Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2361270 C 2009/04/07

(11)(21) 2 361 270

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2000/01/21
(87) Date publication PCT/PCT Publication Date: 2000/08/03
(45) Date de délivrance/Issue Date: 2009/04/07
(85) Entrée phase nationale/National Entry: 2001/07/26
(86) N° demande PCT/PCT Application No.: DE 2000/000191
(87) N° publication PCT/PCT Publication No.: 2000/045617
(30) Priorités/Priorities: 1999/01/27 (DE199 03 090.1);
1999/06/14 (DE299 10 318.8)

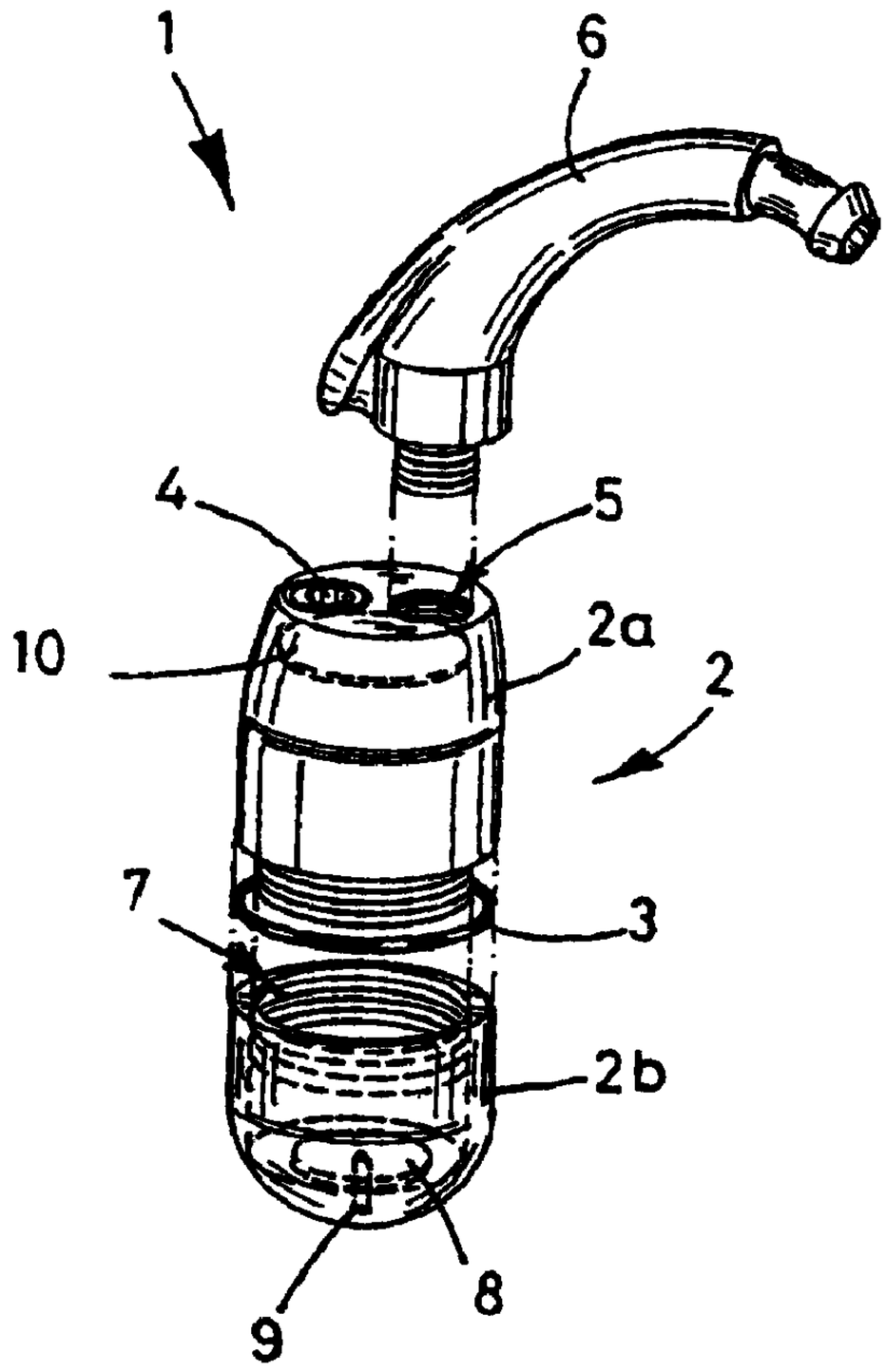
(51) Cl.Int./Int.Cl. *H04R 25/00* (2006.01)

(72) Inventeurs/Inventors:
BOROWSKY, HANS-DIETER, DE;
JANDAUREK, ROMAN, DE;
WESENDAHL, THEO, DE;
LOBBERS, EDMUND, DE

(73) Propriétaire/Owner:
AURIC HORSYSTEME GMBH & CO. KG, DE

(74) Agent: FETHERSTONHAUGH & CO.

(54) Titre : APPAREIL DE CORRECTION AUDITIVE
(54) Title: HEARING AID



(57) Abrégé/Abstract:
The invention relates to a hearing aid for correcting hearing impairments, comprising a metal housing which has a battery compartment and a sound exit opening. According to the invention, the housing surrounds the electronics located in the treatment

CA 2361270 C 2009/04/07

(11)(21) 2 361 270

(13) C

(57) Abrégé(suite)/Abstract(continued):
device in such a way as to shield them from electromagnetic waves on all sides and the sound exit opening is sealed by an acoustically permeable, water-tight film. The housing also has an essentially cylindrical shape.

Abstract

The invention relates to a hearing aid for correcting hearing impairments, comprising a metal housing which has a battery compartment and a sound exit opening. According to the invention, the housing surrounds the electronics located in the treatment device in such a way as to shield them from electromagnetic waves on all sides and the sound exit opening is sealed by an acoustically permeable, water-tight film. The housing also has an essentially cylindrical shape.

"Hearing Aid"

The invention relates to a device for correcting impairments to hearing.

A treatment device of this type is known from WO 95/22879 which has an acoustic module that accommodates the electronic components of the treatment device and does not come in direct contact with the wearer's skin, but is situated in an external outer shell surrounding the module. The housing of the acoustic module has a rectangular cross section, consists of high-grade steel and has two separate sections with cross sections of different sizes which can be curved vis-à-vis one another to enable a rough adaptation to the shape of the ear duct of the respective wearer. The fine adjustment to the shape of the ear duct is accomplished by the outer shape of the outer shell. Due to the metal housing which adequately supports the electronic components of the acoustic module, the outer shell may be configured soft, e.g. made of silicone.

A treatment device which is worn in the ear is known from DE 38 40 393 C3. It has an almost pear-shaped or mushroom-shaped contour and adjoins the outer auditory canal and the external ear. Only the part of an overall actually two-part housing coming in contact with the skin of the wearer is designated as "housing", whereby the front of the device visible on the outside is configured in a known manner as a "cover plate" or also "faceplate" on which the entire electronics of the treatment device are found. Cover plates of this type consist of plastic and are usually optically adapted to the colour of the ear, since this cover plate is visible when the user is wearing the hearing aid, while the metal housing part protruding into the ear is worn so as to be invisible.

Thus, the so-called "housing" is simply mounted on this cover plate in a cap-like manner and enables a shape that is individually anatomically adapted to the ear of every single patient. In this case, it can be provided that this "housing" is made of metal, so that it forms an electrode which forms an automatic on/off switch interacting with a second electrode, said on/off switch automatically turning the hearing aid on when it is inserted into the ear and the resistance between the electrodes is reduced by the moisture of the skin.

Due to the increasingly smaller possible dimensions of the electronics and, as a result, the entire treatment device, whose reduction in size is desired for cosmetic reasons, there is the danger of

undesired damage when the treatment device is unintentionally overlooked or becomes loose from the wearer's ear and falls out, e.g. during sport activities.

It is desirable to improve a generic treatment device in such a way that it enables the wearer to have as active a lifestyle as possible and is as unaffected as possible by mechanical and electronic effects.

In accordance with one aspect of the present invention, there is provided a device for correcting impairments to hearing, comprising: an essentially cylindrically shaped housing, free of externally accessible elements that require movement for operation, and formed of metal, the housing having a battery compartment and a sound exit opening; wherein the housing completely surrounds and shields an electronics unit located therein against electromagnetic waves; and wherein the battery compartment includes a ring magnet retaining means for retaining batteries in the battery compartment and a hole providing external access to the battery compartment, the hole exiting into a center recess of the ring magnet retaining means.

In an embodiment of the invention, the outer housing of a treatment device may be made completely of metal, so that it shields the electronics of the treatment device on all sides without the use of an additional inner housing. In this way, it is assured that, on the one hand, interference pulses from the outside do not affect the hearing aid and, on the other hand, that the pulses that could perhaps be emitted by the hearing aid are suppressed and can not affect external devices.

In addition, by its choice of material - metal - and by its shape with an essentially cylindrical basic form of the housing, the housing has excellent mechanical stability which by far surpasses the stability of treatment devices usually consisting of plastic. Tests have shown that a person can stand on a treatment device of this type and that it can even be run over by a truck and then still be operational.

This mechanical stability is also possible with longitudinal contours curved in a barrel-shaped or slightly banana-shaped manner or with polygonal cross sectional contours which are described as "essentially cylindrical" within the meaning of the present invention.

In addition to this basic mechanical and electrical stability of the hearing aid, a special fitting

against liquids can advantageously be added. Within the meaning of the present invention, not all liquids are to be considered as "liquids", for example, no aggressive acids or the like, but only those liquids that are usually found in the home or in recreational facilities and to which the treatment device is therefore usually exposed, i.e. for example body perspiration or toiletries, as well as water, perhaps mixed with detergents or rinsing agents. The term "water" or "watertight" will always only be used by way of example in the following for these aforementioned liquids.

For this purpose, the battery compartment can be configured so as to be watertight vis-à-vis the rest of the housing; there are various possibilities available to one skilled in the art: A battery compartment cover can be locked together with the rest of the housing so as to be watertight or a surrounding elastomer seal can be provided on the battery compartment or on the cover of the battery compartment or a watertight seal of the battery compartment or battery compartment cover can be assured by a labyrinth-like contouring.

Within the scope of this watertight fitting, it is moreover also advantageously provided to seal the sound exit opening so as to be watertight. According to an aspect of the invention, a film can be provided for this purpose which is, on the one hand, permeable to acoustics, yet watertight on the other hand, so that penetrating water is stopped at the latest at this film and can not penetrate further into the treatment device and cause damage there. A suitable film of this type can, for example, consist of a stretched plastic, as is known e.g. under the trade-name "Gore-Tex"™.

The devices according to some embodiments of the invention can, for example, be configured as tinnitus maskers, so that they only have a sound exit opening for emitting treatment noises. Advantageously, however, a sound receiving opening, which is also sealed in the aforementioned manner by means of a film so as to be watertight, can also be provided in the housing in addition to the sound exit opening. The sound receiving opening enables the configuration of the treatment device as a hearing device which amplifies and emits the received noises. If necessary, two separate films can be used at both openings.

However, if the housing has two openings and both openings are sealed so as to be watertight, then a single piece of film can be used in an advantageously cost-effective and assembly-

effective manner for this purpose. An acoustic separation of the film can be provided at both openings to exclude affects of noises emitted at the sound exit opening due to sound occurrences which are received at the sound receiving opening. The areas of a single film allocated to the two openings can be acoustically separated from one another thereby that at least one of these two areas is limited by a frame which prevents a transmission of vibrations from one area to the respectively other area. For example, the frame may be formed by a ring surrounding the one area or it may surround both areas in an octagonal manner or it may be formed by a component which is adjoined by a film and has an opening in the area of each of the two film areas.

Advantageously, the housing can have two parts, one part of which having the battery compartment and the other part accommodating the actual electronics of the treatment device. Both parts can be screwed together, so that to open the battery compartment it is provided that the part of the housing having the battery compartment simply be unscrewed from the other part instead of a cover that must be opened by hinges.

The threading with its circular cross section enables a simple and reliable seal of the battery compartment by the use of commercial and inexpensive O-rings. In addition, the treatment device can be easily switched on or off with this arrangement by unscrewing the part with the battery compartment from the other part of the treatment device, so that it is not necessary to have an on and off switch that must be operated from the outside and which might be movable and would have to be sealed against water. Therefore, a reliable watertightness and a cost-effective manufacturing of the treatment device are favoured.

The design of a two-part housing of this type, the arrangement of the threading and the O-ring seal, as well as the handling of a treatment device of this type, in particular the screw motion, are favoured by the essentially cylindrical form of the housing.

Moreover, it can be advantageously provided that, on the whole, there are no movable outer operating elements on the treatment device, e.g. rotary potentiometers, toggle switches or pushbutton keys. This facilitates a seal of the treatment device, so that the reliability of the treatment device can be increased and its manufacturing costs reduced.

Advantageously, the housing can consist of titanium or of a titanium alloy: In this way, an allergen-free or allergen-poor housing is made possible which is, in addition, mechanically and chemically highly stable which, due to its low weight, enables a high wearing comfort which, moreover, ensures a reliable electric shield and which can, in addition, be easily configured in various ways by appropriate surface treatments, e.g. anodizing, and can thus be easily adapted to meet customers' wishes with respect to the visual appearance of the treatment device.

Advantageously, retaining means can be provided that fix the battery in its position inside the battery compartment. Retaining means of this type promote the possibility of being able to omit a separate on and off switch: By moving the battery compartment appropriately vis-à-vis the rest of the housing, it can be assured, with a battery fixed in the battery compartment, that the device is switched on or off with aid of the said movement, since the contact between the battery and the actual electronics of the treatment device is made or broken dependent on this movement.

In order to also be able to safely remove the battery from the battery compartment, even with restricted precision mechanics when using retaining means of this type, a bore having a small diameter can advantageously be provided in the battery compartment. A narrow, needle-like pin can, for example, be inserted through this bore into the battery compartment to loosen the battery from its mounting, for example, when the battery is to be changed.

In a simple manner, it can be provided that these retaining means are configured as a magnet. In this way, a sufficient cohesion, on the one hand, and an easy removability of the battery, on the other hand, without difficulty is made possible. In contrast to mechanical retaining means, for example clamps or the like, it can moreover be excluded that the secure hold of the battery can no longer be assured with advanced service life of the treatment device due to the wear of such retaining means.

Advantageously, the magnet can be configured as a ring magnet, either in one piece or composed of several individual parts, whereby the recess of this ring magnet is situated above

the aforementioned small bore in the battery compartment, so that it is possible to eject the battery in the described manner without difficulty.

The proposed hearing aid can e.g. be configured as an in-the-ear device or as a behind-the-ear device. Sound tubes, that are formed accordingly, which convey the sound from the sound exit opening of the housing into the vicinity of the eardrum of the user, can adjoin the housing so as to be detachable, e.g. by means of a threading. In this way, the sound tubes can be removed when damaged or for cleaning. Moreover, if the dimensions are sufficiently small, the same housing can be optionally worn in the ear or also behind the ear by using a corresponding sound tube.

An embodiment of the invention will be described in greater detail in the following with reference to the drawing.

In the drawing, which illustrates by example only an embodiment of the present invention, Fig. 1 is an exploded, perspective view of a treatment device, exemplary of the embodiment.

In Fig. 1, 1 represents the treatment device on the whole which has a two-part housing 2 made of a titanium alloy. The upper housing part 2a contains the electronics of the treatment device, while the part 2b shown at the bottom contains a battery compartment 7 of the treatment device 1. The two parts 2a and 2b are screwed together, wherein an O-ring 3 found in the area of the screw connection enables the configuration of an overall watertight housing 2.

The treatment device 1 is configured as a hearing aid. Thus, it has a sound receiving opening 4 behind which a microphone is situated. The sound receiving opening 4 is sealed so as to be watertight by a watertight, yet acoustically permeable film. Furthermore, the housing part 2a has a sound exit opening 5 via which noises can be delivered to the ear of the patient or wearer of the treatment device 1. These noises are thereby conveyed from the sound exit opening through a sound tube 6 into the ear of the wearer of the treatment device 1.

The sound tube 6 adjoins the housing part 2a in a watertight manner, i.e. it is only open in the area of its front free end and, as a result, prevents the penetration of liquid in many cases. In addition, however, the sound exit opening 5 is also sealed with a watertight, yet acoustically permeable film, so that in any event the penetration of moisture into housing part 2a is

avoided. The electronics arranged in housing part 2a are also accommodated in housing part 2a in a watertight manner, for example, pasted in so as to be watertight, so that it forms a water barrier to the battery compartment 7.

These electronics can have contacts on their underside which are directed into the housing part 2b. In this way, the said contacts can adjoin a battery situated in the battery compartment 7. In addition, these or other contacts can be used for connection to external programming devices, so that, when the housing part 2b has been removed, the electronics of the treatment device 1 can be affected, e.g. be programmed and adapted to the hearing faculty of the patient.

A ring magnet 8 is situated inside the battery compartment 7, said ring magnet holding the battery in its preset position in the battery compartment 7. When housing part 2b is unscrewed from housing part 2a, this ring magnet 8 thus ensures that the battery can be removed from the contacts of the electronics of this treatment device 1, so that, as a result, the treatment device can be automatically switched off even without operating a switch especially provided therefor. Thus, with aid of the ring magnet 8, it is possible to already switch off the treatment device 1 with a small rotational movement, so that the O-ring 3 is conserved and risks of damage to the O-ring 3 are avoided since the housing part 2b does not always have to be completely unscrewed from housing part 2a when the device is to be switched off.

In housing part 2b, a lower bore 9 with a small diameter is provided which opens into the central opening of the ring magnet 8. If a tool with a small diameter is inserted into the bore 9, then the battery can be loosened from the ring magnet 8 and taken out of the battery compartment 7 with aid of this tool, for example, a pin.

Moreover, the bore 9 ensures that air can penetrate into the battery compartment, so that, e.g. when using zinc/air batteries, their trouble-free operation is ensured. Due to the small diameter of the bore 9, on the one hand, and the arrangement of the battery and the ring magnet 8, which together form a type of labyrinth seal, the inside of the housing part 2b is also watertight in spite of the presence of bore 9 for conventional practical applications of a hearing aid, in particular, since the lower housing part 2b adjoins the upper housing part 2b in a watertight and airtight manner, so that the lower housing part 2b merely has its bore 9 as a

one-sided opening, so that the displacement of air contained in the battery compartment 7 and thus the entry of moisture is made more difficult in the absence of a second opening used for ventilation and due to the small diameter of the bore 9.

With increased demands on watertightness of the treatment device, however, a water barrier can be provided between magnet and battery in a variation of the embodiment shown, e.g. in the form of a film sack hung into housing part 2b. The slight material thickness ensures a sufficient cohesion of the magnet. The sack-like shape enables an extensive deformation of the film and thus the ejection of the battery using bore 9. When using an air-permeable film, all types of batteries can be used without difficulty.

10 indicates a film which is watertight and at the same time acoustically permeable and which is air-permeable due to the minutest pores. Due to the small dimensions of the treatment device 1, a single film piece is provided so as to be assembly friendly. In order that the vibrations of this film 10 do not produce a reciprocal effect of sound reception and sound exit, the two film areas allocated to these openings are separated acoustically from one another, e.g. by a frame, which separates at least one of the two areas from the other area. A frame of this type can be formed by the upper side of the block containing the electronics or by a separate component.

The dimensions of the treatment device 1 can be kept comparatively small. For example, with a diameter of about 1 cm and an overall length of about 2 cm, it can, for example, be worn either as a retroauricular treatment device behind the ear or also in the ear.

The housing 2 can be configured matted, grooved or non-circular on its surface, in order to in this way enable a secure hold which facilitates the screwing or unscrewing of the two housing parts 2a and 2b.

WHAT IS CLAIMED IS:

1. A device for correcting impairments to hearing, comprising:

an essentially cylindrically shaped housing, free of externally accessible elements that require movement for operation, and formed of metal, the housing having a battery compartment and a sound exit opening;

wherein the housing completely surrounds and shields an electronics unit located therein against electromagnetic waves; and

wherein the battery compartment includes a ring magnet retaining means for retaining batteries in the battery compartment and a hole providing external access to the battery compartment, the hole exiting into a center recess of the ring magnet retaining means.

2. The device according to claim 1, wherein the battery compartment comprises a watertight seal from the rest of the housing.

3. The device according to claim 1, wherein the sound exit opening is sealed by an acoustically transmitting, watertight film.

4. The device according to claim 2, wherein the sound exit opening is sealed by an acoustically transmitting, watertight film.

5. The device according to any one of claims 1 to 4, wherein the housing comprises a first housing component with the battery compartment being fastened together with a second housing component and an O-ring seal being located therebetween.

6. The device according to any one of claims 1 to 5, wherein the housing is composed of titanium or a titanium alloy.

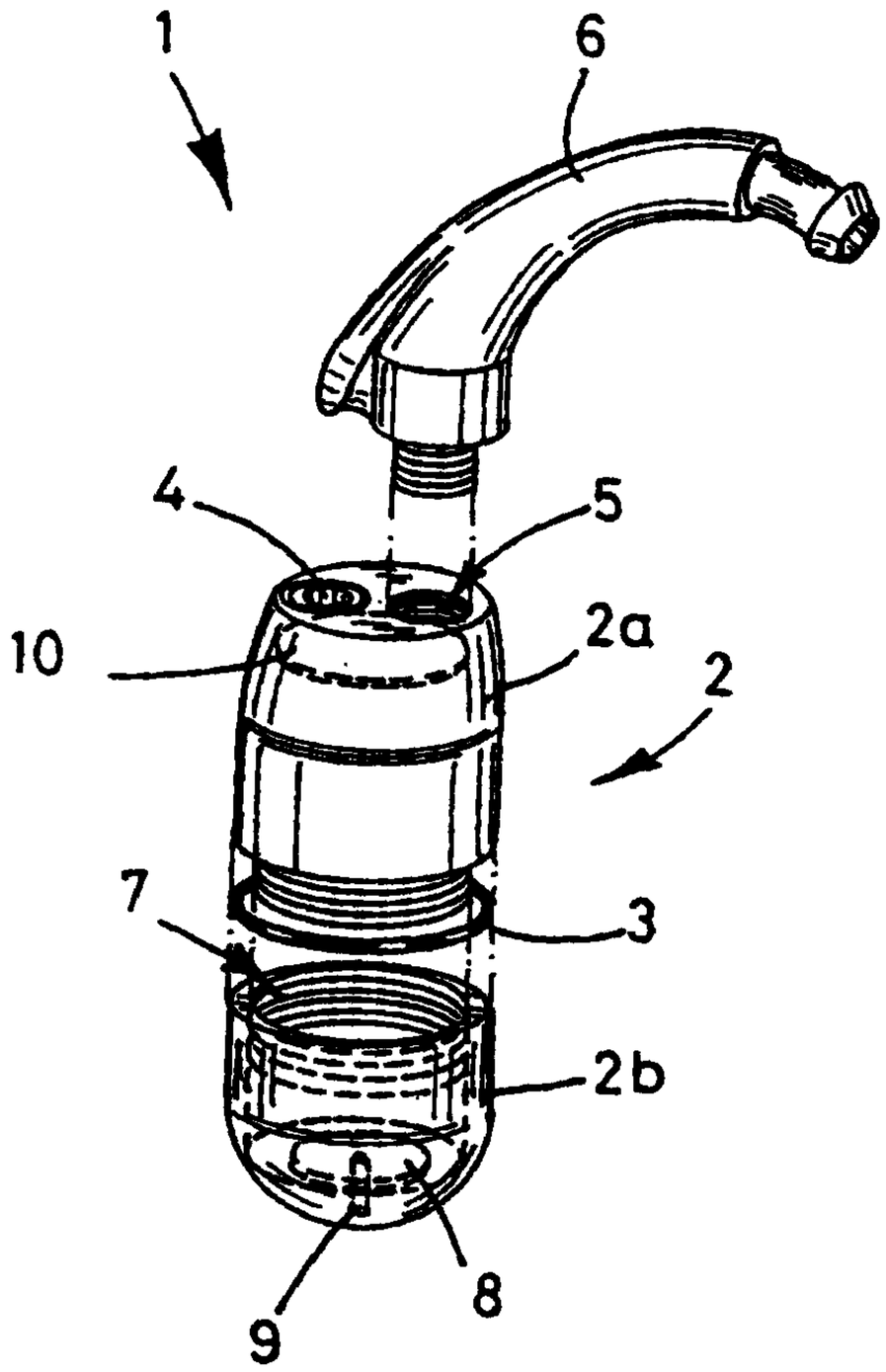
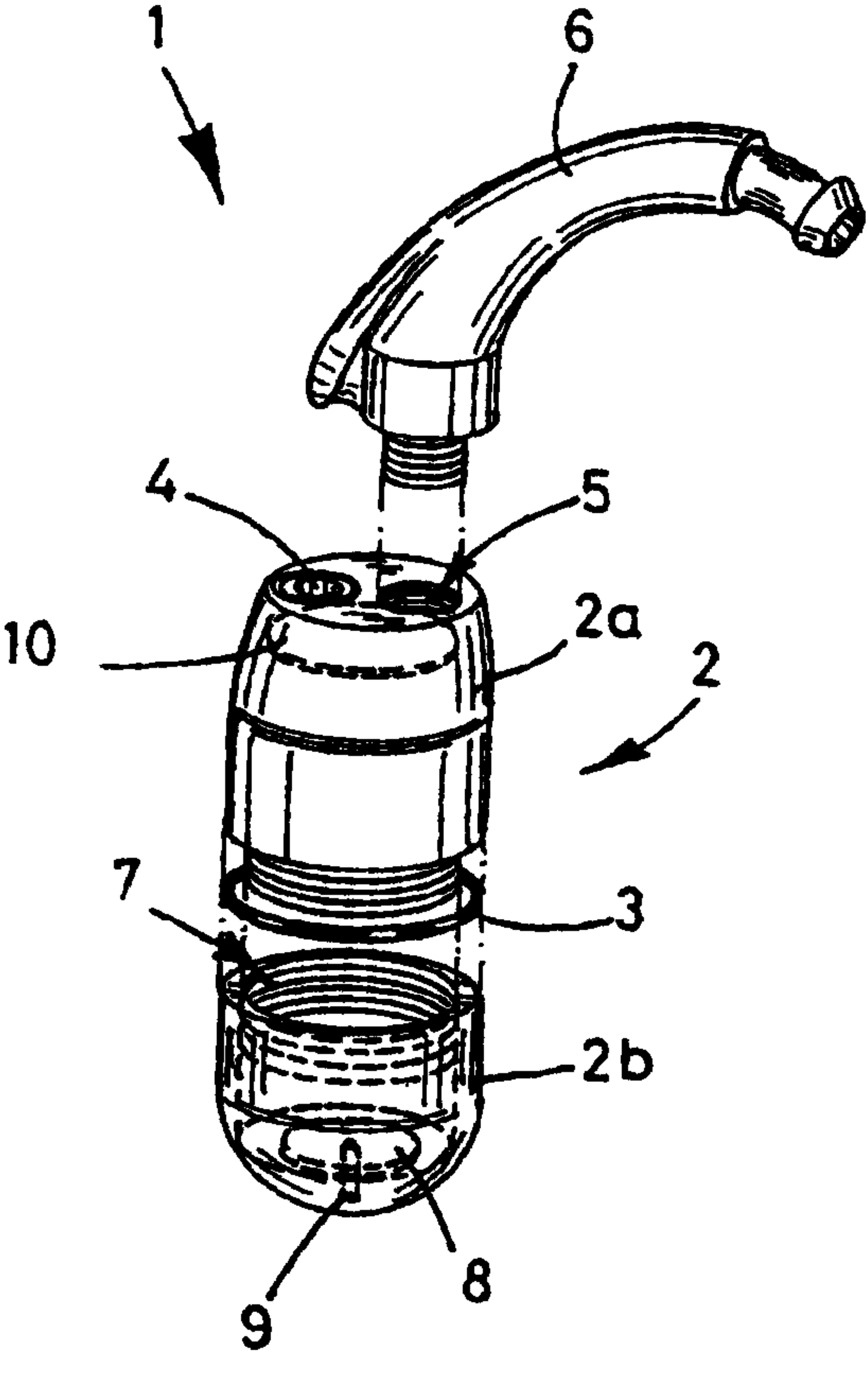


Figure 1


1
6
4
5
10
2a
2
7
3
2b
8
9