Señor
SUPERINTENDENTE DE INDUSTRIA Y COMERCIO
DIVISION DE NUEVAS CREACIONES
E. S D.

Re: P1.-**THE GILLETTE COMPANY**.- Solicitud de Patente de Invención para **"TECNOLOGIA DE HOJAS DE AFEITAR"**.- Clase A. 45 .-Expediente número **01-015.472** .-

1. Me refiero a mi solicitud de patente de fecha 27 de Febrero de 2001.

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 estadinense número 09/515.421 de 29 de Febrero de 2000, junto con su traducción correspondiente a las legalizaciones y reivindicaciones de dicho documento; y

(2) Copia debidamente autenticada por el Notario Sexto del Circulo de Bogotá, de los documentos que acreditan la calidad de Traductor Oficial del señor Gabriel Rueda Chadid quien elaboró la traducción de la legalizaciones de la solicitud estadinense número 09/515.421 de 29 de Febrero de 2000.

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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EL SUSCRITO JEFE DEL AREA DE LEGALIZACIONES DE MINSTERIO DE RELACIONES EXTERIORES.

HACE CONSTAR

COMO NOTARIO SEXTO DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA
AUTENTICA QUE SE TENDO A LA VISTA
16 DIC 2000

Que el señor Gabriel Rueda, se encuentra debidamente registrado ante este Ministerio, como traductor e intérprete oficial para los idiomas INGLES -ESPAÑOL, ESPAÑOL - INGLES.

Para efectos de ésta certificación el interesado presenta copia autenticada de la certificación del Ministerio de Justicia acerca de la vigencia de la resolución 5096 de 1982.

COMO NOTARIO SEXTO ENCARGADO DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE SE TENDO A LA VISTA
21 AGO. 1998

Dada en Santafé de Bogotá, D.C. a los veintiún (21) días del mes de diciembre de mil novecientos noventa y ocho

COMO NOTARIO SEXTO ENCARGADO DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE SE TENDO A LA VISTA
21 FEB. 200
PABLO MENDEZ BARAJAS

Nelson Sánchez Torres
Jefe Area de Legalizaciones

COMO NOTARIO SEXTO ENCARGADO DEL CIRCULO DE SANTAFE DE BOGOTA, HAGO CONSTAR QUE ESTA COPIA FOTOSTATICA CONCIDE CON EL ORIGINAL QUE SE TENDO A LA VISTA
01 JUL 1998

01 SET 2000

COMO NOTARIO SEXTO DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE SE TENDO A LA VISTA
6 DIC. 2000

NST/glm.

República de Colombia

Ministerio de Justicia y del Derecho

COMO NOTARIO SEXTO DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE HE TENIDO A LA VISTA
13 DIC. 2000

EL SECRETARIO GENERAL DEL MINISTERIO DE JUSTICIA Y DEL DERECHO

CERTIFICA:

Que por Resolución 5996 del 29 de noviembre de 1982, le fue expedida licencia para ejercer funciones de Traductor e Intérprete Oficial en los idiomas INGLES-ESPAÑOL, ESPAÑOL-INGLES a GABRIEL RUEDA CHADID, identificado con la cedula de ciudadanía No. 17.124.145 expedida en Bogotá. Que dicha resolución se encuentra vigente en la fecha.

A solicitud del interesado, en Santafé de Bogotá a los 17 días del mes de noviembre de 1994.

COMO NOTARIO SEXTO DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE HE TENIDO A LA VISTA
24 SEP. 2001

COMO NOTARIO SEXTO DE SANTAFE DE BOGOTA
HAGO CONSTAR
QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE HE TENIDO A LA VISTA
31 AGO. 1998

JORGE LUIS SABOGAL SABOGAL

SECRETARIO GENERAL

01 SET. 2001

01 JUL 1998

COMO NOTARIO SEXTO DE SANTAFE DE BOGOTA
HAGO CONSTAR
2001

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23

TRIBUNAL SUPERIOR DEL DISTRITO JUDICIAL DE SANTAFE DE BOGOTA
SECRETARIA GENERAL

LA SUSCRITA SECRETARIA DEL H. TRIBUNAL SUPERIOR DEL DISTRITO JUDICIAL DE SANTAFE DE BOGOTA,

NOTARIO SEXTO DE SANTAFE DE BOGOTA HAGO CONSTAR QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE HE TENIDO A LA VISTA 13 DIC. 2000

C E R T I F I C A :

Que el Acuerdo No. 183 de diciembre 3 de 1982 emanado de esta Corporación, por medio del cual dió posesión como TRADUCTOR E INTERPRETE OFICIAL DE INGLES-ESPAÑOL ESPAÑOL-INGLES, en virtud de la Resolución No. 5996 de 21 AGO. 1998 se encuentra VIGENTE.

COMO NOTARIO SEXTO DE SANTAFE DE BOGOTA HAGO CONSTAR QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE HE TENIDO A LA VISTA 01 SET. 2000

GABRIEL RUEDA CHADID, identificado con Cédula de Ciudadanía Número 17.124.145 de Bogotá

NOTARIA SEXTA DE SANTAFE DE BOGOTA HAGO CONSTAR QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE HE TENIDO A LA VISTA SANTAFE DE BOGOTA 29 FEB 2001 PABLO MENDEZ BARAJAS

21 AGO. 1998

Se expide en Santafé de Bogotá D.C., a dieciseis (16) de noviembre mil novecientos noventa y cuatro (1994).

MARIA INES RODRIGUEZ TORRES
SECRETARIA

COMO NOTARIO SEXTO DE SANTAFE DE BOGOTA HAGO CONSTAR QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE HE TENIDO A LA VISTA SANTAFE DE BOGOTA 08 SET. 1998

COMO NOTARIO SEXTO DE SANTAFE DE BOGOTA HAGO CONSTAR QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE HE TENIDO A LA VISTA 06 ENE. 1999 01 JUL 1998 JUAN DANIEL CASTRO MEDINA NOTARIO

NOTARIO SEXTO DE SANTAFE DE BOGOTA HAGO CONSTAR QUE LA FOTOCOPIA CONCIDE CON LA FOTOCOPIA AUTENTICA QUE HE TENIDO A LA VISTA 24 AGO. 1998 JUAN DANIEL CASTRO MEDINA NOTARIO

crm./

The Gillette Company 01.015.472

REF: LLC-0030-2001. La presente es Traducción Oficial de un documento presentado originalmente en inglés. Esta traducción es elaborada por Gabriel Rueda Chadid (Traductor Oficial).

ESTADOS UNIDOS DE AMERICA

A TODOS AQUELLOS QUE LLEGAREN A LEER EL CONTENIDO DEL PRESENTE DOCUMENTO LES CERTIFICAMOS:

DEPARTAMENTO DE COMERCIO DE LOS ESTADOS UNIDOS

Oficina de Marcas y Patentes de los Estados Unidos

Marzo 14, 2001

Se certifica que anexo se encuentra fiel copia de los Registros de la Oficina de Marcas y Patentes de los Estados Unidos correspondientes a los documentos de la patente solicitada y cuya identificación aparece más adelante, la cual cumplió con los requerimientos exigidos para que se otorgue una fecha de presentación de acuerdo con los dispuesto en la Sección 35 USC 111.

Número de Solicitud: 09/515.421

Fecha de presentación: Febrero 29, 2000

Por autorización del

COMISIONADO DE MARCAS REGISTRADAS Y PATENTES

P. SWAIN

Funcionario Encargado de Certificaciones (Hay firma y sello)

GABRIEL RUEDA CHADID
TRADUCTOR OFICIAL
RESOLUCION 5996 DE NOV. 29-00
MINISTERIO DE JUSTICIA

FISH & RICHARDSON P.C. 03-01-00

Febrero 29, 2000

Expediente No. 00216-483001

Box Patent Application (Casilla de Solicitud de Patente)

Comisionado Adjunto de Patentes

Washington, DC 20231

Se radica una nueva solicitud original de patente que corresponde a:

Solicitante: NEVILLE SONNENBERG, ANDREW ZHUK, CHARLES WHITE, STEVEN HAHN Y COLIN CLIPSTONE

Título del Invento: TECNOLOGIA DE AFEITADORA

Se incluyen los siguientes documentos, junto con los que se exigen para que se otorgue fecha de radicación según l dispuesto en la sección 37 CFR 1.53(b):

	Páginas
Especificaciones	5
Reivindicaciones	4
Resumen	1
Declaración	[Se presentará en fecha posterior]
Dibujos	1

Adjunto: - Tarjeta Postal.

Derechos básicos de presentación	$890
Total de Reivindicaciones superiores a 20 por $18	$306
Reivindicaciones independientes superiores a 3 por $78	$78
Derechos para reivindicaciones dependientes múltiples	$260
Total de derechos de presentación	$1334

CERTIFICADO DE ENVIO POR CORREO EXPRESO (37 CFR 1.10)

No. de Etiqueta de Correo Expreso: EL228033446,

Certifico que los siguientes documentos en relación con la solicitud mencionada fueron depositados en el servicio postal de los Estados Unidos, correo Expreso "Oficina Postal al Destinatario" en Washington, D.C. 20231.

Fecha de Depósito: Febrero 29, 2000. Hay firma:

Se adjunta cheque para cubrir los derechos de presentación. Favor aplicar otros derechos o créditos a la cuenta 08-1050 haciendo referencia al número de expediente que apare e citado anteriormente.

En caso de que este dinero sea incompleto, o si hay necesidad de conferencia por vía telefónica, favor comunicarse con el suscrito en el número (617) 542-5070.

Favor acusar recibo de esta solicitud mediante la devolución de la tarjeta adjunta.

Favor enviar toda correspondencia a:

WILLIAM E. BOOTH
Fish & Richardson P.C.
225 Franklin Street
Boston, MA 02110-2804

Atentamente,

Firmado por: William E. Booth

Registro No. 28,933

Adjunto

WEB/mgc

GABRIEL RUEDA CHADID
TRADUCTOR OFICIAL
RESOLUCION 5996 DE NOV. 29-95
MINISTERIO DE JUSTICIA

REIVINDICACIONES **Expediente No. 00216-483001**

1. Una afeitadora que comprende:

un substrato con un borde cortante definido por una punta afilada y caras adyacentes, una capa de revestimiento duro sobre el mencionado borde de corte,

una capa superpuesta de un material que contiene cromo sobre dicha capa de revestimiento duro, y

una capa externa de revestimiento de politetrafluoro-etileno colocada por encima de la mencionada capa superpuesta.

2. La hoja descrita en la reivindicación 1 donde el mencionado revestimiento duro está hecho de un material con contenido de carbono.

3. La hoja de afeitar descrita en la reivindicación 2 donde el mencionado material con contenido de carbono comprende diamante.

4. La hoja de afeitar descrita en la reivindicación 2 donde el mencionado revestimiento de carbono endurecid comprende un material de carbono similar al diamante.

5. La hoja de afeitar descrita en la reivindicación 2 donde el mencionado revestimiento al carbono endurecido comprende un material amorfo de diamante.

6. La hoja de afeitar descrita en la reivindicación 1 donde la mencionada capa sobrepuesta es de cromo.

7. La hoja de afeitar descrita en la reivindicación 1 donde la mencionada capa sobrepuesta está conformada por una aleación con contenido de cromo compatible con el politetrafluoroetileno

8. La hoja de afeitar descrita en la reivindicación 4 donde la mencionada capa sobrepuesta consiste en cromo.

9. La hoja de afeitar descrita en la reivindicación 7 donde la mencionada aleación es de platino cromo.

10. La hoja de afeitar descrita en la reivindicación 1 que comprende además una intercapa entre el mencionado substrato y la mencionada capa de revestimiento de carbon endurecido.

11. La hoja de afeitar descrita en la reivindicación 10 donde la mencionada intercapa es de niobio.

12. La hoja de afeitar descrita en la reivindicación 10 donde la mencionada intercapa está conformada por un material que contiene cromo.

13. La hoja de afeitar descrita en las reivindicaciones 6, 7, 8 o 9 donde la mencionada capa de sobreposición se somete a un esfuerzo de compresión.

14. La hoja de afeitar descrita en la reivindicación 1 donde el mencionado politetrafluoroetileno es Krytox LW1200.

15. La hoja de afeitar descrita en la reivindicación 4 que comprende además una intercapa de niobio entre el mencionado substrato y el revestimiento endurecido ya mencionado.

16. La hoja de afeitar descrita en la reivindicación 8 donde el mencionado politetrafluoroetileno es Krytox LW1200.

17. La hoja de afeitar descrita en la reivindicación 1 donde la mencionada capa de revestimiento endurecida tiene un espesor inferior a 2000 angstroms.

18. La hoja de afeitar descrita en la reivindicación 1 donde la mencionada capa sobrepuesta tiene un espesor entre 100 y 500 angstroms.

19. La hoja de afeitar descrita en la reivindicación 1 donde la mencionada capa externa tiene un espesor entre 100 y 5.000 angstroms.

20. La hoja de afeitar descrita en las reivindicaciones 1, 8 16 o 17 donde la mencionada hoja de afeitar tiene un borde cortante que tiene un menor redondeo con respecto de las afeitadas repetitivas que lo que tendría sin la mencionada capa de sobreposición.

21. Una afeitadora que comprende un mango, una envoltura conectada con el mencionado mango y por lo menos una hoja de afeitar instalada en el mencionado alojamiento, y donde dicha hoja de afeitar comprende

un substrato con un borde de corte definido por una

punta afilada y facetas adyacentes,

una capa de revestimiento endurecido sobre dicho borde cortante, una capa de sobreposición de material que contiene cromo sobre dicha capa de revestimiento endurecido y una capa externa de revestimiento de politetrafluoroetileno sobre la mencionada capa de sobreposición.

22. La afeitadora descrita en la reivindicación 21 donde el mencionado revestimiento endurecido está hecho de un material que contiene carbono.

23. La afeitadora descrita en la reivindicación 22 que comprende además una intercapa de niobio entre el mencionado substrato y el mencionado revestimiento endurecido.

24. Una afeitadora descrita en las reivindicaciones 21 o 22 donde la donde la mencionada capa de sobreposición está conformada por cromo.

25. Un método para elaborar una hoja de afeitar que comprende el suministro de un substrato con un borde cortante definido por una punta afilada y facetas adyacentes,

adicionando una capa de revestimiento endurecido sobre el mencionado borde cortante, adicionando una capa de sobreposición de material con contenido de cromo sobre dicha capa de revestimiento endurecido, y la adición de una externa de revestimiento de politetrafluoroetileno por encima de dicha capa de sobreposición.

26. El método de la reivindicación 25 donde la mencionada adición de una capa de revestimiento endurecido

incluye el depósito al vapor de un material con contenido de carbono.

27. El método descrito en la reivindicación 25 donde la mencionada adición de una capa de material con contenido de cromo incluye depositar al vapor el mencionado material con contenido de cromo.

28. El método descrito en la reivindicación 27 donde la mencionada adición de una capa de material con contenido de cromo incluye el depósito electrónico bajo condiciones tales que se obtenga un material con esfuerzo compresivo.

29. El método descrito en la reivindicación 28 donde el mencionado procedimiento de depósito electrónico incluye la aplicación de una polarización de corriente DC al mencionado objetivo cuyo valor negativo es superior a -50 voltios o bien un esquema equivalente de polarización RF.

30. El método descrito en la reivindicación 28 donde el mencionado procedimiento de depósito electrónico incluye la aplicación de una polarización DC al mencionado objetivo cuyo valor negativo es superior a -200 voltios o un esquema equivalente de polarización RF.

La anterior es Traducción Oficial de un documento presentado originalmente en inglés. Esta traducción fue realizada por **GABRIEL RUEDA CHADID (Traductor Oficial)**. Resolución 5996 del Minjusticia, por lo cual estampo mi Sello y Firmo.
Bogotá D.C., Abril 6 del 2001.

GABRIEL RUEDA CHADID
TRADUCTOR OFICIAL
RESOLUCION 5996 DE NOV. 30-00
MINISTERIO DE JUSTICIA

The Gillette Co
01.015.492
32

PA 375088

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

March 14, 2001

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: ***09/515,421***
FILING DATE: ***February 29, 2000***

By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

P. SWAIN
Certifying Officer

03-01-00

A

FISH & RICHARDSON P.C.

225 Franklin Street
Boston, Massachusetts
02110-2804

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617 542-8906

Web Site
www.fr.com

February 29, 2000

Attorney Docket No.: 00216-483001

Box Patent Application
Assistant Commissioner for Patents
Washington, DC 20231

Presented for filing is a new original patent application of:

Applicant: NEVILLE SONNENBERG, ANDREW ZHUK, CHARLES WHITE, STEVEN HAHN AND COLIN CLIPSTONE

Title: RAZOR BLADE TECHNOLOGY

Enclosed are the following papers, including those required to receive a filing date under 37 CFR 1.53(b):

	Pages
Specification	5
Claims	4
Abstract	1
Declaration	[To be Filed at a Later Date]
Drawing(s)	1

Enclosures:
— Postcard.

Basic filing fee	$690
Total claims in excess of 20 times $18	$306
Independent claims in excess of 3 times $78	$78
Fee for multiple dependent claims	$260
Total filing fee:	$1334

CERTIFICATE OF MAILING BY EXPRESS MAIL

Express Mail Label No. EL228013446

I hereby certify under 37 CFR §1.10 that this correspondence is being deposited with the United States Postal Service as Express Mail Post Office to Addressee with sufficient postage on the date indicated below and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

February 29, 2000
Date of Deposit

Samantha Bell
Signature

Samantha Bell
Typed or Printed Name of Person Signing Certificate

A check for the filing fee is enclosed. Please apply any other required fees or any credits to deposit account 06-1050, referencing the attorney docket number shown above.

If this application is found to be incomplete, or if a telephone conference would otherwise be helpful, please call the undersigned at (617) 542-5070.

Kindly acknowledge receipt of this application by returning the enclosed postcard.

Please send all correspondence to:

WILLIAM E. BOOTH
Fish & Richardson P.C.
225 Franklin Street
Boston, MA 02110-2804

Respectfully submitted,

William E. Booth
Reg. No. 28,933
Enclosures
WEB/mgc
20052269.doc

Attorney Docket No. 00216-483001

Razor Blade Technology

The invention relates to improvements to razors and razor blades.

A razor blade is typically formed of a suitable substrate material such as stainless steel, and a cutting edge is formed with a wedge-shaped configuration with an ultimate tip having a radius less than about 1000 angstroms, e.g., about 200 - 300 angstroms. Hard coatings such as diamond, amorphous diamond, diamond-like carbon (DLC) material, nitrides, carbides, oxides or ceramics are often used to improve strength, corrosion resistance and shaving ability, maintaining needed strength while permitting thinner edges with lower cutting forces to be used. Polytetrafluoroethylene (PTFE) outer layer can be used to provide friction reduction. Interlayers of niobium or chromium containing materials can aid in improving the binding between the substrate, typically stainless steel, and hard carbon coatings, such as DLC. Examples of razor blade cutting edge structures and processes of manufacture are described in U.S. Patents Nos. 5,295,305; 5,232,568; 4,933,058; 5,032,243; 5,497,550; 5,940,975; 5,669,144; EP 0591334; and PCT 92/03330, which are hereby incorporated by reference.

In use, the ultimate tip of the edges having hard coatings and polytetrafluoroethylene outer layers can become more rounded after repeated shaves such that there is an increase in the tip radius and a generally perceived decrease in shaving performance.

Summary of the Invention

In one aspect, the invention features, in general, a razor blade including a substrate with a cutting edge defined by a sharpened tip and adjacent facets, a layer of hard coating on the cutting edge, an overcoat layer of a chromium containing material on the layer of hard coating, and an outer layer of polytetrafluoroethylene coating on the overcoat layer.

In another aspect the invention features, in general, a shaving razor including a handle and a razor head with a blade having a substrate with a cutting edge defined by a sharpened tip and adjacent facets, a layer of hard coating on the cutting edge, an overcoat layer of a chromium containing material on the layer of hard coating, and an outer layer of polytetrafluoroethylene

coating on the overcoat layer.

Particular embodiments of the invention may include one or more of the following features. In particular embodiments, the hard coating material can be made of carbon containing materials (e.g., diamond, amorphous diamond or DLC), nitrides, carbides, oxides or other ceramics. The hard coating layer can have a thickness less than 2,000 angstroms. The overcoat layer can be made of chromium or a chromium containing alloy compatible with polytetrafluoroethylene such as a chromium platinum alloy. The overcoat layer can be between 100 and 500 angstroms thick. The blade can include an interlayer between the substrate and the layer of hard coating. The interlayer can include niobium or a chromium containing material. The polytetrafluoroethylene can be Krytox LW1200 available from DuPont. The PTFE outer layer can be between 100 and 5000 angstroms thick.

In another aspect, the invention features, in general, making a razor blade by providing a substrate with a cutting edge defined by a sharpened tip and adjacent facets, adding a layer of hard coating on the cutting edge, adding an overcoat layer of a chromium containing material on the layer of hard coating, and adding an outer layer of polytetrafluoroethylene coating over the overcoat layer.

Particular embodiments of the invention may include one or more of the following features. In particular embodiments the layers can be added by physical vapor deposition (i.e., sputtering) or by chemical vapor deposition. The chromium containing layer, preferably chromium, can be sputter deposited under conditions that result in a compressively stressed coating. The sputter deposition of chromium containing materials can include applying a DC bias to the target that is more negative than -50 volts, preferably more negative than -200 volts. Alternatively an appropriate RF bias scheme can be used to achieve an equivalent chromium layer.

Embodiments of the invention may include one or more of the following advantages. The use of a chromium containing overcoat layer provides improved adhesion of the polytetrafluorethylene outer layer to the hard coating layer. The razor blade has improved edge strength provided by hard coating and has reduced tip rounding with repeated shaves. Reduced

tip rounding minimizes the increase in cutting force thereby maintaining excellent shaving performance. The razor blade has excellent shaving characteristics from the first shave onwards.

Other features and advantages of the invention will be apparent from the following description of a particular embodiment and from the claims.

Description of the Drawings

FIG. 1 is a vertical sectional view of a cutting edge portion of a razor blade.

FIG.2 is a perspective view of a shaving razor including the FIG. 1 razor blade.

Description of a Particular Embodiment

Referring to FIG. 1, there is shown razor blade 10 including substrate 12, interlayer 14, hard coating layer 16, overcoat layer 18, and outer layer 20. The substrate 12 is typically made of stainless steel (though other substrates can be employed) and has an ultimate edge sharpened to a tip radius of less than 1,000 angstroms, preferably 200 to 300 angstroms, and has a profile with side facets 22 at an included angle of between 15 and 30 degrees, preferably about 19 degrees, measured at 40 microns from the tip.

Interlayer 14 is used to facilitate bonding of the hard coating layer to the substrate. Examples of suitable interlayer material are niobium and chromium containing material. A particular interlayer is made of niobium greater than 100 angstroms and preferably less than 500 angstroms thick. PCT 92/03330 describes use of a niobium interlayer.

Hard coating layer 16 provides improved strength, corrosion resistance and shaving ability and can be made from carbon containing materials (e.g., diamond, amorphous diamond or DLC), nitrides (e.g., boron nitride, niobium nitride or titanium nitride), carbides (e.g., silicon carbide), oxides (e.g., alumina, zirconia) or other ceramic materials. The carbon containing materials can be doped with other elements, such as tungsten, titanium or chromium by including these additives , for example in the target during application by sputtering. The materials can also incorporate hydrogen, e.g., hydrogenated DLC. Preferably coating layer 16 is made of diamond, amorphous diamond or DLC. A particular embodiment includes DLC less than 2,000

angstroms, preferably less than 1,000 angstroms. DLC layers and methods of deposition are described in U.S. Patent No. 5,232,568. As described in the "Handbook of Physical Vapor Deposition (PVD) Processing," DLC is an amorphous carbon material that exhibits many of the desirable properties of diamond but does not have the crystalline structure of diamond.

Overcoat layer 18 is used to reduce the tip rounding of the hard coated edge and to facilitate bonding of the outer layer to the hard coating while still maintaining the benefits of both. Overcoat layer 18 is preferably made of chromium containing material, e.g., chromium or chromium alloys that are compatible with polytetrafluoroethylene, e.g., CrPt. A particular overcoat layer is chromium about 100-200 angstroms thick. Blade 10 has a cutting edge that has less rounding with repeated shaves than it would have without the overcoat layer.

Outer layer 20 is used to provide reduced friction and includes polytetrafluoroethylene and is sometimes referred to as a telomer. A particular polytetrafluoroethylene material is Krytox LW 1200 available from DuPont. This material is a nonflammable and stable dry lubricant that consists of small particles that yield stable dispersions. It is furnished as an aqueous dispersion of 20% solids by weight and can be applied by dipping, spraying, or brushing, and can thereafter be air dried or melt coated. The layer is preferably less than 5,000 angstroms and could typically be 1,500 angstroms to 4,000 angstroms, and can be as thin as 100 angstroms, provided that a continuous coating is maintained. Provided that a continuous coating is achieved, reduced telomer coating thickness can provide improved first shave results. U.S. Patents Nos. 5,263,256 and 5,985,459, which are hereby incorporated by reference, describe techniques which can be used to reduce the thickness of an applied telomer layer.

Razor blade 10 is made generally according to the processes described in the above referenced patents. A particular embodiment includes a niobium interlayer14, DLC hard coating layer 16, chromium overcoat layer 18, and Krytox LW1200 polytetrafluoroethylene outer coat layer 20. Chromium overcoat layer 18 is deposited to a minimum of 100 angstroms and a maximum of 500 angstroms. It is deposited by sputtering using a DC bias (more negative than -50 volts and preferably more negative than -200 volts) and pressure of about 2 millitorr argon. The increased negative bias is believed to promote a compressive stress (as opposed to a tensile

stress), in the chromium overcoat layer which is believed to promote improved resistance to tip rounding while maintaining good shaving performance. Blade 10 preferably has a tip radius of about 200- 400 angstroms, measured by SEM after application of overcoat layer 18 and before adding outer layer 20.

Referring to FIG. 2, blade 10 can be used in shaving razor 110, which includes handle 112 and replaceable shaving cartridge 114. Cartridge 14 includes housing 116, which carries three blades 10, guard 120 and cap 122. Blades 10 are movably mounted, as described, e.g., in U.S. Patent No. 5,918,369, which is incorporated by reference. Cartridge 114 also includes interconnect member 124 on which housing 116 is pivotally mounted at two arms 128. Interconnect member 124 includes a base 127 which is replaceably connected to handle 112. Alternatively, blade 10 can be used in other razors having one, two or more than three blades, double-sided blades, and razors that do not have movable blades or pivoting heads where the cartridge is either replaceable or permanently attached to a razor handle.

In use, razor blade 10 has excellent shaving characteristics from the first shave onwards. Blade 10 has improved edge strength provided by hard coating and has reduced tip rounding with repeated shaves provided by the overlayer coating while maintaining excellent shave characteristics.

Other embodiments of the invention are within the scope of the appended claims.

What is claimed is:

1. A razor blade comprising

a substrate with a cutting edge defined by a sharpened tip and adjacent facets,

a layer of hard coating on said cutting edge,

an overcoat layer of a chromium containing material on said layer of hard coating, and

an outer layer of polytetrafluoroethylene coating over said overcoat layer.

2. The blade of claim 1 wherein said hard coating is made of a carbon containing material.

3. The blade of claim 2 wherein said carbon containing material comprises diamond.

4. The blade of claim 2 wherein said hard carbon coating comprises diamond-like carbon material.

5. The blade of claim 2 wherein said hard carbon coating comprises amorphous diamond material.

6. The blade of claim 1 wherein said overcoat layer consists of chromium.

7. The blade of claim 1 wherein said overcoat layer consists of a chromium containing alloy compatible with polytetrafluoroethylene.

8. The blade of claim 4 wherein said overcoat layer consists of chromium.

9. The blade of claim 7 wherein said alloy is a chromium platinum alloy.

10. The blade of claim 1 further comprising an interlayer between said substrate and said layer of

hard carbon coating.

11. The blade of claim 10 wherein said interlayer comprises niobium.

12. The blade of claim 10 wherein said interlayer comprises a chromium containing material.

13. The blade of claim 6, 7, 8, or 9 wherein said overcoat layer is compressively stressed.

14. The blade of claim 1 wherein said polytetrafluoroethylene is Krytox LW1200.

15. The blade of claim 4 further comprising a niobium interlayer between said substrate and said hard coating.

16. The blade of claim 8 wherein said polytetrafluoroethylene is Krytox LW1200.

17. The blade of claim 1 wherein said hard coating layer has a thickness less than 2,000 angstroms.

18. The blade of claim 1 wherein said overcoat layer is between 100 and 500 angstroms thick.

19. The blade of claim 1 wherein said outer layer is between 100 and 5,000 angstroms thick.

20. The blade of claim1, 8, 16 or 17 wherein said blade has a cutting edge that has less rounding with repeated shaves than it would have without said overcoat layer.

21. A shaving razor comprising
a handle,
a housing connected to said handle, and

at least one razor blade mounted in said housing, said blade comprising

a substrate with a cutting edge defined by a sharpened tip and adjacent facets,

a layer of hard coating on said cutting edge,

an overcoat layer of a chromium containing material on said layer of hard coating, and

a outer layer of polytetrafluoroethylene coating over said overcoat layer.

22. The razor of claim 21 wherein said hard coating is made of a carbon containing material.

23. The razor of claim 22 further comprising a niobium interlayer between said substrate and said hard coating.

24. The razor of claim 21 or 22 wherein said overcoat layer consists of chromium.

25. A method of making a razor blade comprising

providing a substrate with a cutting edge defined by a sharpened tip and adjacent facets,

adding a layer of hard coating on said cutting edge,

adding an overcoat layer of a chromium containing material on said layer of hard coating, and

adding an outer layer of polytetrafluoroethylene coating over said overcoat layer.

26. The method of claim 25 wherein said adding a layer of hard coating includes vapor depositing a carbon containing material.

27. The method of claim 25 wherein said adding a layer of chromium containing material includes vapor depositing said chromium containing material.

28. The method of claim 27 wherein said adding a layer of chromium containing material includes sputter depositing under conditions to result in compressively stressed material.

29. The method of claim 28 wherein said sputtering includes applying a DC bias to said target that is more negative than -50 volts or an equivalent RF bias scheme.

30. The method of claim 28 wherein said sputtering includes applying a DC bias to said target that is more negative than -200 volts or an equivalent RF bias scheme.

Abstract of the Disclosure

A razor blade including a substrate with a cutting edge defined by a sharpened tip and adjacent facets, a layer of hard coating on the cutting edge, an overcoat layer of a chromium containing material on the layer of hard carbon coating, and an outer layer of polytetrafluoroethylene coating over the overcoat layer.

Attorney's Docket No.: 00216-483001
Client's Ref. No.: Case 8073

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled RAZOR BLADE TECHNOLOGY, the specification of which:

[X] is attached hereto.
[] was filed on _ as Application Serial No. _ and was amended on _____.
[] was described and claimed in PCT International Application No. _____ filed on _____ and as amended under PCT Article 19 on _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information I know to be material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim the benefit under Title 35, United States Code, §119(e)(1) of any United States provisional application(s) listed below:

U.S. Serial No.	Filing Date	Status

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose all information I know to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56(a) which became available between the filing date of the prior application and the national or PCT international filing date of this application:

U.S. Serial No.	Filing Date	Status

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

Country	Application No.	Filing Date	Priority Claimed

Attorney's Docket No.: 00216-483001
Client's Ref. No.: Case 8073

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

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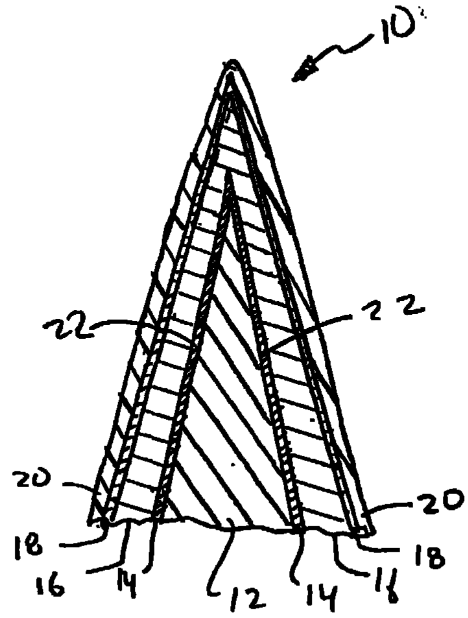
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FIG. 1

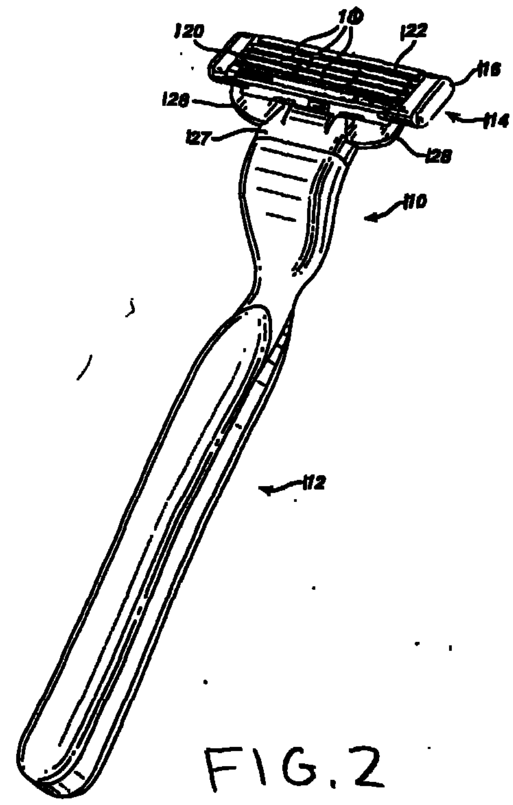
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FIG. 2