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**Togliatti**

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- (54) **DENTAL APPLIANCE**
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- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 124 days.

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(21) Appl. No.: **14/523,115**

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*Primary Examiner* — Keri J Nelson

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*A63B 71/08* (2006.01)

(52) **U.S. Cl.**

CPC ..... *A61F 5/566* (2013.01); *A61F 5/56* (2013.01); *A63B 71/085* (2013.01)

(58) **Field of Classification Search**

CPC ..... *A61F 5/56*; *A61F 5/566*; *A63B 71/085*  
USPC ..... 128/848, 859–861  
See application file for complete search history.

(57) **ABSTRACT**

The invention is generally a dental appliance that, in exemplary embodiments, includes a mandibular advancement mouthpiece equipped with a tongue-securing mechanism. The dental appliance helps to keep a user's airway unobstructed by moving the mandible forward with respect to the maxilla, and securing a tip portion of the tongue slightly anterior to the mandible, so that the tongue is held from falling back into the throat. This invention helps alleviate problems including severe snoring and sleep apnea, which are typically caused by the tongue obstructing the airway at the throat, impeding respiration during sleep or when unconscious. In an exemplary embodiment, the dental appliance comprises of maxillary and mandibular components that make up a mouthpiece, which is configured to circumscribe a tongue retaining mechanism, or tongue sleeve that secures a user's tongue in place.

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**18 Claims, 10 Drawing Sheets**

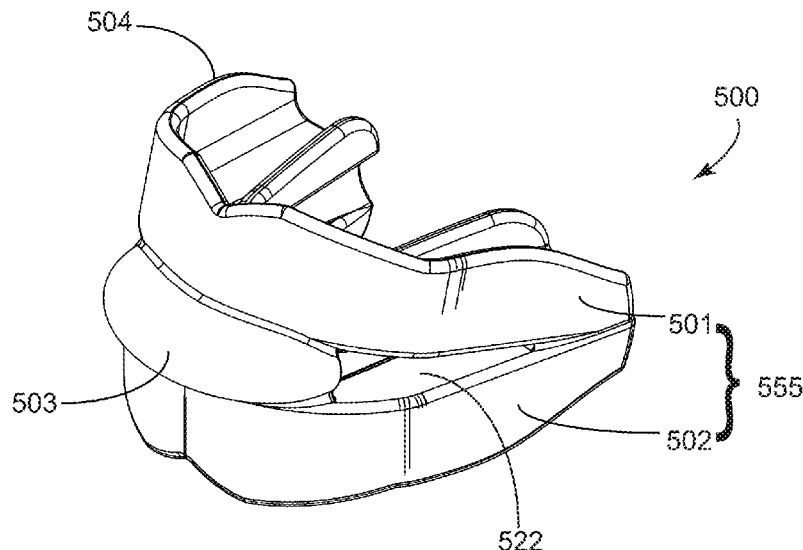


FIG. 1(a)

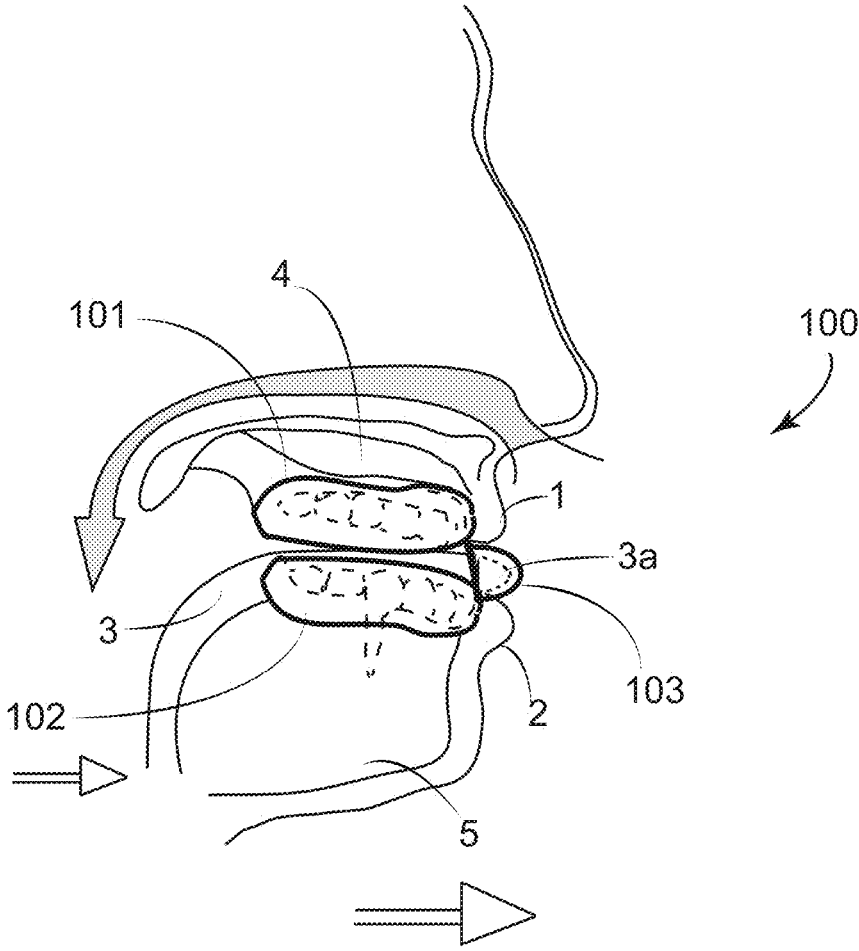


FIG. 1(b)

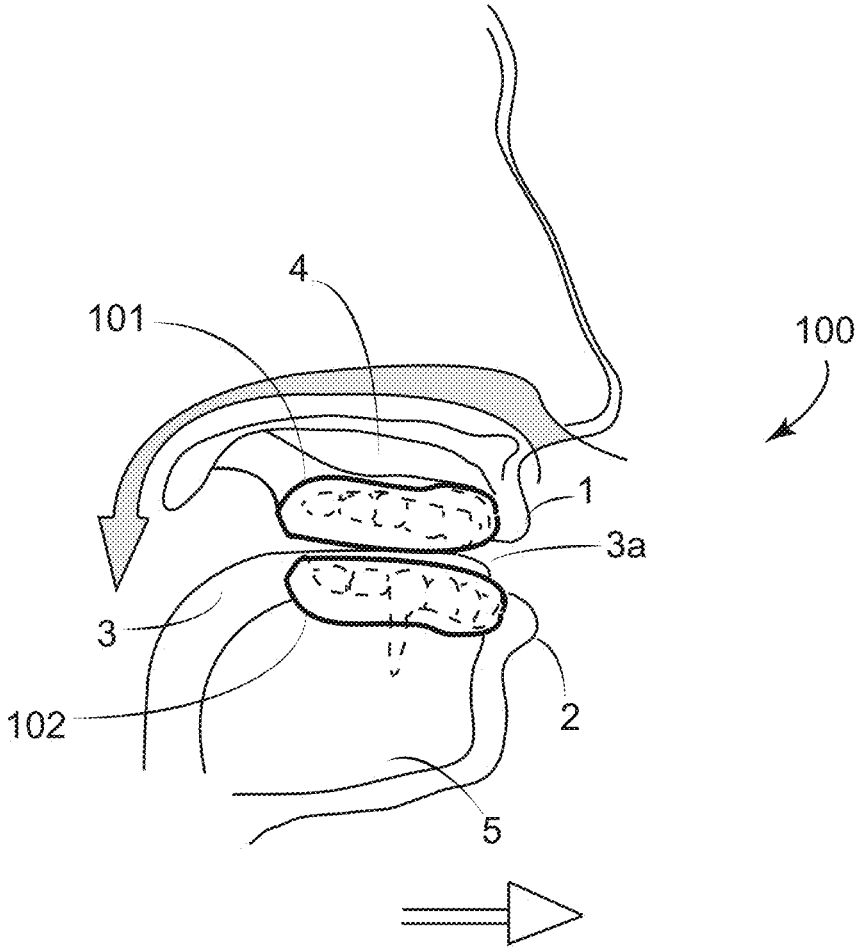


FIG. 2(a)

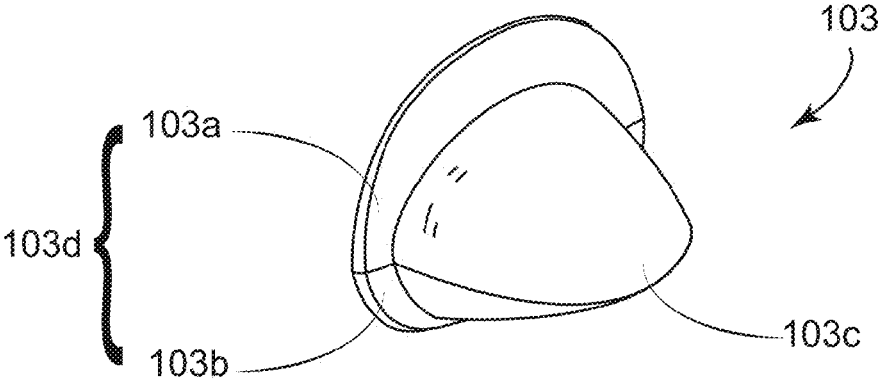


FIG. 2(b)

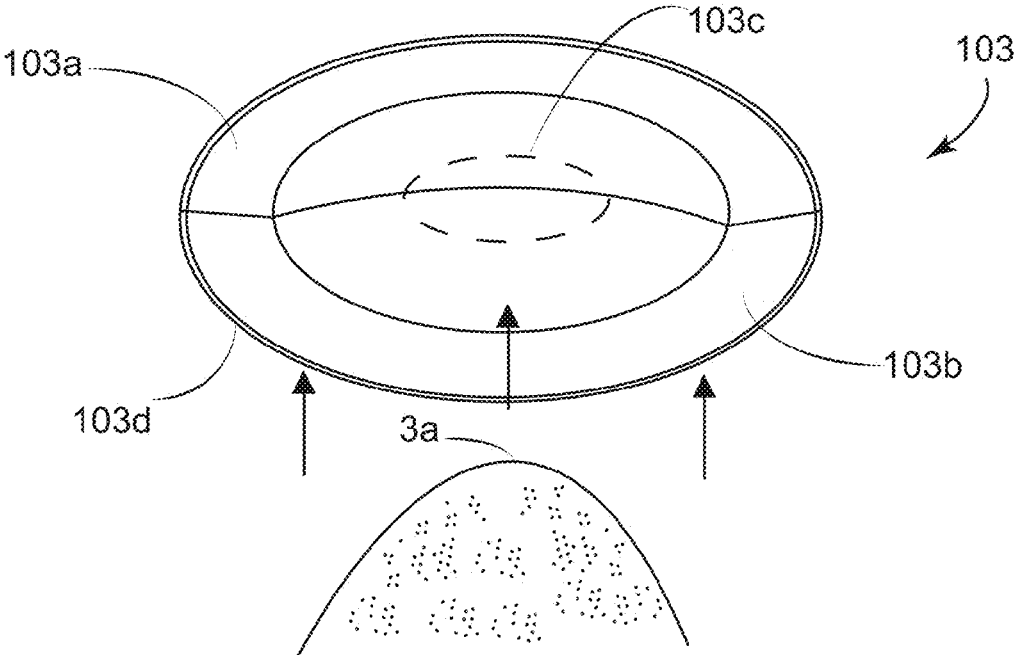


FIG. 3

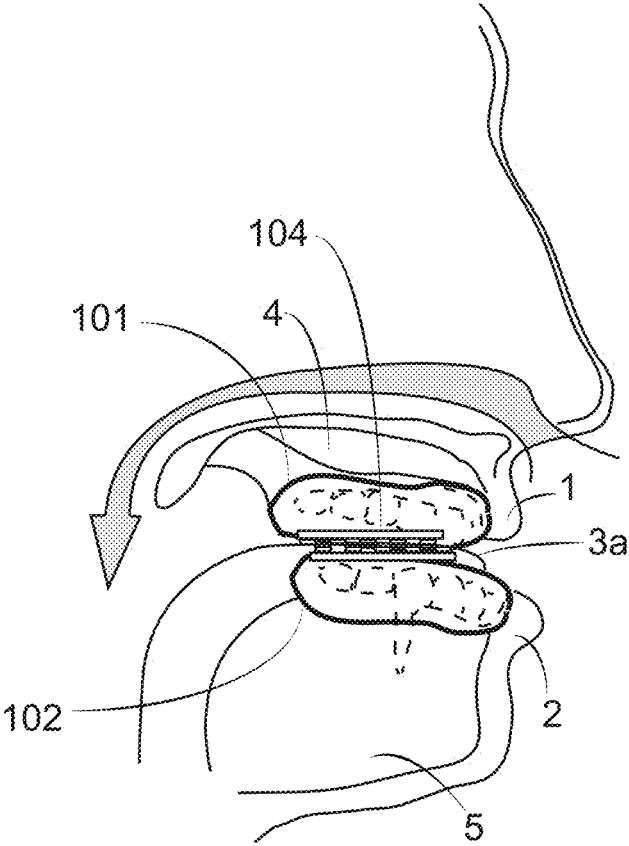


FIG. 4

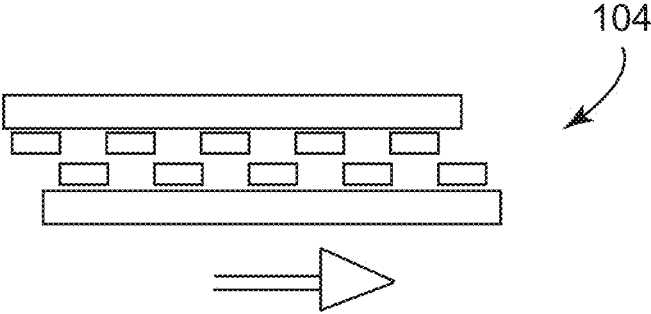


FIG. 5(a)

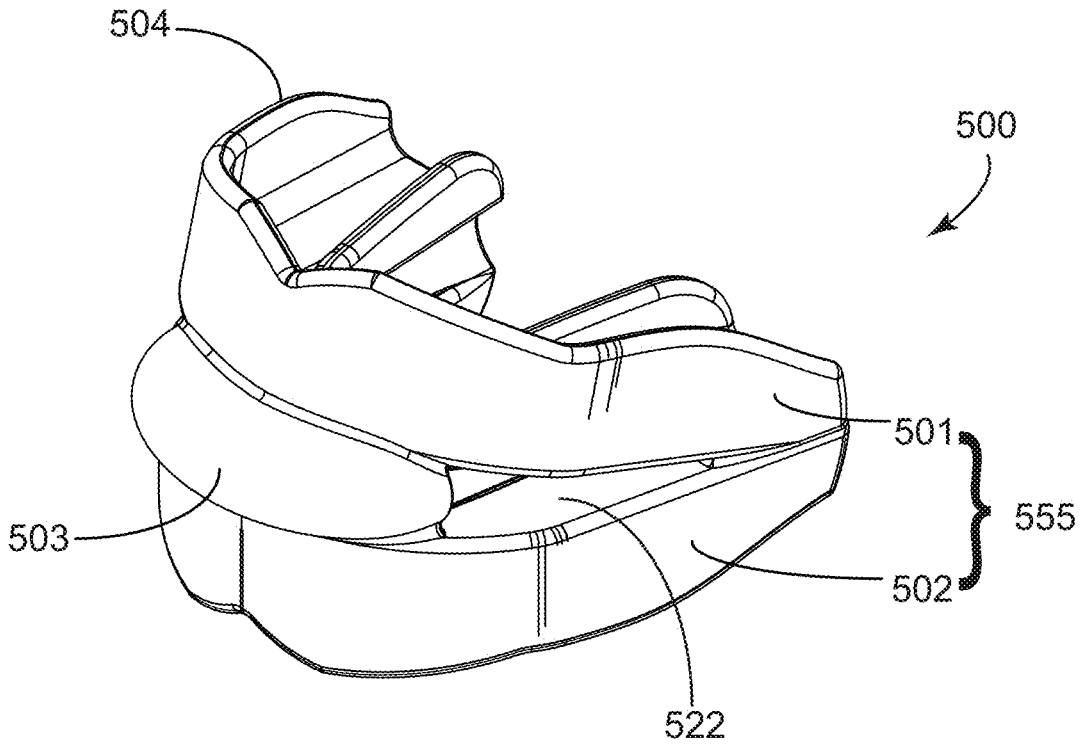


FIG. 5(b)

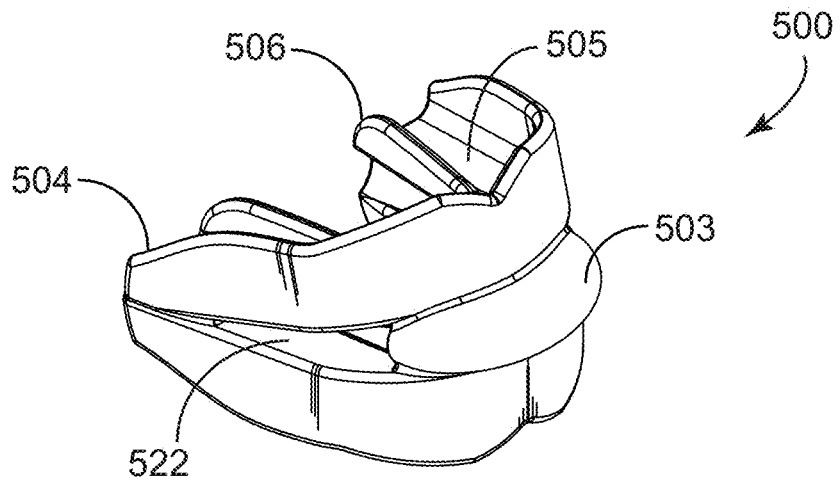


FIG. 6(a)

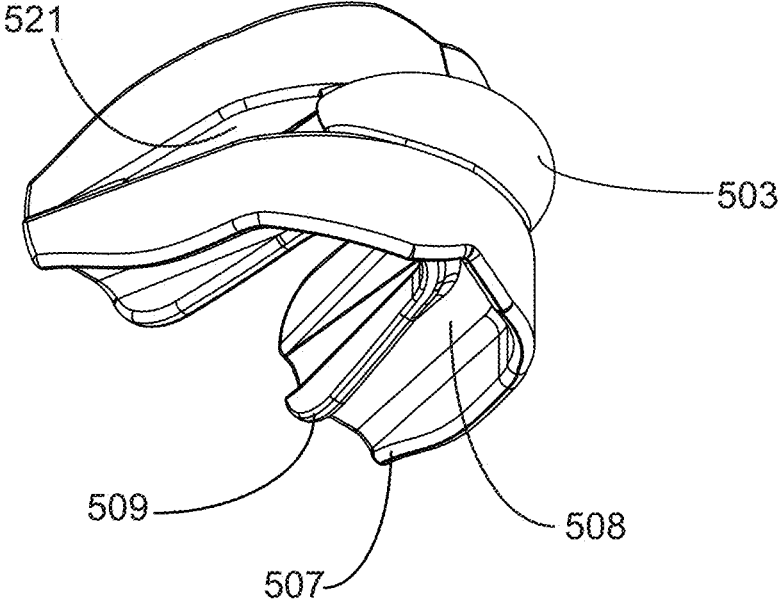


FIG. 6(b)

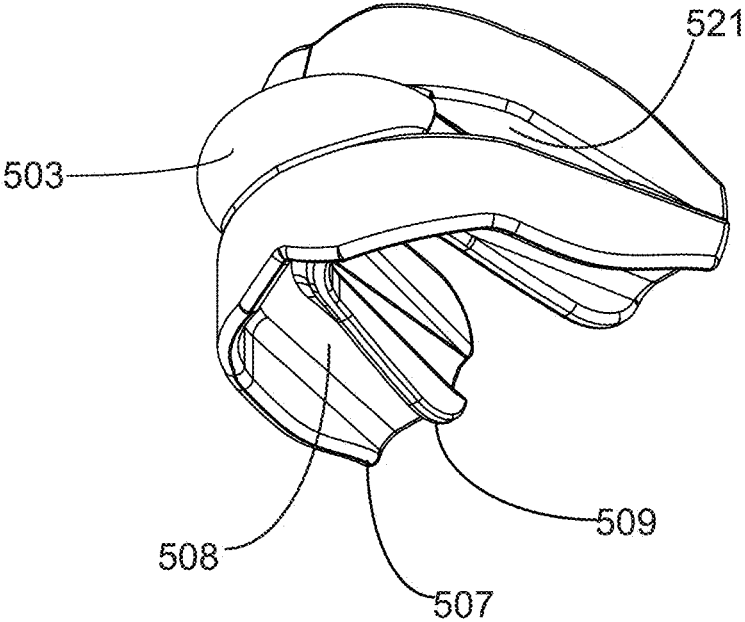


FIG. 7(a)

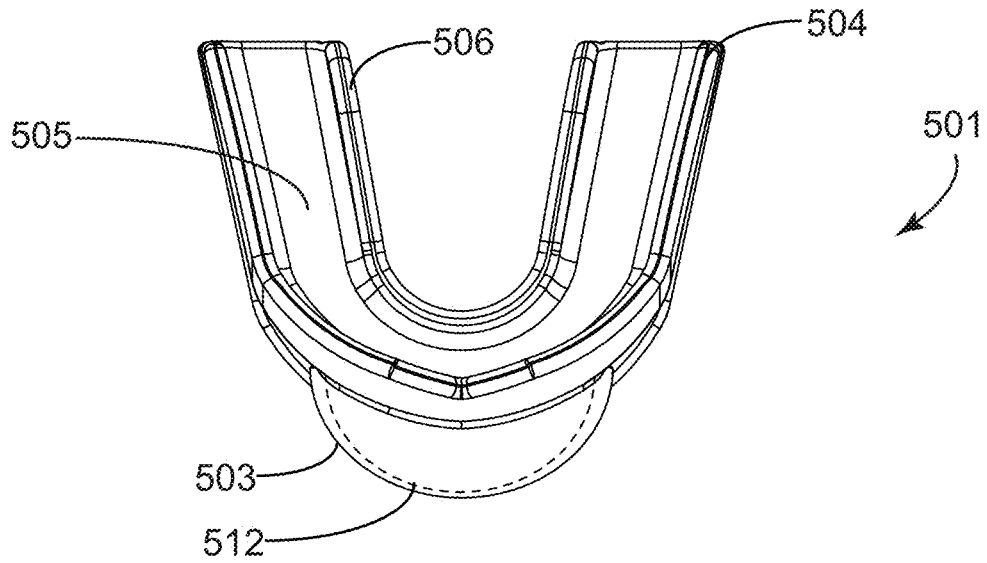


FIG. 7(b)

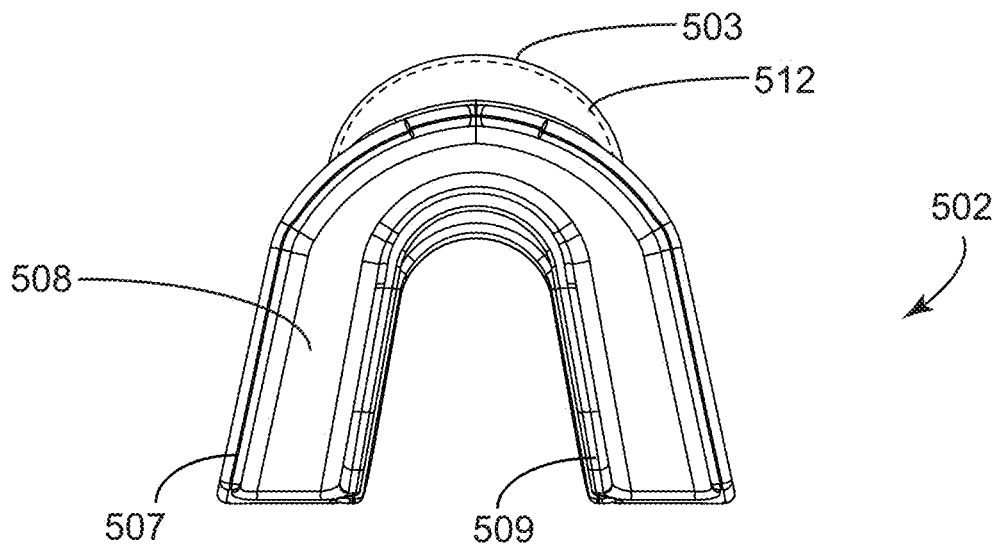




FIG. 8(a)

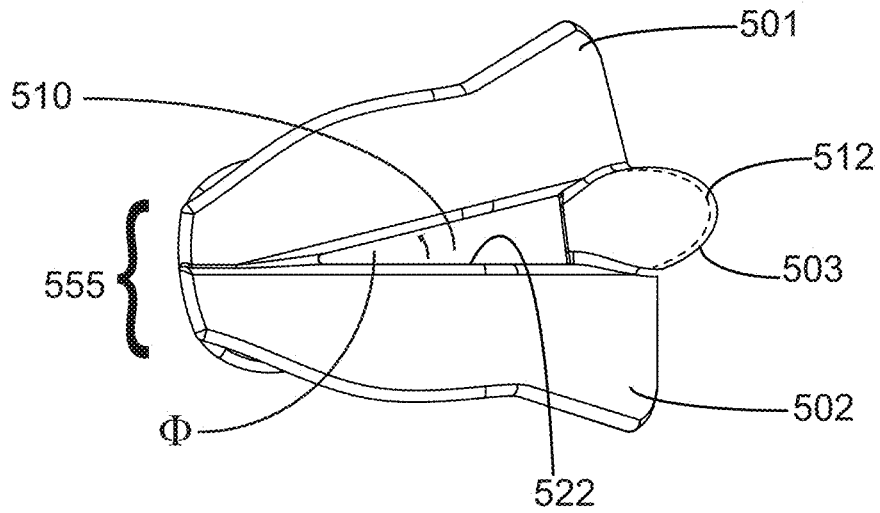


FIG. 8(b)

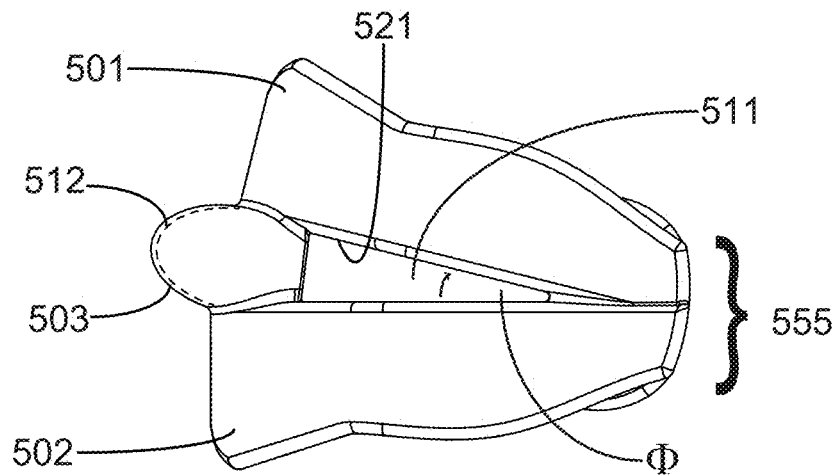


FIG. 9

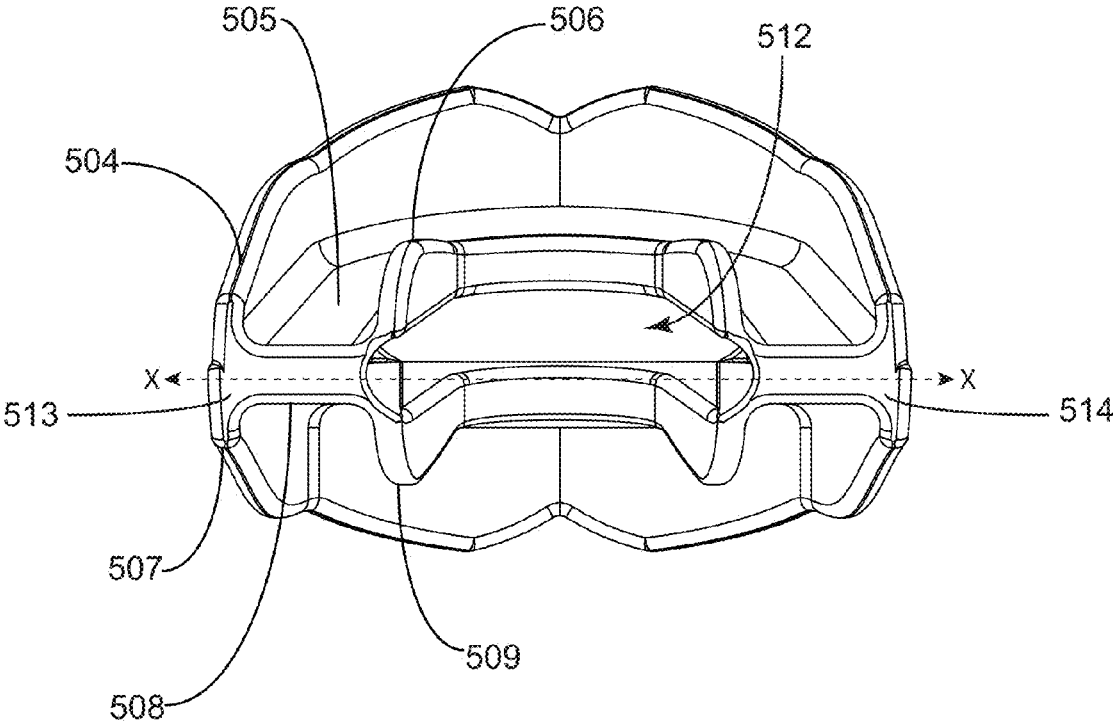


FIG. 10(a)

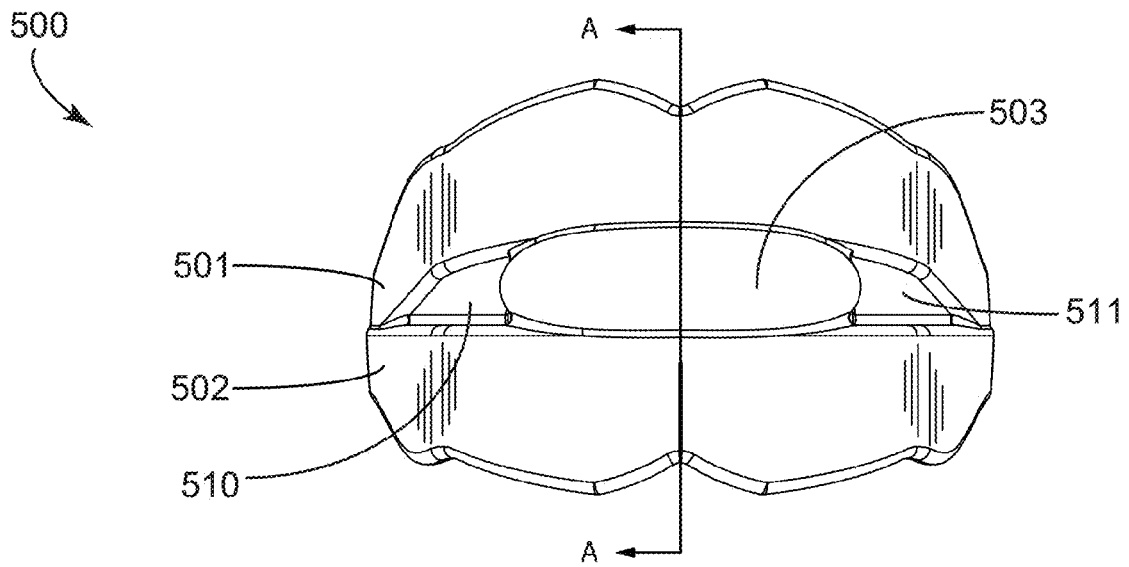
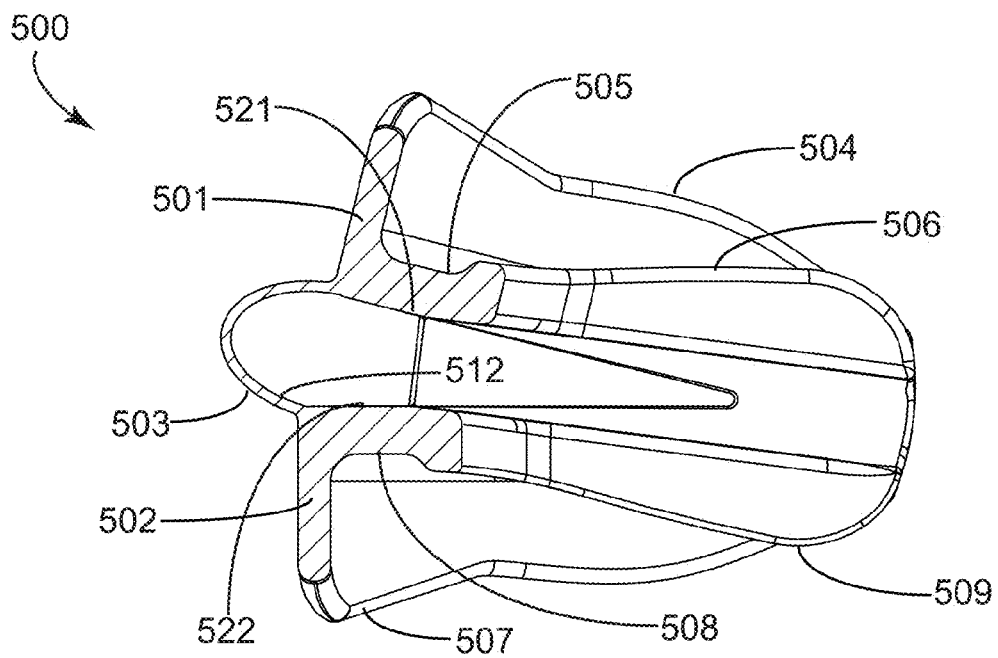


FIG. 10(b)



**DENTAL APPLIANCE**

## TECHNICAL FIELD OF THE INVENTION

The present invention relates in general to a dental appliance, and more specifically, to a mouthpiece or mandibular advancement mouthpiece, equipped with a tongue-securing mechanism, which may open a user's airway by moving the mandible forward with respect to the maxilla, and secures a tip portion of the tongue slightly anterior to the mandible, so that the tongue is held from falling back into the throat. This invention helps alleviate problems including severe snoring and sleep apnea.

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## BACKGROUND OF THE INVENTION

Devices that alleviate or altogether eliminate snoring and obstructive sleep apnea have long been sought after by afflicted consumers because of the deleterious effects such conditions can have on the individual. As a result, there exists a popular research field dedicated to managing these conditions.

While sleeping, the air pathways narrow as a result of muscle relaxation in the throat and tongue. In some people, this narrowing is greatly exacerbated by abnormally high relaxation of the aforementioned muscles, leading to sonorous respiration (snoring) or obstructive sleep apnea. In other people, the natural narrowing of the air pathways while sleeping is combined with one or more of a number of potential factors to produce snoring or sleep apnea including, but not limited to: a proportionally large tongue and/or tonsils as compared to the windpipe, excess fat tissue along the soft palate often a result of being overweight, or an inadequate ability to send/receive signals to/from the brain that otherwise help muscles remain sufficiently stiff throughout the night.

Obstructive sleep apnea, a more severe manifestation of the circumstances from which snoring arises, is characterized by substantial or complete blockage of the air pathways. It can result in the sleeper entering a gasping state after short to intermediate episodes of oxygen deprivation. In extreme cases, this can occur hundreds of times per night, typically unbeknownst to the sleeper. This disrupted sleep cycle can lead to severe sleep deprivation, snoring, headaches, sore throat, dry mouth, inadequate brain oxygenation, and choking in the short-term, in addition to high blood pressure, insulin resistance, and possible brain damage in the long-term.

Several apparatus for treating snoring and sleep apnea exist. For instance, continuous positive airway pressure (CPAP) is a method and apparatus which utilizes a motor that pushes mildly-pressurized air through a tube connected

to the user's mouth by way of a nasal and oral mask. The apparatus is used so as to prevent significant narrowing of the airway while sleeping. Despite improvements in the recent years to minimize noise generated by the motor, CPAP machines can still be disruptive to those near it. Moreover, the constant pressure from the motor can slowly cause uncomfortable pressure ulcers to form on the pharyngeal tissue and other nearby tissue. The noisy machine and mask can also be an unfortunate obstacle to intimacy. More significantly, even though it may be an effective treatment, CPAP compliance is extremely low (i.e. it is thought that compliance is only about 20%) among people that have been prescribed CPAP machines.

The prior art illuminates a clear deficiency in existing snoring and obstructive sleep apnea devices. Therefore, there is a need in the art for a device or dental appliance that can incorporate a comfortable, naturally conforming mechanism to account for the plurality of causes and exacerbating factors of snoring and obstructive sleep apnea. The present invention overcomes the above described disadvantages of presently existing snoring and sleep apnea apparatus. It is to these ends that the present invention has been developed.

## BRIEF SUMMARY OF THE INVENTION

To minimize the limitations in the prior art, and to minimize other limitations that will be apparent upon reading and understanding the present specification, the present invention provides a dental appliance that keeps the user's airway open while sleeping or otherwise unconscious. A dental appliance in accordance with the present invention may incorporate a mandibular advancement mouthpiece equipped with a tongue-receiving mechanism, or tongue sleeve, which may be situated in the gap between the upper and lower components of the mouthpiece.

In one embodiment of the present invention, a dental appliance for alleviating snoring and other sleep disorders comprises: a mouthpiece; and a tongue sleeve situated between a maxillary component and a mandibular component of the mouthpiece.

In another embodiment of the present invention, a dental appliance for alleviating snoring and other sleep disorders comprises: a mouthpiece including a maxillary component and a mandibular component, configured so that the mandibular component is situated forward in relation to the maxillary component of the mouthpiece; and a tongue sleeve situated between the maxillary component and the mandibular component of the mouthpiece, wherein the tongue sleeve includes a semi-spherical portion, comprising a concaved cavity for securely receiving a tip portion of a user's tongue.

In yet another embodiment of the present invention, a dental appliance for alleviating snoring and other sleep disorders comprises: a mouthpiece including a maxillary component and a mandibular component, configured so that the mandibular component is situated forward in relation to the maxillary component of the mouthpiece; and a tongue sleeve integral with the mouthpiece, the tongue sleeve situated between the maxillary component and the mandibular component of the mouthpiece and protruding forward from an anterior of the mouthpiece, the tongue sleeve including a semi-spherical portion, comprising a concaved cavity for securely receiving a tip portion of a user's tongue, wherein the mouthpiece includes a first opening to the right of the tongue sleeve and a second opening to the left of the tongue sleeve, both the first and second openings situated between the maxillary and mandibular components of the mouthpiece; wherein the maxillary component and the man-

dibular component of the mouthpiece form an acute angle with a vertex at a posterior of the mandibular advancement mouthpiece; wherein the semi-spherical portion of the tongue sleeve is situated opposite the vertex of the acute angle formed between the maxillary and mandibular components; wherein the maxillary component includes: a first outer ridge, a first inner ridge, and a maxillary receptacle between the first outer and inner ridge for receiving the maxillary teeth of the user; and wherein the mandibular component includes: a second outer ridge, a second inner ridge, and a mandibular receptacle between the second outer and inner ridge for receiving the mandibular teeth of the user.

It is an objective of the present invention to eliminate or significantly reduce snoring and obstructive sleep apnea in users by opening the airway commonly narrowed or altogether occluded by the tongue, pharyngeal tissue, soft palate or the like while unconscious.

It is another objective of the present invention to maintain ease of breathing while unconscious by comfortably moving the tongue in an advanced configuration away from the throat and sustaining the said advanced configuration.

It is yet another objective of the present invention to provide customization of the various aspects of the apparatus, including degree of mandible protrusion, method of molding the mouthpieces, size and protrusion of the tongue sleeve, and detachability of the tongue sleeve so as to acknowledge and account for the varying needs of those who suffer from snoring or obstructive sleep apnea.

It is yet another objective of the present invention to significantly mitigate the obstacles to intimacy typically brought about by the bulky, uncomfortable configuration of prior art devices.

It is yet another objective of the present invention to provide a means with which to treat snoring and sleep apnea without concern for the apparatus making sound not conducive to restful sleep.

It is yet another objective of the present invention to inexpensively provide an effective means for managing conditions such as snoring and sleep apnea.

These and other advantages and features of the present invention are described herein with specificity so as to make the present invention understandable to one of ordinary skill in the art.

### BRIEF DESCRIPTION OF THE DRAWINGS

Elements in the figures have not necessarily been drawn to scale in order to enhance their clarity and improve understanding of these various elements and embodiments of the invention. Furthermore, elements that are known to be common and well understood to those in the industry are not depicted in order to provide a clear view of the various embodiments of the invention.

FIG. 1(a) is a schematic side view of a device, in accordance with one embodiment of the present invention, worn by a user; the separation between the maxillary and mandibular supports is exaggerated so that a tongue sleeve can more clearly be depicted.

FIG. 1(b) is a schematic side view of the device illustrated in FIG. 1(a), absent the tongue sleeve, in accordance with one embodiment of the present invention, wherein the tongue sleeve may be removably attached to the mouthpiece.

FIG. 2(a) is a perspective view of one embodiment of a tongue sleeve in accordance with the present invention.

FIG. 2(b) is a back view of the tongue sleeve illustrated in FIG. 2(a).

FIG. 3 is a schematic side view of a device incorporating an adjustable mandibular advancement mechanism, in accordance with the present invention.

FIG. 4 illustrates how one mandibular advancement mechanism may function in conjunction with a mouthpiece of a dental appliance in accordance with the present invention.

FIG. 5(a) is a perspective view of a dental appliance in accordance with an exemplary embodiment of the present invention.

FIG. 5(b) is another perspective view of the dental appliance illustrated in FIG. 5(a) shown from a different angle.

FIG. 6(a) is a perspective view of one embodiment of a dental appliance in accordance with the present invention, showing predominantly the bottom left side of the dental appliance.

FIG. 6(b) is a perspective view of one embodiment of a dental appliance in accordance with the present invention, showing predominantly the bottom right side of the dental appliance.

FIG. 7(a) is a top view of a maxillary component of a dental appliance in accordance with the present invention.

FIG. 7(b) is a bottom view of a mandibular component of a dental appliance in accordance with the present invention.

FIG. 8(a) is a side view of one embodiment of a dental appliance in accordance with the present invention, showing the right side of the device.

FIG. 8(b) is a side view of one embodiment of a dental appliance in accordance with the present invention, showing the left side of the device.

FIG. 9 is a back view of one embodiment of a dental appliance in accordance with the present invention.

FIG. 10(a) is a front view of one embodiment of a dental appliance in accordance with the present invention.

FIG. 10(b) is a cross sectional view of one embodiment of the dental appliance shown in FIG. 10(a), the cross section taken at line A.

### DETAILED DESCRIPTION OF THE INVENTION

In the following discussion that addresses a number of embodiments and applications of the present invention, reference is made to the accompanying drawings that form a part thereof, where depictions are made, by way of illustration, of specific embodiments in which the invention may be practiced. It is to be understood that other embodiments may be utilized and changes may be made without departing from the scope of the invention.

Generally, a dental appliance in accordance with the present invention may comprise of a mouthpiece, or a mandibular advancement mouthpiece, that includes a tongue-receiving member, or tongue sleeve, which allows an airway to be kept open during sleep. When in use, a user's mandible (lower jaw) may be positioned outward from the maxilla (upper jaw), whereby the airway is greatly widened; furthermore, the tongue sleeve may securely receive the user's tongue and keep the tongue in a forward configuration—thereby preventing the tongue from slipping back towards the throat and closing the airway. The present invention may permit user control over the amount of mandibular protrusion beyond the maxilla using any number of simple mechanisms known by those skilled in the art. In various embodiments, the dental appliance or components thereof may be made with a number of different medical-

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grade polymers of moderate pliability (i.e. malleable enough to mold to the user's maxilla and mandible, but durable enough to hold its shape after fitting).

In an exemplary embodiment, the dental appliance may be molded to the shape of the user's mouth with steps comprising: placing a malleable mouthpiece into boiling water, removing said mouthpiece from the water shortly thereafter, and biting down on said mouthpiece whilst still hot, whereby it is useable very shortly thereafter. In another embodiment, the dental appliance may be molded to the shape of the user's mouth by having the user bite down on a mold, which subsequently requires a professional such as a dentist to construct the mouthpiece from said mold.

Typically, a dental appliance in accordance with the present invention comprises a mouthpiece, including a maxillary component and mandibular component, and a tongue receiving member, or tongue sleeve that may be removably attached or integral with the maxillary and mandibular components of the mouthpiece. The tongue sleeve, in accordance with one embodiment of the present invention, may be generally defined vertically by the gap between the upper and lower pieces of the mouthpiece of the dental appliance, and horizontally by a configuration primarily designed to serve as a tongue-receiving member, preferably resembling an inverse or negative of the anterior-most portion of the tongue. In one embodiment, the tongue sleeve may be substantially spherical or semi-spherical in shape, and include a concave cavity adapted to receive a tip portion of the user's tongue. In exemplary embodiments, the tongue sleeve is made of a flexible material, which may be squeezed by a user to create a suction force before inserting the tongue therein. This force may gently secure the user's tongue in place, and prevent the tongue from falling back against the throat. The tongue sleeve may have the material makeup, by way of a non-limiting example, of a surgical or medical-grade polymer.

Turning now to the figures, FIG. 1(a) is a schematic side view of a device, in accordance with one embodiment of the present invention, worn by a user; the separation between the maxillary and mandibular components is exaggerated so that a tongue sleeve can more clearly be depicted. More specifically, FIG. 1(a) illustrates apparatus 100 being worn by a user. Unlike a continuous positive airway pressure (CPAP) machine, apparatus 100, of which a plurality of embodiments are disclosed herein, produces no audible sound since it does not require a machine or motor, and as such, does not impede restful sleep for the user or those nearby. Moreover, apparatus 100 includes tongue sleeve 103, which uniquely functions to keep the tongue of the user in a position that allows for an airway to remain open.

As pictured, the entirety of apparatus 100 fits inside a user's mouth, within the confines of upper lip 1 and lower lip 2, much like a sport's mouthpiece. The user's tongue 3 is inferiorly adjacent to maxillary component 101 of apparatus 100. Maxillary component 101 may be a stationary entity covering a plurality of the teeth of maxilla 4. Additionally, tongue 3 is superiorly adjacent to mandibular component 102 of apparatus 100. Mandibular component 102 may be a dynamic entity covering a majority of the teeth of mandible 5, which may be manipulated by the user to force lesser or greater protrusion of mandible 5 as compared to maxilla 4. A mandibular advancement mechanism, mechanism 104, which performs this manipulation is displayed and discussed with reference to FIG. 3 and FIG. 4. Together, maxillary component 101 and mandibular component 102, and optionally mechanism 104, may form a mandibular advancement mouthpiece. The material from

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which such mandibular advancement mouthpiece may be constructed is not to be limited. For example, and without limiting the scope of the present invention, it may comprise of a number of types of polymers, copolymers, or plastics, often thermoplastics, as well as harder materials such as gold or acrylic, or alloys composed of such materials as cobalt or chrome. Alternatives to the enumerated materials should be apparent to those skilled in the art.

Connected to the mouthpiece—maxillary component 101 and mandibular component 102—is tongue sleeve 103. Tongue sleeve 103 receives tongue 3 and securely holds the tongue in a forward configuration between maxillary component 101 and mandibular component 102, in the gap formed by their separation. Tongue sleeve 103 serves as a tongue-receiving member or the component that securely receives a tip portion of the user's tongue or tongue tip 3a. Tongue sleeve 103 may comprise multiple components or a single component, without deviating from the scope of the present invention. For example, tongue sleeve 103 may be a clamping device, a suction device, or any general retaining device. In one embodiment, the tongue sleeve 103 comprises a flexible, substantially spherical or semi-spherical protrusion including an inner surface comprising a concaved portion suitable for receiving a tip portion of a user's tongue. In such embodiment, tongue sleeve 103 may implement suction to keep the tongue securely within. Hence, as illustrated by FIG. 1(a), a portion of tongue sleeve 103 may be configured to receive the anterior-most portion of tongue 3, or tongue tip 3a.

It should be noted that FIG. 1(a) displays a slightly exaggerated separation between maxillary component 101 and mandibular component 102 in order to better illustrate tongue sleeve 103. Typically, this separation is less pronounced and thus provides a more snug fit in the user's mouth.

As shown in FIG. 1(a) and FIG. 1(b), the tongue is a long muscle utilizing both voluntary and automatic control to combat the natural tendency for gravity to pull the tongue deeper into the throat, thereby complicating respiration in some individuals. While unconscious, this control is purely automatic, and in a substantial number of people with snoring or sleep apnea, resultantly problematic. Without sufficient signaling from the brain to the tongue, the tongue begins to succumb to gravity, thinning the airway for air passage. Tongue sleeve 103 as displayed in FIG. 1(a), as well as the other embodiments disclosed herein, address this problem by means of bypassing the need for the tongue to maintain adequate rigidity altogether. In some embodiment wherein the tongue sleeve comprises a suction device, or device configured to hold the tongue using a suction force, the vacuum created by expelling air from tongue sleeve 103 may serve as a sufficient force countervailing the downward force of gravity on the tongue. As illustrated in FIG. 1(a), tongue 3 is thus moved and kept forward away from the back of the throat.

FIG. 1(b) is a schematic side view of the device illustrated in FIG. 1(a), absent the tongue sleeve, in accordance with one embodiment of the present invention, wherein the tongue sleeve may be removably attached to the mouthpiece. Noticeably, an absent tongue sleeve may result in tongue 3 falling back into the throat—while this may not be an issue to some users, other users may not find this option suitable for their needs. As with the embodiment shown in the previous figure, the mouthpiece-comprising maxillary component 101 and mandibular component 102—fits within the confines of the upper lip 1 and lower lip 2. Maxillary component 101 rests superior to tongue 3 and inferior to the

upper lip **2**. Mandibular support rests superior to lower lip **2** and inferior to tongue **3**. The user's mandible **5** rests outward from maxilla **4**, allowing for creation of a gap large enough to receive a tongue sleeve **103**, if so desired by the user. In this illustrated configuration, the tongue sleeve has been removed—as can be seen, even though this configuration may be desirable for some user's, tongue **3** is allowed to fall back.

Thus, in one embodiment, tongue sleeve **103** may be detachable from the rest of apparatus **100**, leaving the user with a more basic mouthpiece. In such embodiments, the mouthpiece is preferably a mandibular advancement mouthpiece so that the airway may be kept somewhat open even though the tongue is allowed to fall back. This feature (i.e. a removable tongue sleeve) may be desirable for use during times in which the user determines his or her snoring and sleep apnea are less severe. This may occur, for example, if the user refrains from alcohol consumption or administration of other muscle relaxants on a particular day. Conversely, if a user typically has little cause for concern over the tongue receding and thereby impeding respiration, but by a change in circumstance the need for tongue sleeve **103** arises, such a user may attach and detach tongue sleeve **103** accordingly. Additionally, with regards to the aforementioned obstacles to intimacy, present with current snoring and sleep apnea apparatus, giving a user the choice to opt out of utilizing tongue sleeve **103** when symptoms do not necessitate its use may further compact the present apparatus.

Turning now to the next figure, FIG. 2(a) is a perspective view of one embodiment of a tongue sleeve in accordance with the present invention. More specifically, tongue sleeve **103** is shown comprising anchor **103a**, anchor **103b**, and tongue receiving member **103c**, which includes a substantially spherical or semi-spherical protrusion that extends from base **103d**, the substantially spherical or semi-spherical protrusion including an inner surface comprising a concaved cavity suitable for receiving a tip portion of a user's tongue, or tongue tip **3a**. Tongue receiving member **103c** receives tongue tip **3a**, and may securely hold tongue tip **3a** within the cavity formed by the protrusion using a suction force.

Tongue receiving member **103c** of tongue sleeve **103** may be made from an array of materials. For example, and without deviating from the scope of the present invention, tongue receiving member **103c** may be constructed using a number of thermoplastics or a surgical or medical grade polymer, such as rubber or the like. Anchor **103a** and anchor **103b** may be substantially semicircular components together forming base **103d** that secures tongue sleeve **103** to the mandibular advancement mouthpiece—that is, to maxillary component **101** and mandibular component **102** of the mouthpiece.

Anchors **103a** and **103b** may be used to removably attach tongue sleeve **103** to the palatal and lingual aspects of the respective maxillary component **101** and mandibular component **102**. In an exemplary embodiment, securement occurs by way of a locking mechanism present on anchors **103a** and **103b** that each support is configured to receive and subsequently interact with. However, in other embodiments, anchors **103a** and **103b** may utilize an adhesive material, such as but not limited to: epoxy, sealant, hot melt or any other suitable adhesive. For example, and without limiting the scope of the present invention, an adhesive may be applied to the inner surfaces of anchors **103a** and **103b**, respectively, in order to adhere tongue sleeve **103** to maxillary component **101** and mandibular component **102** of the

mouthpiece. Moreover, such adhesives may be used to affix tongue sleeve **103** to the mouthpiece either permanently or removably.

Still other embodiments may employ different methods for securement of tongue sleeve **103**. For example, tongue sleeve **103** may be removably affixed to maxillary component **101** and mandibular component **102** using a simple locking mechanism such as a mechanism that may snap, slide, or click into place upon proper insertion of tongue sleeve **103** and the mouthpiece.

In various embodiments, tongue sleeve **103** may be malleable insofar as it provides sufficient internal flexibility for comfortable securement of tongue **3**, but not malleable enough to enable the user to drastically alter the shape of tongue sleeve **103** whereby any efficacy of the apparatus is lost.

FIG. 2(b) is a back view of the tongue sleeve illustrated in FIG. 2(a), further illustrating a close-up of a user's tongue moving forward into the confines of the tongue sleeve. In an exemplary embodiment, the tongue sleeve, in accordance with the present invention, may utilize a light suction to adjoin the tongue to the interior of the sleeve. In an exemplary embodiment, air may be first expelled from tongue sleeve **103** by squeezing tongue receiving member **103c**—the vacuum created by the expelled air aids in snugly fitting the tongue thereafter. To reverse the process and remove the tongue from tongue sleeve **103**, the user again squeezes tongue receiving member **103c**. Typically, the tongue approaches tongue receiving member **103c**, reserving only enough space for the tip of the tongue to enter. In one embodiment, tongue receiving member **103c** comes in a plurality of sizes. In exemplary embodiments, tongue sleeve **103** extends beyond the mouthpiece by as little as 1 or 2 millimeters or as much as 2 centimeters, similarly allowing as little as 1 or 2 millimeters or as much as 2 centimeters of the anterior segment of the tongue to be housed within tongue receiving member **103c**. In another embodiment, the tongue-receiving member instead utilizes a gentle clamp which allows for interaction with the mouthpiece to secure the tongue in a configuration further forward than a tongue may typically rest. Alternatively, several sizes may be offered for tongue sleeve **103**, whereby a more severe manifestation of snoring or sleep apnea is accompanied by a respective increase in the amount of anterior tongue matter allowably housed in the sleeve.

Turning to the next figures, FIG. 3 is a schematic side view of a device incorporating an adjustable mandibular advancement mechanism, in accordance with the present invention, and FIG. 4 illustrates how one mandibular advancement mechanism may function in conjunction with a mouthpiece of a dental appliance in accordance with the present invention.

More specifically, FIG. 3 shows a mandibular advancement mouthpiece that incorporates an adjustable mechanism, or mechanism **104**. Many mechanisms are known, by those skilled in the art, for adjusting the disparity of protrusion between a user's mandible **5** and maxilla **4**. As such, mechanism **104**, as displayed in FIG. 3 and FIG. 4, is merely illustrative and should not be seen as limiting; rather, mechanism **104** is shown as a visual aid for how such a mechanism may be incorporated with the present invention.

In the illustrated embodiment, the mouthpiece of apparatus **100** utilizes mechanism **104**, which extends and connects further forward on the mandible side, causing the mandible to be anterior to the maxillary. Mechanism **104** is shown as an interlocking mechanism that may be advanced between a forward and backward position, and locked in place.

Again, other mechanisms or means of controlling a desired protrusion of the lower jaw may be implemented without deviating from the scope of the present invention. For example, the mouthpiece itself can be shaped so as to force the lower jaw forward. In such embodiment, mechanism 104 would not be necessary. In embodiments where mechanism 104 is not implemented, the mouthpiece may be created from a mold of the user, so that the configuration to maximize the desired protrusion may be achieved by a dentist or professional that customizes the mouthpiece to the user's needs. While such embodiment would not include an adjustable component, such embodiment may be desirable as a more custom fit design that fits a particular user's needs. FIG. 5(a)-FIG. 10(b) illustrate such embodiment of the present invention, which is discussed in detail below.

FIG. 5(a) is a perspective view of a dental appliance in accordance with an exemplary embodiment of the present invention, wherein the device includes a tongue sleeve that is permanently attached or integral with the mouthpiece of the dental appliance. Specifically, FIG. 5(a) illustrates dental appliance 500, which includes maxillary component 501, mandibular component 502, and tongue sleeve 503. The maxillary and mandibular components make up what may be referred to as the appliance's mouthpiece, or mouthpiece 555. Tongue sleeve 503 may be situated between maxillary component 501 and mandibular component 502, centered at an anterior of mouthpiece 555.

In exemplary embodiments, such as is illustrated by dental appliance 500, tongue sleeve 503 is integral with mouthpiece 555. Furthermore, in the shown embodiment, mouthpiece 555 is a mandibular advancement mouthpiece, meaning that mandibular component 502 is situated forward in relation to maxillary component 501 of mouthpiece 555; as explained above, this facilitates keeping a user's airway open, by bringing the lower jaw or mandible of a user forward in relation to the maxillary or upper jaw of the user. In order to help keep a user's tongue from slipping back against the throat and thereby closing the user's airway, tongue sleeve 503 may include a somewhat spherical or semi-spherical portion, comprising a concaved cavity, or interior surface 512, for securely receiving a tip portion of a user's tongue, which protrudes forward from an anterior end of mouthpiece 555.

FIG. 5(b) is another perspective view of the dental appliance illustrated in FIG. 5(a) shown from a different angle. As can be seen from the perspective view (somewhat from the top-left side of the device), maxillary component 501 includes a maxillary receptacle (receptacle 505) for receiving the maxillary teeth of a user. Maxillary receptacle 505 includes, or is formed by, an outer ridge 504 and an inner ridge 506. A similar configuration forms the mandibular component of mouthpiece 555, shown in FIG. 6(a) and FIG. 6(b).

FIG. 6(a) is a perspective view of one embodiment of a dental appliance in accordance with the present invention, showing predominantly the bottom left side of mandibular component 102 of mouthpiece 555, and FIG. 6(b) is a perspective view, showing predominantly the bottom right side of mandibular component 102 of mouthpiece 555. Yet other views of both the maxillary receptacle and the mandibular receptacle are further illustrated by FIG. 7(a) and FIG. 7(b); FIG. 7(a) is a top view of maxillary component 501 of dental appliance 500, and FIG. 7(b) is a bottom view of mandibular component 502 of dental appliance 500.

Maxillary component 501 is adapted to receive a user's maxillary teeth, and includes outer ridge 504, inner ridge 506, and maxillary receptacle 505 between the outer and

inner ridges for receiving the maxillary teeth of the user. Similarly, mandibular component 502 is adapted to receive a user's mandibular teeth, and includes outer ridge 507, inner ridge 509, and mandibular receptacle 508 between the outer and inner ridges for receiving the mandibular teeth of the user.

Turning to the next figures, FIG. 8(a) is a side view of dental appliance 500, and FIG. 8(b) is another side view, showing the other side of the dental appliance. More specifically, an exemplary embodiment of dental appliance 500 is shown, wherein maxillary component 501 and mandibular component 502 of the mandibular advancement mouthpiece form an acute angle  $\Phi$  with its vertex at a posterior region of the mandibular advancement mouthpiece 555. Moreover, the substantially spherical or semi-spherical portion of tongue sleeve 503 is situated opposite the vertex of the acute angle formed at the posterior junction between the maxillary and mandibular components 501 and 502. In this configuration, mouthpiece 555 includes one or more openings for enabling airflow between an exterior and interior of the mouthpiece. That is, openings 510 and 511 allow a user to breathe through their mouth while the dental appliance is in use and the user's tongue is securely placed in tongue sleeve 503. Openings 510 and 511 may be implemented into dental appliance 500 in any number of ways. In the exemplary embodiment shown, the openings are located at either side of tongue sleeve 503, and more particularly, the openings may be implemented so that a first opening is situated to the right of the tongue sleeve and a second opening is situated to the left of the tongue sleeve, wherein both the first and second openings are situated between the maxillary and mandibular components of the mouthpiece.

Turning to the next figure, FIG. 9 is a back view of dental appliance 500, on which line X is imposed to denote the top and bottom portions of the dental appliance. Specifically, the top portion of line X includes a back view of maxillary component 501 with outer ridge 504 lining the entire top outer region of maxillary component 501, and inner ridge 506 lining the entire top inner region of maxillary component 501. In between outer region 504 and inner region 506, lies receptacle 505, which is the region adapted to receive a user's maxillary teeth. Similarly, the bottom portion of line X includes a back view of mandibular component 502 with outer ridge 507 lining the entire bottom outer region of mandibular component 502, and inner ridge 509 lining the entire bottom inner region of mandibular component 502. In between outer region 507 and inner region 509, lies receptacle 508, which is the region adapted to receive a user's mandibular teeth.

Typically, a user's tongue lies in the center region of the dental appliance and may be placed or inserted into tongue sleeve 503 so that a tip portion of a user's tongue comes in contact with the interior surface of tongue sleeve 503, or interior surface 512. From the back view illustrated by FIG. 9, it may be appreciated that in one embodiment, maxillary component 501 and mandibular component 502 may be connected at the vertex of the angle their junction forms, or vertices 513 and 514.

Turning now to the last figures, FIG. 10(a) depicts a front view of dental appliance 500, wherein openings 510 and 511 are substantially situated at a front portion of dental appliance 500; FIG. 10(b) is a cross sectional view of dental appliance 500, wherein a cross section is taken at line A.

Opening 510 (on the right side of dental appliance 500) and opening 511 (on the left side of dental appliance 500) provide airflow for full mouth breathing by the user. Of course, other types of openings may be implemented so long



as they are suitable for allowing a user to breathe through their mouth, for example during sleep; this is desirable as often, a user with conditions such as sleep apnea or severe snoring often cannot properly breathe through their nose.

Maxillary component **501** and mandibular component **502** of mouthpiece **555** are typically constructed of medical-grade polymers or copolymers that may be custom fit to a user's specifications. In exemplary embodiments, the materials used to construct mouthpiece **555** allow easy cleaning of dental appliance **500**. Furthermore, soft or somewhat malleable materials may be implemented so that maxillary component **501** and mandibular component **502** may cushion a user's teeth during sleep. Different materials may be used without deviating from the scope of the invention, including for example materials that prevent or reduce teeth from grinding against the maxillary and mandibular components of mouthpiece **555**.

For example and without limiting the scope of the present invention, maxillary receptacle **505** and mandibular receptacle **508** may include a soft malleable surface so that teeth may be cushioned therein. Of course, the materials used to construct dental appliance **500** desirably provide a rigid aspect to the device so that a user is prevented from completely shutting their jaw during sleep. For example, while maxillary receptacle **505** and mandibular receptacle **508** may include softer malleable materials, the remainder of the dental appliance **500** may include a harder more rigid plastics that keep maxillary component **501** and mandibular component **502** at a fixed angle  $\Phi$  at vertices **513** and **514**; this way, the user's tongue may be continuously held in place inside tongue sleeve **503** thereby preventing the user's tongue from falling back to the user's throat.

Tongue sleeve **503** is integral with mouthpiece **555**, and connects maxillary component **501** and mandibular component **502** at the front or anterior end of dental appliance **500**. Hence, as can be appreciated in FIG. **10(b)**, maxillary component **501** and mandibular component **502** may be joined at an anterior end of dental appliance **500** (i.e. by tongue sleeve **503**), as well as at a posterior end of dental appliance **500** (i.e. by vertices **513** and **514**). In exemplary embodiments, tongue sleeve **103** may extend beyond mouthpiece **555** by as little as 1 or 2 millimeters or as much as 2 centimeters, similarly allowing as little as 1 or 2 millimeters or as much as 2 centimeters of the anterior segment of the tongue to be housed within tongue sleeve **503**.

Tongue sleeve **503** may include any shape that is suitable for receiving a user's tongue. In one embodiment, tongue sleeve **503** protrudes from an anterior and lower portion of maxillary component **501**, and from an anterior and upper portion of mandibular component **502**, the tongue sleeve extending outward from both components to form a semi-spherical shape on the exterior and front portion of dental appliance **500**. In the interior of tongue sleeve **503**, a complementary concaved surface, or inner surface **512**, may be formed. Inner surface **512** should be suitable for receiving the anterior or tip portion of a user's tongue, and in some embodiments, may comprise a composition or texture that maximizes a suction force for retaining or securely holding a user's tongue within tongue sleeve **503**.

Finally, as it may be gleaned from the several views in the figures, the interior portions of mouthpiece **555**, or inner surface **521** and inner surface **522**, are in one embodiment flat. This allows for the openings to maximize airflow between the interior and exterior of the device.

A dental appliance, including a mandibular advancement mouthpiece equipped with a tongue-retaining mechanism, has been described. The foregoing description of the various

exemplary embodiments of the invention has been presented for the purposes of illustration and disclosure. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching without departing from the spirit of the invention.

#### DESCRIPTION OF THE REFERENCE SYMBOLS

- 1**: Upper lip
- 2**: Lower lip
- 3**: Tongue
- 3a**: Tongue tip
- 4**: Maxilla
- 5**: Mandible
- 100**: Apparatus
- 101**: Maxillary component
- 102**: Mandibular component
- 103**: Tongue sleeve
- 103a**: Maxillary anchor
- 103b**: Mandibular anchor
- 103c**: Tongue-receiving member
- 103d**: Base
- 104**: Mandibular advancement mechanism
- 500**: Dental Appliance
- 501**: Maxillary component
- 502**: Mandibular component
- 503**: Tongue sleeve
- 504**: Outer ridge (of maxillary component **501**)
- 505**: Maxillary receptacle
- 506**: Inner ridge (of maxillary component **501**)
- 507**: Outer ridge (of mandibular component **502**)
- 508**: Mandibular receptacle
- 509**: Inner ridge (of mandibular component **502**)
- 510**: Opening (right side of dental appliance **500**)
- 511**: Opening (left side of dental appliance **500**)
- 512**: Interior surface (of tongue sleeve **503**)
- 513**: Vertex (on left side of dental appliance **500**)
- 514**: Vertex (on right side of dental appliance **500**)
- 521**: Inner surface (of maxillary component **501**)
- 522**: Inner surface (of mandibular component **501**)
- 555**: Mouthpiece
- $\Phi$ : Angle (between maxillary component **501** and mandibular component **502**)
- A: Cross-sectional line
- X: Horizontal (point of reference) line

What is claimed is:

1. A dental appliance for alleviating snoring and other sleep disorders, comprising:
  - a mouthpiece;
    - a tongue sleeve situated between a maxillary component and a mandibular component of the mouthpiece, the tongue sleeve including a semi-spherical component comprising a concaved cavity having an interior concaved surface devoid of openings, wherein a top edge of the semi-spherical component is connected to a lower edge of the maxillary component, a bottom edge of the semi-spherical component is connected to an upper edge of the mandibular component, and side edges of the semi-spherical component are detached from the maxillary component and the mandibular component; and
    - a pair of openings, each of the openings defined by:
      - a side edge of the semispherical component that forms an anterior portion of the opening,

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a junction defined by an acute angle with a vertex at a posterior portion of the maxillary component and the mandibular component forming a posterior of the opening,

a substantially flat inner surface of the maxillary component forming a top portion of the opening, and

a substantially flat inner surface of the mandibular component forming a bottom portion of the opening.

2. The dental appliance of claim 1, wherein the mouthpiece comprises a mandibular advancement mouthpiece so that the mandibular component is situated forward in relation to the maxillary component of the mouthpiece.

3. The dental appliance of claim 2, wherein the tongue sleeve is integral with the mandibular advancement mouthpiece.

4. The dental appliance of claim 2, wherein the tongue sleeve protrudes forward from an anterior end of the mandibular advancement mouthpiece.

5. The dental application of claim 1, wherein:

the maxillary component includes:

a first outer ridge, a first inner ridge, and a maxillary receptacle between the first outer and inner ridge for receiving the maxillary teeth of the user; and

the mandibular component includes:

a second outer ridge, a second inner ridge, and a mandibular receptacle between the second outer and inner ridge for receiving the mandibular teeth of the user.

6. The dental appliance of claim 1, wherein the tongue sleeve protrudes beyond the mouthpiece a length ranging from 1 millimeter to 2 centimeters, allowing as little as 1 millimeter or as much as 2 centimeters of the anterior segment of a tongue of a user to be housed within the tongue sleeve.

7. The dental appliance of claim 1, wherein the mouthpiece and tongue sleeve comprise of a malleable polymer.

8. A dental appliance for alleviating snoring and other sleep disorders, comprising:

a mouthpiece including a maxillary component and a mandibular component, configured so that the mandibular component is situated forward in relation to the maxillary component of the mouthpiece; and

a tongue sleeve situated between the maxillary component and the mandibular component of the mouthpiece, wherein:

the tongue sleeve includes a semi-spherical portion, comprising a concaved cavity including an interior concaved surface devoid of openings for securely receiving a tip portion of a user's tongue, wherein a top edge of the semi-spherical component is connected to a lower edge of the maxillary component, a bottom edge of the semi-spherical component is connected to an upper edge of the mandibular component, and side edges of the semi-spherical component are detached from the maxillary component and the mandibular component and

the mouthpiece includes a pair of openings for enabling an airflow between an exterior and interior of the mouthpiece, each of the openings defined by a side edge of the semispherical component that forms an anterior portion of the opening, a junction including an acute angle between the maxillary component and the mandibular component forming a posterior of the opening, a substantially flat inner surface of the maxillary component forming a top portion of the opening, and a substantially flat inner surface of the mandibular component forming a bottom portion of the opening.

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9. The dental appliance of claim 8, wherein the tongue sleeve is integral with the mouthpiece.

10. The dental appliance of claim 8, wherein the tongue sleeve protrudes forward from an anterior end of the mouthpiece.

11. The dental appliance of claim 8, wherein the junction of the maxillary component and the mandibular component of the mouthpiece form an acute angle with a vertex at a posterior of the mandibular advancement mouthpiece.

12. The dental appliance of claim 11, wherein:

the maxillary component includes:

a first outer ridge, a first inner ridge, and a maxillary receptacle between the first outer and inner ridge for receiving the maxillary teeth of the user; and

the mandibular component includes:

a second outer ridge, a second inner ridge, and a mandibular receptacle between the second outer and inner ridge for receiving the mandibular teeth of the user.

13. The dental appliance of claim 12, wherein the mouthpiece and tongue sleeve comprise of a malleable polymer.

14. The dental appliance of claim 8, wherein the tongue sleeve protrudes beyond the mouthpiece a length ranging from 1 millimeter to 2 centimeters, allowing as little as 1 millimeter or as much as 2 centimeters of the anterior segment of a tongue of a user to be housed within the tongue sleeve.

15. A dental appliance for alleviating snoring and other sleep disorders, comprising:

a mouthpiece including a maxillary component and a mandibular component, configured so that the mandibular component is situated forward in relation to the maxillary component of the mouthpiece;

a tongue sleeve integral with the mouthpiece, the tongue sleeve situated between the maxillary component and the mandibular component of the mouthpiece and protruding forward from an anterior of the mouthpiece, the tongue sleeve including a semi-spherical portion, comprising a concaved cavity including an interior concaved surface devoid of openings for securely receiving a tip portion of a user's tongue, wherein a top edge of the semi-spherical component is connected to a lower edge of the maxillary component, a bottom edge of the semi-spherical component is connected to an upper edge of the mandibular component, and side edges of the semi-spherical component are detached from the maxillary component and the mandibular component; and

a pair of openings, each of the openings defined by a side edge of the semispherical component that forms an anterior portion of the opening, a junction of the maxillary component and the mandibular component defined by an acute angle with a vertex forming a posterior of the opening, a substantially flat inner surface of the maxillary component forming a top portion of the opening, and a substantially flat inner surface of the mandibular component forming a bottom portion of the opening.

16. The dental appliance of claim 15, wherein:

the maxillary component includes:

a first outer ridge, a first inner ridge, and a maxillary receptacle between the first outer and inner ridge for receiving the maxillary teeth of the user; and

the mandibular component includes:

a second outer ridge, a second inner ridge, and a mandibular receptacle between the second outer and inner ridge for receiving the mandibular teeth of the user.

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17. The dental appliance of claim 15, wherein the tongue sleeve protrudes beyond the mouthpiece a length ranging from 1 millimeter to 2 centimeters, allowing as little as 1 millimeter or as much as 2 centimeters of the anterior segment of a tongue of a user to be housed within the tongue sleeve.

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18. The dental appliance of claim 15, wherein the mouthpiece and tongue sleeve comprise of a malleable polymer.

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