



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

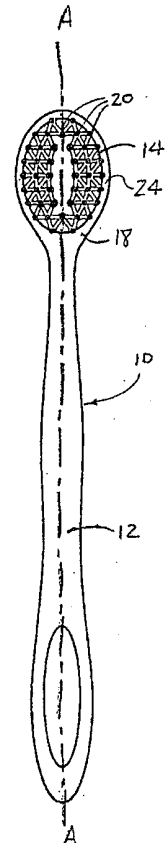
<p>(51) International Patent Classification ⁷ : A46B 9/10, 3/00</p>	<p>A1</p>	<p>(11) International Publication Number: WO 00/47083 (43) International Publication Date: 17 August 2000 (17.08.00)</p>
---	------------------	---

<p>(21) International Application Number: PCT/US00/03333 (22) International Filing Date: 9 February 2000 (09.02.00) (30) Priority Data: 09/247,401 10 February 1999 (10.02.99) US (71) Applicant: COLGATE-PALMOLIVE COMPANY [US/US]; 300 Park Avenue, New York, NY 10022 (US). (72) Inventor: HOHLBEIN, Douglas, J.; 45 Diverty Road, Pennington, NJ 08534 (US). (74) Agent: GOLDFINE, Henry; Colgate-Palmolive Company, 909 River Road, P.O. Box 1343, Piscataway, NJ 08855-1343 (US).</p>	<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
---	---

(54) Title: TOOTHBRUSH HEAD WITH FLEXIBLY MOUNTED BRISTLES

(57) Abstract

The present invention relates to a toothbrush (10) having bristles mounted on a flexibly resilient lattice network, such that the bristles deflect during brushing to conform to the various arcuate surfaces of the teeth for more effective cleaning thereof.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon		Republic of Korea	PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

and gums, without adequate conformation of the brush about and between the teeth to provide the desired cleaning.

Toothbrushes such as those disclosed in PCT WO 98/35584, having
5 bristle tufts capable of a toggling movement partially address the above
problem. PCT WO 98/35584 discloses bristle tufts mounted in a
resilient material held within an array of rigid receptacles or wells whose
connection to the overall frame or skeleton of the brush has been
broken. As the tufts are solely connected to the brush by the resilient
10 material they will independently toggle or move in all planes
(upwards/downwards/sideways). However, such independent motion of
the bristles will not cause them to conform to the configuration of the
teeth.

15 U.S. Patent 4,633,542 discloses a toothbrush in which the bristles are
slidably mounted within a rigid head, resting upon a resiliently
deformable membrane. There is a cavity within the head of the
toothbrush below the membrane, such that the bristles are resiliently
forced into the head as the bristles are applied to the teeth. This
20 independent motion of the bristles, in one plane, will not cause them to
conform to the sloping, arcuate, surfaces of the teeth.

U.S. Patents 5,355,546, 5,483,722 and 5,839,149 disclose
toothbrushes whose head is formed of a rigid frame supporting a flexible
25 resilient member which has a series of linearly parallel lines or arrays of
bristle tufts, which lines of bristle tufts are oriented along the
longitudinal axis of the toothbrush. In each of the these patents the
parallel lines of bristles are flexibly mounted, such that in brushing
when a tooth is forced against the center line of tufts, that line of tufts
30 will yield away from the tooth, causing the adjacent lines of bristle tufts
to orient themselves about the sides of the tooth. As this contouring

about the tooth is in two dimensions, these patents fail to address the overall three dimensional curvature of the teeth, especially the deep "v" shaped interproximal area between one tooth and the next.

5 U.S. Patent 5,651,158 discloses a flexible head toothbrush having many embodiments, including a first embodiment in which the bristles may be mounted on head segments linked by grooves or thinned, i.e. flexible, connections which may be filled with a resilient elastomer. A second embodiment comprises a toothbrush head having bristle
10 mounting segments within a hard peripheral frame, the segments being linked at planar points located 90° to the longitudinal axis of the handle, the linkage being of thinned sections such that the segments may be made to rock about these links, in addition to flexing. A third embodiment includes a hard peripheral frame containing a toothbrush
15 head formed of one or more chains of bristle carriers, flexibly and resiliently linked to each other and linked to at least one end of the frame. A fourth embodiment is formed of segments which are not joined to each other, but are flexibly and resiliently linked to the handle or to the frame, wherein the linkage to the frame may be by thinned sections
20 or spines. In each embodiment the various segments or bristle carriers will flex independently or at most in coordination with the adjacent segments or bristle carriers within the chain of bristle carriers; such limited coordination of the orientation of the bristle tufts about the tooth will not provide the conformation to the various arcuate surfaces of the
25 tooth surfaces necessary for effective cleaning.

There is a need for a toothbrush, wherein the bristles coordinate their orientation to conform to the three dimensional arcuate tooth surfaces and the deep "v" shaped interproximal area between one tooth and the
30 next, such as to provide effective overall cleaning.

Summary of the Invention

5 The present invention encompasses a toothbrush having bristle tufts which are capable of enhanced conformity to the arcuate tooth surfaces, said toothbrush comprised of a handle having a longitudinal axis and at one end thereof a head containing a plurality of bristle tufts extending therefrom; which head has a surrounding rigid periphery with an
10 aperture extending therethrough and across which is a lattice or open network of flexibly resilient spines; wherein, each bristle tuft is anchored to said head at a node formed by the intersection of said spines. The lattice has a portion which is free of spines, this portion being located central to the head and on each side of the longitudinal axis, such that
15 the lattice segments on each side of the longitudinal axis will flex independently. Each lattice segment flexes such that during brushing, as a tooth is forced against a bristle tuft, that bristle tuft will yield into the aperture and the immediate surrounding bristle tufts will tend to deflect toward that particular tooth, such deflecting bristle tufts
20 conforming about the arcuate, three dimensional, surfaces of the particular tooth for more effective cleaning thereof.

Brief Description of the Drawings

25 Fig. 1 is a side plan view, showing the toothbrush with a typical flat bristle pattern.

 Fig. 2 is a front plan view of the toothbrush showing within the head section the network of bristle tuft carriers supporting the bristles shown
30 in Fig. 1.

Fig. 3 is an enlarged front plan view of the toothbrush head shown in Fig. 2.

Fig. 4 is a section view, through section B-B of Fig. 3, showing in two dimensions the conformation of the bristles about the arcuate surfaces of a typical tooth.

Fig. 5 is a detail of the bristle tufts, showing the nodes within the network of bristle tuft carriers, i.e. the fused ends of the bristle tufts secured together by the connecting spines.

Fig. 6 is an alternate detail of the bristle tufts as shown in Fig. 5, i.e. the fused ends of the bristle tufts secured together by the connecting spines overmolded with an elastomer.

15

Detailed Description of the Invention

Referring now to the drawings, wherein like reference numerals refer to the same or similar elements among the several figures, and in particular to Figs 1 and 2; wherein there is shown a toothbrush, 10, in accordance with the present invention. Referring specifically to Fig. 2, a front plan view of such a toothbrush, 10, having head, 18, integral to a handle, 12, extending therefrom and a longitudinal axis, A-A, therethrough. The head, 18, contains a face, 14, which has a central concavity across which is a lattice or open network of flexibly resilient bristle carriers embodying the features and construction of this invention. Shown in Fig. 1, extending from the face, 14, are rows of bristle tufts, 16, transverse to the longitudinal axis A-A. Each bristle tuft, 16, is embedded and supported by at a node, 20, which as can be seen in Fig. 3, is formed at the junction at which the structural elements or spines, 22, of the network intersect.

20
25
30

As in Fig. 3, the face of the toothbrush of the present invention, 14, has a peripheral frame or rigid periphery, 24, the rigid periphery defining an opening or aperture extending through the toothbrush head, 18.

5 Alternatively, the toothbrush can also be formed with a closure across the back of the toothbrush head in the form of a concave segment below and separated from the lattice. In the case where the back of the toothbrush is enclosed, the concavity below the lattice can extend from 50 to 80% of the distance from the face to back, i.e. the depth of the

10 toothbrush head, which depth is up to about $\frac{1}{4}$ of an inch. The deflection of the bristle carriers into the concavity, during brushing, is illustrated by Fig. 4, which is a cross-section B-B of Fig. 3, perpendicular to the longitudinal axis A-A of the toothbrush. Fig. 4 only illustrates the conformation of the bristles about the tooth in two dimensions with the

15 deflection of the center bristle, 26, in the direction of the arrow in Fig. 4. However, the deflection of the center bristle, 26, will not only cause the bristles perpendicular to the longitudinal axis A-A to deflect toward and conform to the tooth; but, also the adjacent bristles parallel to the longitudinal axis will deflect toward and conform about the tooth

20 providing the present inventions three dimensional conformity to the tooth for effective cleaning thereof.

Further, within the present invention the lattice of spines extending across the face, 14, of the toothbrush has a central portion free of said

25 spines, such that the spines located central to the head, 18, and parallel to the longitudinal axis, A-A, do not intersect, i.e. are not connected (see Fig. 3). This discontinuity within the lattice allows the separate tuft supporting network segments, on each side of the longitudinal axis, to move independently. Such independent movement of the tuft supporting

30 network segments facilitates the toothbrushes simultaneous cleaning of different teeth and areas of the dentiture as occurs during brushing.

The head, 18, comprised of the neck, the peripheral frame, 24, and the lattice or network of flexibly resilient bristle carriers is preferably integral with the toothbrushes handle, 12, i.e. molded or otherwise formed as a single piece. The periphery of the head, 24, is at least 1/32 of an inch in width, and preferably at least 1/16 of an inch in width, so as to be rigid enough to adequately support the network of bristle tuft carriers, 20, attached thereto.

The network of bristle tuft carriers, including the spines, 22, and nodes, 20, are of a flexible and resilient material, preferably of polypropylene. Alternatively, the spines, 22, can be of polyethylene or thermoplastic elastomer (TPE), or a combination thereof. The degree of flexibility and resilience of the spines, 22, can be further controlled by varying their dimensions, e.g. reducing the depth or thickness of each spine, 22, to provide additional flexibility or by providing an overcoating of a second elastomer about each spine, 22, and node, 20, as illustrated in Fig. 6. Acceptable TPE materials, including a thermoplastic vulcanate (TPV) which consists of a mixture of polypropylene and EPDM (ethylene propylene diene monomers) which is available as Santoprene (brand), described in U.S. Patent 5,393,796; or Vyram (brand), another TPV consisting of a mixture of polypropylene and natural rubber, both Santoprene and Vyram being elastomers marketed by Advanced Elastomer Systems LP, Akron, Ohio 44311. Another, and preferred TPE is Dynaflex G6713 (brand), marketed by GLS Corp., Cary, Illinois 60013. These and other suitable elastomers have, typically, a Shore A hardness of from about 13 to 94, with about 29 being a preferred hardness.

Toothbrushes today are typically molded of polypropylene, in the present invention it is preferred that the lattice or network of bristle tuft carriers also be of polypropylene to facilitate one-step molding of the

toothbrush. If a clear appearance is desired, the handle, 12, head, 18, and lattice can be of polyester, such as polyethylene terephthalate. A preferred polypropylene is Huntsman Polypropylene 5520 (Brand), manufactured by the Huntsman Polypropylene Corporation, Hinsdale,
5 Illinois 60521.

If desired, the toothbrush of the present invention can be molded as a "dual component" toothbrush, by which is meant that the flexibly resilient material of the bristle supporting network or lattice is of a material different than that of the hard plastic toothbrush head, 18, and
10 handle, 12. The method of manufacture of such a dual component toothbrush by conventional dual component injection molding technology is well known in the art. For example, in accordance with the present invention, the lattice material may be introduced into the head
15 area by a second injection step, after that used for the injection molding of the hard bristle implanting head and handle. In this second injection step the semi-finished toothbrush is positioned in a second mold into which the lattice material is injected about the interior of the rigid periphery, 24. To increase the surface area for the elastomer to adhere
20 to the rigid periphery, 24, for increased adhesion thereto, a groove or recess can be provided about the upper surface of the interior of the rigid periphery.

A one-step molding process can be utilized in the manufacture of
25 toothbrushes of the present invention, when the head, 18, contains an aperture extending therethrough and when the lattice is of the same material as the remainder of the toothbrush frame, i.e. the head, 18, and handle, 12. In contrast, a two-step molding process must be used whenever the head, 18, of the toothbrush contains a concavity below the
30 lattice, this concavity is formed by the toothbrush having an enclosed back, such enclosure being separated from the lattice. In such a two-

step molding process, the toothbrush frame and integral lattice are formed in a first injection mold and the semi-finished toothbrush is repositioned in a second injection mold, wherein the back enclosure is formed.

5

Facilitation of two step injection molding of toothbrushes of the present invention can be by using a two component mold. Two component molds are available from Machines Boucherie N.V., Izegem, Belgium; which molds can be mounted in typical injection molding machines for such implementing the two step injection process, such machines including 300 ton, two component injection molding machines available from Engel Canada, Inc., Guelph, Ontario.

The toothbrush bristles may be implanted as the nodes of the flexibly resilient elastomeric material of the bristle supporting network are formed using non-staple, in-mold tufting (IMT) technology as disclosed in U.S. Patents 5,609,890, 5,390,984, and 5,533,791. Such IMT technology involves a process and the associated machinery wherein each tuft of bristles is first pre-formed into an assembly by fusing its base of bristles together into a knob. This knob is then held in the mold into which the flexibly resilient material of the bristle supporting network or lattice is injected, such that the material flows about the knob, anchoring the tuft into place within the toothbrush face, 14. Fig. 5 illustrates finished IMT tufts of bristles, 16; wherein, the material of the bristle supporting network, i.e. the spines, 22, surrounds and anchors the knob, 28, at the base of each bristle tuft, 16.

Claims

5 *What is claimed is:*

1. A toothbrush having bristle tufts capable of providing enhanced conformity to arcuate tooth surfaces, comprising:

10 a handle having a longitudinal axis and a head at one end thereof, which head contains a face having a plurality of said bristle tufts extending therefrom;

15 said face having a rigid periphery, within which rigid periphery is an aperture extending therethrough;

a network of flexibly resilient spines forming a lattice extending across said aperture and attached to said rigid periphery;

20 said lattice having a center portion which is free of said spines;

said lattice having nodes located at the intersection of said spines, each node having a bristle tuft anchored therein.

25 2. The toothbrush of claim 1, wherein the rigid periphery is at least 1/32 of an inch in width.

3. The toothbrush of claim 1, wherein the spines are of polypropylene, polyethylene, a thermoplastic elastomer, or a combination thereof.

30

4. A toothbrush exhibiting enhanced conformity to arcuate tooth surfaces for enhanced cleaning, comprising:

5 a handle having a longitudinal axis and a head at one end thereof, which head contains a face having a plurality of bristle tufts extending therefrom;

10 said face having a rigid periphery, to which rigid periphery is attached a network of flexibly resilient spines forming a lattice extending across said face;

said lattice having a center portion which is free of said spines;

15 said lattice having nodes located at the intersection of the spines, each node having a bristle tuft anchored therein;

said head having a concave portion therein, beneath said lattice and extending across said head.

20 5. The toothbrush of claim 4, wherein the concave portion can extend from 50 to 80% of the depth of the toothbrush head.

6. The toothbrush of claim 4, wherein the rigid periphery is at least 1/32 of an inch in width.

25

7. The toothbrush of claim 4, wherein the spines are of polypropylene, polyethylene, a thermoplastic elastomer, or a combination thereof.

8. A process for making a toothbrush, comprising:

pre-forming bristle tufts by fusing the base of a plurality of bristles
into a knob;

5

positioning the knobs of said pre-formed bristle tufts within a
toothbrush mold;

10

injecting flexibly resilient material about the knobs to form nodes,
whereby the pre-formed bristle tufts are locked therein and wherein
said flexibly resilient material forms spines connecting said nodes in a
lattice across the face of said toothbrush;

said lattice having a center portion which is free of any spines.

15

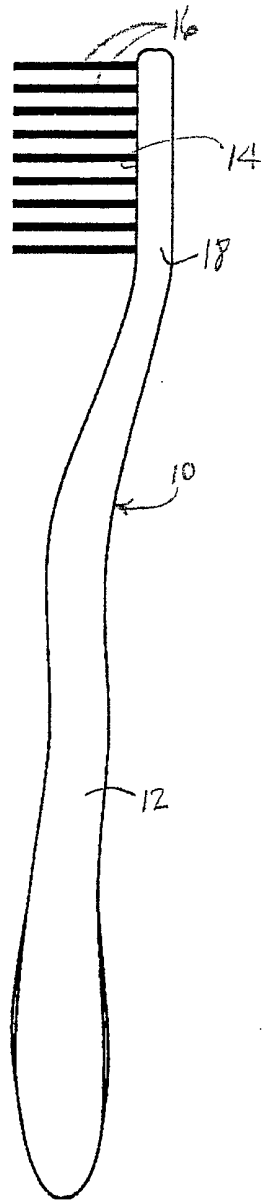


Fig. 1

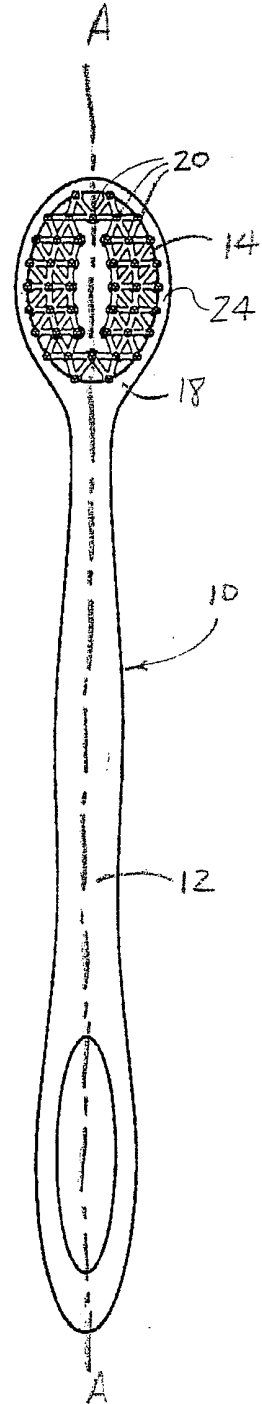


Fig. 2

2/2

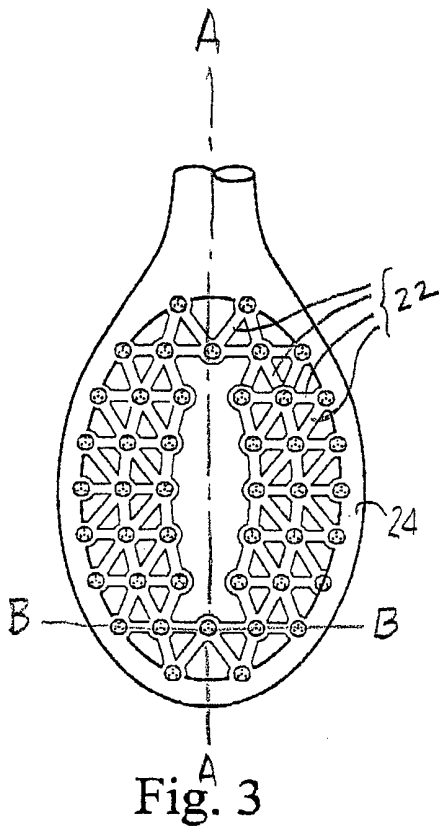


Fig. 3

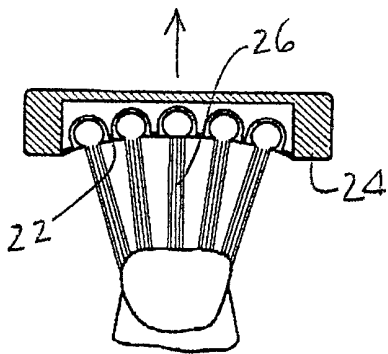


Fig. 4

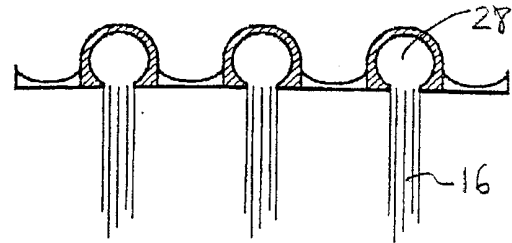


Fig. 5

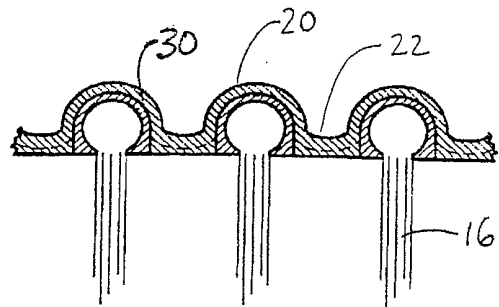


Fig. 6

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/03333

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 A46B9/10 A46B3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A46B

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 836 036 A (IVORY) 17 November 1998 (1998-11-17) column 1, line 59 -column 2, line 53; figures 1-3	1,4,8
A	US 4 500 939 A (GUERET) 19 February 1985 (1985-02-19) column 4, line 9 - line 44; figures 1-4	1,4,8
A	US 3 798 699 A (LEWIS, JR.) 26 March 1974 (1974-03-26) column 4, line 7 -column 7, line 22; figures 1-19	1,4,8
A	DE 30 25 010 A (KRISTA) 21 January 1982 (1982-01-21) page 12, line 20 -page 14, line 2; figure 2	1,4
	-/--	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

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

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

29 May 2000

Date of mailing of the international search report

06/06/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax: (+31-70) 340-3016

Authorized officer

Rivero, C

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/03333

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>US 2 064 860 A (SEKINE) 22 December 1936 (1936-12-22) page 1, right-hand column, line 54 -page 2, right-hand column, line 75; figures 1-13</p> <p style="text-align: center;">-----</p>	1,4

INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. Application No

PCT/US 00/03333

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5836036 A	17-11-1998	NONE	
US 4500939 A	19-02-1985	FR 2524783 A CA 1206709 A DE 3312374 A GB 2118029 A,B JP 1625498 C JP 2054081 B JP 58185113 A	14-10-1983 01-07-1986 13-10-1983 26-10-1983 18-11-1991 20-11-1990 28-10-1983
US 3798699 A	26-03-1974	NONE	
DE 3025010 A	21-01-1982	NONE	
US 2064860 A	22-12-1936	NONE	