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(12) **United States Design Patent**  
**Way et al.**

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(54) **MICROPERFORATION DENTAL DEVICE**

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USPC ..... **D24/152**

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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)

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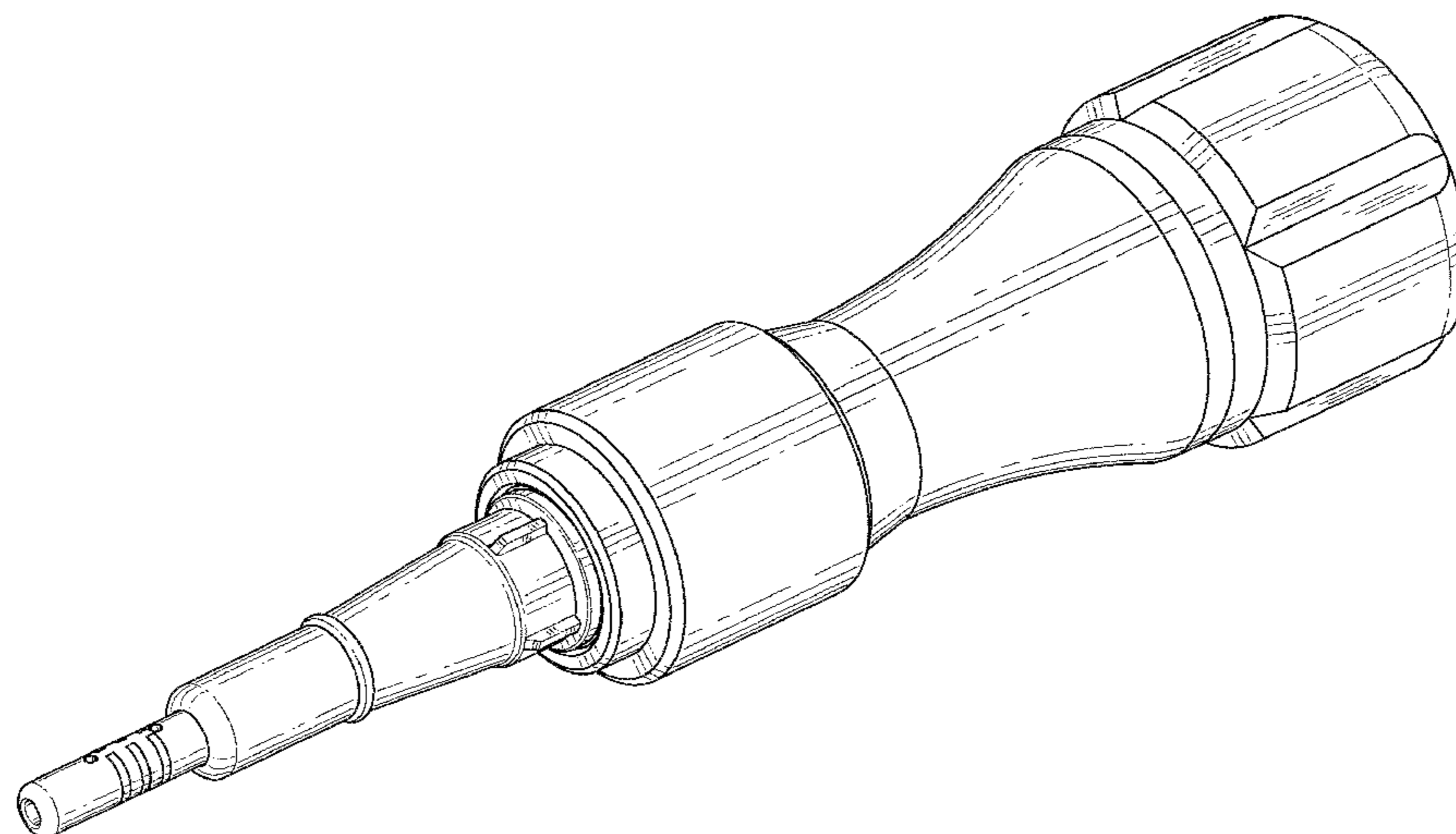
(57) **CLAIM**

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  
 4,433,956 A 2/1984 Witzig  
 4,482,318 A 11/1984 Foerster  
 4,483,674 A 11/1984 Schuetz  
 4,549,538 A 10/1985 Schadrack et al.  
 D285,835 S 9/1986 Hanses  
 4,747,824 A 5/1988 Spinello  
 4,777,852 A 10/1988 Herman et al.  
 4,828,113 A 5/1989 Friedland et al.  
 4,944,677 A 7/1990 Alexandre  
 5,002,485 A 3/1991 Aagesen  
 5,030,098 A 7/1991 Branford  
 5,173,050 A 12/1992 Dillon  
 5,188,531 A 2/1993 Von Sutfin  
 5,191,880 A 3/1993 McLeod et al.  
 5,281,133 A 1/1994 Farzin-Nia  
 5,320,532 A 6/1994 Farzin-Nia et al.  
 5,343,883 A 9/1994 Murayama  
 5,351,404 A 10/1994 Smith  
 5,439,377 A 8/1995 Milanovich  
 5,472,344 A 12/1995 Binder et al.  
 5,547,657 A 8/1996 Singleton et al.  
 D379,750 S 6/1997 Thompson et al.  
 5,676,682 A 10/1997 Yoon  
 5,957,946 A 9/1999 Shuler et al.  
 5,961,535 A 10/1999 Rosenberg et al.  
 6,019,776 A 2/2000 Preissman et al.  
 6,032,677 A 3/2000 Blechman et al.  
 6,106,289 A 8/2000 Rainey et al.  
 6,109,916 A 8/2000 Wilcko et al.  
 D440,479 S 4/2001 Hsiao  
 6,234,975 B1 5/2001 McLeod et al.  
 D454,767 S 3/2002 Edwards  
 6,543,315 B2 4/2003 Huang  
 6,592,368 B1 7/2003 Weathers, Jr.  
 6,648,639 B2 11/2003 Mao  
 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 Minoretta 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 Glukhovskiy et al.  
 2010/0055634 A1 3/2010 Spaulding et al.  
 2010/0092916 A1 4/2010 Teixeira et al.

2010/0136504 A1 6/2010 Sabilla  
 2010/0266983 A1 10/2010 Ng et al.  
 2011/0045435 A1 2/2011 Goodman  
 2011/0065060 A1 3/2011 Teixeira et al.  
 2011/0207075 A1 8/2011 Altshuler et al.  
 2012/0094246 A1 4/2012 Pavlin  
 2012/0179070 A1 7/2012 Pommer et al.  
 2012/0322018 A1 12/2012 Lowe et al.  
 2014/0322663 A1\* 10/2014 Way ..... A61C 7/02  
 433/24  
 2015/0320523 A1 11/2015 Way 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; Principals 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 I. 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 Behçet'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-1 gamma 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

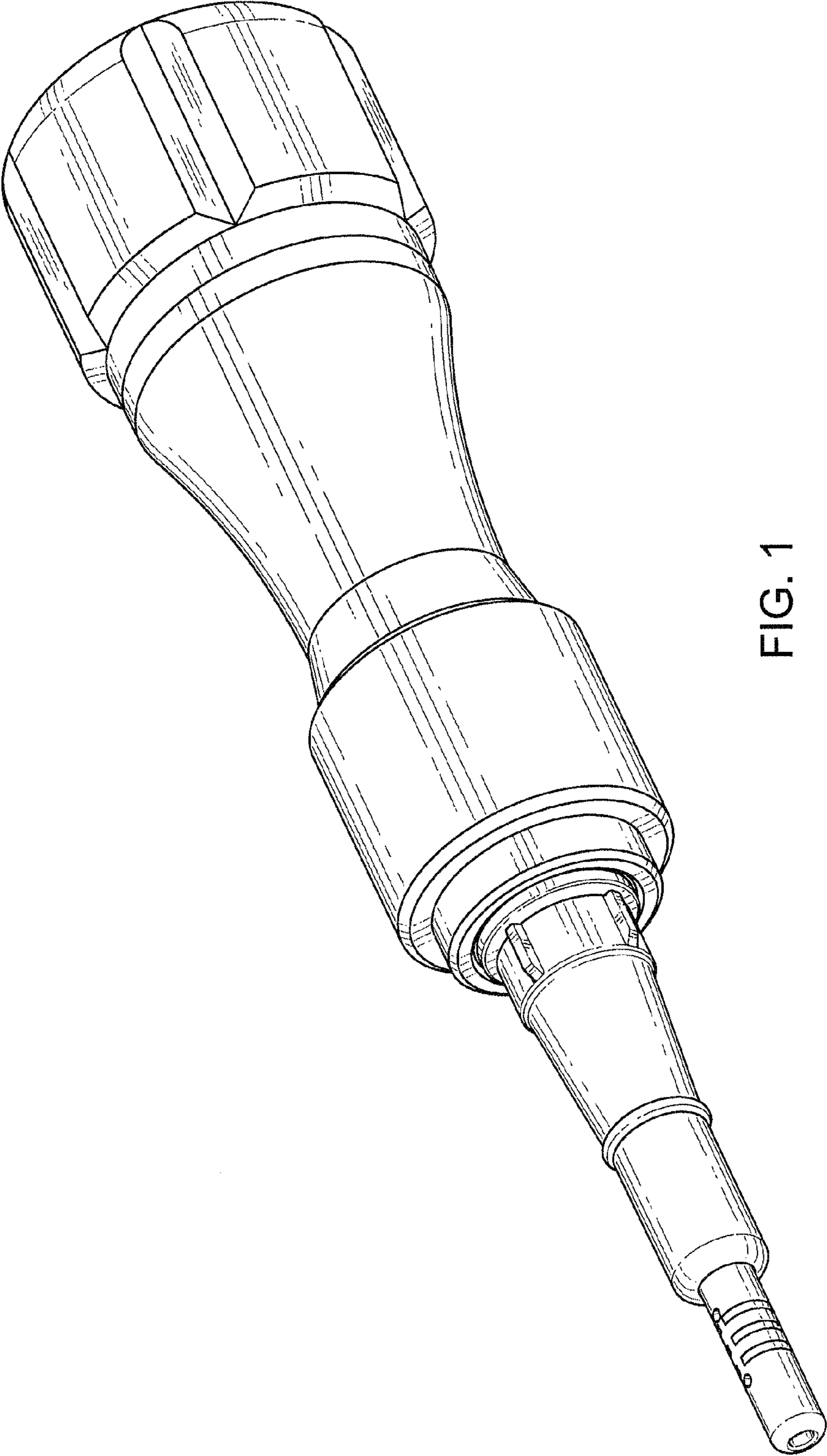


FIG. 1

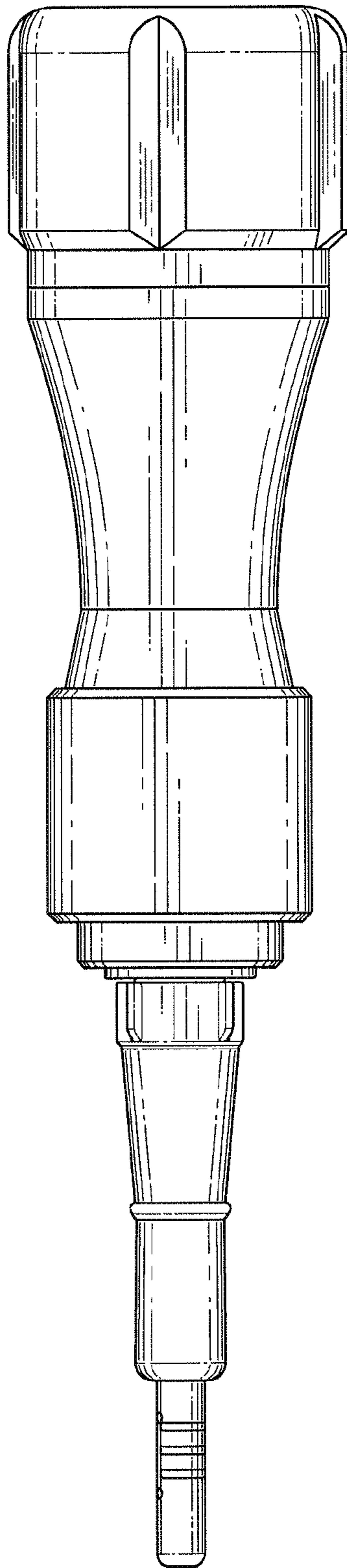


FIG. 2

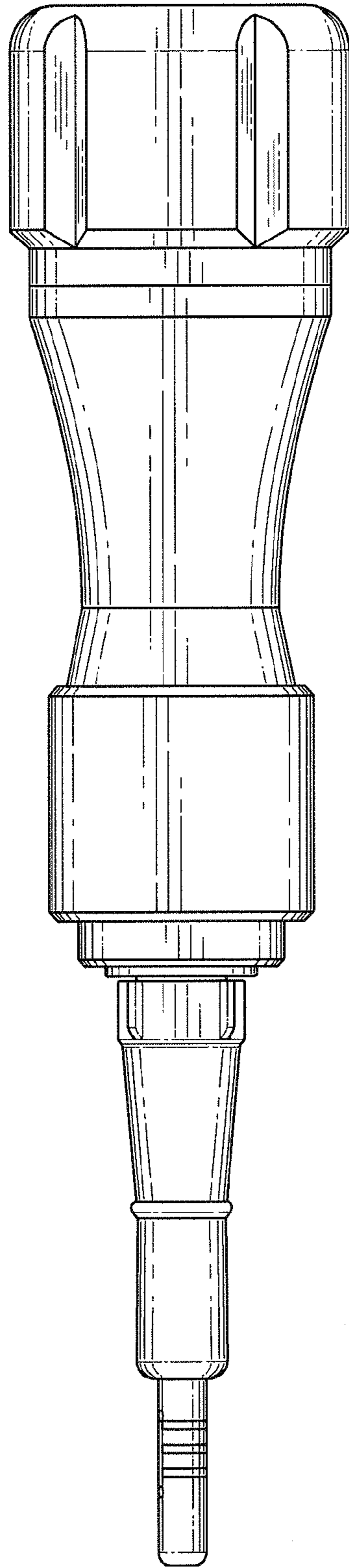


FIG. 3

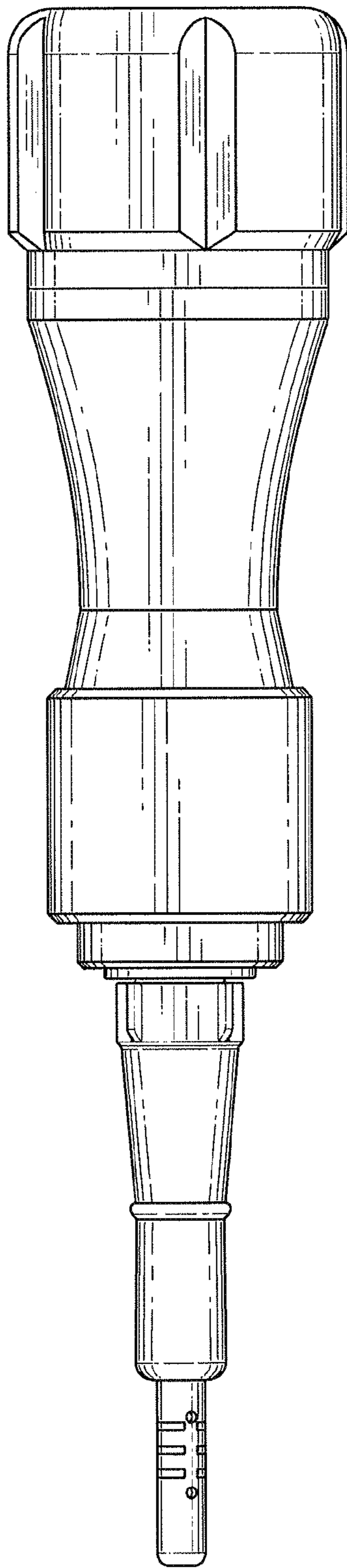


FIG. 4



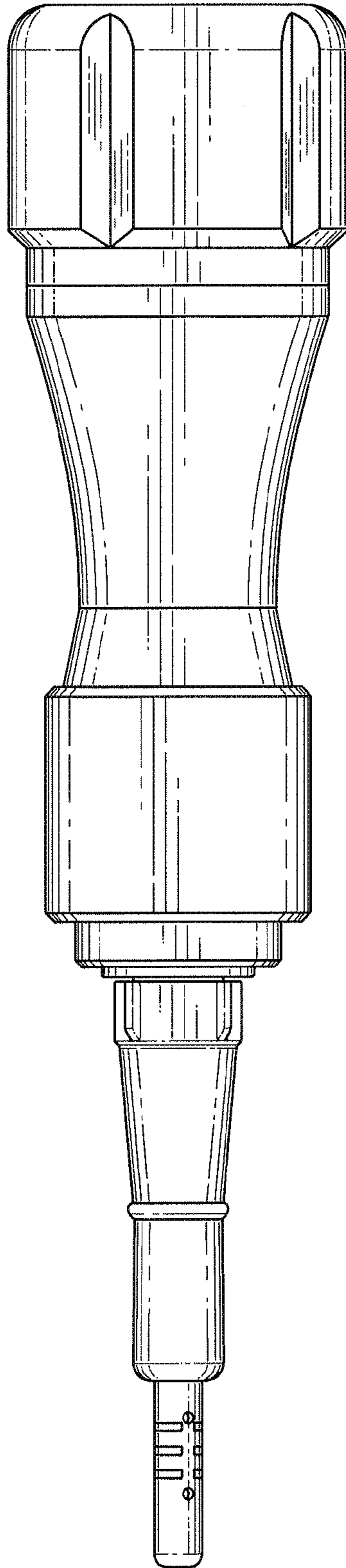


FIG. 5

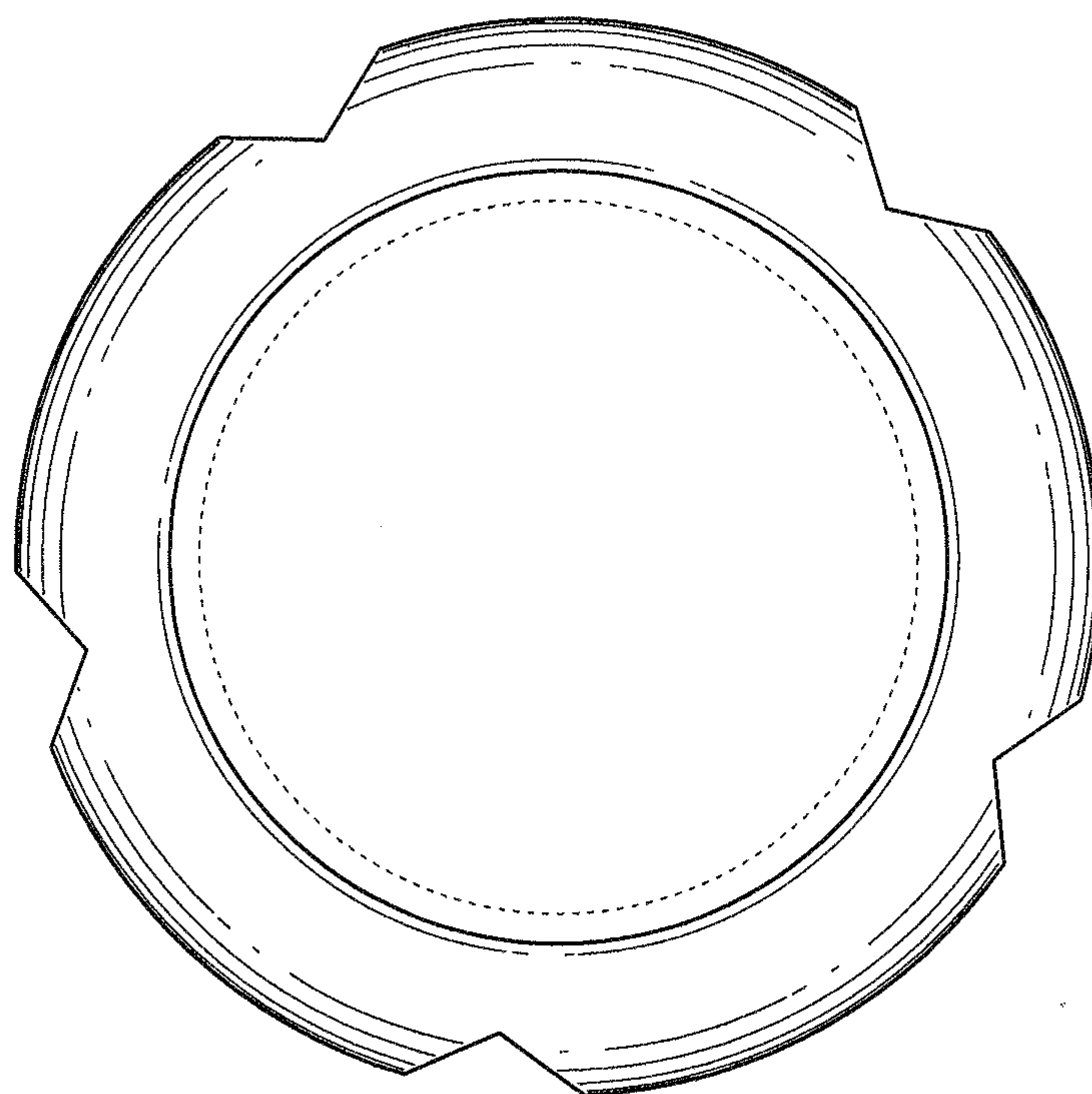


FIG. 6

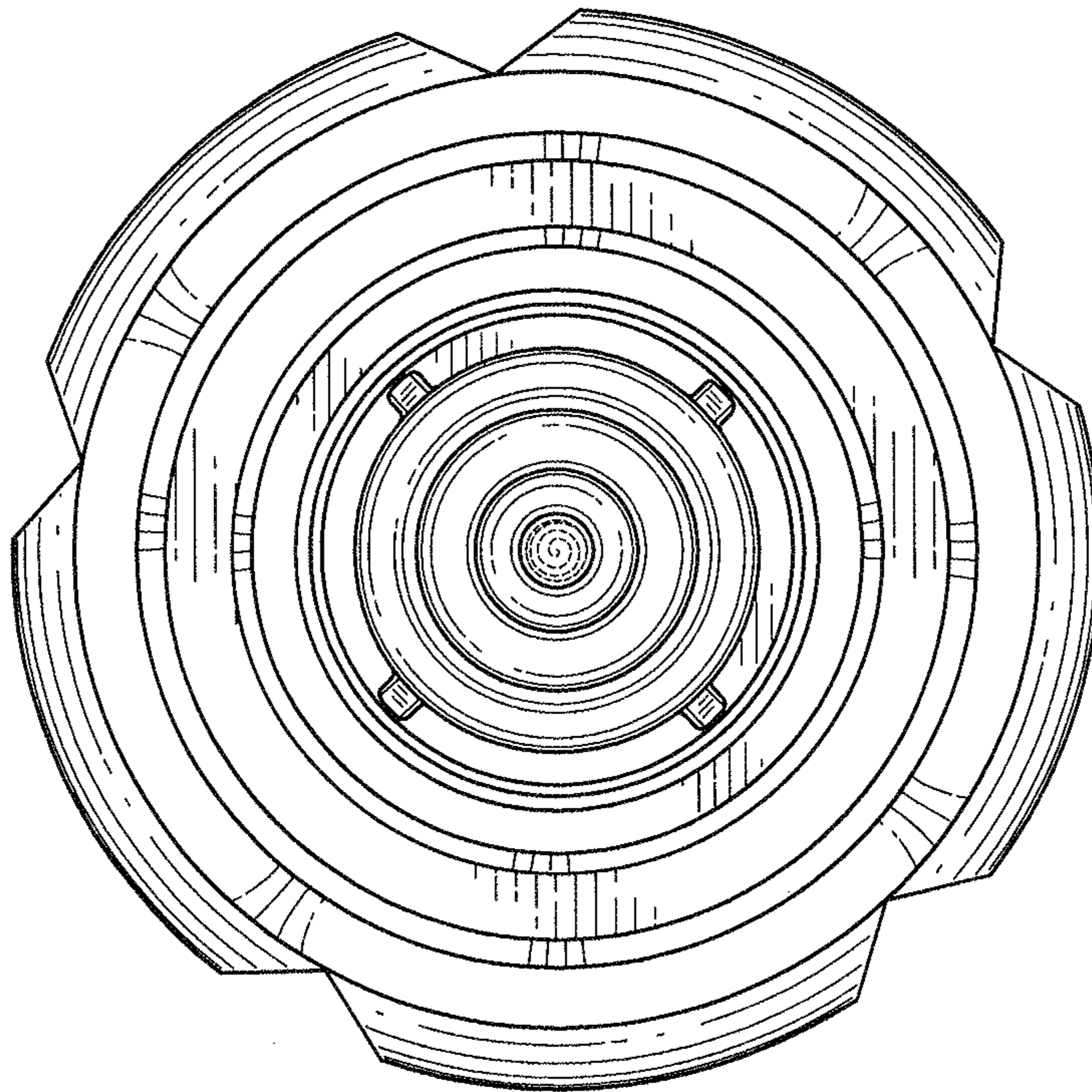


FIG. 7