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SUPERINTENDENCIA Y COMERCIO
REGISTRACION : 00029079 00000000
Fecha (1999): 2000-06-23 14:10:43
Trámite : 002 PATENTES D 1 REGISTRO/ 329 COMPLETO
FOLIOS : 0240 (1) FOLIOS DE NUEVAS CREACIONES

Señor

SUPERINTENDENTE DE INDUSTRIA Y COMERCIO

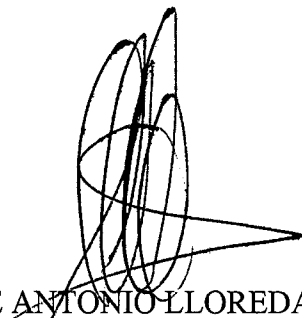
DIVISION DE NUEVAS CREACIONES

E. _____ S _____ D. _____

Re: P1.-THE GILLETTE COMPANY .- Solicitud de Patente de Invención
para "AFEITADORA DE SEGURIDAD".- Clase A45 .-Expediente
número 00-029.079 .-

1. Me refiero a mi solicitud de patente arriba nombrada de fecha 19 de Abril de 2000.
2. Anexos me permito presentar a usted:
 - (1) Copia autentica, debidamente certificada de la solicitud de patente presentada para el invento arriba nombrado **respecto de la cual reclamo prioridad**, a saber la solicitud británica número 9909463.3 de 23 de Abril de 1999, junto con su traducción oficial No. 0248 correspondiente a las legalizaciones y reivindicaciones de dicho documento.
 - (2) Copia debidamente autenticada por el Notario Sexto del Circulo de Bogotá, de los documentos que acreditan la calidad de Traductor Oficial del señor Eduardo Calado Noguera quien elaboró la traducción de la legalizaciones de la solicitud británica número 9909463.3 de 23 de Abril de 1999.
 - (3) Documento que acredita el traspaso que los autores del invento de la referencia hacen a favor de mi poderdante, de sus derechos sobre el mismo, debidamente legalizado hasta por el Ministerio de Relaciones Exteriores de Colombia bajo el número 182194 de 14 de Junio de 2000.; y
 - (4) Traducción Oficial No. 148, debidamente legalizada hasta por el Ministerio de Relaciones Exteriores de Colombia bajo el número 083471 de 21 de Junio de 2000, correspondiente a dicho documento de traspaso.

3. Ruego a usted tomar atenta nota de lo anterior y proceder de conformidad.
Señor Superintendente,

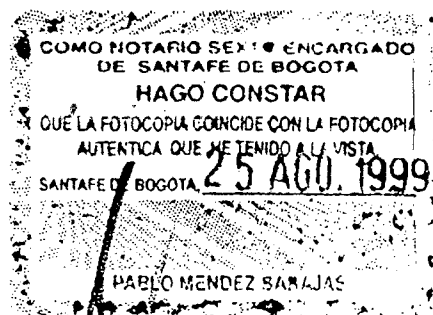


JOSE ANTONIO LLOREDA
T.P. 10.784
Código 231

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REPUBLICA DE COLOMBIA
MINISTERIO DE RELACIONES EXTERIORES

EL SUSCRITO JEFE DEL AREA DE
LEGALIZACIONES DEL MINISTERIO DE
RELACIONES EXTERIORES



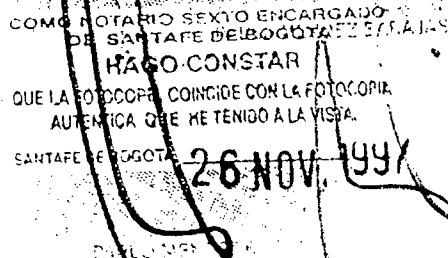
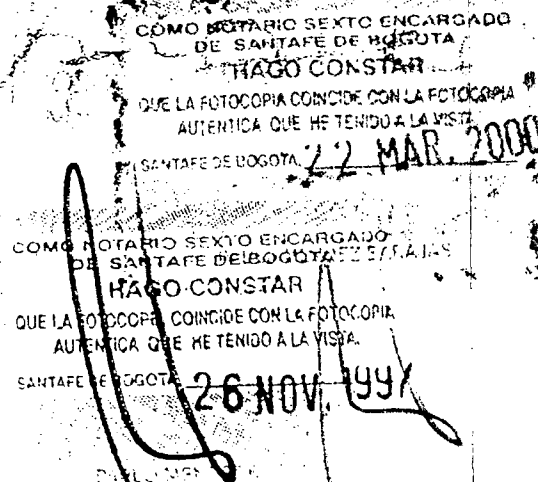
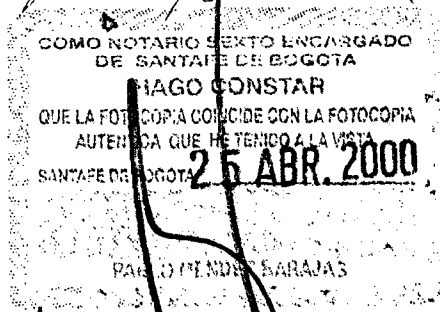
CERTIFICA

Que revisados los registros que se llevan en la oficina de Legalizaciones aparece la firma del señor **EDUARDO CALADO NOGUERA**, como traductor e intérprete oficial para los Idiomas INGLES- ESPAÑOL, ESPAÑOL- INGLES, según resolución 541 del 27 de febrero de 1976.

La anterior certificación se expide a solicitud del interesado quien se identificó con cédula de ciudadanía 17.177.588 expedida en Bogotá.

Dada en Santa Fe de Bogotá, D.C., a los seis (6) de noviembre de 1997.

Blanca Acosta de García
BLANCA ACOSTA DE GARCIA
Jefe Area de Legalizaciones (e)



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República de Colombia



Ministerio de Justicia y del Derecho

EL SECRETARIO GENERAL (E) DEL MINISTERIO DE
JUSTICIA Y DEL DERECHO

CERTIFICA:

Que por Resolución 541 del 27 de febrero de 1976, le fue expedida licencia para ejercer funciones de Traductor e Intérprete Oficial en los idiomas INGLÉS y ESPAÑOL al señor EDUARDO CALADO NOGUERA, identificado con la cédula de ciudadanía No. 17.177.588 expedida en Bogotá.

Que dicha Resolución se encuentra vigente en la fecha.

Se expide la presente certificación a solicitud del interesado.

Dada en Santa Fe de Bogotá, D.C., a

14 OCT. 1997

ALVARO NAMEN VARGAS

COMO NOTARIO SEXTO ENCARGADO
DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA COINCIDE CON LA FOTOCOPIA
AUTENTICA QUE HE TENIDO A LA VISTA
SANTAFE DE BOGOTA 25 AGO. 1999

PABLO MENDEZ BARRAL

COMO NOTARIO SEXTO ENCARGADO
DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA COINCIDE CON LA FOTOCOPIA
AUTENTICA QUE HE TENIDO A LA VISTA
SANTAFE DE BOGOTA 26 NOV. 1997

COMO NOTARIO SEXTO ENCARGADO
DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA COINCIDE CON LA FOTOCOPIA
AUTENTICA QUE HE TENIDO A LA VISTA
SANTAFE DE BOGOTA 25 ABR. 2000
PABLO MENDEZ BARRAL

COMO NOTARIO SEXTO ENCARGADO
DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA COINCIDE CON LA FOTOCOPIA
AUTENTICA QUE HE TENIDO A LA VISTA
SANTAFE DE BOGOTA 04 NOV. 1997
PABLO MENDEZ BARRAL

ICM/mmc
TFR

Abril 115, 2000
Traducción Oficial No.0248
REF: THE GILLETTE COMPANY.
Patente No.9909463.3

Caso: 4255-[PDG]
(Ladas & Parry)

La Oficina de Patentes
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

LA OFICINA DE PATENTES

Yo, el abajo firmante, funcionario debidamente autorizado de acuerdo a la sección 74(1) y (4) de Actos de Patentes y Diseños 1994, otorgado para firmar y expedir certificados a nombre de Comptroller- General, por la presente certifico que la copia anexada aquí es una fiel copia de los documentos originales tal y como fueron registrados en relación con la solicitud de Patentes identificadas en el presente documento.

De acuerdo con las regulaciones de 1982 de Patentes (re-registro de compañías) , si una empresa es mencionada en este certificado o cualquiera de los documentos anexos, ha sido esta re-registrada en el Acta de Compañías bajo el mismo nombre con el cuál fué registrado inmediatamente en ese momento antes de tal re- registro, salvo a sustición tal como, inclusión tal como, la última parte del nombre con las palabras "Compañía Pública Limitada" o su equivalente en Galés, referencias a

Edwardo Calado

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nombre de la compañía en este certificado o cualquier otros documento anexado debe ser tratado como referencias con el nombre con el cual fué re-registrados.

De acuerdo a los reglamentos, las palabras "Compañía Pública Limitada" puede ser remplazados con las siglas Cia. Ltda, C.Ltada, C.P.L. o CPL.

El re-registro bajo el Acta de Compañías no constituye una nueva empresa legal sino que solamente sujeta a la compañía a ciertas reglas adicionales legales impuestas por la compañía.

HAY FIRMA :Andrew Gersey

FECHA:Marzo 8, 2000

Hay sello de "The Patent Office" plastificado de color rojo

Eduardo Calado

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LA OFICINA DE PATENTES

PETICION PARA OTORGAR UNA PATENTE

Actas de Patentes 1977

(Regulación 16)

Cardiff Road

Newport

Gwent NP9 1RH

Hay sello de la Oficina de Patente

1. Su referencia :JL/
2. Número de solicitud de patente: No. 9909463.3
3. Nombre completo de cada solicitante, dirección y código postal

THE GILLETTE COMPANY
38TH FLOOR, PRUDENTIAL TOWER BUILDING
BOSTON
MASSACHUSETTS 02199
ESTADOS UNIDOS

Número de ADP de Patente 771261001
Hay sello de la Oficina de Patentes con Fecha: Abril 23/1999

Si el solicitante es una empresa escriba el
nombre del pais/estado de su incorporación. DELAWARE.

4. Título de la invención: CUCHILLAS DE AFEITAR CON SEGURIDAD

5. Nombre de su suplente (si tiene uno) A. A. THORNTON & CO

Eduardo Calado

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“Dirección para detalles de servicio”
en el Reino Unido para Toda correspondencia

Northumberland House,
303 -306 High Holborn,
London WC1V 7LE

Número de ADP de Patente

75001

8. Si existe una declaración del inventor o un derecho para otorgar una patente y sea necesario confirmar esta petición ? Si

Responda s “Si” en el cado de que:

- a) cualquier solicitante mencionado en la parte 3 no sea un inventor, o
- b) hay un inventor que no aparece mencionado como solicitante, o
- c) cualquier solicitante mencionado forma parte de la empresa;
- Ver nota (d)

9. Favor llenar los números de páginas por cada de los siguientes item incluidos en esta solicitud.

Hojas continuadas de esta forma. 0

Descripción 11

Reivindicación (es) 4

Resumen 0

Gráficas 3

Hay firma (ilegible)

11. Yo/Nosotros solicitamos la otorgación de una patente en base a esta solicitud. Firmado por: A.A.THORTON & CO Funcionario autorizado.
Fecha:Abril 23, 1999.

12. Nombre de persona que se pueda contactar en el Reino Unido y
número telefónico: J. LERWILL Tel: 0171405-4044

Eduardo Calado

REIVINDICACIONES:

1. Una unidad que contiene un elemento cortante para cuchilla de afeitar seguro de protección, la cual consiste de un borde cortante y afilado, el cual se encuentra formado integralmente por elementos de apoyo de un material de cerámica cristal individual.
2. Una unidad estructural que contiene una cuchilla de afeitar con seguro de protección, la cual consiste de:
un elemento cortante con un borde afilado cortante;
elementos de apoyo para ensamblar y ubicar en la unidad el elemento cortante y la cuchilla en posición cortante; y
otro elemento ubicado hacia adelante del borde cortante, dicho elemento cortante con elementos de apoyo y otros elementos, siendo todos integralmente hechos de un material de cristal sencillo.
3. Una unidad con una cuchilla de afeitar de acuerdo a la reivindicación 2, en la cual los elementos de apoyo se encuentran en posición con las puntas opuestas del elemento cortante e interconectadas a otros elementos del elemento cortante.

Eduardo Caludo N.

4. Una unidad con una cuchilla de afeitar de acuerdo a la reivindicación 2 o 3, en el cual el otro elemento es un elemento de seguridad que se extiende paralelamente a través del borde cortante del elemento cortante.
5. Una unidad con una cuchilla de afeitar de acuerdo a la reivindicación 2, 3, o 4 en el cual la se provéen la pluralidad de los elementos cortantes.
6. Una unidad con una cuchilla de afeitar de acuerdo a la reivindicación 2 o 3 en la cual el otro elemento es un segundo elemento cortante.
7. Una unidad con una cuchilla de afeitar de acuerdo a la reivindicación 6, en la cual los elementos cortantes reposan en los respectivos planos paralelos.
8. Una unidad con una cuchilla de afeitar de acuerdo a cualquiera de las reivindicaciones entre la 2 hasta la 7, la cual incluye una tapa integral ubicada detrás del elemento (s) cortante(s) paralelos al este mismo.

Edmundo Calzadilla

9. Una estructura de cuchilla unitaria de acuerdo a cualquiera de las reivindicaciones entre la 2 hasta la 7, la cual incluye las reivindicaciones 2 hasta la 8, incluyendo por lo menos un elemento intermedio transversal que interconecta los elementos cortantes y otros elementos entre los elementos de apoyo.

10. Una unidad con una cuchilla de afeitar adentro con seguro de protección, la cual consiste de dos o más elementos cortantes con bordes cortantes y afilados, encontrándose los elementos cortantes integralmente formados con cada uno y con otros elementos interconectados desde un material de cerámica cristalina individual.

11. Una unidad con una cuchilla de afeitar de acuerdo la reivindicación 10, en la cual los dos elementos cortantes se encuentran ubicados uno detrás del otro y tienen bordes cortantes espaciados paralelamente.

12. Una unidad con una cuchilla de afeitar de acuerdo a cualquiera de las reivindicaciones entre la 10 u 11, en la cual los bordes cortantes de los elementos cortantes reposan substancialmente en un mismo plano, los elementos cortantes se encuentran en sus

Edmundo Salas R.

respectivos planos inclinados a dicho plano en común y los elementos interconectados se encuentran espaciados a lo largo de la estructura de la cuchilla y se extiende de travesa a los elementos cortantes y substancialmente paralelos a un plano en común de los bordes cortantes.

13. Una unidad con una cuchilla de afeitar 10, 11 o 12 en el cual se encuentran una multiplicidad de elementos cortantes que se encuentran distribuidos a lo largo de la estructura de cuchilla y en la parte delantera para guiar la dirección de los mismos.

14. Una unidad con una cuchilla de afeitar de acuerdo a las reivindicaciones 10 hasta 13, en el cual se interconectan los elementos que se extienden hacia adelante desde un elemento cortante se encuentran ubicados a lo largo de los elementos cortantes desde los elementos que se extienden desde la parte posterior del mismo.

15. Una unidad con una cuchilla de afeitar de acuerdo a las reivindicaciones 10 hasta la 14, en el cual cada uno de los elementos cortantes está formado al menos parcialmente por grabados anisotrópicos.

Edmundo Calado

16. Una unidad con una cuchilla de afeitar de acuerdo a las reivindicaciones de la 2 hasta la 15 en el cual el borde afilado y cortante de cada uno de los elementos cortantes se define mediante faceta de superficies amoldadas por un material de cristal individual.

17. Una unidad con una cuchilla de afeitar de acuerdo a las reivindicaciones de la 2 hasta la 16, en la cual el material individual de cristal es silicona.

18. Una unidad con una cuchilla de afeitar de acuerdo a las reivindicaciones de la 2 hasta la 17, en el cual el borde cortante de por lo menos un elemento cortante se encuentra en dirección longitudinal inclinada hacia la dirección longitudinal de la estructura de la cuchilla.

19. Una unidad con una cuchilla de afeitar con seguro de protección la cual consiste de un elemento cortante tal como lo define la reivindicación 1 o una estructura unitaria en cualquiera de las reivindicaciones de la 2 hasta la 18.

Eduardo Celado

20. Un método para fabricar el elemento cortante para la unidad de cuchilla de afeitar con seguro de protección, la cual incluye los siguientes pasos:

siempre y cuando la chapa del material de cristal independiente tiene una superficie que reposa en un plano específico de la estructura cristalográfica; y

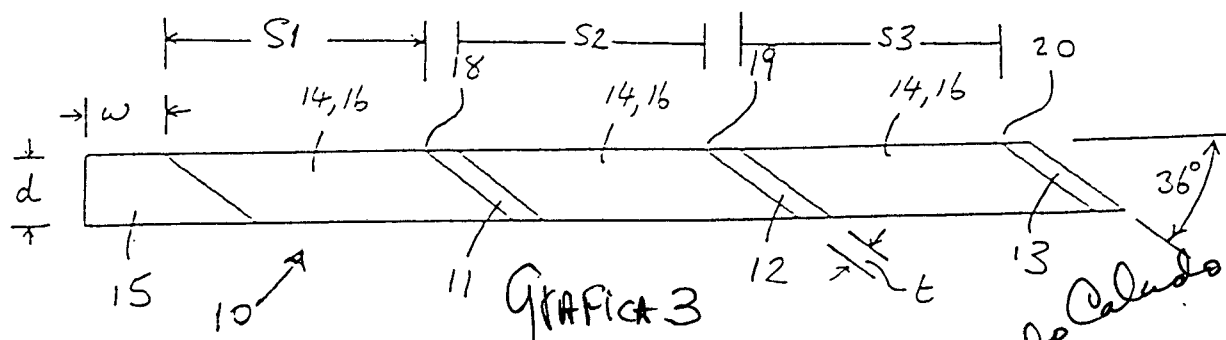
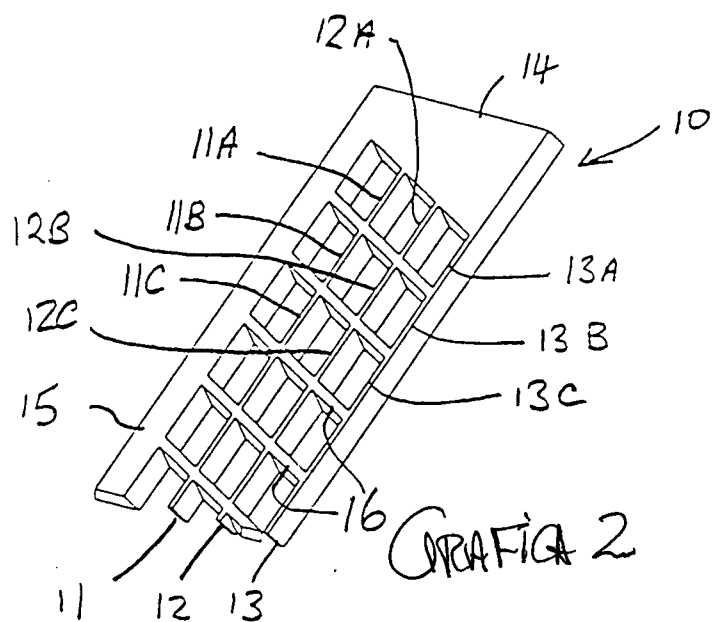
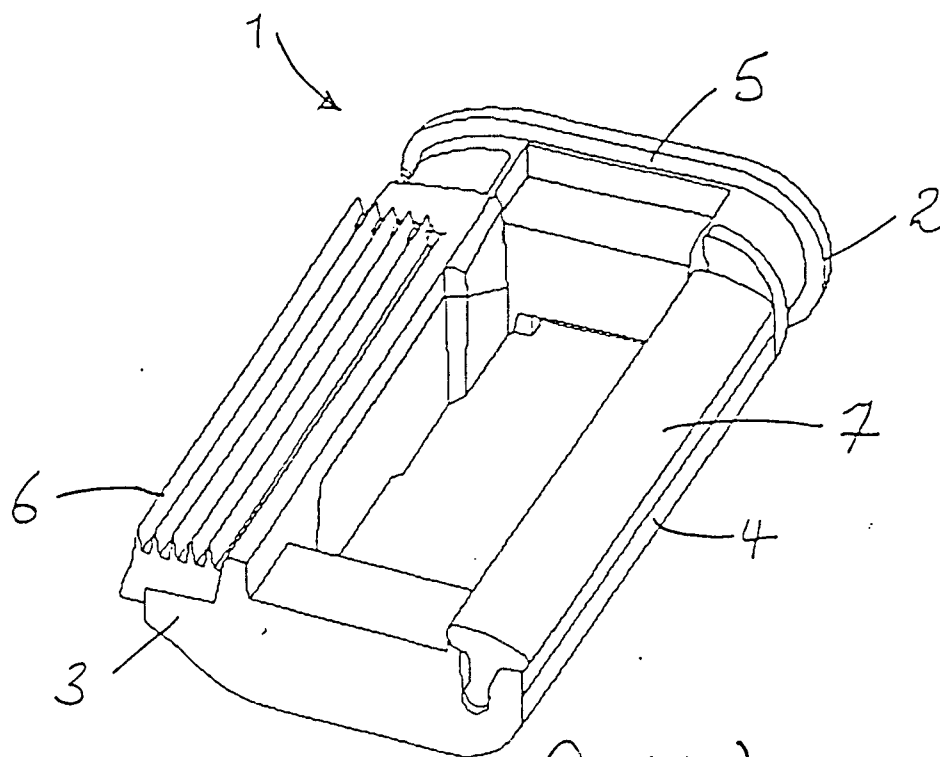
se retira el material de cristal en la superficie de manera selectiva al emplear el proceso de grabado para formar un plano del elemento cortante inclinado en un ángulo agudo para el plano de superficie y el cual tiene un borde afilado substancialmente en la superficie del plano.

21. Un método de acuerdo a la reivindicación 20 en la cual el elemento de seguridad substancialmente paralelo del borde cortante y espaciados hacia adelante de allí, se forma desde la chapa del material cristal original mediante el proceso de grabado, el elemento de seguro de protección se encuentra integralmente conectado al elemento cortante mediante los elementos interconectados.

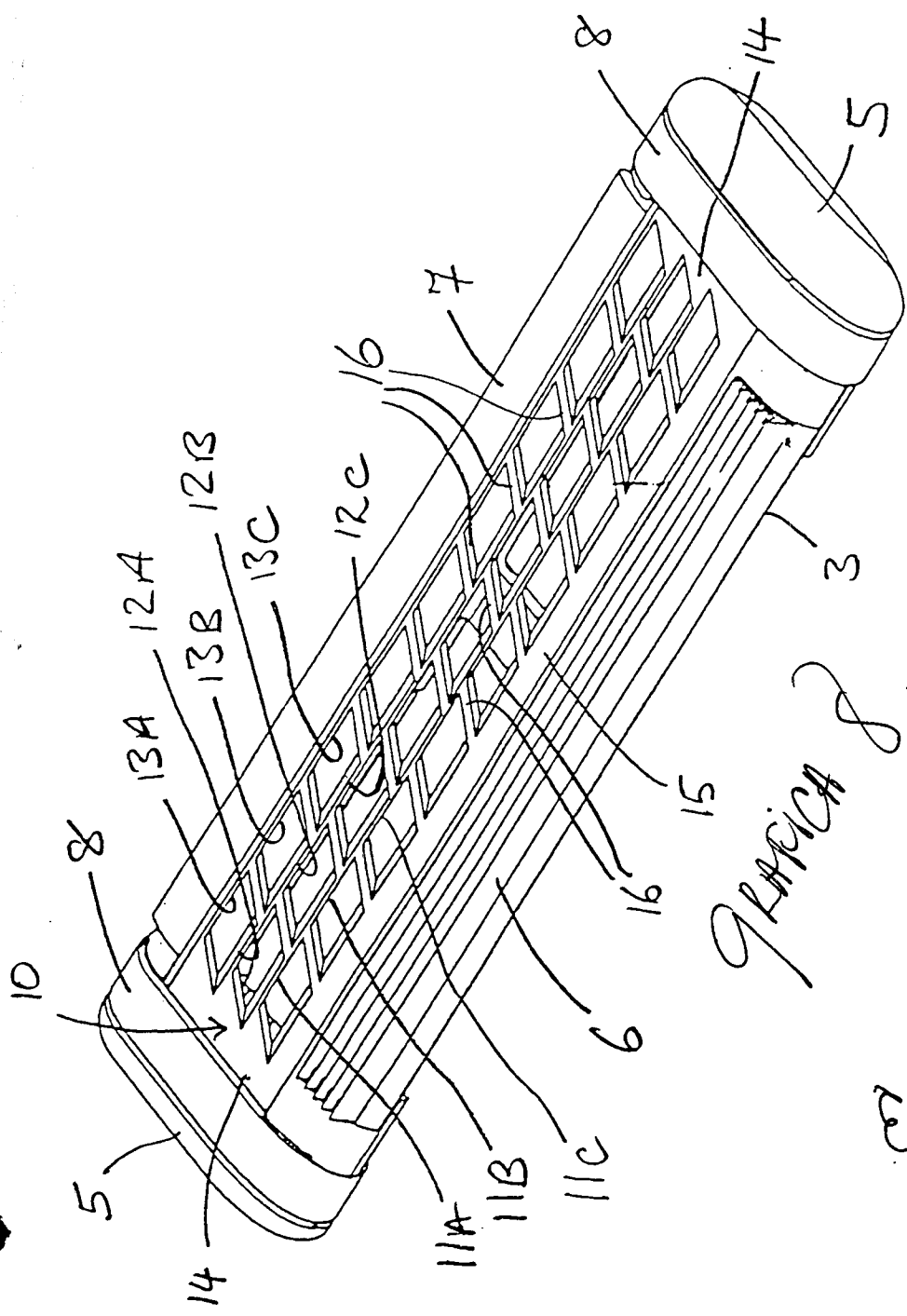
Eduardo Calado

22. Un método de acuerdo a la reivindicación 20 o 21 en el cual el proceso de grabado consiste de un grabado químico amistrópico húmedo.
23. Un método de acuerdo a cualquiera de las reivindicaciones 20 hasta la 22 en el cual el proceso de grabado incluye grabado seco.
24. Una unidad de cuchilla de afeitar la cual consiste de un miembro formado de silicona.

Eduardo Calado



Edwards Caludek



GRFICA 8

Edwards Calado



The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed *Andrew Gersy*
Dated 8 March 2000

Patents Act 1
(Rule 16)

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)



The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference	JL/		
2. Patent application number (The Patent Office will fill in this part)	9909463.3		
3. Full name, address and postcode of the or of each applicant (underline all surnames)	The Gillette Company 38th Floor, Prudential Tower Building Boston Massachusetts 02199 United States of America		
Patents ADP number (if you know it)	771261001		
If the applicant is a corporate body, give the country/state of its incorporation	Delaware		
4. Title of the invention	SAFETY RAZORS		
5. Name of your agent (if you have one)	A. A. THORNTON & CO.		
"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)	Northumberland House, 303 - 306 High Holborn, London WC1V 7LE		
Patents ADP number (if you know it)	75001		
6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number	Country	Priority application number (if you know it)	Date of filing (day / month / year)
7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application		Date of filing (day / month / year)
8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if: a) any applicant named in part 3 is not an inventor, or b) there is an inventor who is not named as an applicant, or c) any named applicant is a corporate body. See note (d))	YES		

20
Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form.
Do not count copies of the same document

Continuation sheets of this form

Description **11**

Claim(s) **4**

Abstract

~~2~~ Drawing(s) **3**

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77) **None**

Request for preliminary examination and search (Patents Form 9/77) **1**

Request for substantive examination (Patents Form 10/77) **None**

Any other documents (please specify) **None**

11. I/We request the grant of a patent on the basis of this application.

Signature

A. A. THORNTON & CO.

Date

23 April 1999

12. Name and daytime telephone number of person to contact in the United Kingdom **J. LERWILL 0171-405-4044**

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.
- b) Write your answers in capital letters using black ink or you may type them.
- c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- e) Once you have filled in the form you must remember to sign and date it.
- f) For details of the fee and ways to pay please contact the Patent Office.

SAFETY RAZORS

This invention is concerned with safety razors and their manufacture, and the invention is particularly concerned with the cutting elements, or blades, used in the blade units of safety razors. A safety razor generally comprises a blade unit having at least one blade with a cutting edge which is moved across the surface of the skin being shaved by means of a handle to which the blade unit is attached. The blade unit may be mounted detachably on the handle to enable the blade unit to be replaced by a fresh blade unit when the blade sharpness has diminished to an unsatisfactory level, or it may be attached permanently to the handle with the intention that the entire razor be discarded when the blade or blades have become dulled. Detachable and replaceable blade units are commonly referred to as shaving cartridges. The shaving performance of a razor blade unit is dependent not only on the sharpness of the blade(s), but on the disposition of the blade(s) in relation to other parts of the blade unit which normally contact the skin during shaving. Modern razor blade units generally have blades made from strips of steel and the manufacture of these blades can involve several steps, many of which will influence the cutting performance of the finished blade. Such manufacturing steps may include edge grinding, edge polishing, edge coating and shaping, and attachment to a blade support. The blades are assembled with other blade unit components and typically are mounted in a rectangular frame or housing which also carries guard and cap members for contacting the skin in front of and behind the blade(s). The or each blade must be set accurately in position during the assembly procedure in order to establish the desired "shaving geometry", i.e. the precise location of the edge of the blade in relation to the skin contacting elements immediately in front and behind, as well as the angular orientation of the blade which determines the blade inclination to the skin surface during

shaving. Whilst modern production techniques enable the blade manufacture and blade unit assembly operations to be automated, it will be understood that the overall blade unit manufacture is a complicated procedure requiring many operations to be performed and completed to close tolerances. Attempts have been made to improve upon stainless steel blades by manufacturing cutting elements from ceramic crystal material, namely sapphire, but the technical difficulties encountered have prevented development of any commercially acceptable alternative to steel blades.

The present invention is based on the realisation that techniques employed in a technology unrelated to shaving could be used to manufacture razor blade cutting elements and could substantially simplify the production of safety razor blade units both in terms of the cutting element manufacture and in establishing the final shaving geometry which is dependent upon the blade position and orientation.

In accordance with one aspect the invention broadly resides in a cutting element in or for a safety razor blade unit, the cutting element having a sharp cutting edge and being formed integrally with supporting elements from a single crystal material.

More specifically, the present invention provides a unitary blade structure in or for a safety razor blade unit, comprising a cutting element with a sharp cutting edge, support elements for mounting and positioning the cutting element in the blade unit, and an element disposed forwardly of the cutting edge for determining shaving parameters of the cutting edge, said cutting element, support elements and further element being integrally formed from a single crystal material.

The unitary blade structure of the invention may include a plurality of cutting elements e.g. 2 or 3 cutting elements disposed one behind another with spaced cutting edges, a more forward cutting element contributing to the

determination of the shaving parameters of a following cutting element. The cutting elements may be elongate and may extend essentially continuously over a major part of the length of the blade unit and can be interconnected by integral supporting elements disposed at the ends of the cutting elements. Alternatively, or in addition, integral elements can be formed to interconnect the cutting elements at one or more locations intermediate their ends. It is also possible for the unitary blade structure to include a relatively large number of cutting elements with these elements being distributed in the lengthwise direction of the blade unit as well as in the front to rear direction. Adjoining cutting elements in the lengthwise direction can then be interconnected through support elements integral with those cutting elements. In a preferred construction the blade structure of the invention includes a guard element which extends parallel to a cutting element and spaced forwardly from the cutting edge thereof. The integral guard element can form a so-called "backstop" in the assembled blade unit and hence constitutes the last part of the blade unit to contact the skin before it encounters the cutting edge of the following blade, the guard element then serving to at least participate in establishing certain parameters of the shaving geometry, most notably the span and exposure of the following blade, and to do so from the time of manufacture of the blade structure so that assembly tolerances become less critical than with conventional blade unit manufacturing methods.

Another possibility is for the blade structure to include an integral element located behind the cutting element or elements in order to form at least part of a cap structure in the assembled blade unit.

The single crystal ceramic material is conveniently silicon. Techniques for making wafers of silicon crystal and shaping such wafers have been developed in the electronics industry and are employed in the production of integrated circuits. Also, whilst the possibility to shape a silicon wafer to form

a cutting edge has been appreciated, it has not been previously recognised that not only can satisfactory razor blades be made in this way, but there are very substantial advantages which can be gained by doing so in terms of simplifying overall razor blade unit manufacture. Single crystal silicon (SCS) has a number of beneficial properties which make it an attractive alternative to steel for razor blade manufacture. It has a similar elastic modulus to steel, although its strength is dependent on defect concentration within the crystal structure. A lack of grain boundaries and inclusions in integrated circuit grade SCS means that the greatest potential source of defects is surface flaws, for which reason when working on wafers of SCS care needs to be taken to minimise the risk of creating such flaws. SCS can be machined non-mechanically to dimensional tolerances less than one micrometre, which can be referred to as "micromachining", by etching processes and then the post-processing defects are for the most part likely to be etching pits, and this should enable an SCS strength similar to steel to be achieved in the shaped SCS razor blade product. The known etching techniques include wet etching using chemicals such as potassium hydroxide, and dry etching, e.g. plasma etching and reactive ion etching, and by these techniques it has been proven that a wide range of shapes can be formed from SCS. In carrying out etching, isotropic or anisotropic etching can be used. In either case a mask is employed to establish the shape or pattern which the etching process is to produce, the mask itself being applied to the surface of the SCS by well known photolithographic techniques. With isotropic etching the removal of material occurs at the same rate in all directions, but can be controlled to produce a face substantially normal to the surface being exposed to the etching treatment, whereas anisotropic etching takes advantage of the characteristic property of the crystal material in allowing material to be removed in directions determined by the crystal structure. In SCS the $\{111\}$ crystallographic planes are the slowest to be etched, so if a

single crystal lying in the $\langle 001 \rangle$ direction is etched, the $\{111\}$ planes should remain at an angle of 54.7° to the surface. This fact can be utilised to advantage in forming the razor blade cutting elements and their cutting edges in accordance with the present invention.

Whilst wet chemical etching has the advantage of being comparatively cheap and quick, the invention includes within its scope blade structure of single crystal ceramic material formed by dry etching methods which remove the crystal material by impingement with ions. The latter gives greater freedom for design, but the dry etching processes are more difficult to control and require the use of more complex and therefore more expensive equipment. Of course blade structures can also be manufactured using a combination of wet and dry etching process, and isotropic and/or anisotropic etching may be involved.

Having regard to the foregoing it is in accordance with a second aspect of the invention that there is provided a method of making a safety razor blade unit cutting element comprising the steps of:

providing a wafer of single crystal material having a surface lying in a predetermined plane of the crystallographic structure; and

selectively removing crystal material at the surface by employing an etching process to form a planar cutting element inclined at an acute angle to the surface and having a sharp edge substantially at the surface.

As indicated above the etching process may be wet etching and/or dry etching and may be isotropic and, or anisotropic etching. The etching process can also be relied upon to form integrally with the cutting element support elements to support and position the cutting element with a safety razor blade unit.

It has been shown that the cutting edges can be formed by the etching process to have a tip radius very close to the tip radius of conventional steel

blades as found in blade units currently marketed, but it may be found that other tip radii may be better suited to the cutting elements produced according to the invention. Although a sharp and reasonably hard edge may be expected from the etching process, if desired a coating of hard material, such as boron nitride, amorphous diamond or diamond-like carbon, as known *per se*, may be applied to the cutting edge formed from the monocrystalline material. In addition and also in a manner known *per se*, a coating of ptfе may be applied to the cutting edge whether or not a hard coating has been applied.

It is preferable for several unitary blade structures according to the invention to be formed simultaneously from a single wafer of monocrystalline material, with the finished individual blade structures then being separated for assembly into respective blade units.

Although as indicated above, single crystal silicon is an especially convenient and the currently preferred monocrystalline ceramic material to be employed in practising the present invention, there are other covalently bonded single crystals which could be used to produce razor blade structures according to the invention.

The ability to determine accurately certain dimensional parameters of the shaving geometry in the final razor blade unit at the time of producing the blade and its cutting edge is a potential major breakthrough in razor blade unit manufacture and has not been previously contemplated as a possibility. The invention also opens up other development possibilities never previously available, such as the use of integrated circuit manufacturing techniques to form *in situ* with a blade electronic components such as sensors and/or actuators which could be utilised to control adjustments within the blade unit.

To assist a clear understanding of the invention an exemplary embodiment is described below in more detail with reference being made to the accompanying drawings in which:

Figure 1 shows in perspective a half sectioned blade unit housing assembly, the half not shown being in essence a mirror image of that which is illustrated;

Figure 2 shows in perspective a half sectioned unitary blade structure according to the invention for mounting in the housing assembly of Figure 1, the half of the blade structure not shown in the Figure being essentially a mirror image of that part which is illustrated;

Figure 3 is a cross-section through the blade structure shown in Figure 2;

Figure 4 is a cross-sectional view through another unitary blade structure having a different cutting edge profile;

Figure 5 is a partial perspective view similar to Figure 3 illustrating a modified unitary blade structure, suitable for use in the blade unit housing of Figure 1;

Figure 6 is a partial plan view of the unitary blade structure shown in Figure 5;

Figure 7 is a partial perspective view similar to Figure 3 showing another unitary blade structure also suitable for use with the blade unit housing of Figure 1; and

Figure 8 is an isometric view showing an assembled cartridge incorporating the unitary blade structure of Figures 5 and 6.

In Figure 1 there is illustrated a safety razor blade unit frame or housing assembly 1 which has a generally rectangular moulded plastics frame 2 with spaced parallel guard and cap members 3,4 interconnected by frame ends 5. A strip of elastomeric material 6 is carried on the guard member 3 and a shaving aid material, such as a lubricating strip 7 is carried by the cap member 4. As shown the elastomeric strip 6 is provided with upwardly directed parallel fins, but it can be differently configured as known in the art. The frame assembly 1

defines an opening in which one or more blades are to be mounted for contact with the skin between the guard and cap during shaving. As described so far the blade unit housing assembly is of a construction known previously.

According to the present invention a unitary blade structure 10 formed from monocrystalline ceramic material, in particular single crystal silicon, as shown in Figures 2 and 3 is mounted in the blade unit frame. The blade structure 10 includes three parallel cutting elements or blades 11,12,13 interconnected at their ends by support elements 14 which are engageable with the frame ends 5 to mount and position the blades 11,12,13 within the blade unit frame. The unitary blade structure also includes a guard element or backstop 15 which is parallel to the blades and lies between the first blade 11 and the guard member 3 of the frame in the assembled blade unit so that this guard element 15 determines the span and the exposure of first blade 11. In the illustrated embodiment the blade structure 10 additionally includes transverse intermediate elements 16 interconnecting the blades and the guard element to provide additional support for the blades and/or to control the skin directly in front of the blade edges should it be desired. These transverse elements 16 are uniformly spaced along the blades so that the blade structure has an overall generally recticular form, although the transverse elements 16 do not extend perpendicularly to the blade edges due to the orientation of the crystal planes in the SCS wafer from which the blade structure is formed. The blades are forwardly and upwardly inclined and have sharp cutting edges 18,19,20 at their upper forwardmost extremities. The positions of the cutting edges are accurately determined in the process of manufacturing the unitary blade structure. As indicated in the exemplary embodiment of Figure 3, the depth d of the blade structure 10 is about 0.4mm, it having been produced from a single wafer of SCS having this thickness, the minimum width w of the guard element 15 is 0.3mm, the span $S1$ of the first blade 11 is 0.8mm and span $S2$ and $S3$ of

each of the second and third blades 12,13 is 1.5mm. Each blade has a thickness t of 0.075mm and is inclined at an angle of 36° to the top plane of the blade structure 10. Other dimensions are of course possible and may even prove to be desirable. The blade structure is manufactured by masking and etching a wafer of SCS, the blades at least being produced by an anisotropic etching process. With a wafer grown in the $\langle 110 \rangle$ direction of the crystal structure, plates to provide the blades are produced by micromachining at an angle of 36° to the wafer surface and they are formed with sharp top forward edges. However, by using a $\langle 110 \rangle$ wafer which has been off-oriented by 16° , it becomes possible to form the blades with the 20° inclination as shown in Figure 4. Furthermore, facets 22 could be provided at the cutting edges by further dry etching. Thus, a desired shaving angle of the blades 11,12,13 may be achieved, together with other desired dimensional parameters contributing to the shaving geometry, to very high accuracy as a direct result of the micromachining process used to produce the unitary blade structure 10. Furthermore, the shaving geometry of the final blade unit may be relatively insensitive to accuracy of assembly of the blade structure 10 within the frame 1, at least in comparison with conventional blade unit constructions.

As described above, the cutting elements 11,12,13 have been considered to be elongate and to extend essentially continuously over substantially the full length of the unitary blade structure. It is, however, equally appropriate when the transverse elements 16 interrupt the continuity of the cutting edges, to consider each blade section 11A, 11B...12A, 12B ... 13A, 13B etc. located between the cross members constituted by the intermediate elements 16 and the end support elements 14 to be a distinct cutting element so that the unitary blade structure incorporates a large number of such cutting elements having cutting edges of short length in comparison to the length of the blade unit and distributed in the lengthwise direction of the unitary blade structure as well as

in the front to rear direction thereof. In the above described embodiment of Figures 2 and 3, the cutting elements 11A, 12A, 13A; 11B, 12B, 13B... etc. which are disposed one behind the other are generally aligned in the front to rear direction, although they are offset a little due to the non-perpendicular orientation of the elements 16 with respect to the blade edges. According to the modified embodiment of Figures 5 and 6 corresponding cutting elements 11A, 12A, 13A; 11B, 12B, 13B.... etc. are staggered in the longitudinal direction of the blade structure, which may be advantageous in that the cross members 16 are not aligned, that is the interconnecting elements 16 extending forwardly from each of the cutting elements is displaced along the element from the connecting elements extending rearwardly therefrom, and as a result there is greater certainty that a hair protruding from a segment of skin sliding across the interconnecting element 16 located between the cutting elements 11A and 11B, for example, will come into contact with and be cut by the cutting edge of the following cutting element 12B. Thus, the chance of hairs passing over the unitary blade structure without being cut is reduced. The unitary blade structure of Figure 7 has similarly staggered cutting elements and interconnecting elements 16, but in this embodiment the cutting elements are inclined at a small angle, e.g. less than 10° and more particularly at about 4° to the longitudinal direction of the blade structure, which may help to reduce risk of the skin being cut should the razor blade unit be moved sideways during shaving. The unitary blade structures of Figures 5 to 7 each have 33 cutting elements 11A, 11B..., 12A, 12B..., 13A, 13B.., but a larger or smaller number could be provided as desired. Figure 8 shows an assembled shaving cartridge with a unitary blade structure 10 as shown in Figures 5 and 6 assembled in a blade unit housing 1 of the form described above with reference to Figure 1. The blade unit structure is retained in the housing by clips 8 which wrap around the housing frame 2 adjacent the end 5 and engage the end support

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elements 14 of the blade structure.

There are, of course, many modifications which are possible without departing from the principles of the invention. Although not included in the embodiment specifically described above, the unitary blade structure could for example include a cap element, which might be similar to the guard element, located behind the third blade 12 and interconnected with the support elements 14 and possibly with the intermediate elements 16. Other modifications are also possible with the spirit and scope of the invention and it is the intention of the Applicants only to be limited by the appended claims.

Claims:

1. A cutting element in or for a safety razor blade unit, comprising a sharp cutting edge and being formed integrally with supporting elements from a single crystal ceramic material.
2. A unitary blade structure in or for a safety razor blade unit, comprising:
a cutting element with a sharp cutting edge;
support elements for mounting and positioning the cutting element in the blade unit; and
a further element disposed forwardly of the cutting edge,
said cutting element, supporting elements and further element all being integrally formed from a single crystal material.
3. A unitary blade structure according to claim 2, wherein the supporting elements are positioned at the opposite ends of the cutting element and interconnect the further element with the cutting element.
4. A unitary blade structure according to claim 2 or 3, wherein the further element is a guard element extending parallel with the cutting edge of the cutting element.
5. A unitary blade structure according to claim 2,3 or 4, wherein a plurality of parallel cutting elements are provided.
6. A unitary blade structure according to claim 2 or 3, wherein the further element is a second cutting element.

7. A unitary blade structure according to claim 6, wherein the cutting elements lie in respective parallel planes.
8. A unitary blade structure according to any of claims 2 to 7, including an integral cap member positioned behind the cutting element(s) and parallel thereto.
9. A unitary blade structure according to any of claims 2 to 8, including at least one intermediate transverse element interconnecting the cutting element(s) and the further element between the supporting elements.
10. A unitary blade structure in or for a safety razor blade unit, comprising two or more cutting elements with sharp cutting edges, the cutting elements being integrally formed with each other, and with other elements interconnecting the cutting elements, from a single crystal ceramic material.
11. A unitary blade structure according to claim 10, wherein two cutting elements are disposed one behind the other and have spaced parallel cutting edges.
12. A unitary blade structure according to claim 10 or 11, wherein the cutting edges of the cutting elements lie substantially in a common plane, the cutting elements are disposed in respective planes inclined to said common plane, and the interconnecting elements are spaced apart along the blade structure and extend transverse to the cutting elements and substantially parallel to the common plane of the cutting edges.
13. A unitary blade structure according to claim 10, 11 or 12, wherein there

is a multiplicity of cutting elements distributed along the blade structure and in the front to rear direction thereof.

14. A unitary blade structure according to any one of claims 10 to 13, wherein interconnecting elements extending forwardly from a cutting element are displaced along the cutting elements from the interconnecting elements extending rearwardly therefrom.

15. A unitary blade structure according to any one of claims 10 to 14, wherein the or each cutting element is formed at least partially by anisotropic etching.

16. A unitary blade structure according to any one of claims 2 to 15, wherein the sharp cutting edge of the or each cutting element is defined by facet surfaces shaped by etching the single crystal material.

17. A unitary blade structure according to any one of claims 2 to 16, wherein the single crystal material is silicon.

18. A unitary blade structure according to any one of claims 2 to 17, wherein the cutting edge of at least one cutting element is inclined to the longitudinal direction of the blade structure.

19. A safety razor blade unit comprising a cutting element as defined in claim 1 or a unitary blade structure as defined in any one of claims 2 to 18.

20. A method of making a cutting element for a safety razor blade unit, comprising the steps of:

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providing a wafer of single crystal material having a surface lying in a predetermined plane of the crystallographic structure; and

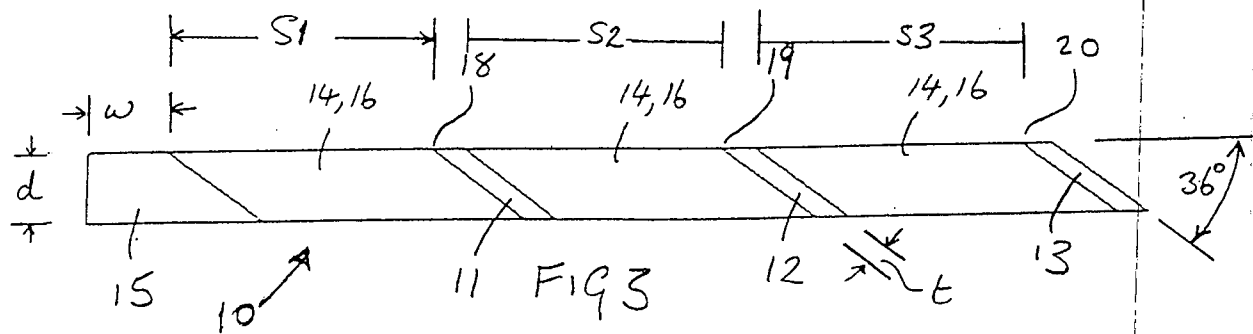
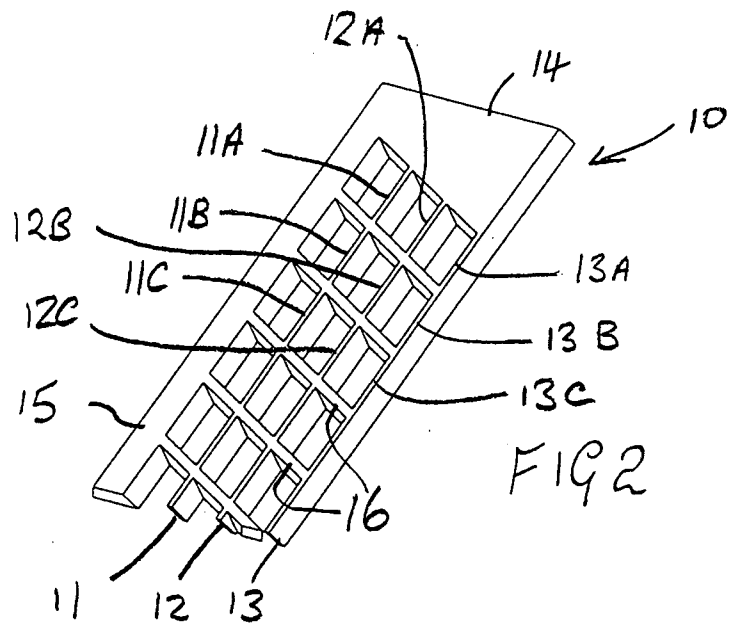
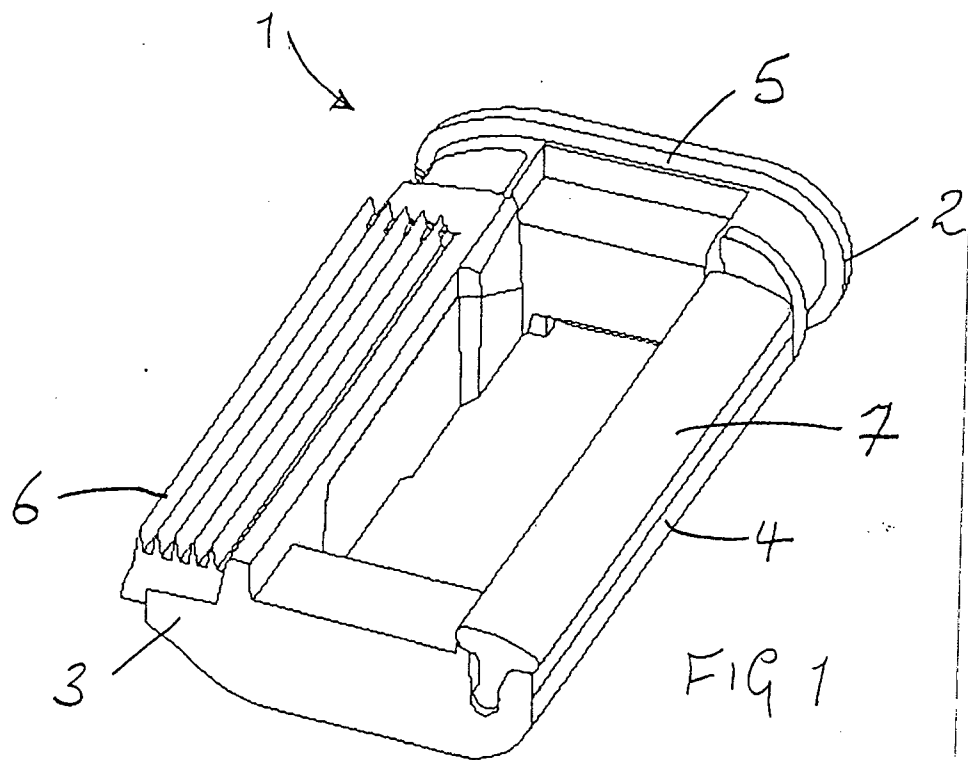
selectively removing crystal material at the surface by employing an etching process to form a planar cutting element inclined at an acute angle to the surface plane and having a sharp edge substantially at the surface plane.

21. A method according to claim 20, wherein a guard element substantially parallel to the cutting edge and spaced forwardly therefrom is formed from the wafer of single crystal material by the etching process, the guard element being integrally connected to the cutting element by interconnecting elements.

22. A method according to claim 20 or 21, wherein the etching process comprises anisotropic wet chemical etching.

23. A method according to any one of claims 20 to 22, wherein the etching process includes dry etching.

24. A safety razor blade unit comprising a blade member formed from silicon.



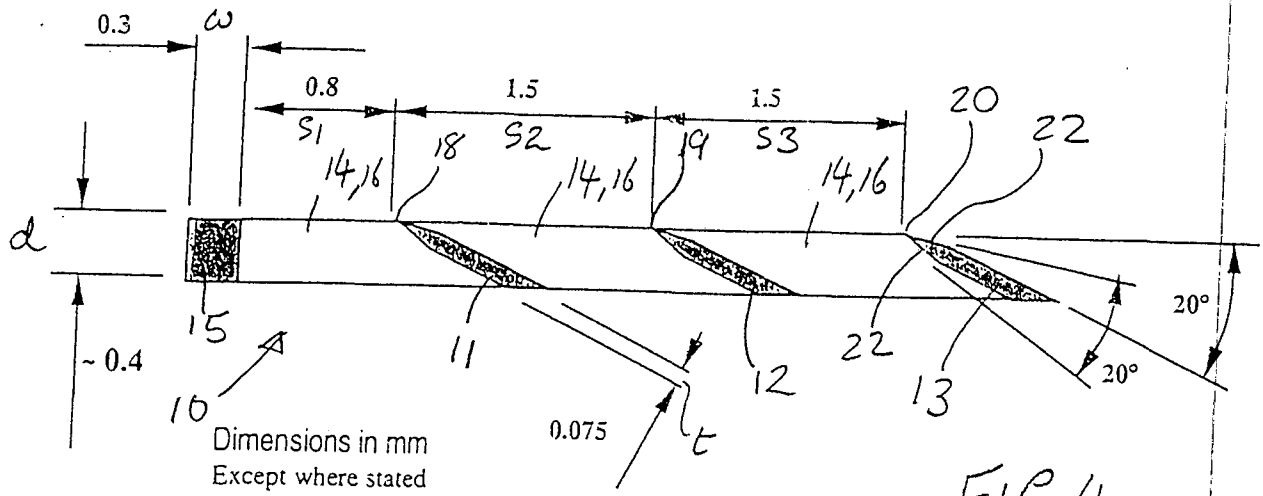


FIG 4:

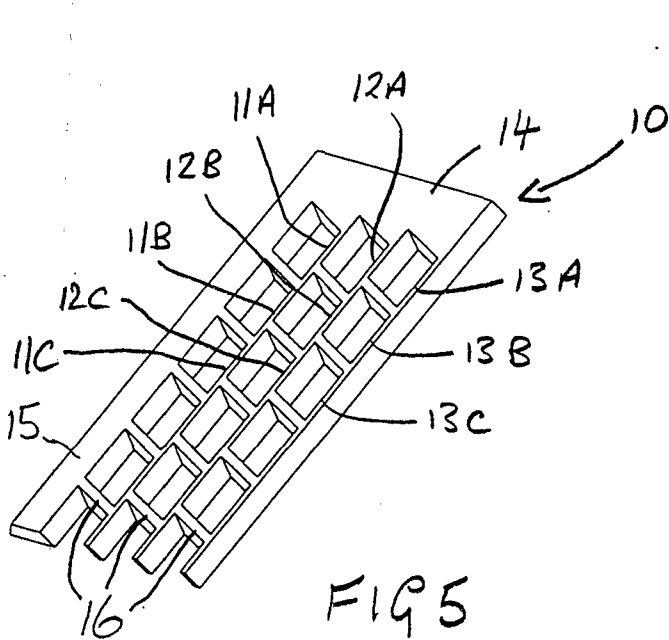


FIG 5

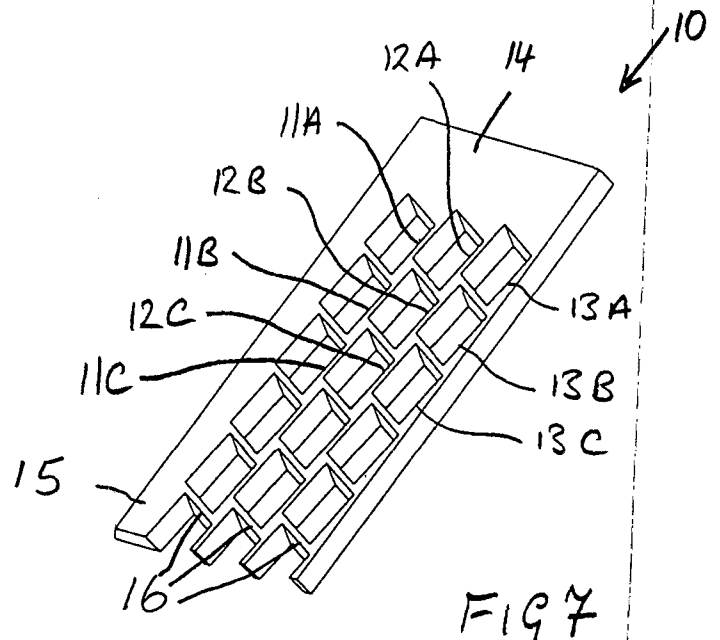


Fig 7

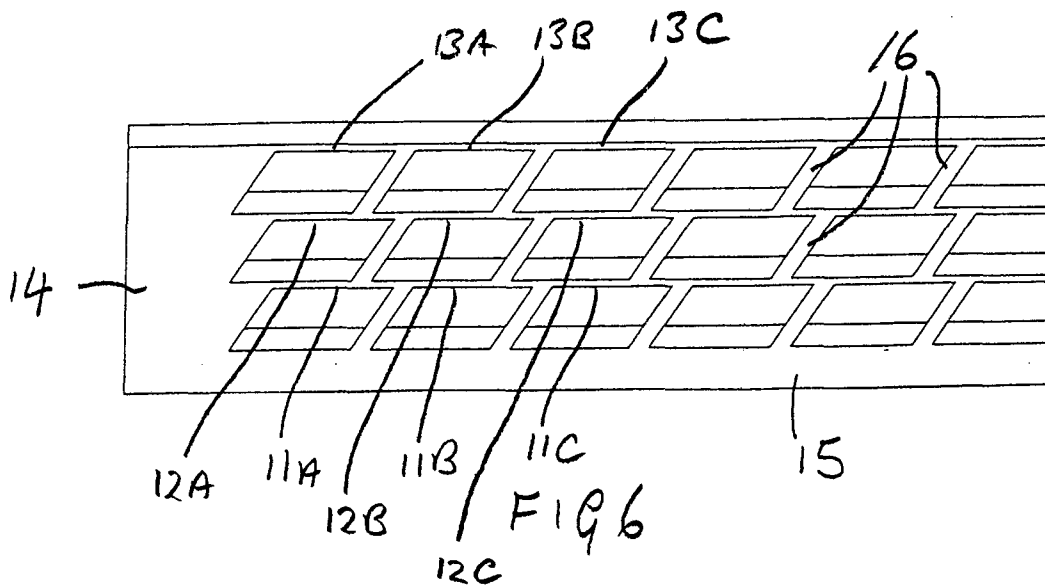


Fig 6

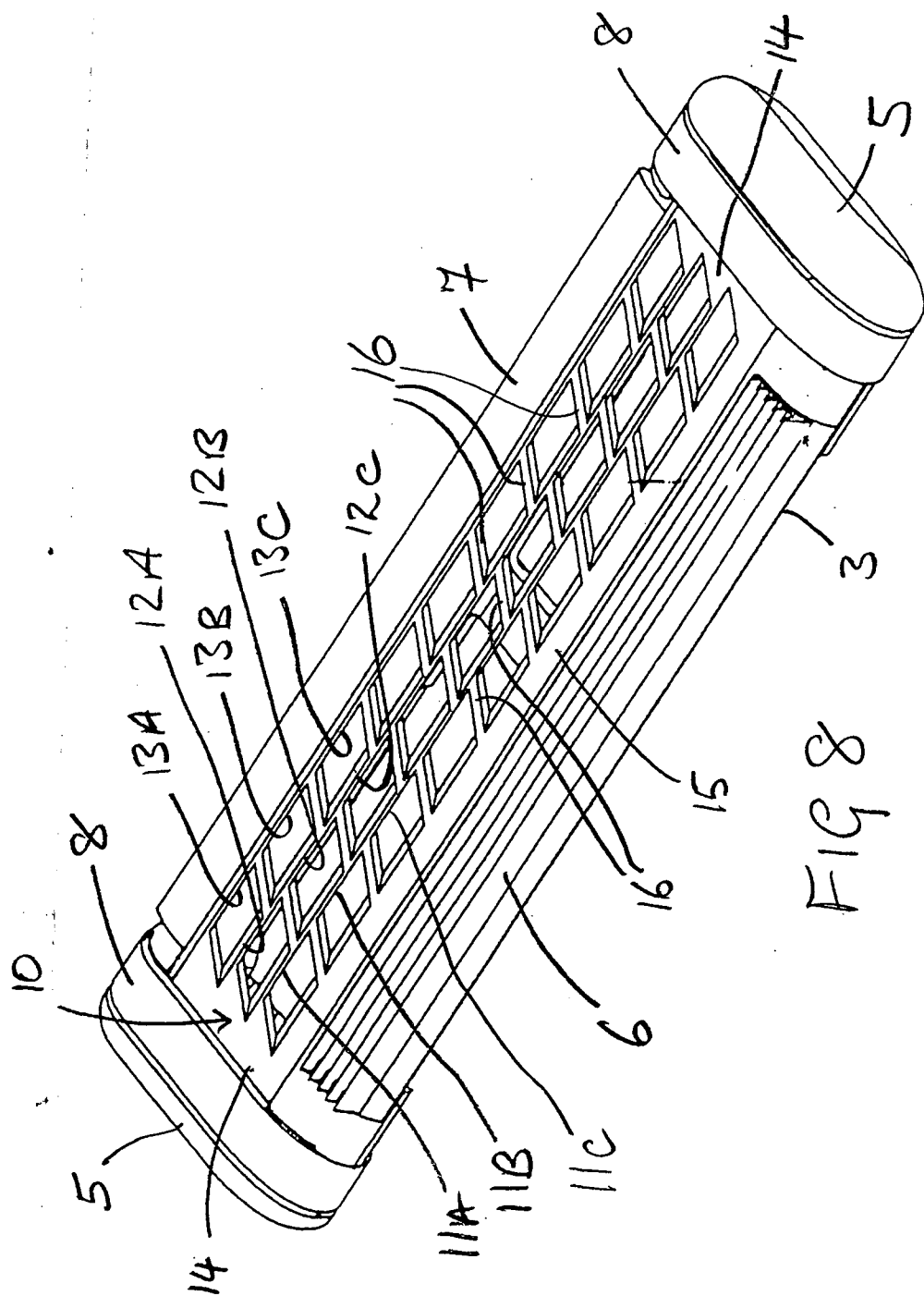


FIG 8

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Firmado: Kevin L. Powell


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AUTENTICACIÓN No. 867-05

CERTIFICA el cargo y funciones de **A. Exintaris** y la autenticidad de su sello y firma. Expedida mayo 15, 2000, en Londres

Firmado: **JAIME LOZADA PERDOMO**
Cónsul General de Colombia

Hay sello del Consulado General de Colombia en Londres

**MINISTERIO DE RELACIONES EXTERIORES
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CERTIFICA la firma y el cargo del funcionario consular **JAIME LOZADA PERDOMO**, el día 14 de junio, 2000.

(Firma) Ilegible

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Santafé de Bogotá, D.C.


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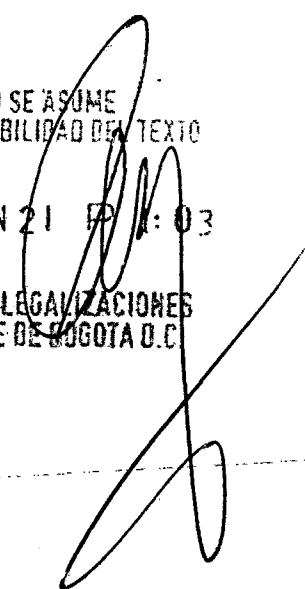
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Kevin L. Powell, all British subjects,
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Lane, Tokers Green, Reading, Berkshire
RG4 9EB and 9 Cranstown Close, Keen's Park,
Guildford, Surrey GU33HL, all in the
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hereby is enabled to apply,
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(Individual)

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A los 30 días del mes de Marzo
2000,

On this *30* day of
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personally appeared before me, a
Notary Public, in and for the above
mentioned county,

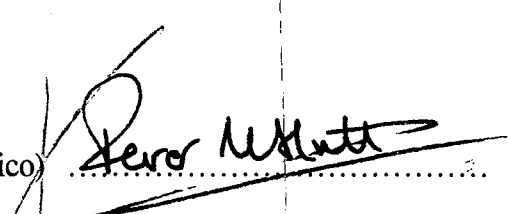
Robert White, Graham John Simms y
Kevin L. Powell.

**Robert White, Graham John Simms and
Kevin L. Powell**

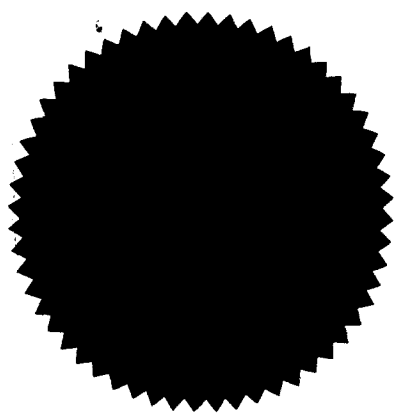
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For Foreign and Commonwealth Affairs*

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QUE A. EXINTARIS

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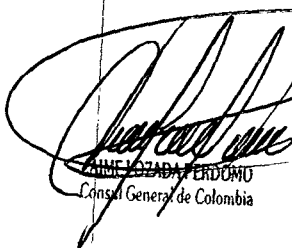
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DANIEL LOZADA PERDOMO
Consul General de Colombia

