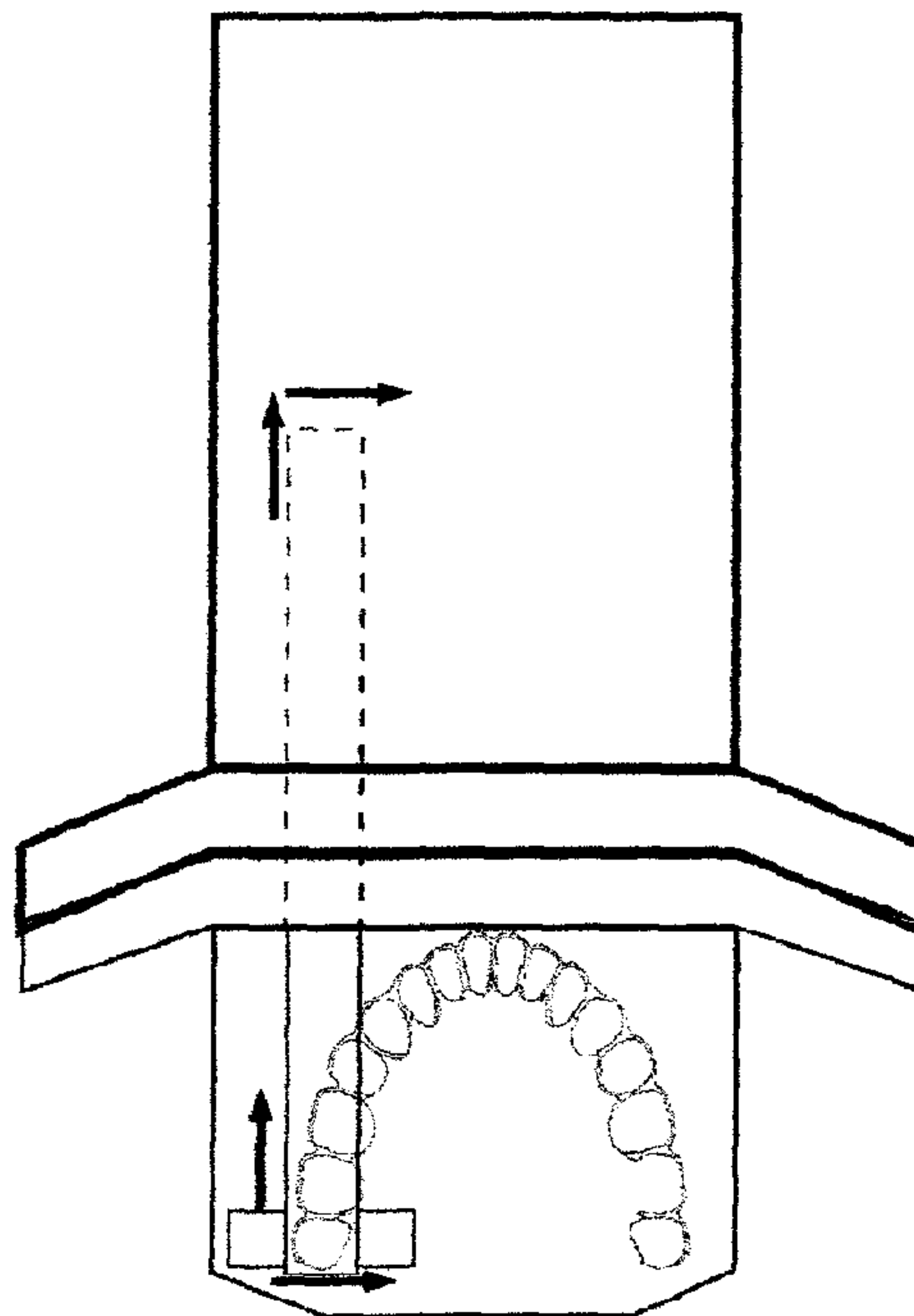




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(54) Titre : DISPOSITIF DE TOMODENSITOMETRIE DENTAIRE ET METHODE ASSOCIEE
(54) Title: DENTAL SCANNER DEVICE AND RELATED METHOD



(57) **Abrégé/Abstract:**

The invention relates to a dental scanning device characterized in that it is essentially formed by: two bodies, the first body or scanner body (1) housing a moving scan head (3) consisting of a longitudinal mobile element ending in the so-called scanning head (4), and the second body or bite body (2) consisting of a casing for receiving the scanning head (4); in addition to the element that allows the patient to hold and position the device by means of the force or pressure exerted by the patient's bite.

ABSTRACT

The invention relates to a dental scanning device characterized in that it is essentially formed by: two bodies, the first body or scanner body (1) housing a moving scan head (3) consisting of a longitudinal mobile element ending in the so-called scanning head (4), and the second body or bite body (2) consisting of a casing for receiving the scanning head (4); in addition to the element that allows the patient to hold and position the device by means of the force or pressure exerted by the patient's bite.

DENTAL SCANNER DEVICE AND RELATED METHOD

FIELD OF THE INVENTION

5 [0001] The present disclosure generally relates to the field of stomatology and dental prosthetics manufacturing, and in particular to an intraoral dental scanner for 3D teeth and gingivae imaging and related method.

10 BACKGROUND OF THE INVENTION

[0002] Teeth and gingivae 3D diagnostic and therapeutic images have been traditionally obtained by using replicas or models from alginate-impressed molds. Such replicas get gingiva and tooth negative images, which are later on converted into positive, and then scanned. However, these mainstream
15 techniques pose a double problem: the patient is uncomfortable; and they are not very reliable and accurate; thus, the process is slow and costly.

[0003] There are several state-of-the-art devices that try to solve the problems posed by mainstream techniques; e.g.: panoramic dental X rays or computerized
20 dental tomographies.

[0004] EP 0825837, "Modular intra-oral imaging system video camera", for instance, mainly provides a I-hand-held video camera to take images of the patient's inner part of the mouth. The camera has a socket; in the inner part of
25 the socket there is a base, and a visualizing device, as well as a socket's long axis optically aligned sensor that converts into data the images taken by the camera.

[0005] US 2006154198 3D dental scanner is both an imaging method and a system to get images of the dental structure in the inner part of the oral cavity, through the motion of at least one image capturer set on a fixed-reference-system coupled arm, external to the mouth, to generate a 3D model of the structure, based on the images captured.

[0006] ES2 383 220, "Intraoral dental imaging sensor and X-ray system, using such sensor" is an intraoral dental radiological system equipped with a mouth-insertable x-ray imaging sensor. It is made up of an image-detection matrix to provide electronic signals. The system comprises a light source to receive the matrix-generated signals; it emits binary light impulses corresponding to a digital image to be transmitted; it also has a light receiver placed at a certain distance from the patient; it can detect a light modulation triggered by the light source; it can transmit to the image-treating device the signal corresponding to such modulation.

[0007] Lastly, ES2324658 (T3), "Laser-digitalizing system for dental applications" is a laser digitizer that has a light source with collimation optics to generate a collimated light beam; a scanner optically coupled with the light source (configured to scan the collimated beam towards the object to be optically represented in a predetermined pattern); an imaging instrument with an optical axis in a θ angle with the scanner; this is set up to detect a pattern reflection from the object, and generate the object surface representative data, based on the pattern reflection; and a scanner-coupled processor, and the imaging system, configured to render a data-based 3D image of the object; it is characterized by the fact that the scanner is set up to scan the collimated beam all along at least to axes in the predetermined pattern. Such pattern encompasses a series of curvilinear segment.

[0008] These devices and systems have several inconveniences. First, in some cases, a technician must manually operate them with a toothbrush-like motion, which, obviously, is inaccurate. Likewise, they are based on photographs taken by the various devices; usually, a software interprets and interpolates such photographs to take a final 3D image. Thus, besides the time needed to get the final image, these known systems depend on the operator's skill for manipulating the camera and inserting it in not-easy-to-reach parts of the mouth.

[0009] Other known devices do not depend so much on manual operation, but have an external fixed-coordinate system, independent of the patient; therefore, the final image is exclusively based on the images captured with no extra projection; thus, they are not very accurate, as the reference system changes with the slightest movement of the patient.

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SUMMARY OF THE INVENTION

[0010] This invention is a dental scanning device that overcomes at least some of the above-noted defects in certain embodiments. For example, the invention may capture 3D images with respect to a fixed-reference system; i.e. the patient's mouth; thus, images are accurate, as the device moves along with the patient; i.e.; teeth-position point of reference, for instance, as related to the device, is preserved at all moments, and remains in place while scanning.

[0011] In one aspect, there is provided a dental scanner device for 3D teeth and gingivae imaging, said device including: a scanner housing, which houses an elongate mobile element which juts out the scanner housing and ends in a scanner head probe, the scanner head probe comprising an element for emitting scanning energy; and a bite fixture being held by a patient when biting said bite fixture during a dental scan procedure wherein the dental scan procedure is fully automated and generates a 3D image of the dental arch and gingivae, wherein

the mobile element ending in the scanner head probe moves within the bite fixture parallel to a long axis of the elongate mobile element and perpendicular thereto, and wherein the scanner housing, the elongate mobile element, the scanner head probe, and the bite fixture can move with the patient's mouth, the patient's mouth being a fixed point of reference for the dental scan procedure, and thereby preserving the fixed point of reference at all moments while scanning.

[0012] In another aspect, there is provided a method for scanning a dental arch including the steps of: a) providing a dental scanner described herein; b) placing the bite fixture in the patient's mouth; and c) performing the dental scan procedure to produce a three-dimensional image of the dental arch.

[0013] In yet another aspect there is provided a dental scanning device made up of two components; one component lodges the scanner as such, as well as a mobile head probe; the other component is to be held when the patient bites, and is to correspondingly house the mobile head probe. Once the head probe part is introduced in the bite fixture - and therefore is held by the patient's mouth-the head probe moves in at least two directions. One direction following the long axis of the head probe; and the other direction perpendicular to it, so that scanning is the result of a combination of both movements, as related to the dental arcade of the patient. The component(s) to be held in the patient's mouth may be made of an easy-to-disinfect / sterilize material.

[0014] Optionally, the aforementioned components can be coupled to one another, and may be disassembled and joined again; in this case, either the patient's mouth-held piece is made of an easy-to-disinfect I sterilize material, or is disposed after use. In this case, a scanning component and a bite fixture may be easily coupled to one another through specially placed devices in the coupling ends.

BRIEF DESCRIPTION OF THE DRAWINGS

5 [0015] Below there is a description of the invention, based on one of the versions of choice, and as per attached drawings in which:

[0016] Figure 1 illustrates a scanner device as per one version of the invention, as seen from above;

10 [0017] Figure 2 illustrates a side view of the scanner device in figure 1, showing how it is placed in the patient's mouth; and

[0018] Figure 3 is a schematization of figure 1, showing device scanning directions.

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DETAILED DESCRIPTION OF THE INVENTION

[0019] As shown in figure 1, the dental scanner is made up of two components. 20 The first component, a scanner housing (1), houses an elongate mobile element (3) which juts out of the scanner housing and ends in a scanner head probe (4). That is to say, the elongate mobile element (3) and the scanner head probe (4) are partially kept inside the scanner housing (1). The scanner head probe (4) may include an element for emitting scanning energy.

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[0020] The scanner probe head (4) juts out the scanner housing (1) and is adapted to be lodged in a pocket of the second embodiment or bite fixture (2). Thus, the bite fixture (2) is, therefore, a scanner head probe lodging pocket (4).

[0021] The scanner housing (1) and the bite fixture (2) may be coupled, and separated and coupled again, the above is equally applied, just as when both components (1 & 2) have been previously coupled to one another.

5 [0022] As indicated, the bite fixture (2) is introduced in the patient's mouth; and it is held in place when the patient bites it, so that the scanner head probe (4) is introduced in the mouth to scan the corresponding dental arcade.

10 [0023] Likewise, the bite fixture (2) may be mouth shaped to make it easier to hold. Such bite fixture (2) is basically a protective pocket for the scanner head probe (4), and can be bitten by the user. The bite fixture (2) may be made of a suitable transparent material.

15 [0024] Once the part of the scanner head probe (4) that is housed in the bite fixture (2) is introduced, as shown in figure 2, the scanner head probe moves along in at least two directions; one parallel to a the long axis of the elongate mobile element (3), while the other one goes perpendicular to the long axis of the elongate mobile element, in such a way that scanning is the result of combining motions with regard the dental arcade, as shown in figure 3.

20

[0025] For the intraoral scanning, the device includes detection sensors, laser sensors or similar devices in the scanner head probe (4), as well as cameras to capture tooth-by-tooth images from the dental arcade and gingivae. These are automatically generated and exact 3D images, as a result of their fixed and
25 constant reference system.

CLAIMS

1. A dental scanner device for 3D teeth and gingivae imaging, said device comprising:

5 a scanner housing, which houses an elongate mobile element which juts out the scanner housing and ends in a scanner head probe, the scanner head probe comprising an element for emitting scanning energy; and

a bite fixture being held by a patient when biting said bite fixture during a dental scan procedure wherein the dental scan procedure is fully automated and generates a 3D image of the dental arch and gingivae,

10 wherein the elongate mobile element ending in the scanner head probe moves within the bite fixture parallel to a long axis of the elongate mobile element and perpendicular thereto,

and wherein the scanner housing, the elongate mobile element, the scanner head probe, and the bite fixture can move with the patient's mouth, the patient's mouth being a fixed point of reference for the dental scan procedure, and thereby preserving the fixed point of reference at all moments while scanning.

2. The dental scanner device of claim 1, wherein the bite fixture comprises a transparent material through which a scan can be performed.

3. The dental scanner device of claims 1 or 2, wherein the bite fixture is capable of being coupled to and separable from the scanner housing.

25 4. The dental scanner device of any one of claims 1 to 3, wherein the bite fixture is disposable.

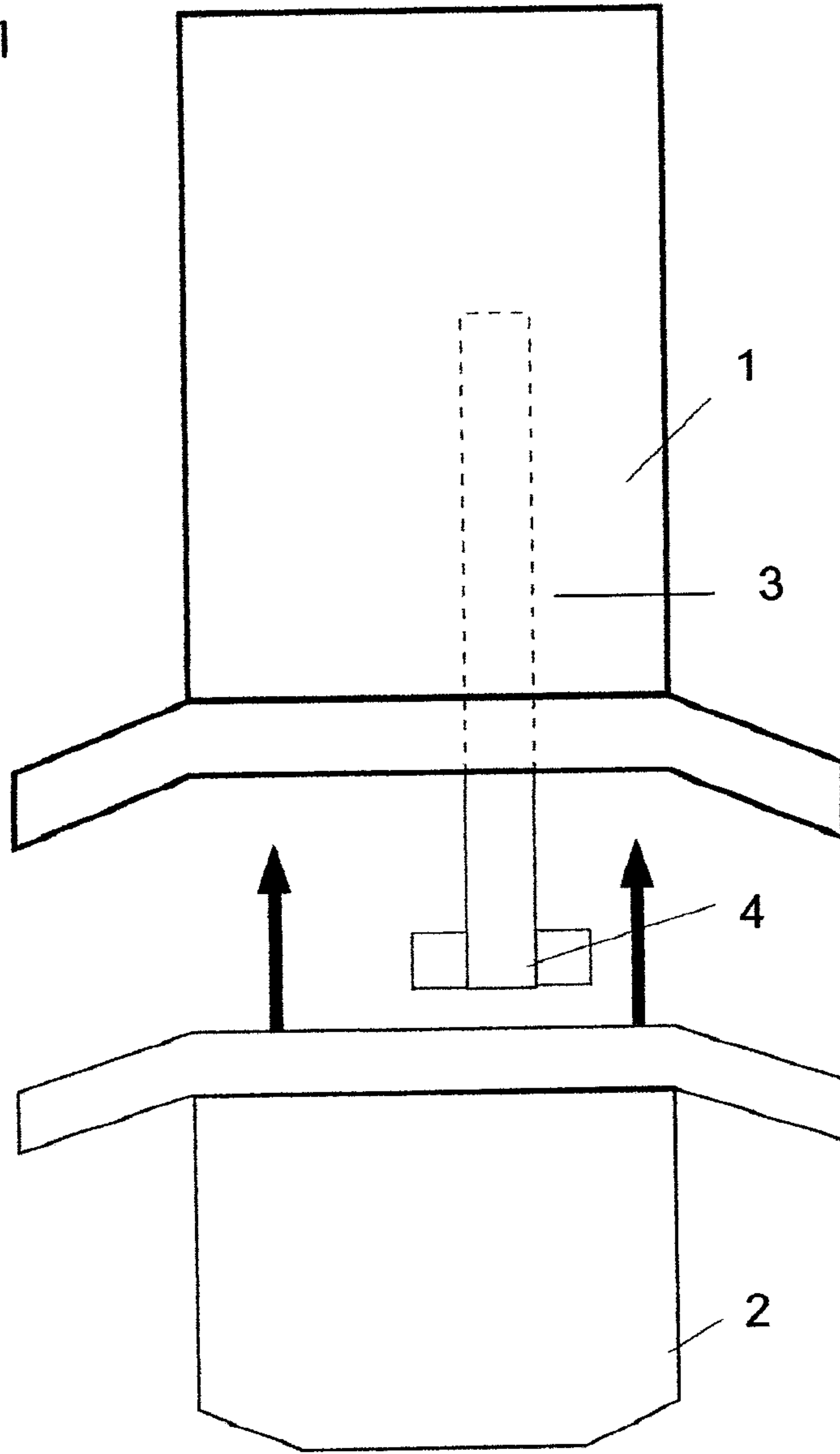
5. The dental scanner device of any one of claims 1 to 4, wherein the device is portable and capable of being hand-held by the patient during the scanning procedure.

- 5 6. A method for scanning a dental arch comprising the steps of:
- a) providing a dental scanner of any one of claims 1 to 5;
 - b) placing the bite fixture in the patient's mouth; and
 - c) performing the dental scan procedure to produce a three-dimensional image of the dental arch.

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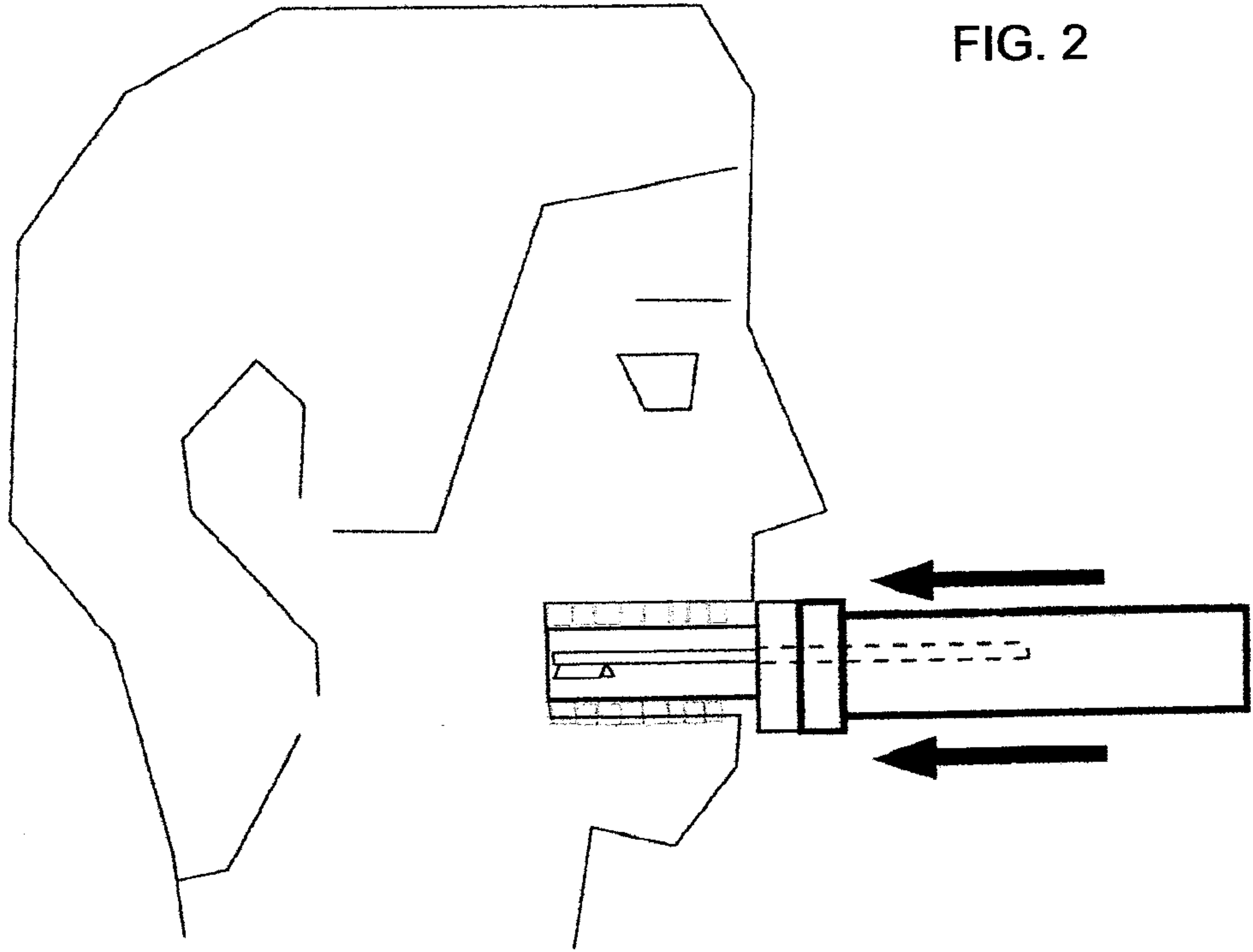
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FIG. 1



2/3

FIG. 2



3/3

FIG. 3

