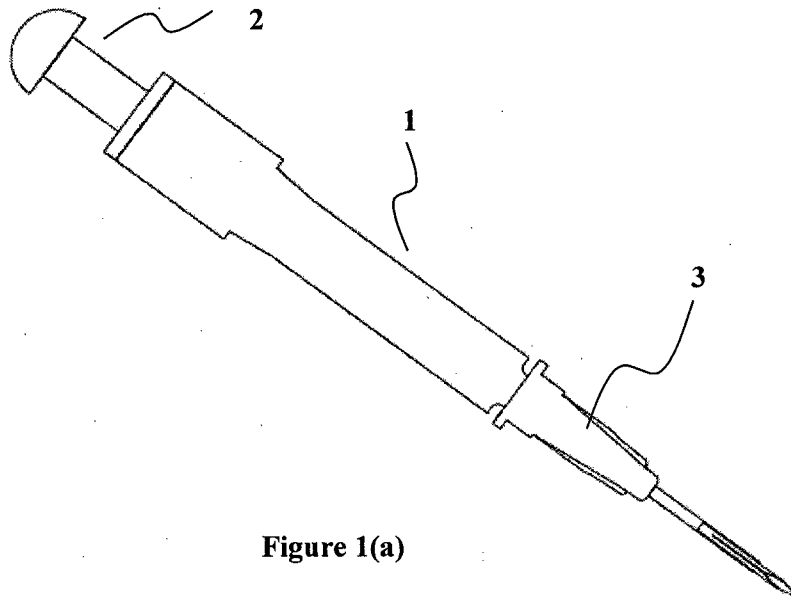


Figure 1(a)

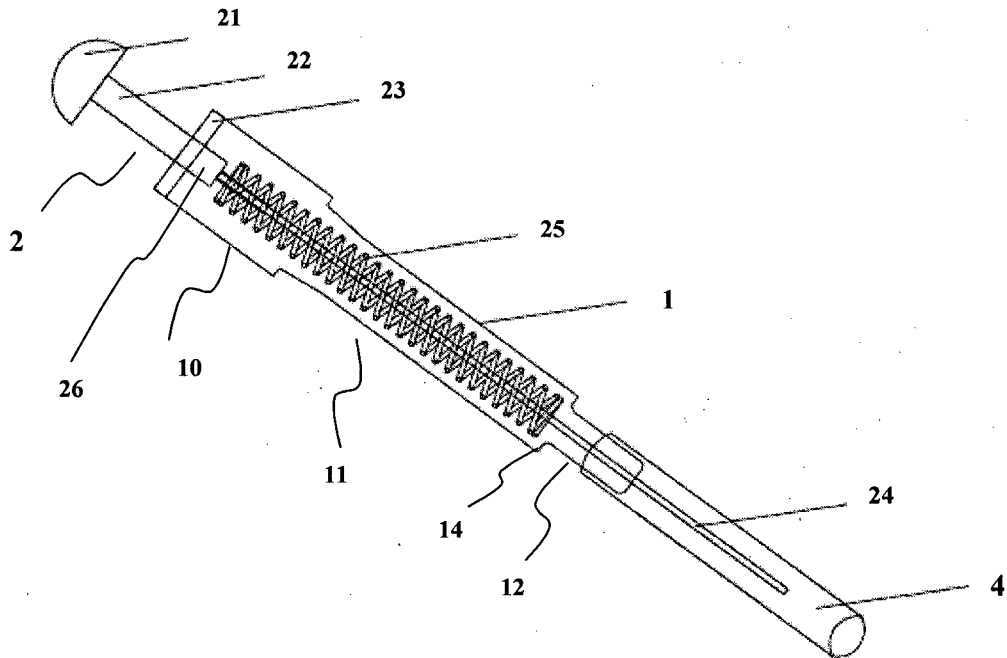


Figure 1(b)

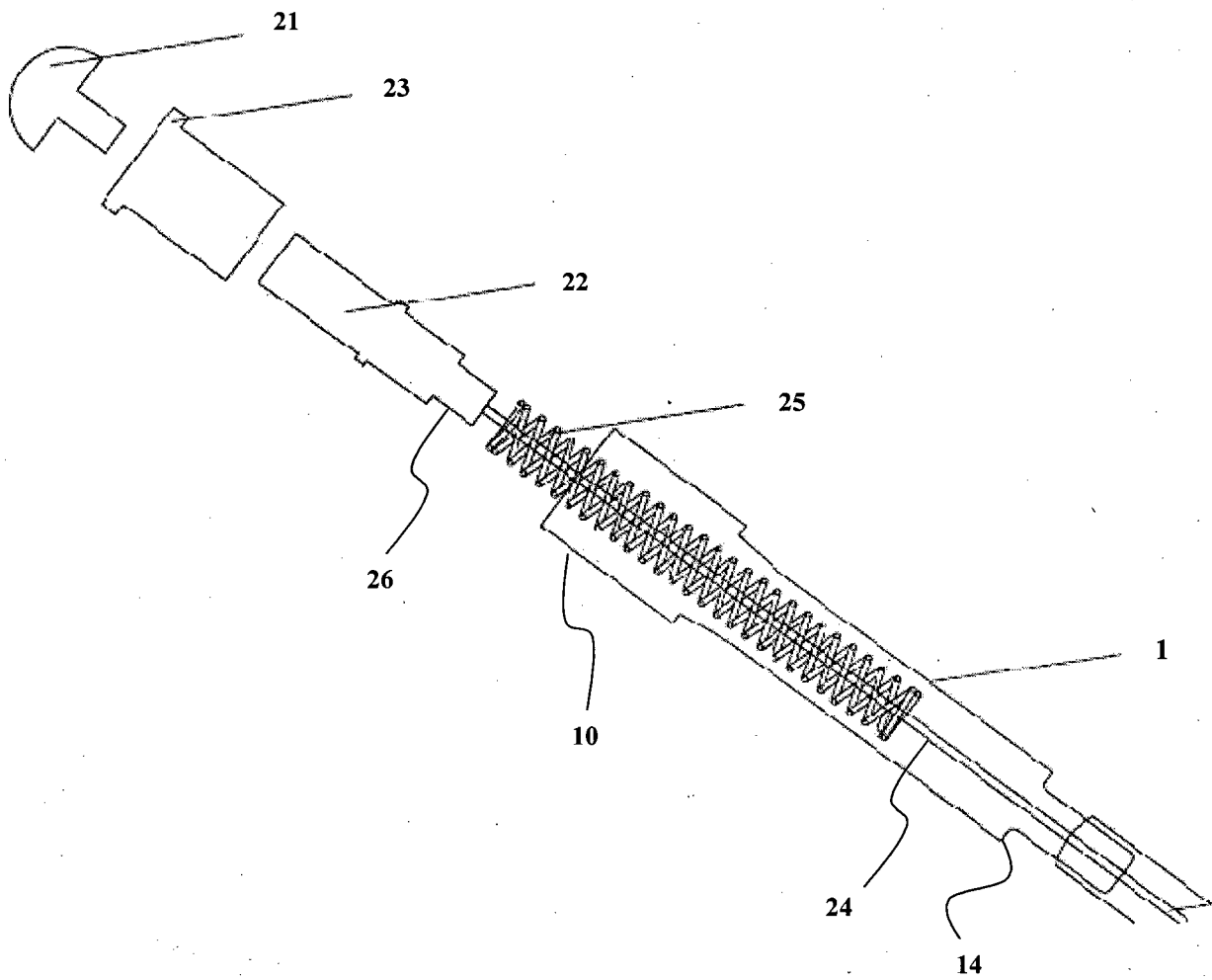


Figure 2

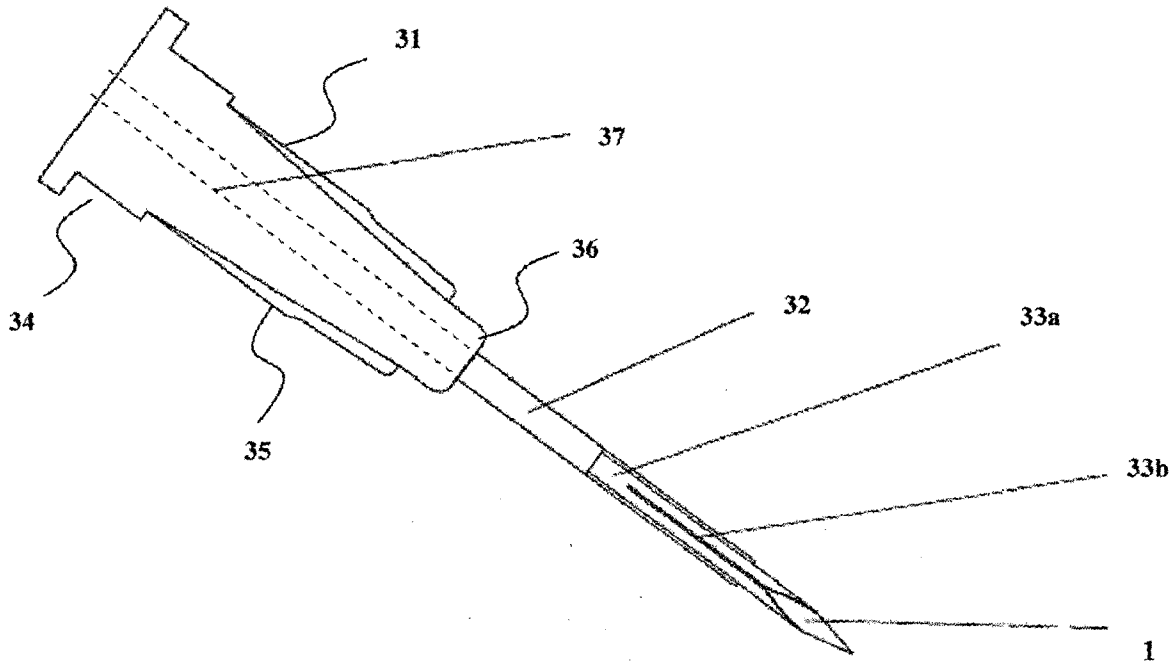


Figure 3(a)

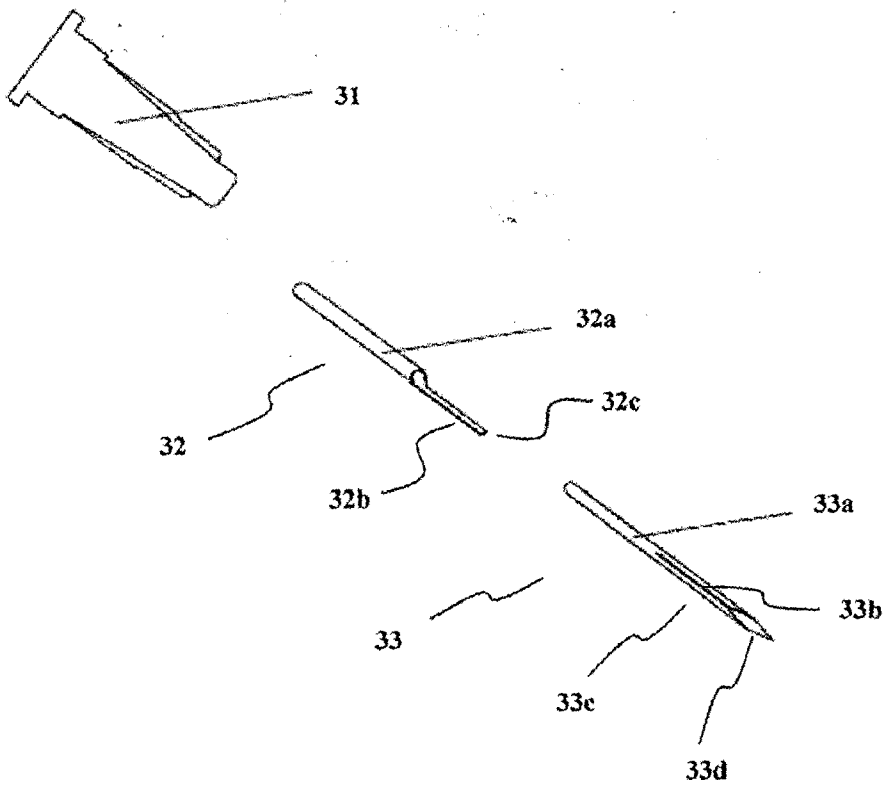


Figure 3(b)

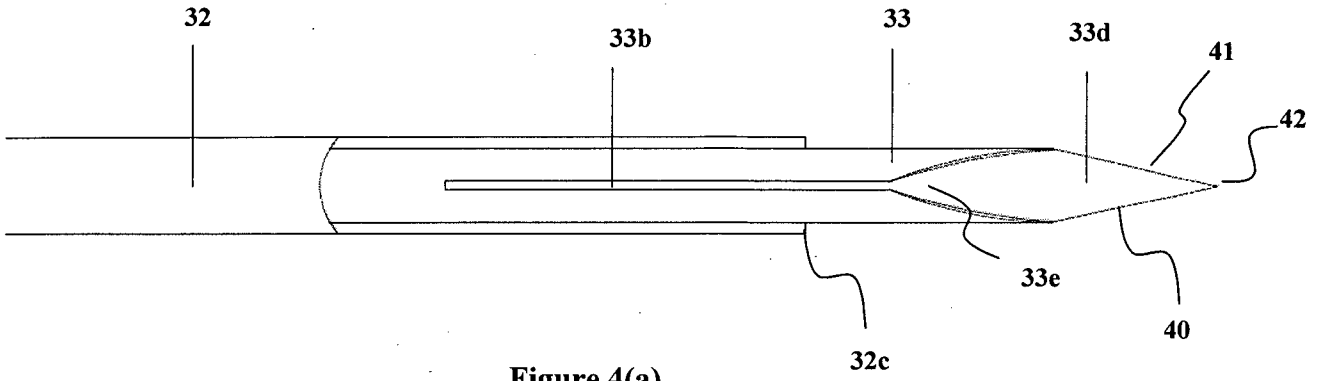


Figure 4(a)

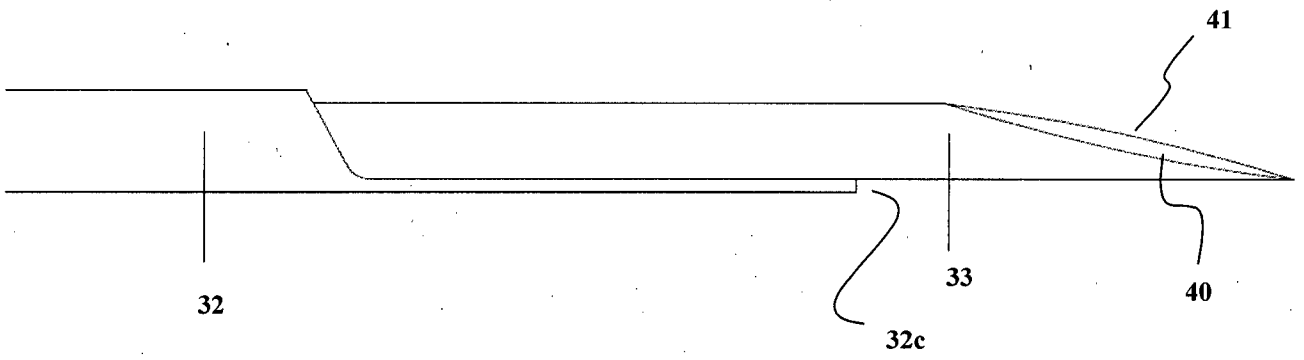


Figure 4(b)

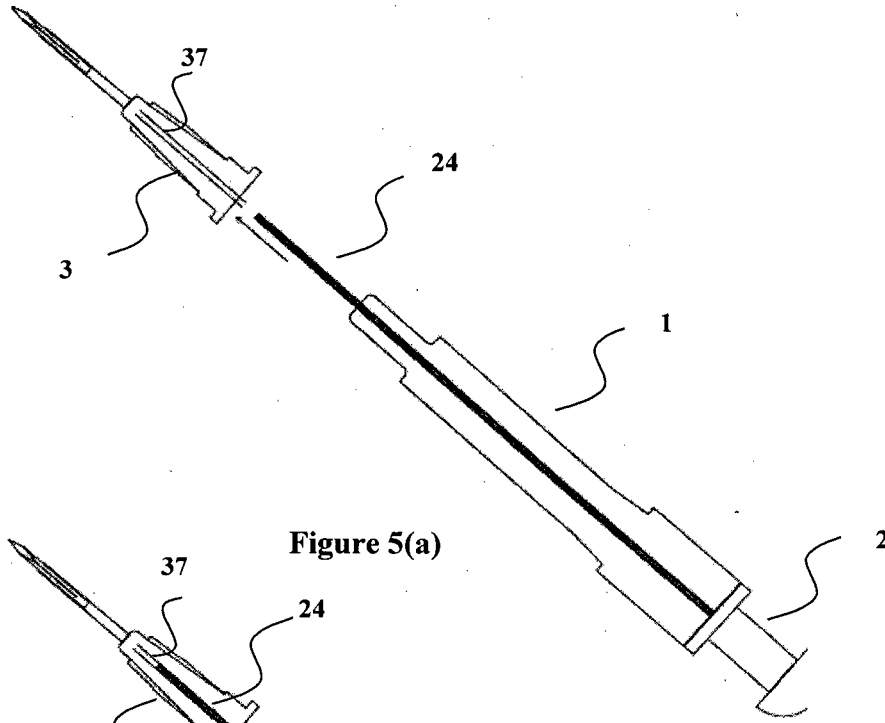


Figure 5(a)

Figure 5(b)

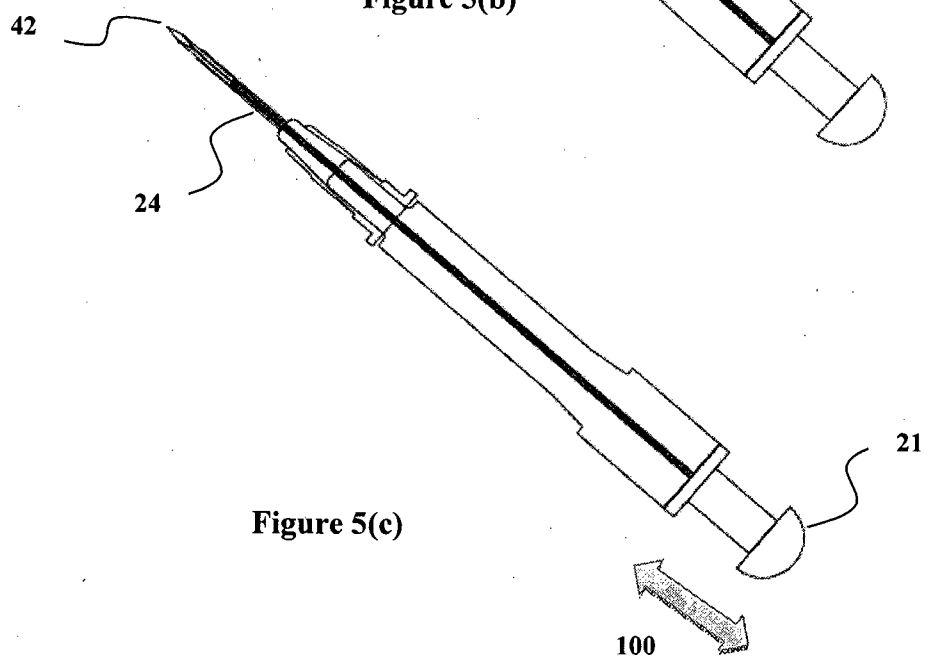


Figure 5(c)

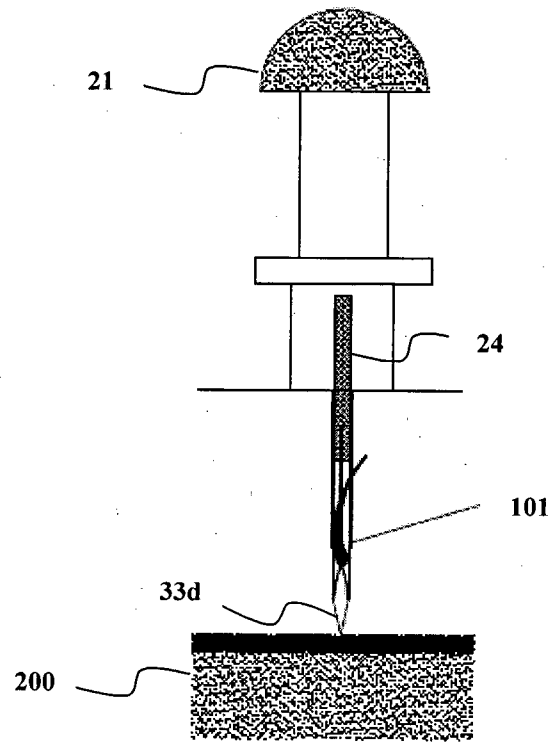


Figure 6

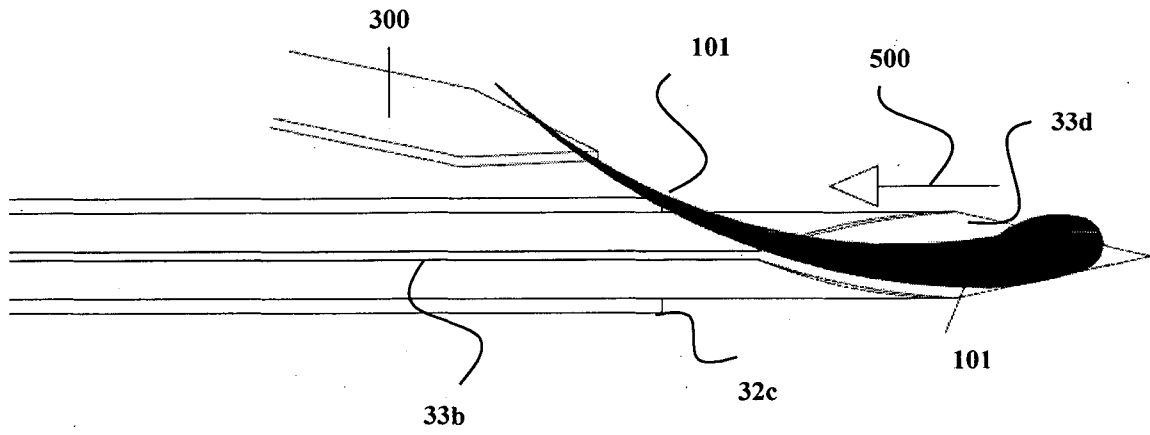


Figure 7a

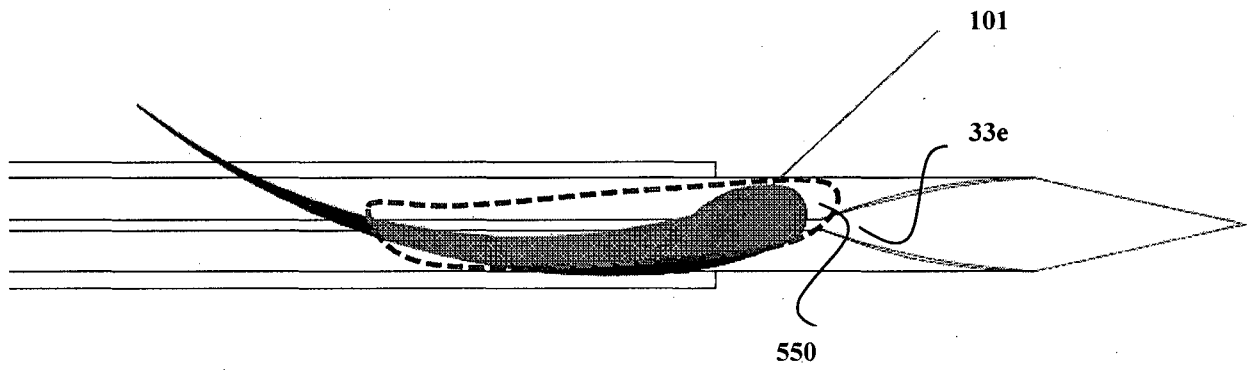


Figure 7b

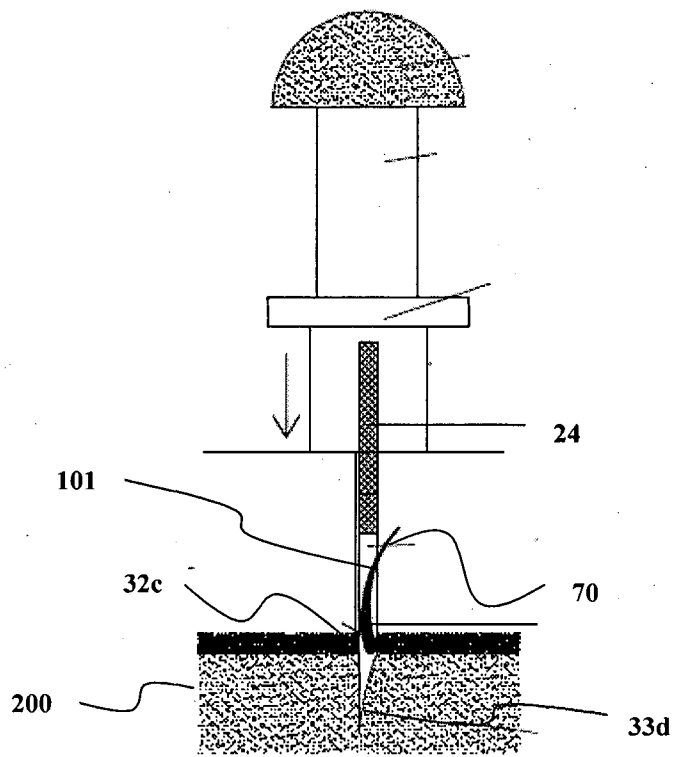


Figure 7c

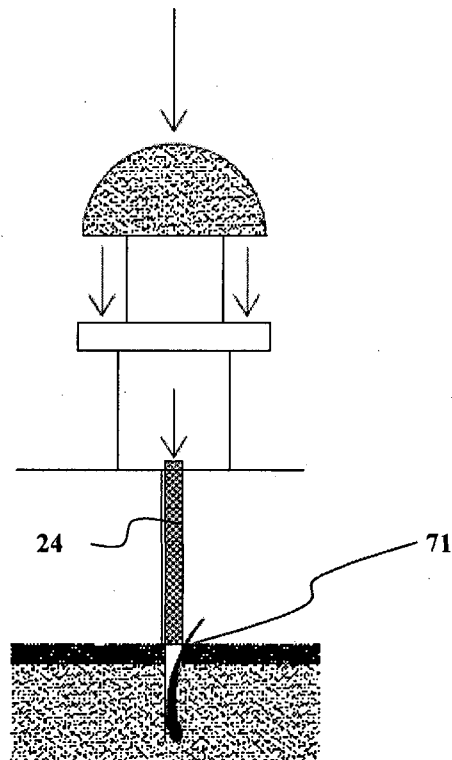


Figure 7d

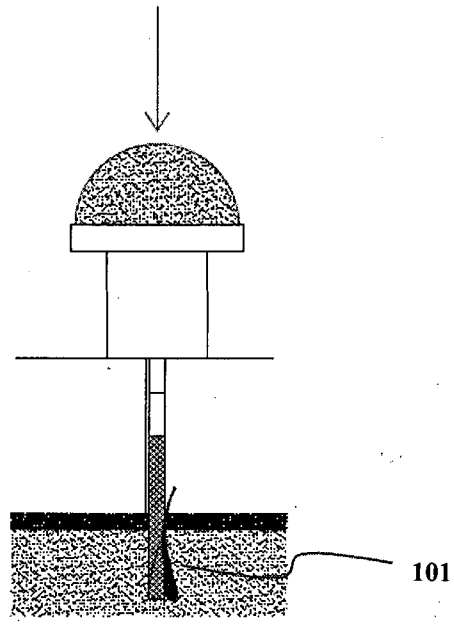


Figure 8a

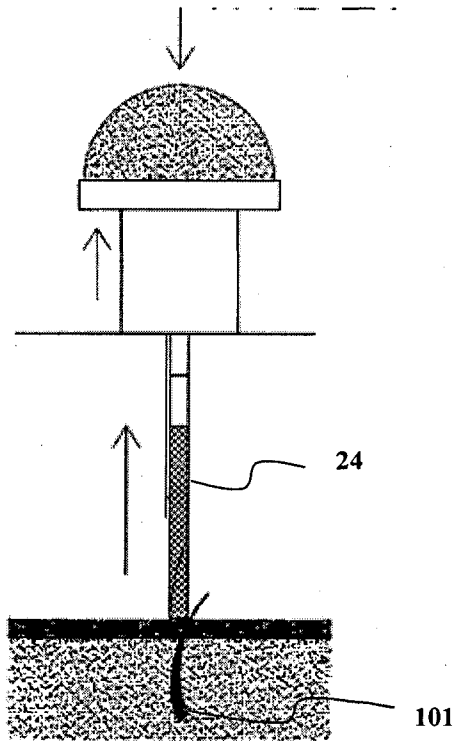
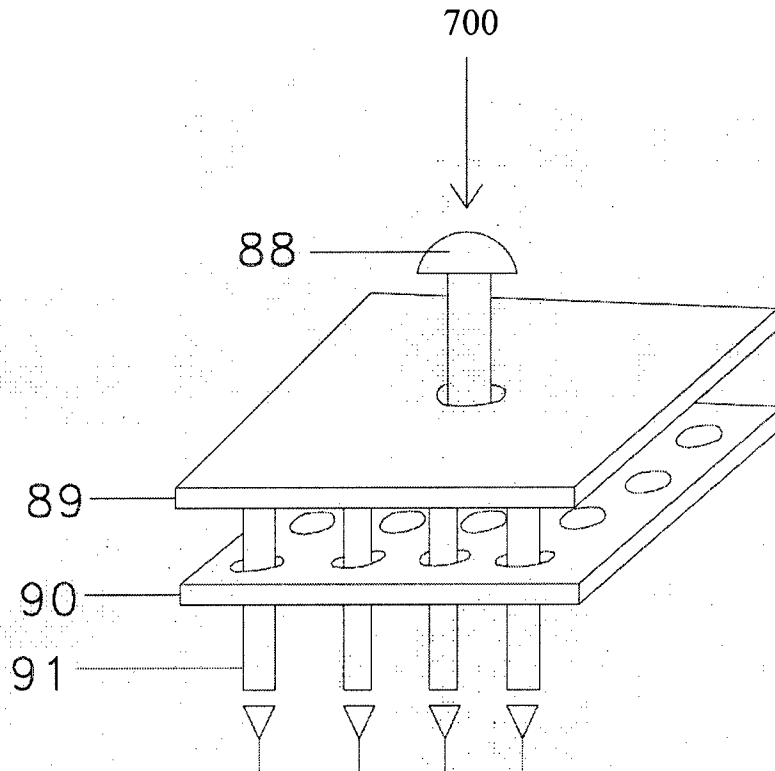


Figure 8b



INTERNATIONAL SEARCH REPORT

International application No
PCT/IN2013/000276

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61F2/10 A61B17/34
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
A61B A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2004/092924 A1 (VASA SANJIV A [IN]) 13 May 2004 (2004-05-13) the whole document	1,2,4-6, 8-13,15, 18-22, 25,27-30
Y	WO 01/60267 A1 (EZAKI TETSUO [JP]) 23 August 2001 (2001-08-23) figures 16,17	1,2,4-6, 8-13,15, 18-22, 25,27-30
A	JP H04 152944 A (KAKINUMA MEDEIKARU KK) 26 May 1992 (1992-05-26) figures 1-8 ----- -/--	1

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search 22 November 2013	Date of mailing of the international search report 02/12/2013
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Barton, Simon

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2013/000276

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

see FURTHER INFORMATION sheet PCT/ISA/210

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/IN2013/000276

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP H10 286257 A (EZAKI TETSUO) 27 October 1998 (1998-10-27) figure 1 -----	1
A	JP H10 151134 A (IKEN KOGYO KK; ENATSUKU KK) 9 June 1998 (1998-06-09) figure 1 -----	1
A	FR 2 715 823 A1 (CRASSAS YVES [FR]) 11 August 1995 (1995-08-11) figure 2 -----	1
A	US 2011/319921 A1 (GIOTIS KONSTANTINOS P [GR]) 29 December 2011 (2011-12-29) figure 3c -----	1
A	US 6 461 369 B1 (KIM JUNG CHUL [KR]) 8 October 2002 (2002-10-08) figures 1a,1b,2,3 -----	1
A	US 5 417 683 A (SHIAO I-SEN [TW]) 23 May 1995 (1995-05-23) figure 1 -----	1
A	US 2005/187573 A1 (RASSMAN WILLIAM R [US] ET AL) 25 August 2005 (2005-08-25) figure 1 -----	1
A	US 2003/036770 A1 (MARKMAN BARRY S [US]) 20 February 2003 (2003-02-20) figure 9 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/IN2013/000276

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004092924	A1	13-05-2004	AU 2003269745 A1 02-12-2003
			EP 1507478 A2 23-02-2005
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			WO 03096906 A2 27-11-2003

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			JP H10286257 A 27-10-1998

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			CN 1318992 A 24-10-2001
			JP 3697413 B2 21-09-2005
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			KR 20010016936 A 05-03-2001
			KR 20010072422 A 31-07-2001
			US 6461369 B1 08-10-2002
			WO 0110307 A1 15-02-2001

US 5417683	A	23-05-1995	NONE

US 2005187573	A1	25-08-2005	NONE

US 2003036770	A1	20-02-2003	NONE

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 3, 7, 14, 16, 17, 23, 24, 26(completely); 1, 2, 4-6, 8-13, 15, 18-22, 25, 27-30(partially)

1 The claims are addressed to "a plantation device", while what is apparently intended is an "implanting device".

1.1 However, the description provides full support as required by Article 6 PCT for this intrinsically unclear wording only as a device for the surgical implantation of hair follicles. All the prior art discussed relates to devices for implanting or transplanting hair, and no device modified to render it suitable for planting seeds or for attaching heat sink fins in a heat sink is disclosed.

1.2 Claims 16,17 are unclear in that they are device claims entirely further defining their subject matter by steps of intended method of use, such use itself being a surgical method excluded from patentability.

1.3 Claims 14,23,24 are unclear in that they seek to define their subject matter by reference to elements not part of the claimed subject matter, contrary to the requirements of Rule 6 PCT. No clear technical limitation of the claimed subject matter is implied by such definition.

1.4 The wording of claim 3 contradicts that of claim 2 from which it depends.

1.5 The wording of claim 7 contradicts that of claim 6 from which it depends.

1.6 The wording of claim 26 contradicts that of claim 2 from which it depends.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.