



US00D761963S

(12) **United States Design Patent** (10) **Patent No.:** US D761,963 S
Way et al. (45) **Date of Patent:** ** Jul. 19, 2016

(54) **MICROPERFORATION DENTAL DEVICE**(71) Applicant: **Propel Orthodontics, LLC**, Ossining, NY (US)(72) Inventors: **Bryce A. Way**, San Jose, CA (US); **Richard Johnson**, Briarcliff Manor, NY (US); **Peter Migneault**, Succasunna, NJ (US); **Gerald Zilles**, Phoenix, AZ (US); **Christopher U. Phan**, San Leandro, CA (US); **Phillip Abatelli**, Wesbury, NY (US); **Maria V. Nuestro**, San Jose, CA (US)(73) Assignee: **Propel Orthodontics, LLC**, Ossining, NY (US)(**) Term: **14 Years**(21) Appl. No.: **29/497,897**(22) Filed: **Jul. 29, 2014**(51) LOC (10) Cl. **24-02**

(52) U.S. Cl.

USPC **D24/152**(58) **Field of Classification Search**

USPC D24/152, 133, 146-147, 155-156, D24/176-177, 180; D8/80-83, 85-86, 107; 81/177.1, 436-439; 433/3, 82, 108, 433/114, 126, 141

CPC A61C 7/02; A61C 3/02; A61C 1/082; A61B 17/1604; A61B 17/1673

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

430,299 A	6/1890	Rand
D88,859 S	1/1933	Curtis
2,390,309 A	12/1945	Keys
2,564,356 A	8/1951	Dianda
3,360,861 A	1/1968	Hoffman

3,682,177 A	8/1972	Ames et al.
3,838,517 A	10/1974	Michnick
4,123,844 A	11/1978	Kurz
4,347,054 A	8/1982	Kraus et al.
D266,109 S	9/1982	Sertich et al.

(Continued)

FOREIGN PATENT DOCUMENTS

CA	2406986 A1	4/2004
CN	2209958 Y	10/1995

(Continued)

OTHER PUBLICATIONS

Adachi et al; Enhancement of cytokine production by macrophages stimulated with (1-->3)-beta-D-glucan, grifolan (GRN), isolated from Grifola frondosa; Biol Pharm Bull; 17(12):1554-60; Dec. 1994.

(Continued)

Primary Examiner — Wan Laymon*Assistant Examiner* — Mark Booker(74) *Attorney, Agent, or Firm* — Shay Glenn LLP(57) **CLAIM**

We claim the ornamental design for a microperforation dental device, as shown and described.

DESCRIPTION

FIG. 1 is a perspective view of the microperforation dental device showing our new design;

FIG. 2 is a right view thereof;

FIG. 3 is a left view thereof;

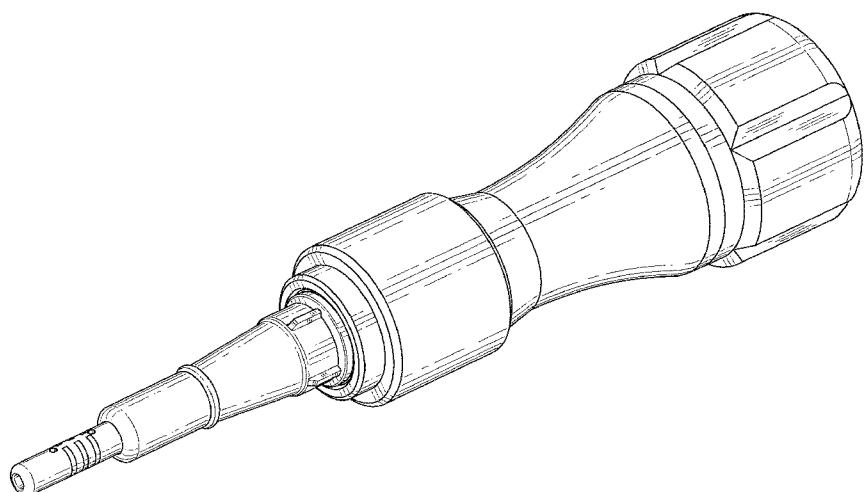
FIG. 4 is a front view thereof;

FIG. 5 is a back view thereof;

FIG. 6 is an enlarged top view thereof; and,

FIG. 7 is an enlarged bottom view thereof.

The broken lines shown in the figures are included for the purpose of illustrating portions of the article and form no part of the claimed design.

1 Claim, 7 Drawing Sheets

(56)

References Cited

U.S. PATENT DOCUMENTS

4,354,832 A	10/1982	Wallshein	2010/0136504 A1	6/2010	Sabilla
4,433,956 A	2/1984	Witzig	2010/0266983 A1	10/2010	Ng et al.
4,482,318 A	11/1984	Foerster	2011/0045435 A1	2/2011	Goodman
4,483,674 A	11/1984	Schuetz	2011/0065060 A1	3/2011	Teixeira et al.
4,549,538 A	10/1985	Schadreck et al.	2011/0207075 A1	8/2011	Altshuler et al.
D285,835 S	9/1986	Hanses	2012/0094246 A1	4/2012	Pavlin
4,747,824 A	5/1988	Spinello	2012/0179070 A1	7/2012	Pommer et al.
4,777,852 A	10/1988	Herman et al.	2012/0322018 A1	12/2012	Lowe et al.
4,828,113 A	5/1989	Friedland et al.	2014/0322663 A1*	10/2014	Way A61C 7/02 433/24
4,944,677 A	7/1990	Alexandre	2015/0320523 A1	11/2015	Way et al.
5,002,485 A	3/1991	Aagesen	CN	2266999 Y	11/1997
5,030,098 A	7/1991	Branford	CN	1359277 A	7/2002
5,173,050 A	12/1992	Dillon	CN	1371663 A	10/2002
5,188,531 A	2/1993	Von Sutfin	CN	101262831 A	9/2008
5,191,880 A	3/1993	McLeod et al.	CN	201179118 Y	1/2009
5,281,133 A	1/1994	Farzin-Nia	CN	201200485 Y	3/2009
5,320,532 A	6/1994	Farzin-Nia et al.	CN	202028800 U	11/2011
5,343,883 A	9/1994	Murayama	CN	202113173 U	1/2012
5,351,404 A	10/1994	Smith	CN	202277392 U	6/2012
5,439,377 A	8/1995	Milanovich	CN	102908198 A	2/2013
5,472,344 A	12/1995	Binder et al.	CN	102935014 A	2/2013
5,547,657 A	8/1996	Singleton et al.	CN	202843827 U	4/2013
D379,750 S	6/1997	Thompson et al.	CN	202908860 U	5/2013
5,676,682 A	10/1997	Yoon	CN	103249372 A	8/2013
5,957,946 A	9/1999	Shuler et al.	CN	103271773 A	9/2013
5,961,535 A	10/1999	Rosenberg et al.	CN	203303172 U	11/2013
6,019,776 A	2/2000	Preissman et al.	EP	0531950 A1	3/1993
6,032,677 A	3/2000	Blechman et al.	EP	1535586 A2	6/2005
6,106,289 A	8/2000	Rainey et al.	JP	2007097987 A	4/2007
6,109,916 A	8/2000	Wilcko et al.	JP	2009000412 A	1/2009
D440,479 S	4/2001	Hsiao	KR	20030066288 A	8/2003
6,234,975 B1	5/2001	McLeod et al.	RU	2223056 C2	2/2004
D454,767 S	3/2002	Edwards	WO	WO 2006/070957 A1	7/2006
6,543,315 B2	4/2003	Huang	WO	WO 2007/047983 A2	4/2007
6,592,368 B1	7/2003	Weathers, Jr.	WO	WO 2007/140579 A1	12/2007
6,648,639 B2	11/2003	Mao	WO	WO 2009/088165 A1	7/2009
6,652,473 B2	11/2003	Kaufman et al.			
6,739,872 B1	5/2004	Turri			
7,166,067 B2	1/2007	Talish et al.			
D547,868 S	7/2007	Nakanishi			
7,258,694 B1	8/2007	Choi et al.			
7,322,948 B2	1/2008	Talish et al.			
7,329,121 B2	2/2008	De Clerck			
7,329,122 B1	2/2008	Scott			
7,338,494 B2	3/2008	Ryan			
7,347,687 B2	3/2008	Minoretti et al.			
7,419,680 B2	9/2008	LeGeros			
7,462,158 B2	12/2008	Mor			
7,611,355 B2	11/2009	Murias			
7,618,450 B2	11/2009	Zarowski et al.			
D607,300 S	1/2010	Lin			
D616,278 S	5/2010	Deguglimo et al.			
D628,697 S	12/2010	Murias			
D629,102 S *	12/2010	Murias	D24/152		
D644,910 S *	9/2011	Hsu	D8/107		
D662,206 S *	6/2012	Way	D24/147		
D668,339 S *	10/2012	Luoto	D24/152		
8,602,777 B2	12/2013	Way et al.			
D700,330 S *	2/2014	Way	D24/152		
8,770,969 B2	7/2014	Way et al.			
2006/0116581 A1	6/2006	Zdeblick et al.			
2006/0281040 A1	12/2006	Kelling			
2007/0298375 A1	12/2007	Hirsch et al.			
2008/0227046 A1	9/2008	Lowe et al.			
2008/0233541 A1	9/2008	De Vreese et al.			
2009/0035727 A1	2/2009	Maissami			
2009/0042159 A1	2/2009	Yamamoto et al.			
2009/0061375 A1	3/2009	Yamamoto et al.			
2009/0061379 A1	3/2009	Yamamoto et al.			
2009/0061380 A1	3/2009	Yamamoto et al.			
2009/0068285 A1	3/2009	LeGeros et al.			
2009/0275954 A1	11/2009	Phan et al.			
2009/0326602 A1	12/2009	Glukhovsky et al.			
2010/0055634 A1	3/2010	Spaulding et al.			
2010/0092916 A1	4/2010	Teixeira et al.			

FOREIGN PATENT DOCUMENTS

CN	2266999 Y	11/1997
CN	1359277 A	7/2002
CN	1371663 A	10/2002
CN	101262831 A	9/2008
CN	201179118 Y	1/2009
CN	201200485 Y	3/2009
CN	202028800 U	11/2011
CN	202113173 U	1/2012
CN	202277392 U	6/2012
CN	102908198 A	2/2013
CN	102935014 A	2/2013
CN	202843827 U	4/2013
CN	202908860 U	5/2013
CN	103249372 A	8/2013
CN	103271773 A	9/2013
CN	203303172 U	11/2013
EP	0531950 A1	3/1993
EP	1535586 A2	6/2005
JP	2007097987 A	4/2007
JP	2009000412 A	1/2009
KR	20030066288 A	8/2003
RU	2223056 C2	2/2004
WO	WO 2006/070957 A1	7/2006
WO	WO 2007/047983 A2	4/2007
WO	WO 2007/140579 A1	12/2007
WO	WO 2009/088165 A1	7/2009

OTHER PUBLICATIONS

- Alhashimi et al; Orthodontic movement induces high numbers of cells expressing IFN-gamma at mRNA and protein levels; *J Interferon Cytokine Res*; 20(1):7-12; Jan. 2000.
- Anholm et al; Corticotomy-facilitated orthodontics; *CDA J*; 14(12):7-11; Dec. 1986.
- Arend et al.; IL-1, IL-18, and IL-33 families of cytokines; *Immunol Rev*; 223:20-38; Jun. 2008.
- Arias et al.; Aspirin, acetaminophen, and ibuprofen: their effects on orthodontic tooth movement; *Am J Orthod Dentofacial Orthop*; 130(3):364-370; Sep. 2006.
- Bai et al.; Interleukin-18 gene polymorphisms and haplotypes in patients with oral lichen planus: a study in an ethnic Chinese cohort; *Tissue Antigens*; 70(5):390-397; Nov. 2007.
- Basaran et al.; Interleukins 2, 6, and 8 levels in human gingival sulcus during orthodontic treatment; *Am J Orthod Dentofacial Orthop*; 130(1):7.e1-6; Jul. 2006.
- Bishara et al.; Maxillary expansion: clinical implications; 91(1):3-14; Jan. 1987.
- Bolander; Regulation of fracture repair by growth factors; *Proc Soc Exp Biol Med*; 200(2):165-170; Jun. 1992.
- Bossù et al; Interleukin 18 gene polymorphisms predict risk and outcome of Alzheimer's disease; *J Neurol Neurosurg Psychiatry*; 78(8):807-811; Aug. 2007 (Author's Manuscript).
- Busti et al.; Effects of perioperative antiinflammatory and immunomodulating therapy on surgical wound healing; *Pharmacotherapy*; 25(11):1566-1591; Nov. 2005.
- Chao et al.; Effects of prostaglandin E2 on alveolar bone resorption during orthodontic tooth movement; *Acta Anat (Basel)*; 132(4):304-309; Jul. 1988.
- Chung et al.; Corticotomy-assisted orthodontics; *J Clin Orthod*; 35 (5):331-339; May 2001.

(56)

References Cited**OTHER PUBLICATIONS**

- Davidovitch et al.; Neurotransmitters, cytokines, and the control of alveolar bone remodeling in orthodontics; *Dent Clin North Am*; 32(3):411-435; Jul. 1988.
- De Sá et al.; Immunolocalization of interleukin 4, interleukin 6, and lymphotoxin alpha in dental granulomas; *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*; 96(3):356-60; Sep. 2003.
- Dienz et al.; The effects of IL-6 on CD4 T cell responses; *Clin Immunol*; 130 (1):27-33; Jan. 2009 (Author's Manuscript).
- Erben; Embedding of bone samples in methylmethacrylate: an improved method suitable for bone histomorphometry, histochemistry, and immunohistochemistry; *J Histochem Cytochem*; 45(2):307-313; Feb. 1997.
- Fischer; Orthodontic treatment acceleration with corticotomy-assisted exposure of palatally impacted canines; *Angle Orthod*; 77(3):417-420; May 2007.
- Foster; Principles of removable appliance treatment; in A Textbook of Orthodontics; 2nd Ed.; Blackwell Sci. Pub.; Chap. 13; pp. 246-261; Nov. 1975.
- Frost; A Synchronous Group of Mammalian Cells Whose In Vivo Behavior Can be Studied; *H Ford Hosp Med Bull*; 13:161-172; Jun. 1965.
- Frost; Part 1. The biology of fracture healing. An overview for clinicians; *Clin Orthop Relat Res*; 248:283-293; Nov. 1989.
- Frost; Part II. The biology of fracture healing. An overview for clinicians; *Clin Orthop Relat Res*; 248:294-309; Nov. 1989.
- Frost; The regional acceleratory phenomenon: a review; *H Ford Hosp Med J*; 31(1):3-9; (year of pub. sufficiently earlier than effective US filing date and any foreign priority date) 1983.
- Gantes et al.; Effects on the periodontium following corticotomy-facilitated orthodontics. Case reports; *J Periodontol*; 61(4):234-238; Apr. 1990.
- Garlet et al.; Cytokine expression pattern in compression and tension sides of the periodontal ligament during orthodontic tooth movement in humans; *Eur J Oral Sci*; 115(5):355-62; Oct. 2007.
- Germeç et al.; Lower incisor retraction with a modified corticotomy; *Angle Orthod*; 76(5):882-890; Sep. 2006.
- Glantschnig et al.; M-CSF, TNFalpha and RANK ligand promote osteoclast survival by signaling through mTOR/S6 kinase; *Cell Death Differ*; 10(10):1165-77; Oct. 2003.
- Han et al.; TGFbeta1 selectively up-regulates CCR1 expression in primary murine astrocytes; *Glia*; 30(1):1-10; Mar. 2000.
- Handelman; Nonsurgical rapid maxillary alveolar expansion in adults: a clinical evaluation; *Angle Orthod*; 67(4):291-305; Aug. 1997.
- Haruyama et al.; Estrous-cycle-dependent variation in orthodontic tooth movement; *J Dent Res*; 81(6):406-410; Jun. 2002.
- Hinton et al.; Upper airway pressures during breathing: a comparison of normal and nasally incompetent subjects with modeling studies; *Am J Orthod*; 89(6):492-498; Jun. 1986.
- Hwang et al.; Intrusion of overerupted molars by corticotomy and magnets; *Am J Orthod Dentofacial Orthop*; 120(2):209-216; Aug. 2001.
- Iino et al.; Acceleration of orthodontic tooth movement by alveolar corticotomy in the dog; *Am J Orthod Dentofacial Orthop*; 131(4):448.e1-e8; Apr. 2007.
- Ito et al.; Augmentation of type I IL-1 receptor expression and IL-1 signaling by IL-6 and glucocorticoid in murine hepatocytes; *J Immunol*; 162(7):4260-4265; Apr. 1, 1999.
- Jäger et al.; Soluble cytokine receptor treatment in experimental orthodontic tooth movement in the rat; *Eur J Orthod*; 27(1):1-11; Feb. 2005.
- Jang et al.; Interleukin-18 gene polymorphisms in Korean patients with Behcet's disease; *Clin Exp Rheumatol*; 23(4 Suppl 38):S59-63; Jul.-Aug. 2005.
- Kao et al.; Up-regulation of CC chemokine ligand 20 expression in human airway epithelium by IL-17 through a JAK-independent but MEK/NF-kappaB-dependent signaling pathway; *J Immunol*; 175(10):6676-6685; Nov. 15, 2005.
- Kawasaki et al.; Effects of aging on RANKL and OPG levels in gingival crevicular fluid during orthodontic tooth movement; *Orthod Craniofac Res*; 9(3):137-142; Aug. 2006.
- Khapli et al.; IL-3 acts directly on osteoclast precursors and irreversibly inhibits receptor activator of NF-kappa B ligand-induced osteoclast differentiation by diverting the cells to macrophage lineage; *J Immunol*; 171(1):142-151; Jul. 2003.
- Khoo et al.; Accelerated Orthodontic Treatment; *Dentista Y Pacienta Mexican Dental Journal*; Feb. 2011 edition; 11 pages total.
- King et al.; Later orthodontic appliance reactivation stimulates immediate appearance of osteoclasts and linear tooth movement; *Am J Orthod Dentofacial Orthop*; 114(6):692-697; Dec. 1998.
- King et al.; Measuring dental drift and orthodontic tooth movement in response to various initial forces in adult rats; *Am J Orthod Dentofacial Orthop*; 99(5):456-465; May 1991.
- Kitaura et al.; An anti-c-Fms antibody inhibits orthodontic tooth movement; *J Dent Res*; 87(4):396-400; Apr. 2008.
- Knüpfer et al.; sIL-6R: more than an agonist?; *Immunol Cell Biol*; 86 (1):87-91; Jan. 2008.
- Kole; Surgical operations on the alveolar ridge to correct occlusal abnormalities; *Oral Surg Oral Med Oral Pathol*; 12(5):515-529; May 1959.
- Krishnan et al.; Cellular, molecular, and tissue-level reactions to orthodontic force; *Am J Orthod Dentofacial Orthop*; 129(4):469.e1-469.e32; Apr. 2006.
- Krishnan et al.; On a path to unfolding the biological mechanisms of orthodontic tooth movement; *J Dent Res*; 88(7):597-608; Jul. 2009.
- Lean et al.; CCL9/MIP-1gamma and its receptor CCR1 are the major chemokine ligand/receptor species expressed by osteoclasts; *J Cell Biochem*; 87(4):386-393; Sep. 2002.
- Leng et al.; Interleukin-11; *Int J Biochem Cell Biol*; 29(8-9):1059-1062; Aug.-Sep. 1997.
- Liou et al.; Rapid orthodontic tooth movement into newly distracted bone after mandibular distraction osteogenesis in a canine model; *Am J Orthod Dentofacial Orthop*; 117(4):391-398; Apr. 2000.
- Luster; Chemokines—chemotactic cytokines that mediate inflammation; *N Engl J Med*; 338(7):436-445; Feb. 12, 1998.
- McNamara et al.; Orthodontic and Orthopedic Treatment in the Mixed Dentition; Needham Press; pp. 131-144; Jun. 1993.
- Meikle; The tissue, cellular, and molecular regulation of orthodontic tooth movement: 100 years after Carl Sandstedt; *Eur J Orthod*; 28(3):221-240; Jun. 2008.
- Mermut et al.; Effects of interferon-gamma on bone remodeling during experimental tooth movement; *Angle Orthod*; 77(1):135-141; Jan. 2007.
- Murphy; In Vivo Tissue Engineering for Orthodontists: A Modest First Step; Biological Mechanisms of Tooth Eruption, Resorption and Movement; Harvard Society for the Advancement of Orthodontics; pp. 385-410; Jan. 2006.
- Piemonti et al.; Human pancreatic islets produce and secrete MCP-1/CCL2: relevance in human islet transplantation; *Diabetes*; 51(1):55-565; Jan. 2002.
- Ren et al.; Cytokine profiles in crevicular fluid during orthodontic tooth movement of short and long durations; *J Periodontol*; 78(3):453-458; Mar. 2007.
- Ren et al.; Cytokines in crevicular fluid and orthodontic tooth movement; *Eur J Oral Sci*; 116(2):89-97; Apr. 2008.
- Rubin et al.; Inhibition of osteopenia by low magnitude, high-frequency mechanical stimuli; *Drug Discov Today*; 6(16):848-858; Aug. 16, 2001.
- Rygh et al.; Activation of the vascular system: a main mediator of periodontal fiber remodeling in orthodontic tooth movement; *Am J Orthod*; 89(6):453-468; Jun. 1986.
- Saito et al.; Interleukin 1 beta and prostaglandin E are involved in the response of periodontal cells to mechanical stress in vivo and in vitro; *Am J Orthod Dentofacial Orthop*; 99(3):226-240; Mar. 1991.
- Sallusto et al.; Flexible programs of chemokine receptor expression on human polarized T helper 1 and 2 lymphocytes; *J Exp Med*; 187(6):875-883; Mar. 16, 1998.
- Schneider et al.; Lymphotoxin and LIGHT signaling pathways and target genes; *Immunol Rev*; 202:49-66; Dec. 2004.
- Seidenberg et al.; Is there an inhibitory effect of COX-2 inhibitors on bone healing?; *Pharmacol Res*; 50(2):151-156; Aug. 2004.

(56)

References Cited**OTHER PUBLICATIONS**

- Shih et al.; Regional acceleration of remodeling during healing of bone defects in beagles of various ages; *Bone*; 6(5):377-379; Feb. 1985.
- Shireman; The chemokine system in arteriogenesis and hind limb ischemia; *J Vasc Surg*; 45 Suppl A:A48-A56; Jun. 2007 (Author's Manuscript).
- Teixeira et al.; Cytokine Expression and Accelerated Tooth Movement; *J Dent Res*; 89(10):1135-1141; Oct. 2010.
- Iran Ma; Method for studying the vascular region of bone; *J Pharmacol*; 13:495-499; Jul.-Sep. 1982 (in French).
- Uematsu et al.; Interleukin (IL)-1 beta, IL-6, tumor necrosis factor alpha, epidermal growth factor, and beta 2-microglobulin levels are elevated in gingival crevicular fluid during human orthodontic tooth movement; *J Dent Res*; 75 (1):562-567; Jan. 1996.
- Verna et al.; Histomorphometric study of bone reactions during orthodontic tooth movement in rats; *Bone*; 24(4):371-379; Apr. 1999.
- Viazis, A; Atlas of Orthodontics: Principles and Clinical Applications; WB Saunders Co.; pp. 205-213; Apr. 1993.
- Vignery et al.; Dynamic histomorphometry of alveolar bone remodeling in the adult rat; *Anat Rec*; 196(2):191-200; Feb. 1980.
- Wilcko et al.; Rapid Orthodontic Decrowding with Alveolar Augmentation: Case Report; *World J Orthod*; 4(3):197-205; Sep.-Nov. 2003.
- Wilcko et al.; Rapid orthodontics with alveolar reshaping: two case reports of decrowding; *Int J Periodontics Restorative Dent*; 21(1):9-19; Feb. 2001.
- Williams et al.; Orthodontic tooth movement analysed by the Finite Element Method; *Biomaterials*; 5(6):347-351; Nov. 1984.
- Xu et al.; Interleukin-18 promoter gene polymorphisms in Chinese patients with systemic lupus erythematosus: association with CC genotype at position -607; *Ann Acad Med Singapore*; 36(2):91-95; Feb. 2007.
- Yaffe et al.; Regional accelerated phenomenon in the mandible following mucoperiosteal flap surgery; *J Periodontol*; 65(1):79-83; Jan. 1994.
- Yamamoto et al.; Cytokine production in human periodontal ligament cells stimulated with *Porphyromonas gingivalis*; *J Periodontal Res*; 41(6):554-559; Dec. 2006.
- Yao et al.; Osteoclast precursor interaction with bone matrix induces osteoclast formation directly by an interleukin-1-mediated autocrine mechanism; *J Biol Chem*; 283(15):9917-9924; Apr. 11, 2008.
- Yen et al.; Closure of an unusually large palatal fistula in a cleft patient by bony transport and corticotomy-assisted expansion; *J Oral Maxillofac Surg*; 61(11):1346-1350; Nov. 2003.
- Yoshimatsu et al.; Experimental model of tooth movement by orthodontic force in mice and its application to tumor necrosis factor receptor-deficient mice; *J Bone Miner Metab*; 24(1):20-27; Jan. 2006.
- Zittermann et al.; Physiologic fluctuations of serum estradiol levels influence biochemical markers of bone resorption in young women; *J Clin Endocrinol Metab*; 85(1):95-101; Jan. 2000.

* cited by examiner

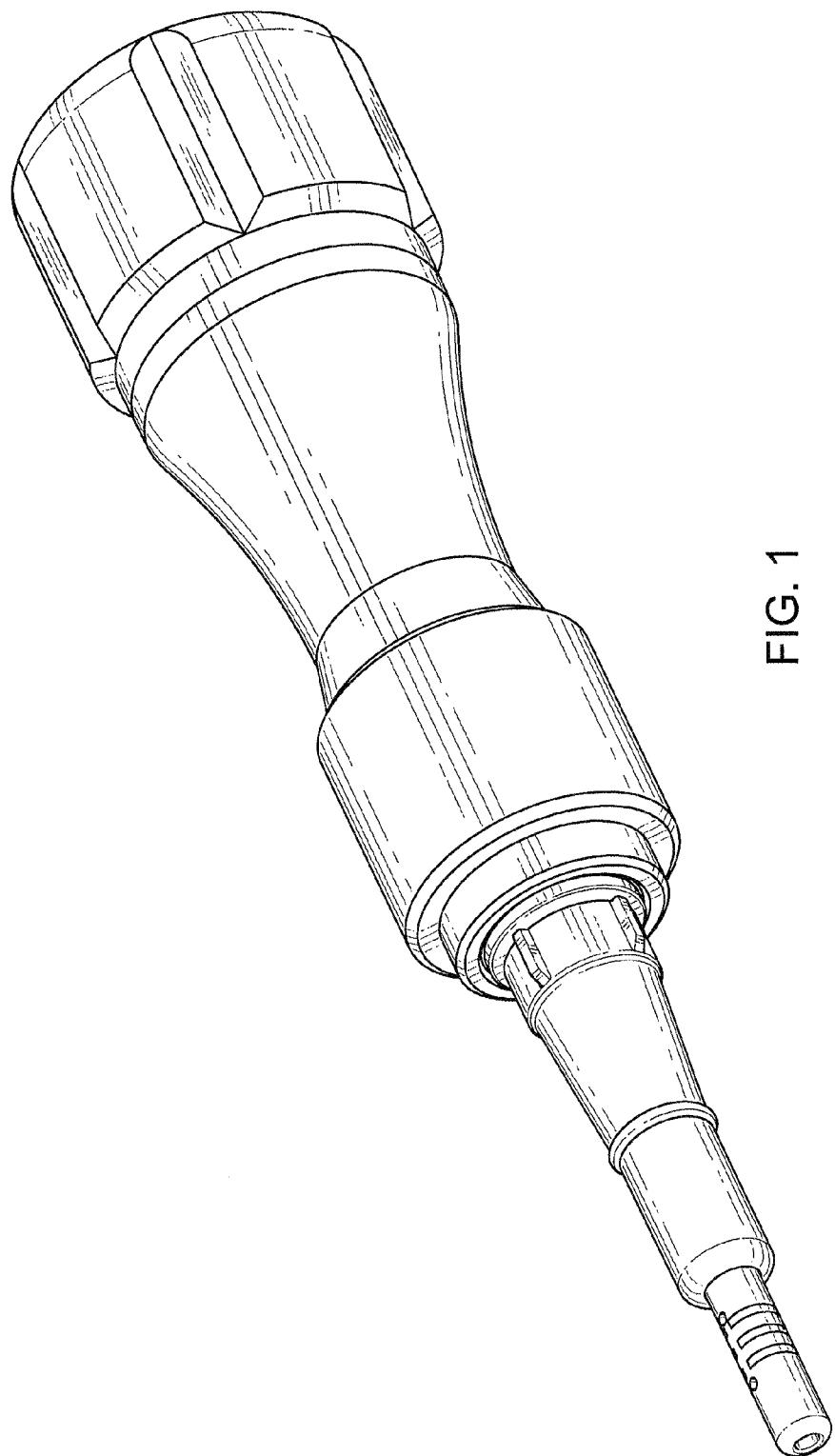


FIG. 1

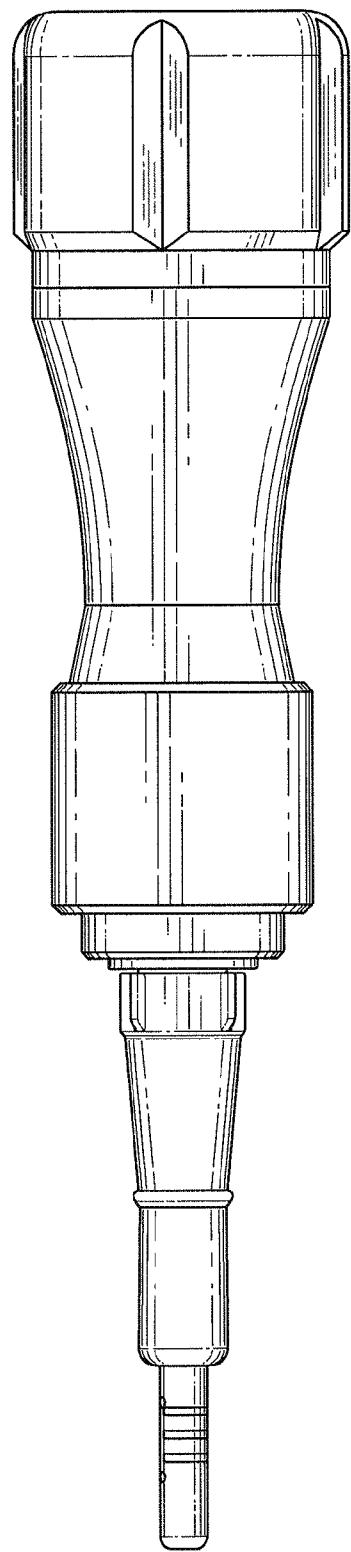


FIG. 2

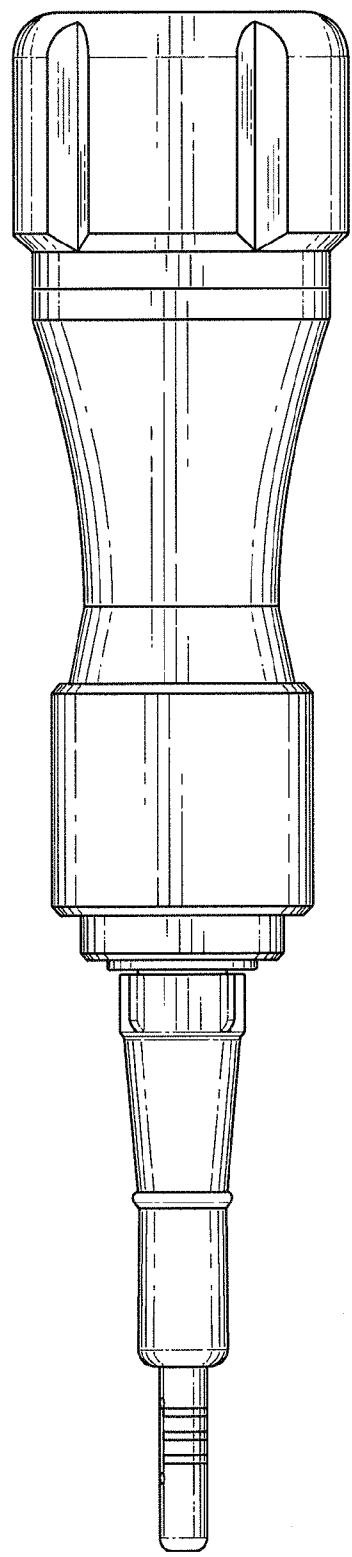


FIG. 3

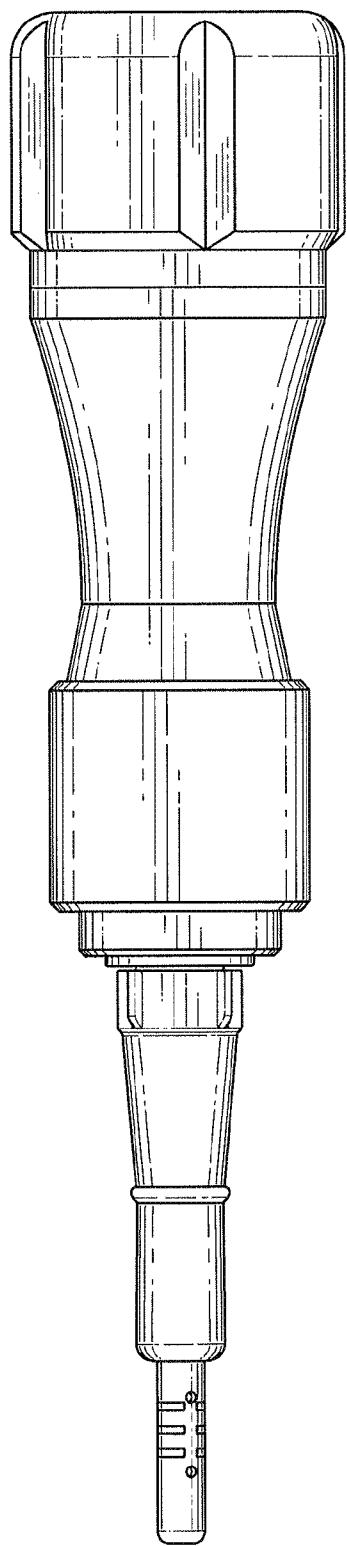


FIG. 4

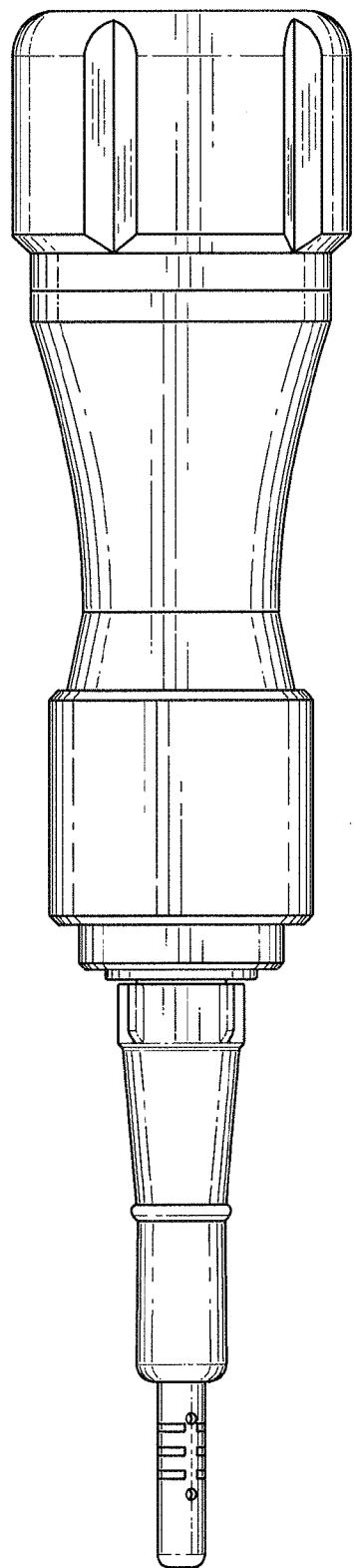


FIG. 5

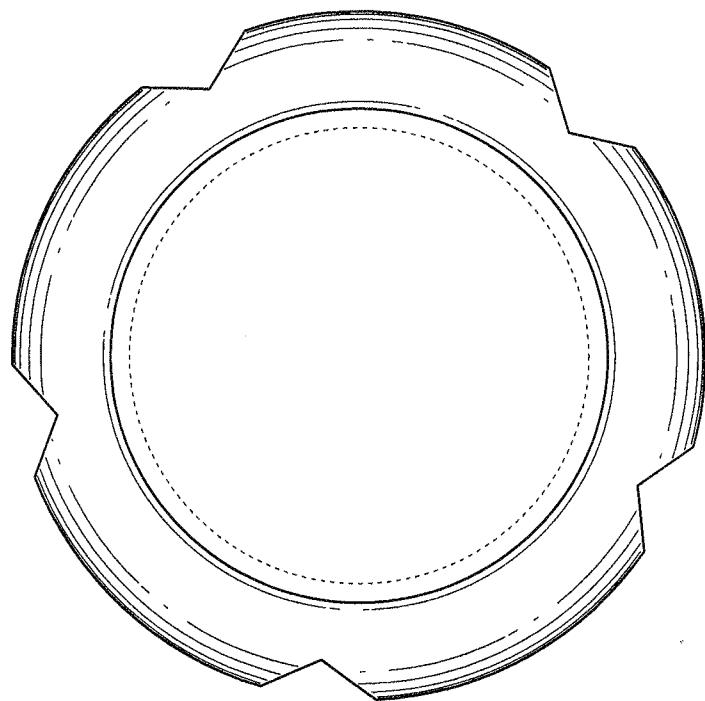


FIG. 6

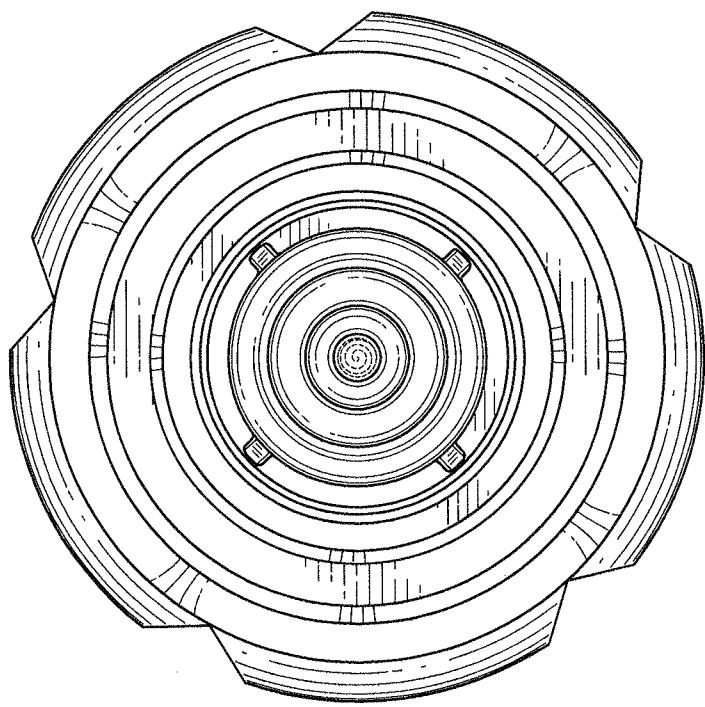


FIG. 7