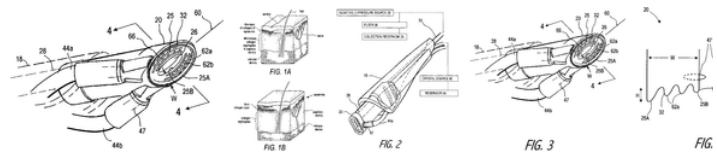
Patents

Instruments and techniques for controlled removal of epidermal layers

Abstract

An instrument and technique for the removal of epidermal layers in a controlled manner utilizing a hand-held instrument with a working end that (i) a vacuum aspiration system, (ii) a source for delivery of a sterile fluids or pharmacological agents to the skin; and (iii) a skin interface surface in the working end that has specially shape structure for abrading surface layers of the patient's epidermis as the working end is moved over the patient's skin while at the same time causing rapid penetration of the fluids into the skin for therapeutic purposes. Movement of the working end across the skin causes abrasion of the surface layers in a path over the patient's skin. The method of the invention may be used in a periodic treatment for the removal of superficial skin layers that enhances the synthesis of dermal collagen aggregates by inducing the body's natural wound healing response. The method of the invention creates more normal dermal architectures in skin with limited depths of skin removal by the series of superficial treatments that may be comparable to the extent of neocollagenesis caused by a deep skin removal treatment (e.g., CO_2 laser skin removal).

Images (10)



Classifications

A61B17/54 Chiropodists' instruments, e.g. pedicure

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Current Assignee : Hydrafacial LLC

Worldwide applications

2000 US 2003 US 2006 US US 2007 US 2012 US 2015 US US

Application US10/699,747 events

	US case filed in Florida Southern District Court
2003-11-03	Priority to US10/699,747
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2010-09-07	Publication of US7789886B2
2010-09-07	Application granted
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Info: Patent citations (302), Non-patent citations (3) , Cited by (69), Legal events, Similar documents, Priority and Related Applications

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Claims (16)

Hide Dependent

1. A method for treating a skin surface of a patient, comprising:

(a) applying against the skin surface of a patient an instrument body with a longitudinal axis and a distal working end, said distal working end comprising a working surface that carries an abrading structure comprising a plurality of sharp elements for engaging and abrading the skin surface together with a vacuum source coupled to at least one aperture about said working surface, the abrading structure and the at least one aperture positioned within a raised outer periphery that completely circumscribes the abrading structure and the at least one aperture;

(b) translating the working surface over the skin surface to thereby abrade the skin surface; and

(c) contemporaneously actuating the vacuum source to thereby cause suction engagement of the skin surface against the raised outer periphery and the plurality of sharp elements of the working surface and to aspirate skin debris through the at least one aperture.

2. The method as in claim 1 further comprising the step of providing a fluid to the skin to enhance suction engagement of the skin against the working surface.

3. The method as in claim 2 wherein the fluid is provided from a fluid source to a distal region of the instrument body.

4. The method as in claim 3 wherein the fluid is provided from a fluid source to at least one outflow port in the working surface.

5. The method as in claim 2 wherein the fluid is provided with a pharmacologically-active agent for treating skin.

6. The method as in claim 2 wherein the fluid is provided with an agent selected from the class consisting of citric acid and lactic acid.

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7. The method as in claim 2 wherein the fluid is provided with an agent selected from the class comprising TCA (trichloroacetic acid), glycolic acid, alphahydroxy acid (AHA).

8. The method as in claim 2 wherein the fluid is provided with an acid for etching the skin surface.

9. The method as in claim 2 wherein the fluid is provided with a crystalline abrasive.

10. The method as in claim 1 wherein step (a) provides a working surface with undulations for increasing the area of the working surface for engaging skin.

11. A method for treating a skin surface of a patient, comprising:

translating a working surface of a handheld device relative to the skin surface, said working surface comprising an abrasive structure configured to abrade the skin surface, an aperture in the working surface, an outer periphery that encircles the abrasive structure and the aperture, at least a portion of the abrasive structure spaced from the aperture; and

continuously applying a vacuum through the aperture formed in the working surface in order to draw the skin against the outer periphery and the abrasive structure and aspirate debris away from the working surface while abrading the skin surface.

12. The method as in claim 11, further comprising the step of providing a fluid to the skin, said providing a fluid occurring while the skin surface is being abraded.

13. The method as in claim 12, wherein providing a fluid to the skin surface comprises supplying at least one fluid through a fluid opening located at or near the working surface of the handheld device.

14. The method as in claim 12 wherein the fluid comprises a pharmacologically-active agent.

15. A method for treating human skin, comprising:

translating a handheld device relative to a skin surface to abrade said skin surface, said handheld device comprising a working surface with an abrasive structure at a distal end of said handheld device and at least one aperture at or near the working surface, said abrasive structure and said at least one aperture being circumscribed by an outer periphery of the working surface, and the at least one aperture being positioned radially closer to the outer periphery than said abrasive structure, said aperture being in fluid communication with a vacuum source to remove debris away from the working surface;

abrading the skin surface by translating the abrading structure over the skin surface; and

continuously aspirating debris through the at least one aperture while the skin surface is being abraded.

16. The method as in claim 15, further comprising the step of providing a fluid toward the working surface.

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 09/648,025 filed Aug. 25, 2000 now U.S. Pat. No. 6,641,591, which claims benefit of Provisional U.S. Patent Application Ser. No. 60/150,782 filed Aug. 26, 1999.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to devices for dermatology and more particularly to a hand-held instrument with a working end that carries (i) a negative pressure aspiration system, (ii) a source for delivery of a sterile fluids to the skin; and (iii) a skin interface surface in the working end that has specially shape structure for abrading surface layers of the patient's epidermis as the working end is moved over the patient's skin while at the same time causing rapid penetration of the fluids into the skin for therapeutic purposes.

2. Description of Background Art

Dermatologists and plastic surgeons have used various methods for removing superficial skin layers to cause the growth of new skin layers (i.e., commonly described as skin resurfacing techniques) since the early 1900's. Early skin resurfacing treatments used an acid such as phenol to etch away surface layers of a patient's skin that contained damage to thereafter be replaced by new skin. (The term damage when referring to a skin disorder is herein defined as any cutaneous defect, e.g., including but not limited to rhytides, hyperpigmentation, acne scars, solar elastosis, other dyschromias, stria distensae, seborrheic dermatitus).

Following the removal of surface skin layers at a particular depth, no matter the method of skin removal, the body's natural wound-healing response begins to regenerate the epidermis and underlying wounded skin layers. The new skin layer will then cytologically and architecturally resemble a younger and more normal skin. The range of resurfacing treatments can be divided generally into three categories based on the depth of the skin removal and wound: (i) superficial exfoliations or peels extending into the epidermis, (ii) medium-depth resurfacing treatments extending into the papillary dermis, and (iii) deep resurfacing treatments that remove tissue to the depth of the reticular dermis (see FIGS. 1A-1B).

Modern techniques for skin layer removal include: CO_2 laser resurfacing which falls into the category of a deep resurfacing treatment; Erbium laser resurfacing which generally is considered a medium-depth treatment; mechanical dermabrasion using high-speed abrasive wheels which results in a medium-depth or deep resurfacing treatment; and chemical peels which may range from a superficial to a deep resurfacing treatment, depending on the treatment parameters. A recent treatment, generally called micro-dermabrasion, has been developed that uses an air-pressure source to deliver abrasive particles directly against a patient's skin at high-velocities to abrade away skin layers. Such a micro-dermabrasion modality may be likened to sandblasting albeit at velocities that do no cause excess pain and discomfort to the patient. Micro-dermabrasion as currently practiced falls into the category of a superficial resurfacing treatment.

A superficial exfoliation, peel or abrasion removes some or all of the epidermis (see FIGS. 1A-1B) and thus is suited for treating very light rhytides. Such a superficial exfoliation is not effective in treating many forms of damage to skin. A medium-depth resurfacing treatment that extends into the papillary dermis (see FIG. 1B) can treat many types of damage to skin. Deep resurfacing treatments, such as CO_2 laser treatments, that extend well into the reticular dermis (see FIG. 1B) causes the most significant growth of new skin layers but carry the risk of scarring unless carefully controlled.

It is useful to briefly explain the body's mechanism of actually resurfacing skin in response to the removal of a significant depth of dermal layers. Each of the above-listed depths of treatment disrupts the epidermal barrier, or a deeper dermal barrier (papillary or reticular), which initiates varied levels of the body's wound-healing response. A superficial skin layer removal typically causes a limited wound-healing response, including a transient inflammatory response and limited collagen synthesis within the dermis. In a medium-depth or a deep treatment, the initial inflammatory stage leads to hemostasis through an activated coagulation cascade. Chemotactic factors and fibrin lysis products cause neutrophils and monocytes to appear at the site of the wound. The neutrophils sterilize the wound site and the monocytes convert to macrophages and elaborate growth factors which initiate the next phase of the body's wound-healing response involving granular tissue formation. In this phase, fibroblasts generate a new extracellular matrix, particularly in the papillary and reticuilar dermis, which is sustained by angiogenesis and protected anteriorly by the reforming epithelial layer. The new extracellular matrix is largely composed of collagen fibers (particularly Types I and III) which are laid down in compact parallel arrays (see FIG. 1B). It is largely the collagen fibers that provide the structural integrity of the new skin—and contribute to the appearance of youthful skin.

All of the prevalent types of skin damage (rhytides, solar elastosis effects, hyperpigmentation, acne scars, dyschromias, melasma, stria distensae) manifest common histologic and ultrastructural characteristics, which in particular include disorganized and thinner collagen aggregates, abnormalities in elastic fibers, and abnormal fibroblasts, melanocytes and keratinocytes that disrupt the normal architecture of the dermal layers. It is well recognized that there will be a clinical improvement in the condition and appearance of a patient's skin when a more normal architecture is regenerated by the body's wound-healing response. Of most significance to a clinical improvement is skin is the creation of more dense parallel collagen aggregates with decreased periodicity (spacing between fibrils). The body's wound-healing response is responsible for synthesis of these collagen aggregates. In addition to the body's natural wound healing response, adjunct pharmaceutical treatments that are administered concurrent with, or following, a skin exfoliations can enhance the development of collagen aggregates to provide a more normal dermal architecture in the skin—the result being a more youthful appearing skin.

The deeper skin resurfacing treatments, such as laser ablation, chemical peels and mechanical dermabrasion have drawbacks. The treatments are best used for treatments of a patient's face and may not be suited for treating other portions of a patient's body. For example, laser resurfacing of a patient's neck or decolletage may result in post-treatment pigmentation disorders. All the deep resurfacing treatments are expensive, require anesthetics, and must be performed in a clinical setting. Perhaps, the most significant disadvantage to deep resurfacing treatments relates to the post-treatment recovery period. It may require up to several weeks or even months to fully recover and to allow the skin the form a new epidermal layer. During a period ranging from a few weeks to several weeks after a deep resurfacing treatment, the patient typically must wear heavy make-up to cover redness thus making the treatment acceptable only to women.

The superficial treatment offered by micro-dermabrasion has the advantages of being performed without anesthetics and requiring no extended post-treatment recovery period. However, micro-dermabrasion as currently practices also has several disadvantages. First, a micro-dermabrasion treatment is adapted only for a superficial exfoliation of a patient's epidermis which does not treat many forms of damage to skin. Further, the current micro-dermabrasion devices cause abrasive effects in a focused area of the skin that is very small, for example a few $mm.^2$, since all current devices use a single pin-hole orifice that jets air and abrasives to strike the skin in a highly focused area. Such a focused treatment area is suitable for superficial exfoliations when the working end of the device is passed over the skin in overlapping paths. Further, such focused energy delivery is not well suited for deeper skin removal where repeated passes may be necessary. Still further, current micro-dermabrasion devices are not suited for deeper skin removal due to the pain associated with deep abrasions. Other disadvantages of the current micro-dermabrasion devices relate to the aluminum oxide abrasive particles that are typically used. Aluminum oxide can contaminate the working environment and create a health hazard for operators and patients alike. Inhalation of aluminum oxide particles over time can result in serious respiratory disorders.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A-1B are sectional illustrations of a patient's skin showing dermal layers.

FIG. 2 is a view of a Type “A” body and working end of the instrument of the invention.

FIG. 3 is an enlarged view of the working end of the instrument of FIG. 2.

FIG. 4 is a sectional view of working end of FIG. 3.

FIG. 5 is a view showing the manner of using the working end of the invention of FIGS. 3-4 in performing a method of the invention.

FIG. 6 is a view of a Type “B” body, working end and handle in an exploded view.

FIG. 7 is a view of the working end of the instrument of FIG. 6 and a housing.

FIG. 8 is an enlarged view of the skin interface of the working end of FIG. 7.

FIG. 9 is a sectional view of the skin interface of FIG. 8.

DETAILED DESCRIPTION OF THE INVENTION

1. Type “A” Skin Resurfacing System. Referring to FIGS. 2-3, an exemplary instrument system **5** is shown for removing superficial skin layers. The instrument system **5** includes: (i) a hand-held body **18** with a working end **20** that defines a skin interface surface portion indicated at **25** in FIGS. 2-3. An opening portion **26** transitions into an interior passageway **28** that extends through the body to communicate with a negative (−) pressure source (or aspiration source) indicated at **30** that operates as vacuum means for aspirating skin debris from a targeted skin surface treatment site TS.

Of particular interest, FIGS. 3-4 show views of the working end **20** with the skin interface **25** being configured with a particular irregular or ridged surface structure indicated at **32**. The ridged surface structure **32** further has a particular minimum width dimension W to accommodate from the ridge shape with as many as about 25 ridges on each side of opening **26** depending on the overall dimensions of the working end **20**. More particular aspects of the irregular or ridged surface structure **32** will be described below.

In this preferred embodiment, the working end **20** is of any suitable material, such as a transparent medical grade plastic. The transparency of the working end will assist the operator in localizing treatment in a particular targeted skin treatment area. The overall transverse dimension of the working end **20** of FIGS. 2-3 may be from around about 5.0 mm. to about 50.0 mm. with a larger dimensioned end being adapted for treating a larger skin area (e.g., arms, back legs and decolletage). A typical dimension is from about 5.0 mm. to 15.0 mm. for a skin treatment site area TS around a patient's face.

The invention allows the area (e.g., in $mm.^2$) of opening **26** be in any selected shape but preferably is an elongate shape in the center of the working end **25**. The open distal end **26** comprises the distal termination of passageway **28** and the proximal end of the passageway in handle **18** is connected to a flexible aspiration tube **33** that extends to a remote collection reservoir **35** intermediate to the actual aspiration source **30**. The aspiration source **30** thus is adapted to draw the working end **20** and more particularly the skin interface **25** against the skin treatment site TS to perform the method of the invention as will be described below. The aspiration source or negative (−) pressurization source **30** may be any suitable vacuum source known in the art. Between the aspiration source **30** and remote collection reservoir **35** may be

a filter **38** subsystem that is known in the art for collecting aspirated skin detritus and spent crystalline agents CA that are captured in the open distal end of passageway chamber **28**. The collection reservoir **35** and filter **38** are preferably of inexpensive plastic and other materials that are disposable.

The aspiration source **30** may be provided with an adjustable valve means **40** for adjusting the pressure level setting to any suitable range. The physician will learn from experience how to balance the pressure level to attain the desired level of suction against the patient's skin. A trigger or switch component **42** is provided as a foot-switch (FIG. 2) but any suitable finger switch in the body **18** also may be used.

The working end **20** also carries means for introducing abrasive crystals into the working end or distalmost end of passageway **28** to allow individual loose crystalline agents CA to thereafter be captured between the skin interface **25** and the patient's skin. In this embodiment, two channels **44** *a*-**44** *b* are provided together with flexible tubes **46** *a*-**46** *b* to introduce the loose crystalline agents CA into the working end (see FIGS. 2-4). Each distal portion **47** (collectively) of the channels **44** *a*-**44** *b* may comprise a small dimension aperture to limit the rate of flow of crystalline agents CA into the working end. The number of such channels (i.e., **44** *a*-**44** *n*) may range from one to about ten and fall within the scope of the invention. Any singular or plural number of channels can serve the purpose of slowly introducing crystal into the working end, Referring to FIGS. 2-3, the crystalline agent CA delivery source **50** comprises a reservoir **55** that holds a suitable volume of abrasive crystals for a single treatment or a number of treatments. A flexible supply tube **56** extends between a remote the reservoir **55**, and in this embodiment the tube is split to connect to the two channels **44** *a*-**44** *b*. Preferably, the remote reservoir **55** that carries the crystalline agent CA is unpressurized but carries air intake relief valve **58** such that any slight negative pressure created by the aspiration source **30** when the skin interface is in contact with a patient's skin will draw crystals to the working end. It should be appreciated that reservoir **55** may be built into handle body **18** and fall within the scope of the invention. The crystal delivery source **50** may carry crystals ranging in size from about 1 μm to about 50 μm in maximum cross-sectional dimension, (for example, aluminum oxide crystals). Preferably, the crystals are from about 5 μm to about 30 μm in maximum cross-sectional dimension to allow a very fine abrasion of the epidermis.

It has been found that by a slight negative pressure environment the open end **26** and passageway **28**, the crystalline agent will be caused to dribble into, or be sucked into, the passageway **28** in the working end **20**. Thereafter, the movement of the working end **20** in a sideways movement over the skin causes a portion of the crystalline agent CA volume to be captured temporarily in the irregular or corrugated surface structure of the skin interface **25**. In this process of moving the skin interface **25** over the targeted treatment site TS, it has been found that the sharp-edged crystalline agents are rolled over and over while being pressed into the surface of the skin and thereby abrade and remove the skin surface in a controllably gentle manner that is below any threshold of significant pain.

After the spent crystals are rolled over and over by the skin interface when moving in a first lateral direction across the skin, and after the working end is then is reversed in directional movement across the skin, a portion of the spent crystals and abraded skin debris necessarily roll into the central opening portion **26** wherein the negative pressure environment captures and aspirates the abraded materials to the remote collection reservoir **35**.

To facilitate the process described above, the invention is provided with novel aspects that relate to the irregular or ridged surface structure **32** mentioned above. The entire skin interface **25** may be of any suitable plan form (e.g., round, oval, rectangular etc.) and fall within the scope of the invention. More in particular, the interface **25** defines a 1st outer periphery **25**A and a 2nd inner periphery **25**B that generally are in apposition to one another and are spaced apart by width W with the inner periphery about the edge of opening **26** (see FIG. 3).

In a preferred embodiment shown in FIGS. 3-4, the concept of 1st and 2nd peripheries **25**A and **25**B in apposition thus comprise peripheries that are dual and side-by-side as shown in FIG. 4 and are thus adapted for side-to-side lateral or sideways movement while performing the technique of the invention, for example which is a natural movement of a human hand over a patient's skin. Thus, the direction of the ridges **60** extend generally transverse relative to a line drawn that indicates the direction of movement of the working end **20** in performing the method of the invention. That is, in the exemplary working end of FIG. 4, the working end is generally optimized for side-to-side or lateral movement. Thus, the ridge alignment is generally transverse to the direction of movement in operations indicated by arrow A. (In a circular working end that is adapted generally for movement is any direction, the direction of the ridges **60** may be generally transverse to any direction of movement by being concentric relative to a central opening **26** (not shown)).

The terms irregular or ridged shape structure **32** as used herein mean that a series of at least one projecting edge portion **62** *a* projects distally as a ridge within the skin interface portion **25**. The irregular shape structure **32** further typically carries recessed portions or valley portions **62** *b* that are recessed in the proximal direction intermediate to any plurality of projecting edge portions **62** *a*. These surface configurations for convenience are herein termed the primary shape structure (or ridge and valley elements). The width of the skin interface **25** containing shape structure **32** may be from about 2.0 mm. to 25.0 mm. or more and preferably is from about 3.0 mm. to 10.0 mm. The number of ridges preferably are from about 1 ridge to 25 ridges on each side of the opening **26**. The height H of any ridge from the apex of the projecting portion **62** *a* to the depth of the valley portion **62** *b* may be from about 0.25 mm. to about 5.0 mm. and is preferably from about 0.5 mm. to about 2.0 m. It has been found that various ridge height dimensions are optimal depending on the patient's skin type. Further, but optionally, it has been found that secondary shape structure of notches or recessed grooves **66** configured across the primary shape structure of ridge and valley elements may help introduce loose crystals to regions of the skin interface **25** in contact with the skin which is desirable. Such secondary grooves **66** are shown in FIG. 4 and are preferably somewhat in alignment with an axis of channels **44** *a*-**44** *b* that introduce crystals into the working end **20** thus allowing the crystals to be suctioned into the valleys **62** *b* of the primary shape structure.

While the series of primary ridge and valley elements together the secondary grooves seems to be optimal for the method described below, it should be appreciated that the method also may be performed with a skin interface that has (i) only primary ridge and valley elements; (ii) or only a particular surface roughness that is appropriate for partially capturing loose crystals as will be described below-as long as the skin interface has a minimum width of about 3.0 mm. which was described as a preferred width dimension previously.

FIG. 4 further shows that at least some of the crests or apexes of some of the ridge portions **62** *a* together with the outermost periphery of the skin interface **25** define an overall tissue-receiving shape **64** that may range from flat to concave and is shown in a preferred concave configuration. The alternative shapes **64** *a*-**44** *b* are intended to indicate an approximate range of shapes that are suitable. The apexes of ridges **62** *a* need not all be at the same height to define shape **64**. The purpose of the concave shape is to cause the outer periphery of the working end to be in firm contact with the tissue surface while the negative pressure from aspiration source **30** draws the skin into firm contact with tissue interface **25**.

2. Practice of the Method of the Invention. Now turning to FIG. 5, a sectional view of working end **20** shows the technique of the present invention in exfoliating or removing skin surface layers. FIG. 5 shows the working end **20** after actuation of the negative (−) pressure source **30** with the skin surface **70** initially being drawn into the concave shape **64**. The operating negative pressures may be in any suitable range that is determined by investigation. It has been found by experimentation that optimal pressure levels vary greatly depending on (i) the type of skin targeted for treatment, (ii) the dimensions across the working end, and (iii) the dimensions of opening **26**.

Next, the operator moves the skin interface **25** across a treatment site TS which is a path on the patient's skin while still actuating moves the trigger **42** thereby maintaining the negative pressure environment in the passageway **26**. The negative pressure environment within the working end causes crystalline particles and entrained in air to be drawn into passageway **28** proximate to the skin surface and into the shape structure **32** of the skin interface **25**. The sideways or lateral movement of the skin interface **25** captures a portion of the crystals between the interface and the skin surface, in part by over-rolling them. The continued rolling of the sharp-edged crystals trapped between the instrument and the skin surface **70** causes an abrasion and removal of the skin surface in a controllable manner.

As working end is moved in a reverse direction, the negative pressure environment in the passageway **28** captures and aspirates the spent crystals and skin debris to the remote collection reservoir **35**. At the end of a particular lateral movement of the working end, the operator may release the trigger **42** which terminates the crystal agent delivery and further allows the operator to easily lift the working end from the patient's skin. The treated path can be easily seen and the operator then can exfoliate another slightly overlapping or adjacent path by repeating the above steps until surface removal is completed over the targeted treatment area.

3. Type “B” Skin Resurfacing System. Referring to FIGS. 6-9, another exemplary instrument system and treatment device **205** is shown for removing superficial skin layers. This system differs greatly from the Type “A” embodiment in the mechanism of action that abrades the skin since the Type “B” system uses a fluid media plus an abrading structure on the skin interface. Still several features of the Type “B” embodiment are similar to the Type “A” embodiment and the two modalities of treatment may be used to complement one another.

FIG. 6 shows that a hand-held instrument **208** has a removable working end **220** that defines a skin interface surface portion indicated at **225**. Handle portion **227** *a* mates with housing **227** *b*. A flexible tube **228** extends to a vacuum source **230**. A fluid reservoir **235** carrying a fluid skin treatment media is housed in the handle although it could also be a remote reservoir.

Referring now to FIGS. 7-9, a first aperture arrangement consisting of at least one port or opening portion **240** of skin interface **225** that communicates with an interior passageway **242** that extends through housing **227** *b* to hose **228** and the vacuum or negative (−) pressure source.

FIGS. 7-9 further show a second aperture arrangement in the skin interface consisting of at least one port or openings **250** that extend around an outer periphery of the skin interface **225**. These opening(s) of the second aperture arrangement are in fluid communication with the reservoir **235** and the treatment media therein. The skin interface has a series of primary ridge elements **255** *a* and valley elements **255** *b* together the secondary notches or grooves **260** as defined above with similar dimensional parameters. This embodiment differs however in that the apexes of ridge elements **255** *a* are substantially a sharp edge as are the edged of the notches **260**. Thus, these primary surface elements **255** *a* and secondary surface elements thereby define teeth therebetween that seem well suited to abrading skin layers particularly after being hydrated by the fluid source of the system. Experimentation has shown that the vacuum source and fluid source may be reversed between the first and second aperture arrangements **240** and **250** with the method of skin removal still working well. The vacuum system aspirates away skin debris and spent fluids as described previously. Of particular interest, the method of the invention appears to work well because the suction on the skin treatment site very quickly hydrated, or puffs up, the skin which in turn make the surface layer susceptible to painless abrasion. The ability of the system to rapidly deliver fluids to subsurface tissues allows the use of any pharmacological agent known in the art for enhancing skin rejuvenation as a part of the skin treatment. The system can use sterile water or saline solution for a treatment to remove dermal tissue with the abrasive surface of the treatment device. The system can also use a fluid carrying a chemical agent of a suitable concentration be selected from a group of acids including TCA (trichloroacetic acid), a glycolic acid including an alphahydroxy acid (AHA), a lactic acid, a citric acid, or phenol as disclosed in co-pending U.S. patent application Ser. No. 09/524,731 filed Mar. 14, 2000 which is incorporated herein by this reference.

Specific features of the invention may be shown in some figures and not in others, and this is for convenience only and any feature may be combined with another in accordance with the invention. While the principles of the invention have been made clear in the exemplary embodiments, it will be obvious to those skilled in the art that modifications of the structure, arrangement, proportions, elements, and materials may be utilized in the practice of the invention, and otherwise, which are particularly adapted to specific environments and operative requirements without departing from the principles of the invention. The appended claims are intended to cover and embrace any and all such modifications, with the limits only of the true purview, spirit and scope of the invention.

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US4378804A	1981-06-17	1983-04-05	Cortese Jr Thomas A	Facial treatment device
US4560373A	1983-06-06	1985-12-24	Sugino Machine Limited	Surgical nozzle apparatus
US4646480A	1985-10-23	1987-03-03	Inventive Machine Corporation	Pressurized abrasive cleaning device for use with plastic abrasive particles
US4646482A	1985-11-12	1987-03-03	Clements National Company	Recirculating sandblasting machine
US4676749A	1984-03-08	1987-06-30	Ems Electro Medical Systems, S.A.	Nozzle head for the hand piece of a dental prophylactic apparatus
US4706676A	1985-02-11	1987-11-17	The United States Of America As Represented By The Secretary Of The Army	Dermal substance collection device
US4754756A	1986-12-12	1988-07-05	Shelanski Morris V	Dermatome
US4757814A	1985-02-28	1988-07-19	Alcon Laboratories, Inc.	Proportional control for pneumatic cutting device
US4900316A	1986-10-18	1990-02-13	Azz International Co., Ltd.	Vacuum skin cleaner
US4917086A	1988-05-26	1990-04-17	Snyder Laboratories, Inc.	Dermatome blade assembly
US4957747A	1989-05-15	1990-09-18	Stiefel Laboratories, Inc.	Method of treating aged skin
US5012797A *	1990-01-08	1991-05-07	Montefiore Hospital Association Of Western Pennsylvania	Method for removing skin wrinkles
US5035089A	1990-01-29	1991-07-30	Pauli & Griffin	Blast media recovery and cleaning system
US5037431A	1989-11-03	1991-08-06	The Curators Of The University Of Missouri	Surgical liquid lance apparatus
US5037432A *	1987-11-27	1991-08-06	Lorenzo Molinari	Adjustable apparatus for removing surface portions of human tissue
US5100412A	1988-01-11	1992-03-31	L.I.C.A. Di Rosso & C. S.N.C.	Apparatus for making micro-abrasions, particularly on human tissue or on hides
US5122153A	1990-03-22	1992-06-16	Harrel Stephen K	Tissue removing instrument and method
US5207234A	1988-01-11	1993-05-04	L.I.C.A. Di Rosso & C.S. N.C.	Method for making micro-abrasions on human tissue
EP0564392A2	1992-03-04	1993-10-06	D. Antonio Fructuoso Martinez	Medical equipment, useful in the cutaneous dermabrasion technique, achieved by means of abrasive powder
US5612797A	1994-05-14	1997-03-18	U.S. Philips Corporation	Liquid crystal projection display systems
US5674235A	1995-05-10	1997-10-07	Ultralase Technologies International	Ultrasonic surgical cutting instrument
US5759185A	1994-10-24	1998-06-02	Smith & Nephew, Inc.	Surgical instrument
US5800446A	1997-02-27	1998-09-01	Banuchi; Isabel M.	Article and method for dermabrading
US5810842A	1994-06-29	1998-09-22	Mattioli Engineering S.R.L.	Equipment for microdermoabrasion through a flow of an air/reducing substances mix
US5873881A	1995-12-05	1999-02-23	Mcewen; James Allen	Linear drive dermatome
US5882201A	1997-01-21	1999-03-16	Salem; George	Dental debridement method and tool therefor
US5971999A	1995-06-16	1999-10-26	Naldoni; Moreno	Apparatus for microdermabrasion by means of a jet of mixture of air/reducing substances and relating handle
US6019749A	1998-04-01	2000-02-01	Squeezease, Llc	Apparatus and method for removing material from skin pores
US6024733A	1995-06-07	2000-02-15	Arthrocare Corporation	System and method for epidermal tissue ablation
US6039745A	1995-06-29	2000-03-21	Mattioli Engineering Ltd.	Equipment for microdermoabrasion through a flow of air/reducing substances mix and relative handpiece
US6042552A	1995-11-27	2000-03-28	Laboratoire C.C.D.	Device for collecting endometrial fragments
US6080165A	1999-03-15	2000-06-27	Dejacma; Frederick W.	Self-contained disposable handpiece for a skin tissue removing apparatus
US6080166A	1995-12-05	2000-06-27	Mcewen; James Allen	Direct linear drive dermatome
US6090085A	1991-05-30	2000-07-18	Mehl, Sr.; Thomas L.	Skin moisturizing and buffing device

US6136008A	1998-03-19	2000-10-24	3M Innovative Properties Company	Skin abrader for biomedical electrode
US6139553A	1997-09-22	2000-10-31	Dotan; Simon	Facial treatment implement and method
US6139554A	1999-06-10	2000-10-31	Karkar; Maurice N.	Multipurpose tissue resurfacing handpiece
US6149634A	1996-05-10	2000-11-21	Mattioli Engineering Ltd.	Collecting bottle for dermabrasion treatment
US6162232A	1999-03-18	2000-12-19	Shadduck; John H.	Instruments and techniques for high-velocity fluid abrasion of epidermal layers with skin cooling
US6183483B1	2000-04-03	2001-02-06	Henry Ping Chang	Peeling apparatus for removing surface portions of human tissue with purging arrangement
US6238275B1	1998-08-19	2001-05-29	Alva Wesley Metcalf	Contained direct particle beam flow abrasion system
US6241739B1	1999-11-12	2001-06-05	Altair Instruments, Inc.	Microdermabrasion device and method of treating the skin surface
US6283978B1 *	2000-06-09	2001-09-04	Peter J. Cheski	Method and apparatus for microdermabrasion
US6299620B1	1999-03-18	2001-10-09	Aq Technologies, Inc.	Instruments and techniques for inducing neocollagenesis in skin treatments
US6306119B1	1999-01-20	2001-10-23	Pearl Technology Holdings, Llc	Skin resurfacing and treatment using biocompatible materials
US6387103B2	1999-12-30	2002-05-14	Aq Technologies, Inc.	Instruments and techniques for inducing neocollagenesis in skin treatments
US6423078B1 *	1999-04-23	2002-07-23	Medtronic Xomed, Inc.	Dermabrasion instrument, instrument assembly and method
US20020107527A1	2000-10-05	2002-08-08	Burres Steven A.	Dermabrasion and skin care apparatus
US6629983B1	2000-10-27	2003-10-07	Edge Systems Corporation	Apparatus and method for skin/surface abrasion
US6641591B1	1999-08-26	2003-11-04	John H. Shadduck	Instruments and techniques for controlled removal of epidermal layers
US20030212415A1	2001-11-21	2003-11-13	Karasiuk Kenneth B.	Skin treatment system and method of use
US6685853B1 *	1997-05-29	2004-02-03	International Business Machines Corporation	Energy sensitive electrically conductive admixtures, uses thereof, methods of fabrication and structures fabricated therewith
US6695853B2	2001-11-21	2004-02-24	Emed, Inc.	Microdermabrasion system and method of use
US6869611B1 *	1996-02-08	2005-03-22	Douglas E. Kligman	Composition and method of effecting superficial chemical skin peels
US7087063B2 *	2003-02-19	2006-08-08	Unilever Home & Personal Care Usa, Division Of Conopco, Inc.	Abrasion device and method
Family To Family Citations				
US2631583A	1951-11-30	1953-03-17	Eli J Lavergne	Home beauty aid
DE1235879B *	1964-03-17	1967-03-09	Basf Ag	Process for the production of alcohols by catalytic hydrogenation of carboxylic acids
US3866264A	1971-09-30	1975-02-18	Foerenade Fabriksverken	Cleaning device
SE374272B	1973-08-31	1975-03-03	D A Safwat	
US3865352A	1973-11-16	1975-02-11	Minnesota Mining & Mfg	Static mixing device
US3977084A	1974-08-26	1976-08-31	Tsset Scientific And Pharmaceutical Limited	Dental hygienic device
US4170821A	1977-12-02	1979-10-16	Warner-Lambert Company	Razor cartridges
US4299219A	1979-12-17	1981-11-10	Norris Jr George P	Intravenous needle insertion device
IT211654Z2	1985-07-17	1989-04-07	Abbate Mariarosa	VARIABLE DEPRESSION TREATMENT APPARATUS FOR LOCATION, AMPLITUDE AND FREQUENCY WITH ELECTRONIC COMMAND AND CONTROL.
DE3421390C2	1984-06-08	1986-07-17	Werner Dr.med. 4330 Mülheim Schubert	High pressure catheter with cutting and / or abrasion device
DD234608B5	1985-02-18	1996-09-19	Dietmar Dr-Ing Rath	Water jet scalpel
IT1184922B	1985-03-22	1987-10-28	Ginebri Otello & E R I T Di Po	APPARATUS FOR THE CONTROLLED APPLICATION ON HUMAN TISSUE OF REDUCING SUBSTANCES TO REALIZE MICROABRASIONS

US4655743A	1985-05-06	1987-04-07	Hyde Lawrence L	Frog aspirator
JPS6245061A	1985-08-22	1987-02-27	Hitachi Ltd	Semiconductor integrated circuit for image-reading sensor
US4795421A	1986-04-25	1989-01-03	Chesebrough-Pond's Inc.	Oral hygiene swab
JPS6363450A	1986-09-03	1988-03-19	トノクラ医科工業株式会社	Water jet operation apparatus
US4764362A	1986-10-22	1988-08-16	The Cook Bates Company	Nail-conditioning emery boards and process for making them
US4875287A	1986-11-14	1989-10-24	Hydromer, Inc.	Shaving articles lubricious when wet and compositions therefor
US4925450A	1987-03-20	1990-05-15	The Cooper Companies, Inc.	Surgical aspirator cannula
US4886078A	1987-06-17	1989-12-12	Jack Shiffman	Nail cleaner
US5006004A	1987-11-25	1991-04-09	The Proctor & Gamble Company	Topical applicator for liquid
US4887994A	1988-07-06	1989-12-19	Bedford Peter H	Applicator swabs and method of making same
GB8817199D0	1988-07-19	1988-08-24	Unilever Plc	Package containing sheet-like article
US5100424A	1990-05-21	1992-03-31	Cardiovascular Imaging Systems, Inc.	Intravascular catheter having combined imaging abrasion head
GB9100819D0	1991-01-15	1991-02-27	Medimech Int Ltd	Subcutaneous injector
US5697920A	1991-01-18	1997-12-16	Gibbons; De Lamar	Body vacuum
WO1992012741A1	1991-01-18	1992-08-06	Delamar Gibbons	Body vacuum
US5119839A	1991-05-16	1992-06-09	Rudolph James M	Method and device for strengthening nails using carnauba wax
US5885260A	1991-05-30	1999-03-23	Mehl, Sr.; Thomas L.	Freeze-dried liposome delivery system for application of skin treatment agents
JPH0588552A	1991-09-27	1993-04-09	Yokogawa Hewlett Packard Ltd	Method for detecting remaining ink on printer
US5222956A	1992-07-06	1993-06-29	Altair Instruments, Inc.	Surgical drill collet mechanism and bur
US5242433A	1992-12-07	1993-09-07	Creative Products Resource Associates, Ltd.	Packaging system with in-tandem applicator pads for topical drug delivery
US5460620A	1992-07-31	1995-10-24	Creative Products Resource, Inc.	Method of applying in-tandem applicator pads for transdermal delivery of a therapeutic agent
US5368581A	1992-12-07	1994-11-29	Creative Products Resource Associates, Ltd.	Method of using a packaging system with folded applicator pads for topical drug delivery
US5254109A	1992-12-07	1993-10-19	Creative Products Resource Associates, Ltd.	Separately packaged applicator pads for topical delivery of incompatable drugs
TW311085B	1993-03-18	1997-07-21	Dymon Inc	
US5419772A	1993-09-29	1995-05-30	Teitz; Bernard R.	Surgical irrigation apparatus for cleaning and sterilizing wounds and surgical areas during surgery
EP0841965B1	1994-03-21	2002-04-10	Dusa Pharmaceuticals, Inc.	Patch and controller for the photodynamic therapy of a dermal lesion
US20010037095A1	1994-06-14	2001-11-01	Rucinski Paul J.	Novel wound irrigation device and method
US6368333B2	1994-06-29	2002-04-09	Mattioli Engineering Ltd.	V-shaped handpiece for dermabrasion
US6306147B1	1994-06-29	2001-10-23	Mattioli Engineering Ltd.	Dermabrasion by a flow of reducing substances and having disposable sterilized components
US7052503B2	1994-06-29	2006-05-30	Mattioll Engineering, Ltd.	Dermabrasion apparatus and method having oval-shaped mixing bottle
US6514262B1	1994-06-29	2003-02-04	Mattioli Engineering Ltd.	Dermabrasion by a flow of reducing substances and having disposable sterilized components
US5676643A	1995-02-13	1997-10-14	The Procter & Gamble Company	Dispenser for friably releasing dry particulate medicaments
IL113459A	1995-04-23	2000-07-16	Electromagnetic Bracing System	Electrophoretic cuff apparatus
GB9520209D0	1995-09-25	1995-12-06	Cawley R	Skin cleaning apparatus

US5707383A	1995-10-05	1998-01-13	Xomed Surgical Products, Inc.	Method of removing soft tissue in the middle ear
US5611687A	1995-11-06	1997-03-18	Dental Concepts Inc.	Oral hygiene delivery system
US5769816A	1995-11-07	1998-06-23	Embol-X, Inc.	Cannula with associated filter
US5861142A	1996-03-25	1999-01-19	Schick; Mary Pichler	Method for promoting hair, nail, and skin keratinization
JPH09294747A	1996-05-01	1997-11-18	Fukutaro Yamazaki	Athlete's foot treating implement
US5908401A	1996-05-08	1999-06-01	The Aps Organization, Llp	Method for iontophoretic delivery of antiviral agents
US5676648A	1996-05-08	1997-10-14	The Aps Organization, Llp	Iontophoretic drug delivery apparatus and method for use
US6562013B1	1996-07-11	2003-05-13	Pulsecare Medical Llc	Kit assembly for complete wound treatment
US5848998A	1996-07-11	1998-12-15	Marasco, Jr.; Patrick V.	Tissue debriding apparatus
US5807353A	1996-09-16	1998-09-15	Schmitz; Thomas David	Aspiration device with separating element
US5779519A	1996-11-18	1998-07-14	Sunfiles, Llc	Scented fingernail files and buffers
US6027402A	1996-11-18	2000-02-22	Sunfiles, Llc	Cosmetic file/buffer with microencapsulated treatment substances
US5735833A	1996-12-11	1998-04-07	Bristol-Myers Squibb Co.	Lavage tip
US5713785A	1997-01-17	1998-02-03	Linax Co., Ltd.	Vacuum type portable sander
US6607509B2	1997-12-31	2003-08-19	Medtronic Minimed, Inc.	Insertion device for an insertion set and method of using the same
DE19710676C2	1997-03-16	1999-06-02	Aesculap Meditec Gmbh	Arrangement for photoablation
US5813416A	1997-04-03	1998-09-29	Rudolph; James M.	File with sanitizing agent
US5817050A	1997-05-29	1998-10-06	Klein; Jeffrey A.	Liposuction cannula
IL122016A	1997-10-22	2001-09-13	Tav Tech Ltd	Apparatus for dermal abrasion
EP1037682B1	1997-11-07	2005-09-14	ACIST Medical Systems, Inc.	Angiographic injector system with multiple processor redundancy
US5846215A	1997-12-11	1998-12-08	Chesebrough-Pond's Usa Co., Division Of Conopco, Inc.	Antibacterial swabs
USRE37796E1	1997-12-16	2002-07-23	Biophoretic Therapeutic Systems, Llc	Methods for iontophoretic delivery of antiviral agents
US20080027328A1	1997-12-29	2008-01-31	Julia Therapeutics, Llc	Multi-focal treatment of skin with acoustic energy
US6264666B1	1998-01-26	2001-07-24	William P. Coleman	Water jet for dermatological treatment
JP3249469B2	1998-05-12	2002-01-21	漢俊 金	Tongue cleaning equipment
US7004933B2	1998-05-29	2006-02-28	Light Bioscience L.L.C.	Ultrasound enhancement of percutaneous drug absorption
US6277128B1	1998-07-11	2001-08-21	J. Scott Muldner	Skin abrasion treatment device
US6458109B1	1998-08-07	2002-10-01	Hill-Rom Services, Inc.	Wound treatment apparatus
US6428528B2	1998-08-11	2002-08-06	Antares Pharma, Inc.	Needle assisted jet injector
IL126236A0	1998-09-16	1999-05-09	Ultra Cure Ltd	A method device and system for skin peeling
US6129701A	1998-11-19	2000-10-10	Sound Surgical Technologies, Llc	Vented aspirator and method
US20050059940A1	1999-01-20	2005-03-17	Pearl Technology Holdings, Llc.	Skin resurfacing and treatment using biocompatible materials
US6726693B2	2000-11-10	2004-04-27	Pearl Technology Holdings, Llc	Tissue resurfacing using biocompatible materials
US6235039B1	1999-02-23	2001-05-22	Roger C. Parkin	Skin abrasion device
US6432113B1 *	1999-02-23	2002-08-13	Roger C. Parkin	Skin abrasion device
US6477410B1	2000-05-31	2002-11-05	Biophoretic Therapeutic Systems, Llc	Electrokinetic delivery of medicaments
US20010049511A1	1999-03-17	2001-12-06	William P. Coleman	Water jet for dermatological treatment
US20020151826A1 *	1999-05-11	2002-10-17	John S. Ramey	Massage apparatus and methods

US6582442B2	2000-02-28	2003-06-24	Dynatronics Corporation	Method and system for performing microabrasion
US6926681B1	1999-05-11	2005-08-09	Dynatronics Corporation	Method and system for performing microabrasion and suction massage
US6743211B1	1999-11-23	2004-06-01	Georgia Tech Research Corporation	Devices and methods for enhanced microneedle penetration of biological barriers
IT1307045B1	1999-06-16	2001-10-23	L I C A Di Rosso Luciano & C S	HYDROMICROABRASION DEVICE OF THE HUMAN TISSUE.
US6193589B1 *	1999-06-21	2001-02-27	Ben M. Khalaj	Hand piece apparatus for abrasive cleaning devices
US6645184B1	1999-08-09	2003-11-11	Brian D. Zelickson	Tape stripping system and method
US7354423B2	1999-08-09	2008-04-08	J&J Consumer Co., Inc.	Skin abrasion system and method
US6623457B1	1999-09-22	2003-09-23	Becton, Dickinson And Company	Method and apparatus for the transdermal administration of a substance
US6211243B1	1999-09-22	2001-04-03	B. Ron Johnson	Methods for treating cold sores with anti-infective compositions
US6835184B1	1999-09-24	2004-12-28	Becton, Dickinson And Company	Method and device for abrading skin
US7638144B2	1999-10-04	2009-12-29	Dermanew, Inc.	Composition, apparatus and method for skin rejuvenation
US6652888B2	1999-10-04	2003-11-25	Dermanew, Inc.	Method for skin rejuvenation with buffing cream
AU3672000A	1999-10-14	2001-04-23	Pola Chemical Industries Inc.	Compositions for electroporation
US20030093089A1	1999-10-20	2003-05-15	Greenberg Ronald Allan	Apparatus for variable micro abrasion of human tissue and/or hides using different size and types of abrasive particles
US6562050B1	1999-11-29	2003-05-13	Vital Assist, Inc.	Equipment for microdermabrasion
WO2001039675A1	1999-12-01	2001-06-07	Aesthetic Technologies, Inc.	Skin abrasion system and method
US20020016601A1	2000-01-03	2002-02-07	Shadduck John H.	Instruments and techniques for inducing neocollagenesis in skin treatments
US20060116674A1	2000-02-22	2006-06-01	Rhytec Limited	Method of regenerating the recticular architecture of the dermis
US6592595B1	2000-03-31	2003-07-15	Edge Systems Corporation	Microdermabrasion and suction massage apparatus and method
US6537242B1	2000-06-06	2003-03-25	Becton, Dickinson And Company	Method and apparatus for enhancing penetration of a member for the intradermal sampling or administration of a substance
US20020041891A1	2000-06-09	2002-04-11	Cheski Peter J.	Method and apparatus for microdermabrasion
US6565535B2	2000-06-16	2003-05-20	Nardo Zaias	Medical infusion and aspiration system
US20050209611A1	2000-10-20	2005-09-22	Greenberg Ronald A	Apparatus for variable micro abrasion of human tissue and/or hides using different size and types of abrasive particles
EP1219254A1	2000-12-28	2002-07-03	Gabriel Bernaz	Skin peeling device
US20020133110A1	2001-01-19	2002-09-19	Citow Jonathan Stuart	Device for treatment of inflamed tissue
US6589218B2	2001-01-23	2003-07-08	Teddy Garcia	Suction device for removing material from skin pores
US6511486B2	2001-03-09	2003-01-28	Silhouet-Tone Ltee	Dermabrasion hand tool for abrasively removing skin surface
US6503256B2	2001-03-13	2003-01-07	Dermamed, Inc.	Microderm abrasion device and method
US20040166172A1	2001-03-27	2004-08-26	Coni Rosati	Bioctive tissue abrasives
US7597900B2	2001-03-27	2009-10-06	Schott Ag	Tissue abrasives
JP2004526517A	2001-04-06	2004-09-02	マッティオリ エンジニアリング リミテッド	Transdermal absorption enhancer
US7083580B2	2001-04-06	2006-08-01	Mattioli Engineering Ltd.	Method and apparatus for skin absorption enhancement and transdermal drug delivery
US6687537B2	2001-04-06	2004-02-03	Mattioli Engineering Ltd.	Method and apparatus for skin absorption enhancement and cellulite reduction

US6743215B2	2001-04-06	2004-06-01	Mattioli Engineering Ltd.	Method and apparatus for skin absorption enhancement and cellulite reduction
US20020188261A1	2001-06-07	2002-12-12	Dermacel Inc.	Hand piece for use in a dermal abrasion system
US20030012415A1	2001-07-10	2003-01-16	Cossel Travis M.	Method and apparatus to biometrically authenticate MFP users
US6540757B1	2001-07-13	2003-04-01	James C. Fallon	Cartridge for use in a dermal abrasion system
IL144463A0	2001-07-19	2002-05-23	Lrr & D Ltd	Device and method for treating pathologically affected skin
US7364565B2	2001-07-27	2008-04-29	Ramot At Tel Aviv University Ltd.	Controlled enzymatic removal and retrieval of cells
US7094252B2	2001-08-21	2006-08-22	Cooltouch Incorporated	Enhanced noninvasive collagen remodeling
US6401289B1	2001-08-24	2002-06-11	Linda S. Herbert	Skin cleaning device
US6905487B2	2001-08-27	2005-06-14	Maryann B. Zimmerman	Dermal treatment applicator and method relating thereto
US6494856B1	2001-09-12	2002-12-17	Unilever Home & Personal Care Usa, Division Of Conopco, Inc.	Swab deliverable actives
US6488646B1	2001-09-12	2002-12-03	Unilever Home & Personal Care Usa	Swab deliverable actives
AU2002324966A1	2001-09-12	2003-03-24	Joon Park	Pedicure implement having a contoured surface
US6911031B2	2001-09-24	2005-06-28	Janelle Marie Muldner	Single-hand operable microdermabrasion device
DE10148933A1	2001-10-04	2003-04-24	Beiersdorf Ag	Cosmetic cleaning device comprising a container for a cleaning preparation, and a massaging unit for application of such a preparation is provided with a device which allows massaging parameters to be varied
US20030093040A1	2001-10-29	2003-05-15	Mikszta John A.	Method and device for the delivery of a substance
TWI220386B	2002-01-21	2004-08-21	Matsushita Electric Works Ltd	Ultrasonic transdermal permeation device
DE10206257C1	2002-02-15	2003-06-26	Beiersdorf Ag	Massage system for applying preparation with e.g. analgesic or heating effect to the skin, comprising active preparation reservoir, massaging device and contact surface adjusting system
US6942649B2	2002-03-01	2005-09-13	Edge Systems Corporation	Microdermabrasion fluid appplication system and method
US6730098B2	2002-03-14	2004-05-04	Henry Ping Chang	Tissue removal pen
KR200280320Y1	2002-03-21	2002-07-02	이명호	The device for peeling a thin skin
US20030212127A1	2002-05-09	2003-11-13	Bradley Pharmaceuticals, Inc.	Method of treating actinic keratosis
JP3906483B2	2002-05-24	2007-04-18	ツインバード工業株式会社	Horny grinding beauty machine
US7482314B2	2002-07-11	2009-01-27	Orchid Scientific, Inc.	Microdermabrasion composition and kit
US7044938B2	2002-07-17	2006-05-16	La Bianco Kerrie L	Skin treatment apparatus and methods
KR200297355Y1	2002-09-06	2002-12-11	정태준	A skin keratin peeling device
AU2003266159A1	2002-09-16	2004-04-30	Zicam, Llc.	System and method for delivering a composition to the nasal membrane
US20040087972A1	2002-09-16	2004-05-06	Mulholland Robert Stephen	Skin abrading apparatus
US20040219179A1	2002-09-20	2004-11-04	Mcdaniel David H.	Skin abrasive agents
WO2004037098A1	2002-10-21	2004-05-06	Bionoface	Micro-abrasion device
US20040092895A1	2002-11-07	2004-05-13	Harmon Kim R.	Soft contact tip for use with a hand-held debridement device
US20040111071A1	2002-12-09	2004-06-10	Jeffrey Lewis Powers	Portable device for dispensing hand treatments
US20040122447A1	2002-12-19	2004-06-24	Harmon Kim R.	Brush tip for use with a hand-held debridement device
US7198623B2	2003-01-10	2007-04-03	Ultradent Products, Inc.	Fiber-coated dental infusor systems and methods of use
US7320691B2	2003-01-15	2008-01-22	Pacific Bioscience Laboratories, Inc.	Apparatus and method for acoustic/mechanical treatment of early stage acne
EP1447670A1	2003-02-12	2004-08-18	Dialog Semiconductor GmbH	Sensor read out

JP4428014B2	2003-02-25	2010-03-10	パナソニック電工株式会社	Ultrasonic biological cleaning equipment
US20050037034A1	2003-05-05	2005-02-17	Rhoades Dean L.	Method, apparatus, and composition for treating acne
US7044955B2	2003-05-27	2006-05-16	Focus Medical, Llc	Removable cartridge for a microdermabrasion unit
CA2527237C	2003-06-06	2012-06-26	Reckitt Benckiser (Uk) Limited	Device and method for removing a composition from the skin
US7232444B2	2003-06-24	2007-06-19	Mei Yin Chang	Microdermabrasion canister rack system
US7507228B2	2003-06-30	2009-03-24	Johnson & Johnson Consumer Companies, Inc.	Device containing a light emitting diode for treatment of barrier membranes
US7477938B2	2003-06-30	2009-01-13	Johnson & Johnson Cosumer Companies, Inc.	Device for delivery of active agents to barrier membranes
US7276072B2	2003-08-14	2007-10-02	Tae-Jun Chung	Skin resurfacing device
US20050084509A1	2003-10-20	2005-04-21	Bernstein Eric F.	Use of citric acid and low concentrations of alpha-hydroxy acids for superficial skin treatment
WO2005079841A2	2003-12-09	2005-09-01	Iomai Corporation	Gm1 binding deficient exotoxins for use as immunoadjuvants
IL159783A	2004-01-08	2009-06-15	Tavtech Ltd	High velocity liquid-gas mist tissue abrasion device
GB0401550D0	2004-01-21	2004-02-25	Ball Philip	A handheld apparatus for use in micro-dermabrasion
US20060212029A1	2004-02-20	2006-09-21	Arcusa Villacampa Francisco J	Equipment and method for reducing and eliminating wrinkles in the skin
JP2005245521A	2004-03-01	2005-09-15	Japan Natural Laboratory Co Ltd	Beautiful skin or beauty system using iontophoresis device, ultrasonic facial device and cosmetic additives.
US20050203111A1	2004-03-12	2005-09-15	Vvii Newco 2003, Inc.	Compositions and methods for preventing and treating skin and hair conditions
RU2270469C2	2004-03-11	2006-02-20	Олег Алексеевич Суханов	System for controlling modes of electric energy based systems
DE202004020684U1	2004-03-31	2005-12-08	Bundesrepublik Deutschland, vertreten durch das Bundesministerium der Verteidigung, dieses vertreten durch das Bundesamt für Wehrtechnik und Beschaffung	Arrangement for applying 2-component skin detoxifying agent to combat skin and nerve chemical warfare agents, has separate pump bottles for supplying components to common application head
US8571648B2	2004-05-07	2013-10-29	Aesthera	Apparatus and method to apply substances to tissue
US20050283176A1	2004-06-22	2005-12-22	Wahson Law	Advanced disposable microdermabrasion system/method of treating the skin surface
BE1016163A6	2004-08-18	2006-04-04	Mc Anton Sa	METHOD Percutaneous HYPERBARIC OXYGEN SPRAY fluorocarbons.
US7384405B2	2004-09-10	2008-06-10	Rhoades Dean L	Oxygenating cosmetic instrument having various numbers of heads
US7318828B1	2004-09-20	2008-01-15	Jacob Revivo	Microdermabrasion machine
JP4483605B2	2005-01-31	2010-06-16	パナソニック電工株式会社	Skin care equipment
US20060253125A1	2005-03-07	2006-11-09	Ignon Roger G	Microdermabrasion method and apparatus
US7582067B2	2005-03-15	2009-09-01	Ted Gerard Van Acker	Prepared medication applicator including a swab and a pharmacological active agent
JP4728678B2	2005-03-31	2011-07-20	三星食品株式会社	New candy and its manufacturing method
EP1871459B1	2005-04-07	2019-06-19	3M Innovative Properties Company	System for tool feedback sensing
US8088085B2	2005-06-03	2012-01-03	L'oreal	Massaging and/or dispensing device
DE102005026771B4	2005-06-10	2007-04-19	Erdmann, Alfons, Dr. med.	Device for treating patients suffering from skin lesions distributed on the skin surface as well as body coverage
US20070005078A1	2005-06-30	2007-01-04	Cosmedic R & D, Inc.	System for abrading skin to remove outer portions thereof
US7837695B2	2005-06-30	2010-11-23	Dermasweep, Inc.	Skin treatment system
US8025669B1	2005-07-22	2011-09-27	Biorenew Labs, Llc	Portable microderm abrasion device
AU2006274530B2	2005-08-01	2009-03-12	Hawk Medical Technologies Ltd.	Eradication of pigmentation and scar tissue

US8579916B2	2005-08-18	2013-11-12	Sharon Ann Cheney	Thermal separation of impurities from the scalp, hair, and skin
US20070065515A1	2005-09-22	2007-03-22	Key Douglas J	Methods and compositions for treating skin lines and wrinkles and improving skin quality
US7320801B2	2005-09-26	2008-01-22	Jack Perez Kelly	Patch for treating symptoms of a skin abscess
US20070154502A1	2005-12-30	2007-07-05	Judy Hattendorf	Method of treating skin requiring microdermabrasion
US8048089B2	2005-12-30	2011-11-01	Edge Systems Corporation	Apparatus and methods for treating the skin
US20070178121A1	2006-01-27	2007-08-02	Allergan, Inc.	Methods for enhancing skin treatments
US20070198031A1	2006-02-21	2007-08-23	David Kellogg	Method for performing dermabrasion
US10172644B2	2006-03-29	2019-01-08	Edge Systems Llc	Devices, systems and methods for treating the skin
US9566088B2	2006-03-29	2017-02-14	Edge Systems Llc	Devices, systems and methods for treating the skin
US20070239173A1	2006-03-30	2007-10-11	Khalaj Ben M	Hydro-dermabrasion apparatus and method of use
US20100008959A1	2006-04-04	2010-01-14	Amcol International Corporation	Cosmetic and Therapeutic Stick Products
US20090048557A1	2006-04-20	2009-02-19	Yehushua Yeshurun	Device and methods combining vibrating micro-protrusions with phototherapy
WO2008008971A1	2006-07-13	2008-01-17	Candela Corporation	Compact, handheld device for home-based acne treatment
US20080103563A1	2006-10-26	2008-05-01	Lumiport, Llc	Light therapy personal care device
US20080119781A1	2006-11-22	2008-05-22	Jonathan King	Method and apparatus for treating scar tissue
US9492686B2	2006-12-04	2016-11-15	Koninklijke Philips N.V.	Devices and methods for treatment of skin conditions
EP2091454A4	2006-12-13	2012-03-28	Pollogen Ltd	Apparatus and method for skin treatment
US20080214987A1	2006-12-22	2008-09-04	Nanomed Devices, Inc.	Microdevice And Method For Transdermal Delivery And Sampling Of Active Substances
US20080154161A1	2006-12-22	2008-06-26	Abbott Laura W	Handheld massager
US20080300552A1	2007-06-01	2008-12-04	Cichocki Frank R	Thermal forming of refractory alloy surgical needles
WO2008151260A2	2007-06-04	2008-12-11	Farr Laboratories, Llc	Skin care method and kit using peltier thermoelectric device
WO2008157348A1	2007-06-13	2008-12-24	The Procter & Gamble Company	Skin treatment device
CN101795703B	2007-06-27	2015-05-06	里兰斯坦福初级大学理事会	Peptide tyrosinase inhibitors and uses thereof
KR20150083931A	2007-06-27	2015-07-20	더 보드 어브 트러스티스 어브 더 리랜드 스탠포드 주니어 유니버시티	Oligopeptide tyrosinase inhibitors and uses thereof
US8128638B2	2007-08-28	2012-03-06	Emed, Inc.	Handheld microdermabrasion device
US20090138026A1	2007-11-26	2009-05-28	Yueh-Chin Wu	Water dermabrasion and skincare device and method thereof
KR20100129269A	2008-01-04	2010-12-08	엣지 시스템즈 코포레이션	Skin treatment device and method
WO2009097451A1	2008-01-29	2009-08-06	Edge Systems Corporation	Apparatus and method for treating the skin
US8236008B2	2008-02-29	2012-08-07	Envy Medical, Inc.	Microdermabrasion treatment heads
EP2106780B1	2008-04-03	2016-03-09	Rodolfo Pomar	Method for treating the scalp to slow and prevent hair loss and kit for performing the method
US8945104B2	2008-08-22	2015-02-03	Envy Medical, Inc.	Microdermabrasion system with combination skin therapies
US8986323B2	2008-08-22	2015-03-24	Envy Medical, Inc.	Microdermabrasion system upgrade kit
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WO2011006009A1	2009-07-08	2011-01-13	Edge Systems Corporation	Devices, systems and methods for treating the skin using time-release substances
US20110066162A1	2009-09-16	2011-03-17	Vandolay, Inc.	Cryo-micro-dermabrasion

US8221437B2	2009-11-25	2012-07-17	Altair Instruments, Inc.	Device for applying liquid skincare products in combination with vacuum and abrasion
US20110259974A1	2009-12-04	2011-10-27	Mt Industries, Inc.	Base unit for hand held skin treatment spray system
MX2012006497A	2009-12-06	2012-07-30	Syneron Medical Ltd	A method and apparatus for personal skin treatment.
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CN104114236A	2011-12-19	2014-10-22	J·大卫	Fluid skin treatment device
US10238812B2	2013-03-15	2019-03-26	Edge Systems Llc	Skin treatment systems and methods using needles
EP4324414A3	2014-12-23	2024-05-01	HydraFacial LLC	Devices and methods for treating the skin using a rollerball or a wicking member
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File History of Reexamination U.S. Appl. No. 90/007,683 (Reexamination of U.S. Patent No. 6,241,739, issued Jun. 5, 2001).
File History of Reissue U.S. Appl. No. 11/027,590, filed Dec. 29, 2004 (Reissue of U.S. Patent No. 6,500,183, issued Dec. 31, 2002).

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US10194935B2 *	2013-12-31	2019-02-05	L'oreal	Shear-induced dermal infusion
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Priority And Related Applications

Parent Applications (1)

Application	Priority date	Filing date	Relation	Title
US09/648,025	1999-08-26	2000-08-25	Continuation	Instruments and techniques for controlled removal of epidermal layers

Child Applications (3)

Application	Priority date	Filing date	Relation	Title
US11/417,709	1999-08-26	2006-05-03	Continuation	Instruments and techniques for controlled removal of epidermal layers
US11/417,396	1999-08-26	2006-05-03	Continuation	Instruments and techniques for controlled removal of epidermal layers
US11/739,615	1999-08-26	2007-04-24	Division	Instruments and techniques for controlled removal of epidermal layers

Priority Applications (7)

Application	Priority date	Filing date	Title
US10/699,747	1999-08-26	2003-11-03	Instruments and techniques for controlled removal of epidermal layers
US11/417,396	1999-08-26	2006-05-03	Instruments and techniques for controlled removal of epidermal layers
US11/417,709	1999-08-26	2006-05-03	Instruments and techniques for controlled removal of epidermal layers
US11/739,615	1999-08-26	2007-04-24	Instruments and techniques for controlled removal of epidermal layers
US13/620,164	1999-08-26	2012-09-14	Instruments and techniques for controlled removal of epidermal layers
US14/702,509	1999-08-26	2015-05-01	Devices and systems for treating the skin using vacuum
US14/702,486	1999-08-26	2015-05-01	Methods for treating the skin using vacuum

Applications Claiming Priority (3)

Application	Filing date	Title
US15078299P	1999-08-26	
US09/648,025	2000-08-25	Instruments and techniques for controlled removal of epidermal layers
US10/699,747	2003-11-03	Instruments and techniques for controlled removal of epidermal layers

Legal Events

Date	Code	Title	Description
2007-11-13	AS	Assignment	**Owner name**: AXIA MEDSCIENCES, LLC, CALIFORNIA **Free format text**: ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:SHADDUCK, JOHN H.;REEL/FRAME:020108/0350 **Effective date**: 20040604
2010-08-18	STCF	Information on status: patent grant	**Free format text**: PATENTED CASE
2014-03-04	FPAY	Fee payment	**Year of fee payment**: 4
2016-12-06	AS	Assignment	**Owner name**: SILVER POINT FINANCE, LLC, CONNECTICUT **Free format text**: SECURITY INTEREST;ASSIGNORS:EDGE SYSTEMS INTERMEDIATE CORPORATION;EDGE SYSTEMS LLC;REEL/FRAME:040538/0026 **Effective date**: 20161201
2018-02-28	MAFP	Maintenance fee payment	**Free format text**: PAYMENT OF MAINTENANCE FEE, 8TH YR, SMALL ENTITY (ORIGINAL EVENT CODE: M2552) **Year of fee payment**: 8
2018-09-06	AS	Assignment	**Owner name**: EDGE SYSTEMS LLC, CALIFORNIA **Free format text**: ASSIGNMENT OF ASSIGNORS INTEREST;ASSIGNOR:AXIA MEDSCIENCES, LLC;REEL/FRAME:046808/0007 **Effective date**: 20180826
2020-04-13	AS	Assignment	**Owner name**: SILVER POINT FINANCE, LLC, AS AGENT, CONNECTICUT **Free format text**: SECURITY INTEREST;ASSIGNOR:EDGE SYSTEMS LLC;REEL/FRAME:052377/0738

			Effective date: 20200410
2021-05-11	AS	Assignment	**Owner name**: EDGE SYSTEMS INTERMEDIATE, LLC, NEW YORK **Free format text**: RELEASE BY SECURED PARTY;ASSIGNOR:SILVER POINT FINANCE, LLC;REEL/FRAME:056675/0606 **Effective date**: 20210505 **Owner name**: EDGE SYSTEMS LLC, NEW YORK **Free format text**: RELEASE BY SECURED PARTY;ASSIGNOR:SILVER POINT FINANCE, LLC;REEL/FRAME:056675/0606 **Effective date**: 20210505 **Owner name**: EDGE SYSTEMS INTERMEDIATE, LLC, NEW YORK **Free format text**: RELEASE OF SECURITY INTEREST;ASSIGNOR:SILVER POINT FINANCE, LLC;REEL/FRAME:056675/0606 **Effective date**: 20210505 **Owner name**: EDGE SYSTEMS LLC, NEW YORK **Free format text**: RELEASE OF SECURITY INTEREST;ASSIGNOR:SILVER POINT FINANCE, LLC;REEL/FRAME:056675/0606 **Effective date**: 20210505
2022-01-03	AS	Assignment	**Owner name**: JPMORGAN CHASE BANK, N.A., AS ADMINISTRATIVE AGENT, ILLINOIS **Free format text**: SECURITY INTEREST;ASSIGNOR:EDGE SYSTEMS LLC;REEL/FRAME:058526/0897 **Effective date**: 20211230
2022-04-25	FEPP	Fee payment procedure	**Free format text**: MAINTENANCE FEE REMINDER MAILED (ORIGINAL EVENT CODE: REM.); ENTITY STATUS OF PATENT OWNER: SMALL ENTITY
2022-10-10	LAPS	Lapse for failure to pay maintenance fees	**Free format text**: PATENT EXPIRED FOR FAILURE TO PAY MAINTENANCE FEES (ORIGINAL EVENT CODE: EXP.); ENTITY STATUS OF PATENT OWNER: SMALL ENTITY
2022-10-10	STCH	Information on status: patent discontinuation	**Free format text**: PATENT EXPIRED DUE TO NONPAYMENT OF MAINTENANCE FEES UNDER 37 CFR 1.362
2022-11-01	FP	Lapsed due to failure to pay maintenance fee	**Effective date**: 20220907
2024-08-06	AS	Assignment	**Owner name**: HYDRAFACIAL LLC (FORMERLY KNOWN AS EDGE SYSTEMS LLC), CALIFORNIA **Free format text**: RELEASE OF SECURITY INTEREST IN PATENTS AT REEL/FRAME NO. 58526/0897;ASSIGNOR:JPMORGAN CHASE BANK, N.A., AS ADMINISTRATIVE AGENT;REEL/FRAME:068378/0060 **Effective date**: 20240806

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