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|--|--------------------------------|----|---|--------------------------|----|
| (51) International Patent Classification: | | | 63/503,168 | 19 May 2023 (19.05.2023) | US |
| <i>A61C 3/00</i> (2006.01) | <i>A61C 13/00</i> (2006.01) | | 63/503,165 | 19 May 2023 (19.05.2023) | US |
| <i>A61C 1/00</i> (2006.01) | <i>A61C 15/047</i> (2006.01) | | 63/503,167 | 19 May 2023 (19.05.2023) | US |
| <i>A61C 5/00</i> (2017.01) | <i>A61C 17/22</i> (2006.01) | | | | |
| (21) International Application Number: | | | (72) Inventor; and | | |
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| (22) International Filing Date: | | | (74) Agent: NEIFELD, Richard; 9112 Shearman Street, Fairfax, VA 22032-1479 (US). | | |
| | 28 September 2023 (28.09.2023) | | | | |
| (25) Filing Language: | English | | (81) Designated States (<i>unless otherwise indicated, for every kind of national protection available</i>): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, | | |
| (26) Publication Language: | English | | | | |
| (30) Priority Data: | | | | | |
| 63/377,375 | 28 September 2022 (28.09.2022) | US | | | |
| 63/377,380 | 28 September 2022 (28.09.2022) | US | | | |
| 63/377,722 | 29 September 2022 (29.09.2022) | US | | | |
| 63/385,993 | 04 December 2022 (04.12.2022) | US | | | |
| 63/503,166 | 19 May 2023 (19.05.2023) | US | | | |

(54) Title: ORAL APPLIANCES, THEIR COMPONENTS, AND METHODS OF USE FOR ORAL MAPPING AND HYGIENE

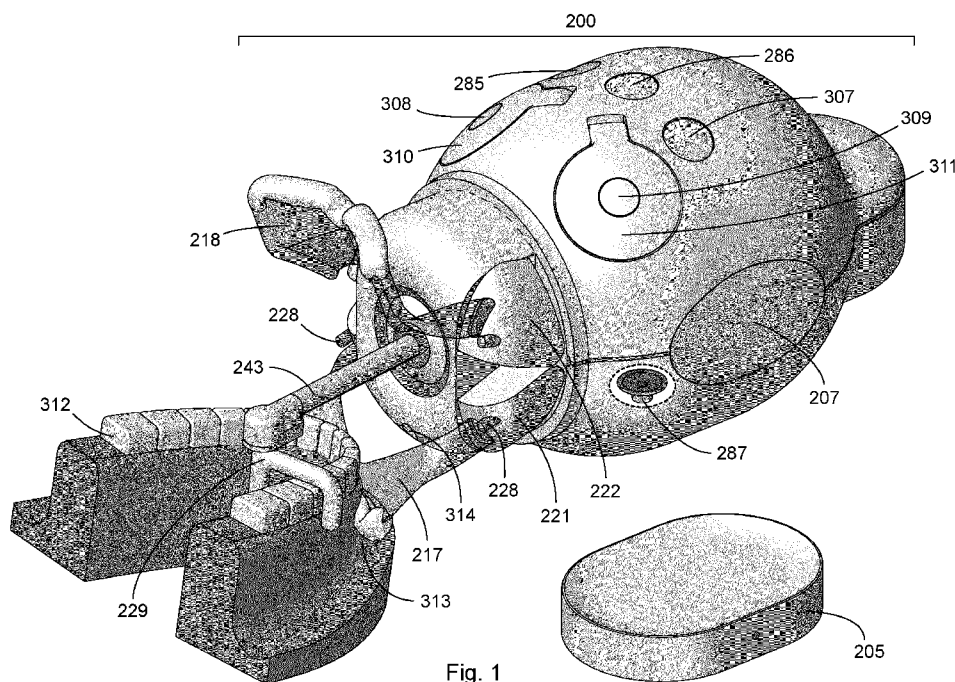


Fig. 1

(57) Abstract: Oral appliances, their components, and methods of their use for oral mapping and hygiene are disclosed. One method of using an oral appliance, comprises using a tool while the tool is at least partially within the oral cavity of a living creature; moving the tool, with a motion generator comprised of at least one linear and/or rotary motion-producing device; retrieving a map from machine-readable memory; and processing, with nonhuman processing circuitry, the map to generate control signals for controlling movement of the motion generator; and the processing circuitry using the map to control the motion generator to move the tool within the oral cavity so that the tool performs one of the functions of: cleaning, inspecting, scanning, imaging, dispensing, repairing, and surgery of anatomical features of the oral cavity.



RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH,
TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS,
ZA, ZM, ZW.

- (84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- *of inventorship (Rule 4.17(iv))*

Published:

- *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:

10 May 2024 (10.05.2024)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2023/075452

A. CLASSIFICATION OF SUBJECT MATTERIPC: **A61C 3/00** (2024.01); **A61C 1/00** (2024.01); **A61C 5/00** (2024.01); **A61C 13/00** (2024.01); **A61C 15/047** (2024.01); **A61C 17/22** (2024.01)CPC: **A61C 3/00**; **A61C 15/047**; **A61C 17/22**; **A61C 1/00**; **A61C 5/00**; **A61C 13/00**

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)

See Search History Document

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

See Search History Document

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

See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/0154198 A1 (DURBIN et al.) 13 July 2006 (13.07.2006) entire document	1-5, 8-10, 12, 13, 15-20, 23-26, 28, 32-35, 57-62
Y	entire document	6, 7, 11, 14, 21, 22, 27, 29-31, 36- 56, 63-66, 70, 71
X	US 6152733 A (HEGEMANN et al.) 28 November 2000 (28.11.2000) entire document	68, 69, 72, 74-76, 79
Y	entire document	63-67, 70, 71, 73, 77, 78
Y	CN 109700556 A (HOU) 03 May 2019 (03.05.2019) see machine translation	6



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“D” document cited by the applicant in the international application

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“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

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Date of the actual completion of the international search

07 February 2024 (07.02.2024)

Date of mailing of the international search report

05 April 2024 (05.04.2024)

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450

Facsimile No. 571-273-8300

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2023/075452

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2019/0223991 A1 (KRAMER) 25 July 2019 (25.07.2019) entire document	7, 11, 14, 36, 38, 45, 46, 51-56, 65
Y	CN 201393679 Y (SUZHOU KECHUANG MANAGEMENT CONSULTING) 03 February 2010 (03.02.2010) see machine translation	21, 22, 27
Y	US 2022/0273408 A1 (ORALUCENT INC.) 01 September 2022 (01.09.2022) entire document	29-31
Y	KR 20020026394 A (KIM) 10 April 2002 (10.04.2002) see machine translation	37
Y	WO 2012/093761 A1 (PARK) 12 July 2012 (12.07.2012) see machine translation	39-44
Y	KR 20210103694 A (CHEONGJU UNIVERSITY INDUSTRY AND ACADEMY COOPERATION FOUNDATION) 24 August 2021 (24.08.2021) see machine translation	47-50
Y	US 4687442 A (WONG) 18 August 1987 (18.08.1987) entire document	67
Y	US 5,224,500 A (STELLA) 06 July 1993 (06.07.1993) entire document	73, 77, 78
A	US 2021/0177130 A1 (KONINKLIJKE PHILIPS N.V.) 17 June 2021 (17.06.2021) entire document	1-79

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-58, is drawn to an oral appliance, comprising: a motion generator comprising a tool arm having a distal end, and an assembly.

Group II, claim 59, is drawn to a method of using an oral appliance, comprising: using a tool while the tool is at least partially within the oral cavity of a living creature.

Group III, claims 60-62, is drawn to a method for automatically generating an oral map of features within an oral cavity of a living animal, comprising: moving a tool relative to a reference point that is fixed relative to oral cavity.

Group IV, claims 63-66, is drawn to an oral hygiene apparatus comprising: an oral hygiene tool; a member connected to the oral hygiene tool.

Group V, claim 67, is drawn to an oral positioning apparatus, comprising: one or more members configured so that the one or more members hold an upper jaw spaced from a lower jaw of a vertebrate.

Group VI, claims 68-79, is drawn to an automated oral hygiene apparatus, for automatically performing an oral hygiene task within a mouth of an individual, comprising: a probe; wherein the probe comprises a tool.

The inventions listed as Groups I-VI do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: the assembly comprises a mechanism to rotate the tool arm and structure allowing the tool arm to move linearly; wherein a distal end of the tool arm is configured to mechanically attach to an oral cavity tool; at least one sensor configured to output a signal indicating locations of surfaces of an oral cavity; machine-readable and/or readable and writable memory; non-human processing circuitry which is coupled to the memory and the at least one sensor; wherein the processing circuitry is configured to read from and/or write to the memory; wherein the processing circuitry is configured to receive signals from the at least one sensor; and wherein the processing circuitry is configured to automatically generate control signals to control the motion generator to move the tool arm as claimed therein is not present in the invention of Groups II-VI. The special technical feature of the Group II invention: using a tool while the tool is at least partially within the oral cavity of a living creature; moving the tool, with a motion generator comprised of at least one linear and/or rotary motion-producing device; and retrieving a map from machine-readable memory; and processing, with non-human processing circuitry, the map to generate control signals for controlling movement of the motion generator; and the processing circuitry using the map to control the motion generator to move the tool within the oral cavity so that the tool performs one of the functions of: cleaning, inspecting, scanning, imaging, dispensing, repairing, and surgery of anatomical features of the oral cavity as claimed therein is not present in the invention of Groups I, III-VI. The special technical feature of the Group III invention: moving a tool relative to a reference point that is fixed relative to oral cavity; detecting, using a sensor, positions of the tool, indicating that either the tool or an object mechanically connected to the tool, has hit an obstruction; and storing oral mapping data, in computer writable memory, based upon the detected positions as claimed therein is not present in the invention of Groups I, II, IV-VI. The special technical feature of the Group IV invention: an oral hygiene tool; a member connected to the oral hygiene tool; a connector configured to connect to an actuator; wherein the connector is mechanically coupled to the member so that motion of the connector causes the member to move; and a retention feature which is configured to retain the connector to an actuator and enable the actuator to rotate the connector as claimed therein is not present in the invention of Groups I, II, III or V-VI. The special technical feature of the Group V invention: one or more members configured so that the one or more members hold an upper jaw spaced from a lower jaw of a vertebrate, when the one or more members are positioned relative to anatomical features of the vertebrate; a cam follower connected to one or more of said locating members either directly or through intermediate members; and a cam having a plurality of positions which constrain the motion of said cam follower as claimed therein is not present in the invention of Groups I-IV or VI. The special technical feature

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

of the Group VI invention: a probe; wherein the probe comprises a tool; wherein the oral hygiene apparatus is configured to automatically move and orient the probe within the mouth; and wherein the oral hygiene apparatus is configured to automatically operate the tool to perform an oral hygiene task as claimed therein is not present in the invention of Groups I-V.

Groups I, II, III, IV, V, and VI lack unity of invention because even though the inventions of these groups require the technical feature of an oral appliance, comprising: a motion generator; machine-readable memory; and non-human processing circuitry coupled to the memory, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2021/0177130 to KONINKLIJKE PHILIPS N.V. teaches an oral appliance, comprising: a motion generator; machine-readable memory; and non-human processing circuitry coupled to the memory (See Paras. [0152-0155]).

Since none of the special technical features of the Group I, II, III, IV, V, or VI inventions are found in more than one of the inventions, unity of invention is lacking.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.