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CA 2422403 C 2011/01/25

(11)(21) **2 422 403**

(12) **BREVET CANADIEN**
CANADIAN PATENT

(13) **C**

(86) Date de dépôt PCT/PCT Filing Date: 2000/09/07
(87) Date publication PCT/PCT Publication Date: 2002/12/14
(45) Date de délivrance/Issue Date: 2011/01/25
(85) Entrée phase nationale/National Entry: 2003/03/03
(86) N° demande PCT/PCT Application No.: CH 2000/000480
(87) N° publication PCT/PCT Publication No.: 2000/074915

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

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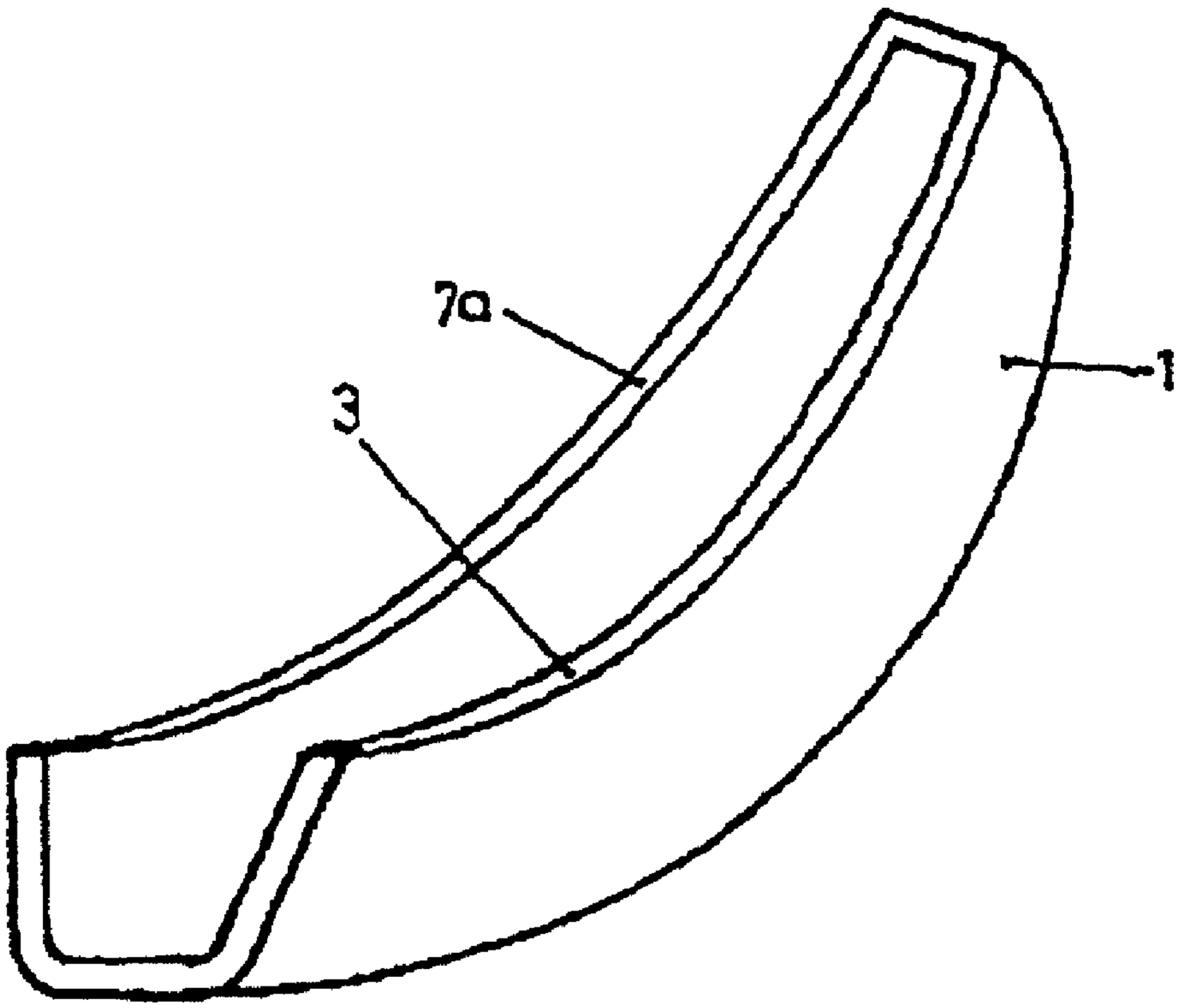
(54) Titre : PROCEDE DE PRODUCTION D'APPAREILS AUDITIFS, ET APPAREIL AUDITIF
(54) Title: METHOD OF PRODUCING HEARING AIDS AND A HEARING AID



(57) Abrégé/Abstract:
The aim of the invention is to increase hearing aid packing density. To this end, at least two elements that are to be assembled on the hearing aid and that are produced from different materials are produced by two- or multicomponent injection molding. For example, in the case of a two- or multipart shell of a hearing aid, the sealing (7a) is coinjected on a part (1) in the marginal area (3) together with the material of said shell part.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
14. Dezember 2000 (14.12.2000)

PCT

(10) Internationale Veröffentlichungsnummer
WO 00/74915 A3

(51) Internationale Patentklassifikation[7]: H04R 25/00

(21) Internationales Aktenzeichen: PCT/CH00/00480

(22) Internationales Anmeldedatum:
7. September 2000 (07.09.2000)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

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(81) Bestimmungsstaaten *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Bestimmungsstaaten *(regional)*: ARIPO-Patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), eurasisches Patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI-Patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

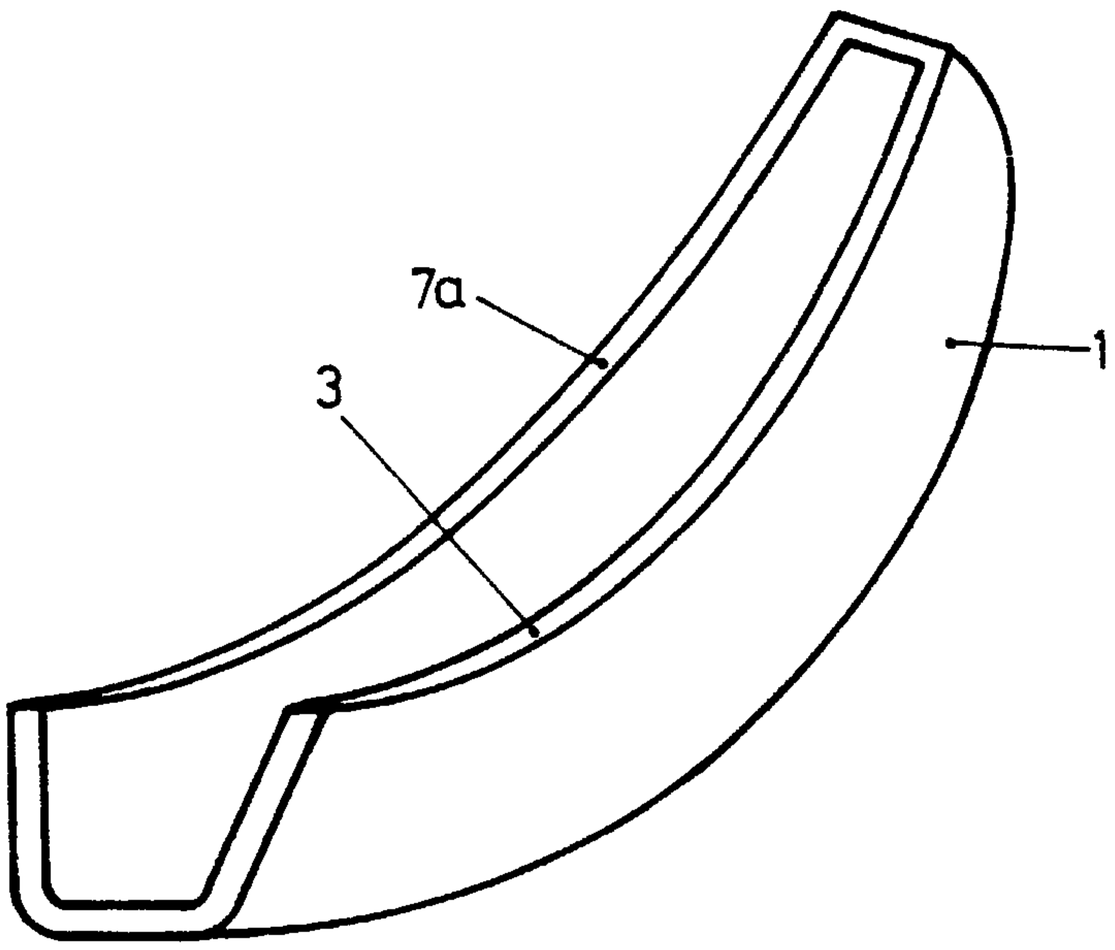
Veröffentlicht:
— *mit internationalem Recherchenbericht*
— *auf Antrag des Anmelders, vor Ablauf der nach Artikel 21 Absatz 2 Buchstabe a geltenden Frist*

(88) Veröffentlichungsdatum des internationalen Recherchenberichts: 25. April 2002

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(54) **Title:** METHOD OF PRODUCING HEARING AIDS AND A HEARING AID

(54) **Bezeichnung:** VERFAHREN ZUR HERSTELLUNG VON HÖRGERÄTEN UND HÖRGERÄT



(57) Abstract: The aim of the invention is to increase hearing aid packing density. To this end, at least two elements that are to be assembled on the hearing aid and that are produced from different materials are produced by two- or multicomponent injection molding. For example, in the case of a two- or multipart shell of a hearing aid, the sealing (7a) is coinjected on a part (1) in the marginal area (3) together with the material of said shell part.

(57) Zusammenfassung: Um die Baudichte an Hörgeräten zu erhöhen, wird vorgeschlagen, mindestens zwei der am Hörgerät zu assemblierenden Teile, die aus unterschiedlichen Materialien zu fertigen sind, in Zwei-oder Mehrkomponenten-Spritztechnik zu fertigen. So wird beispielsweise an einer zwei- oder mehrteiligen Schale eines Hörgerätes, an einem Teil (1), gemeinsam mit dem Material dieses Schalenteils im Randbereich (3) die Dichtung (7a) mitgespritzt.

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METHOD OF PRODUCING HEARING AIDS AND A HEARING AID

The present invention relates to a method of producing hearing devices in which at least two parts made of different materials are produced and assembled, and to a hearing device assembled from a plurality of parts.

Two-component or multi-component injection-molding methods are known from plastics processing technology. Reference can be made, for example, to Ch. Jaroschek "Das Mehrkomponenten-Spritzgiessverfahren" [Multi-Component Injection-Molding] in Swiss Plastics 19 (1997) No. 12, or to U. Stenglin "Hart/Weich-Verbindungen und anwendungsbezogene Modifizierbarkeit von TPE-S (SEBS/SEPS)" [Hard/Soft Compounds and Application-Related Modifiability of TPE-S (SEBS/SEPS)] in Swiss Plastics 20 (1998) No. 3. These discuss the advantages of two-component or multi-component injection-molding, specifically those relating to tool costs, personnel costs, machine costs and material costs. The methods mentioned are basically categorized into sandwich injection-molding methods and overmolding methods. In the present case, it is the overmolding method which is of principal interest, albeit not exclusively so. In said method, a part is formed from a first material component, and a second, different

material component is then injected over at least some areas of the first material component, by which means the second part made of different material is built up on top of the first part. All injectable thermoplastics can be used, in particular also for the overmolding method, but also, quite specifically, nonconnectable further materials.

Of course, the abovementioned costs are also important production factors in the production of hearing devices. In addition, however, in the production of hearing devices, there is the basic problem of space, since a permanent requirement of said branch is to achieve the most space-saving constructions.

The object of the present invention is to propose a production method and, correspondingly, a hearing device resulting from this method, said method permitting a significant increase in the packing density of hearing devices.

According to the present invention, there is provided a method of producing hearing devices in which at least two parts made of different materials are produced and assembled, characterized in that the parts are produced, already joined-together, by two-component or multi-component injection-molding, said parts being produced from different material components.

According to the present invention, there is also provided a hearing device assembled from a plurality of parts, characterized in that at least two of the parts, made of different materials, are produced together by two-component or multi-component injection-molding.

According to the present invention, there is also provided a method of manufacturing a hearing device comprising:

manufacturing a first functional part of a first material to provide a first function for the hearing device;

manufacturing a second functional part of a second material to provide a second function for the hearing device;

assembling said first and second functional parts to form a composite part to provide both said first and second functions at the hearing device, thereby injection molding said second functional part of said second material integrally with said first part and simultaneously performing manufacturing of said second part of said second material and assembling of said second part and of said first part of said first material, and

wherein manufacturing and assembling the first and second functional parts take place within a common mold.

According to the present invention, there is also provided a method of manufacturing a hearing device comprising:

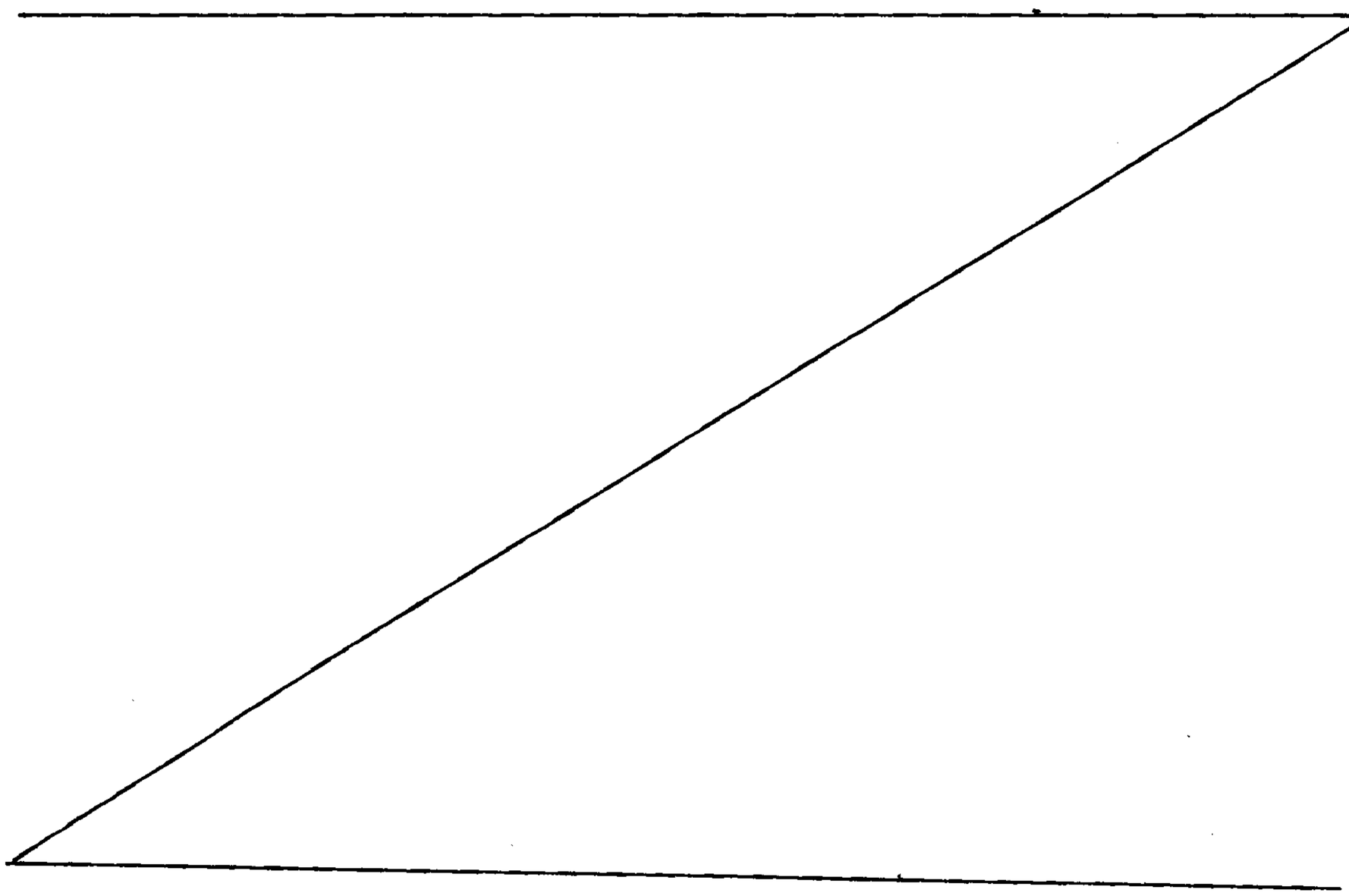
manufacturing a first functional part of a first material to provide a first function for the hearing device and as a first separate part;

manufacturing a second functional part of a second material to provide a second function for the hearing device and as a second part; and

assembling the first and second separate parts to form a composite part to provide both the first and the second function at the hearing device;

wherein injection molding the second functional part of the second material integrally with the first part and thereby simultaneously performing manufacturing of the second part of the second material and assembling the second part and the first part of the first material.

Preferably, to this end, it is proposed, in said method, that at least two of the parts to be assembled on the hearing device are produced by two-component or multi-component injection-molding and assembled together. The advantage possibly ensuing from this, namely a reduction in the aforementioned costs, is of course greatly welcome, although a more important point is that using said method achieves the essential criterion for hearing device construction, namely that of increasing the



component density per cm^3 of available space.

If, according to a preferred embodiment of the method according to the invention, one of the parts used is at least a portion of the hearing device housing, for example one shell of a two-shell housing, then it is possible to build directly onto the latter, using two-component or multi-component injection-molding, further active parts, in particular seals, for example for tight connection to the second shell of the housing and/or impact-damping recesses for receiving delicate components and/or further active hearing device components such as acoustic leads. In principle, this affords the possibility of dispensing with connection elements between said parts, which connection elements are necessary in conventional types of construction, or of giving such parts only the exact volume necessary for their function, without however having to provide any connecting portions such as grooves and webs.

As has been stated, in a preferred embodiment of the method according to the invention, in principle at least one seal is built up in connection with the two-component or multi-component injection-molding, together with a further part directly adjoining the seal, for example and preferably a housing part, or an operating member projecting through the housing, or a further hearing device part which itself has to be

sealed off especially precisely.

In a further preferred embodiment of the production method, in particular for hearing devices worn outside the ear, it is proposed that the acoustic lead at the output of the electro-mechanical transducer, which acoustic lead is usually designed as a plastic tube, be produced in said injection-molding method, either together directly with a housing portion or, for example, with an elastic, form-fitting, sealing fixture to be inserted into a seat in the housing.

In a further preferred embodiment of said method, it is proposed that an acoustic lead at the input of the acoustic-electric hearing-device transducer be produced in said injection-molding method, for example either again together with a portion of the hearing device housing, or with a specifically designed, for example sealing, elastic fixture. In further embodiments of the method according to the invention, which can of course each be used individually or in combinaton with other preferred embodiments, receiving seats for hearing device components or parts are produced in said injection-molding method, either together with housing portions and/or together with other structural parts directly adjoining them.

In a further preferred embodiment, predetermined

surface areas on the outside of the housing are produced together with the housing, but from different material, in said injection-molding method, for example for design reasons and/or to make it easier to feel, just with the fingers, the operating members arranged on the housing.

The invention is explained below by way of example with reference to figures, where:

Fig. 1 shows a diagrammatic and perspective view of a portion of a hearing device housing, with a seal built on in accordance with the invention.

Fig. 2 shows a cross section through a part of the housing in Fig. 1, with the seal built on in accordance with the invention.

Fig. 3 shows a cross section through the housing wall of a hearing device constructed by a conventional method, with assembled seal.

Fig. 4 shows a diagrammatic cross section through a

part of a hearing device housing, with an acoustic lead mounted in accordance with the invention and/or a receiving seat for a module.

Fig. 5 shows a diagrammatic cross section through a housing wall portion with an operating unit and with a through-opening and unit holder built on in accordance with the invention.

Fig. 6 shows a diagrammatic representation of the connection, according to the invention, of two function units of a hearing device.

From the explanations given in the introductory part of the description, it will already be apparent to the skilled person that, depending on the hearing device to be designed and on its structure, there are a large number of possible ways, in combined processing in two-component or multi-compnent injection-molding methods, in particular overmolding, of producing two or more of the required structural parts in a space-saving manner, and then of assembling them as one integral part. Nevertheless, preferred ways of using said injection-molding method are discussed below on the basis of a number of illustrative examples. The actual technique of two-component or multi-component injection-molding is not discussed since, as has been mentioned, this is already sufficiently known from general component

construction, in particular from plastic pressure-molding and injection-molding technology.

Fig. 1 is a diagrammatic and perspective view of the shell 1 of a hearing device housing, for example of a hearing device worn outside the ear. Along its front faces 3, it is to be assembled to further housing parts so that its interior is tightly sealed off along these front faces 3. This is customarily achieved by the fact that, as is shown in Figure 3, positioning and retaining devices are incorporated in the area of the front faces 3, for example grooves are incorporated into the wall of the housing portion 1, into which grooves a seal 7 is then mounted manually.

According to the invention, a seal 7a is now injected directly onto said housing shell 1 or the front face 3 by two-component overmolding/injection-molding. The material of the actual wall of the housing part is sufficient to satisfy the requirements in respect of the stability of the housing, etc., while the material of the second component injected on in the overmolding method satisfies the requirements imposed on the seal 7a. The sealing portion 7a can in this case be exactly dimensioned to comply with the sealing requirements, and, likewise, the wall of the housing portion 1 can be dimensioned and shaped exclusively on the basis of the criteria to be placed on the housing. A design of the

housing wall which additionally satisfies the assembling of a separate seal 7, according to Fig. 3, no longer applies.

Fig. 4 is a diagrammatic representation showing how, for example, an acoustic lead 13 is built onto one end of a hearing device housing 10 in the manner according to the invention, for example at the output of an electro-mechanical transducer mounted in the hearing device, or, in analogy, at the input of an acoustic-electric transducer (not shown) provided on the hearing device. In addition, an elastic and resilient receiving block 15 can be integrated in the housing 10 for the transducer unit 12. Housing 10 and acoustic lead 13 and/or housing 10 and receiving block 15, or all three, housing 10, receiving block 15 and acoustic lead 13, are produced as one part in a two-component or three-component injection-molding method. Here, the material usually chosen for the housing 10 or its wall is a material which satisfies the requirements to be placed on the housing, the material chosen for the acoustic lead 13 is, for example, a material which is biocompatible, as for example for a hearing device worn outside the ear, and the material chosen for the receiving block 15 is a material which satisfies the requirements in respect of impact and shock absorption and mounting of the transducer 12. It is also readily possible, for example, to choose an electrically

conductive material for the block 15, if for example the transducer 12 is to be electrically screened.

Fig. 5 shows, once again diagrammatically, a first part, for example once again a wall of a housing portion 10, with a through-opening 17 via which there protrudes an operating member 19, such as a switch [lacuna] an operating element 25 of the hearing device. By virtue of the fact that, in the two-component or multi-component injection-molding together with the housing part 10, elastic and optionally sealing portions 21 are injected in the area around the through-opening 17 for the operating member 19, and also, if appropriate, a receiving seat 23 for resilient, tight fixing of the unit 25, an optimum space-saving installation of the unit 25 is permitted.

Fig. 6 shows how, on the housing 30 of a unit 34, for example an electronics module of the hearing device, a receiving seat 32 is built on for corresponding positioning and holding of a further unit 34 using said two-component or multi-component injection-molding method, by which means once again an optimum small-size assembly with high packing density is permitted.

By virtue of the production method according to the invention, considerable economies are achieved during assembly. Assembly steps are eliminated by the integral

two-component or multi-component production. Moreover, an extremely important advantage pertaining to hearing devices is achieved, namely that functionally different parts, which come to lie on one another anyway after assembly, can be specifically configured with the respectively required material properties, but nonetheless as one integral part. Measures for long-lasting assembly of these parts, which measures take up structural volume, are thus dispensed with. If we take as an example the embodiment shown in Figures 1 through 3, it is evident that a seal 7a, which only has to satisfy the exact sealing requirements, can be made substantially smaller and thinner, if it is formed integrally on the part 1, than is the case if it has to be produced separately as seal 7 and then fitted, for example manually, onto the corresponding front faces of the part 1, either by adhesion, engagement, or the like. The precision with which the sealing part 7a can be built directly onto the wall of the part 1 forming the front face 3 is, with the same dimensions, virtually impossible, or possible only with great effort, by assembly of separate parts.

WHAT IS CLAIMED IS:

1. A method of producing hearing devices in which at least two parts made of different materials are produced and assembled, characterized in that the parts are produced, already joined-together, by two-component or multi-component injection-molding, said parts being produced from different material components.

2. The method as claimed in claim 1, characterized in that, as one of the parts, at least a portion of the housing is produced by two-component or multi-component injection-molding.

3. The method as claimed in claim 1 or 2, characterized in that, as one of the parts, a seal is produced by two-component or multi-component injection-molding.

4. The method as claimed in claim 3, characterized in that said one of the parts includes at least a portion of the housing and a seal.

5. The method as claimed in any one of claims 1 to 4, characterized in that, as one of the parts, an acoustic lead at the output of an electro-mechanical transducer of the hearing device is produced by two-component or multi-component injection-molding.

6. The method as claimed in any one of claims 1 to 5, characterized in that, as one of the parts, an acoustic lead at the input of an acoustic-electric transducer is produced by two-component or multi-component injection-molding.

7. The method as claimed in any one of claims 1 to 6, characterized in that a receiving seat for parts of the hearing device in the housing is produced by two-component or multi-component injection-molding.

8. The method as claimed in claim 7, characterized in that the receiving seat is produced together with at least a portion of the housing.

9. The method as claimed in any one of claims 1 to 8, characterized in that a boundary portion of a through-opening in the housing is produced by two-component or multi-component injection-molding.

10. The method as claimed in claim 9, characterized in that the boundary portion is produced together with at least a portion of the housing.

11. The method as claimed in any one of claims 1 to 10, characterized in that, on the outside of a housing portion, at least one predetermined surface area is produced, together with the housing portion, by two-component or multi-component injection-molding.

12. The method as claimed in claim 11, characterized in that said at least one predetermined surface area is produced as a design element or as a surface area which has a feel which helps in using the hearing device.

13. A hearing device assembled from a plurality of parts, characterized in that at least two of the parts, made of different materials, are produced together by two-component or multi-component injection-molding.

14. The hearing device as claimed in claim 13, characterized in that one of the parts is a portion of the hearing device housing.

15. The hearing device as claimed in claim 13 or 14, characterized in that one of the parts is a seal.

16. The hearing device as claimed in claim 15, characterized in that the second part is at least a portion of the housing.

17. The hearing device as claimed in any one of claims 13 to 15, characterized in that one part is an acoustic lead at the output of an electro-mechanical transducer of the hearing device.

18. The hearing device as claimed in any one of claims 13 to 17, characterized in that one of the parts is an acoustic lead at the input of an acoustic-electric transducer of the hearing device.

19. The hearing device as claimed in any one of claims 13 to 18, characterized in that at least one receiving seat for a further part of the hearing device is provided in the housing, and in that the receiving seat is produced together with at least one further part by two-component or multi-component injection-molding.

20. The hearing device as claimed in claim 19, characterized in that said at least one receiving seat is for an electro-mechanical transducer of the hearing device, and is produced with a portion of the housing.

21. The hearing device as claimed in any one of claims 13 to 20, characterized in that the housing has a through-opening for an operating member and the border of the opening is one of the parts.

22. The hearing device as clamed in claim 21, characterized in that the operating member is a switch member, and the border of the opening is one of the parts with the housing or the operating member as the second of the parts.

23. The hearing device as claimed in any one of claims 13 to 22, characterized in that surface areas of different material than adjoining housing areas are formed on the outside of the housing, and are produced together with these by two-component or multi-component injection-molding.

24. A method of manufacturing a hearing device comprising:

manufacturing a first functional part of a first material to provide a first function for the hearing device;

manufacturing a second functional part of a second material to provide a second function for the hearing device;

assembling said first and second functional parts to form a composite part to provide both said first and second functions at the hearing device, thereby injection molding said second functional part of said second material integrally with said first part and simultaneously performing manufacturing of said second part of said second material and assembling of said second part and of said first part of said first material, and

wherein manufacturing and assembling the first and second functional parts take place within a common mold.

25. The method of claim 24, wherein at least one of the first and second functional parts is a portion of a housing of the hearing device.

26. The method of claim 24, wherein at least one of the first and second functional parts is a seal.

27. The method of claim 24, wherein one of the first and second functional parts is a portion of a housing of the hearing device and the other of the first and second functional parts is a seal.

28. The method of claim 24, wherein at least one of the first and second functional parts is an acoustical conductor.

29. The method of claim 28, wherein the acoustical conductor is formed at an output side of an electromechanical transducer of the hearing device.

30. The method of claim 28, wherein the acoustical conductor is formed at an input side of an acoustical/electrical transducer of the hearing device.

31. The method of claim 24, wherein one of the first and second functional parts is a resilient bush configured to seat a transducer.

32. The method of claim 24, further comprising forming and joining a third functional part of the hearing device integrally with the first and second functional parts by multi component injection molding.

33. The method of claim 32, wherein the first, second, and third functional parts comprise a housing, a seating bush, and an acoustical conductor.

34. The method of claim 24, wherein said second functional part is a rim portion of a feed-through aperture of a housing.

35. The method of claim 24, wherein the first functional part is a first surface area of a housing for the hearing device and the second functional part is a second surface area of the housing, the second surface area being adjacent to the first surface area.

36. The method of claim 35, wherein the first and second surface areas are differently palpable.

37. The method of claim 24, further comprising mounting a unit of the hearing device into an opening of a bordering area, the bordering area being formed by the first and second functional parts.

38. The method of claim 37, wherein the unit of the hearing device is a manually operable control element.

39. The method of claim 24, wherein said first functional part is injection molded of said first material simultaneously with injection molding said second functional part of said second material.

40. A method of manufacturing a hearing device comprising:

manufacturing a first functional part of a first material to provide a first function for the hearing device and as a first separate part;

manufacturing a second functional part of a second material to provide a second function for the hearing device and as a second part; and

assembling the first and second separate parts to form a composite part to provide both the first and the second function at the hearing device;

wherein injection molding the second functional part of the second material integrally with the first part and thereby simultaneously performing manufacturing of the second part of the second material and assembling the second part and the first part of the first material.

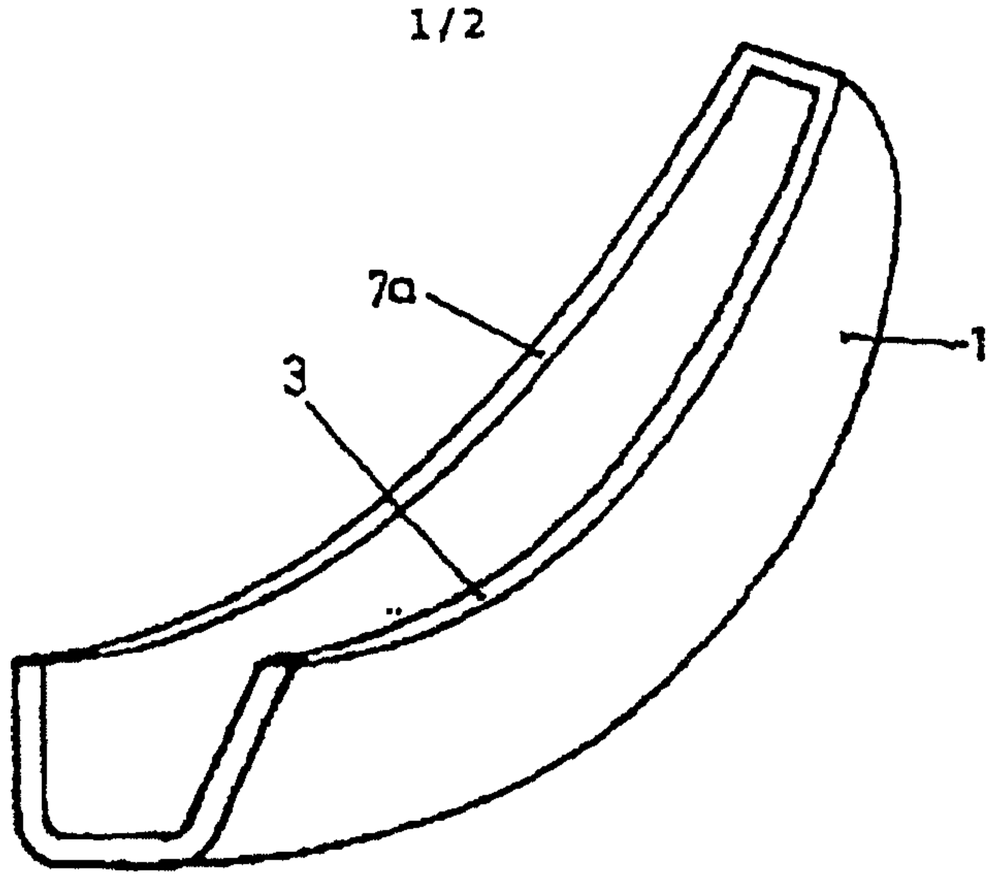


FIG.1

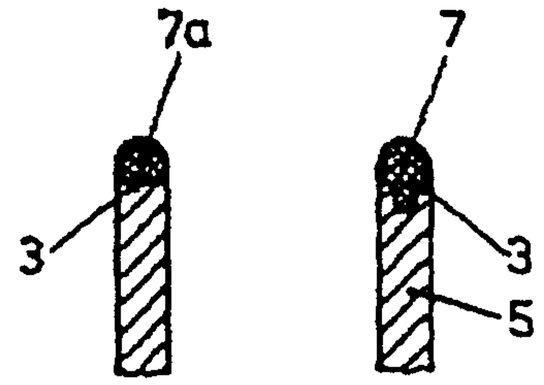


FIG.2 FIG.3

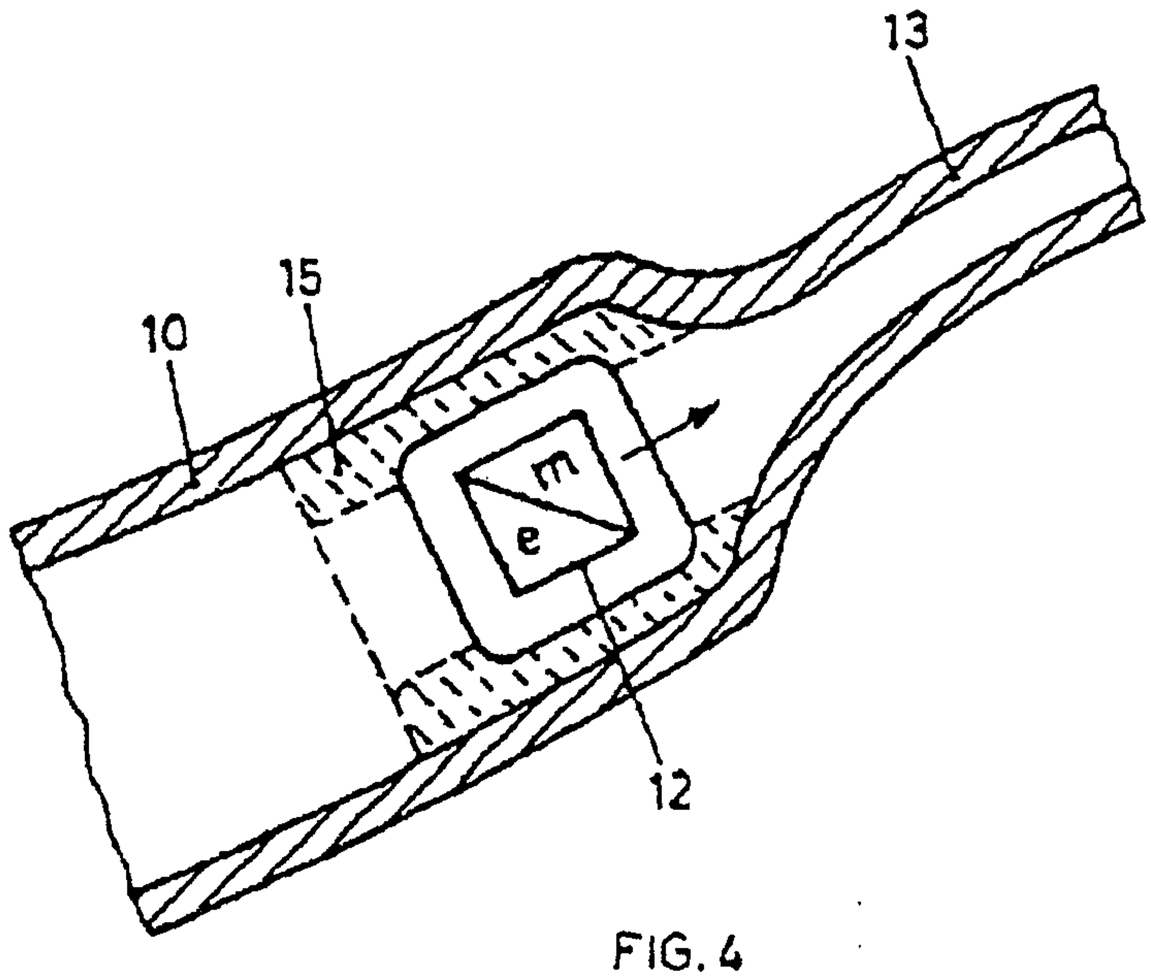


FIG.4

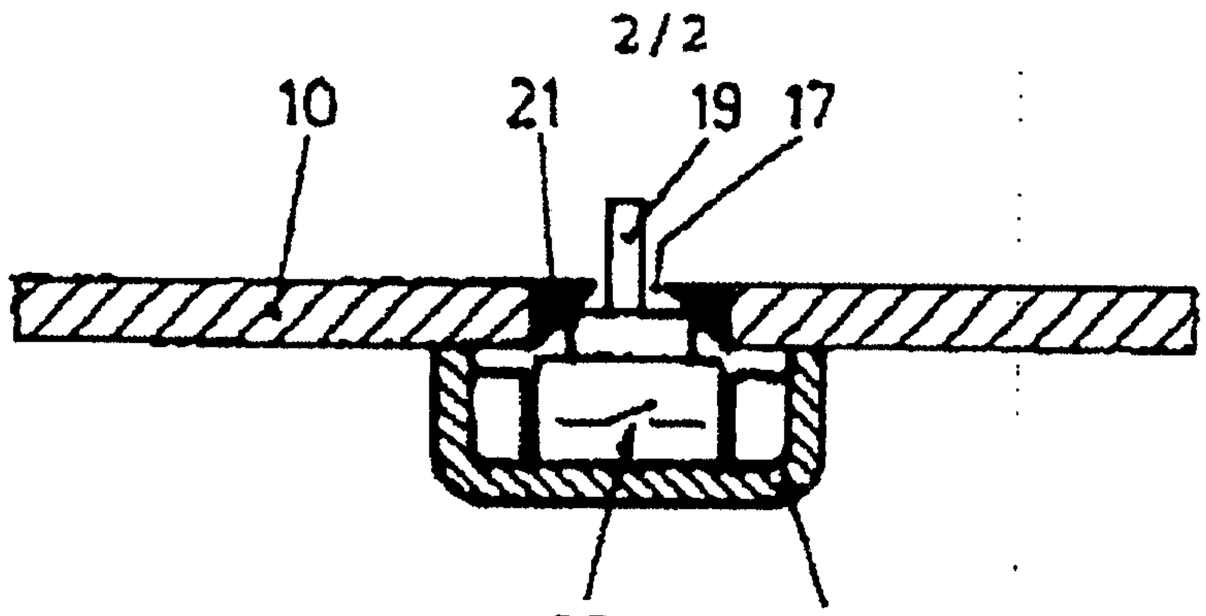


FIG.5

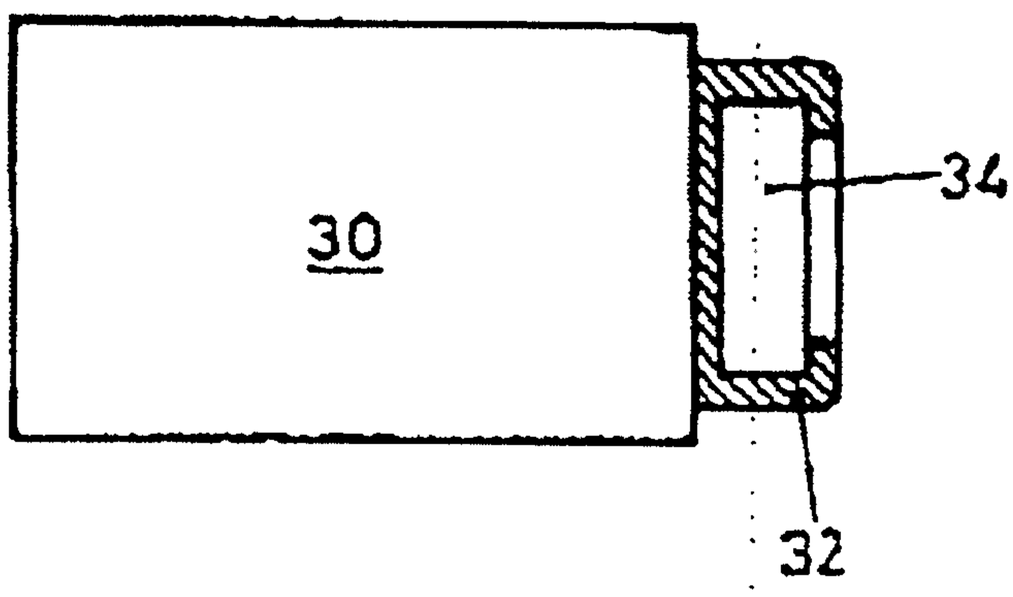
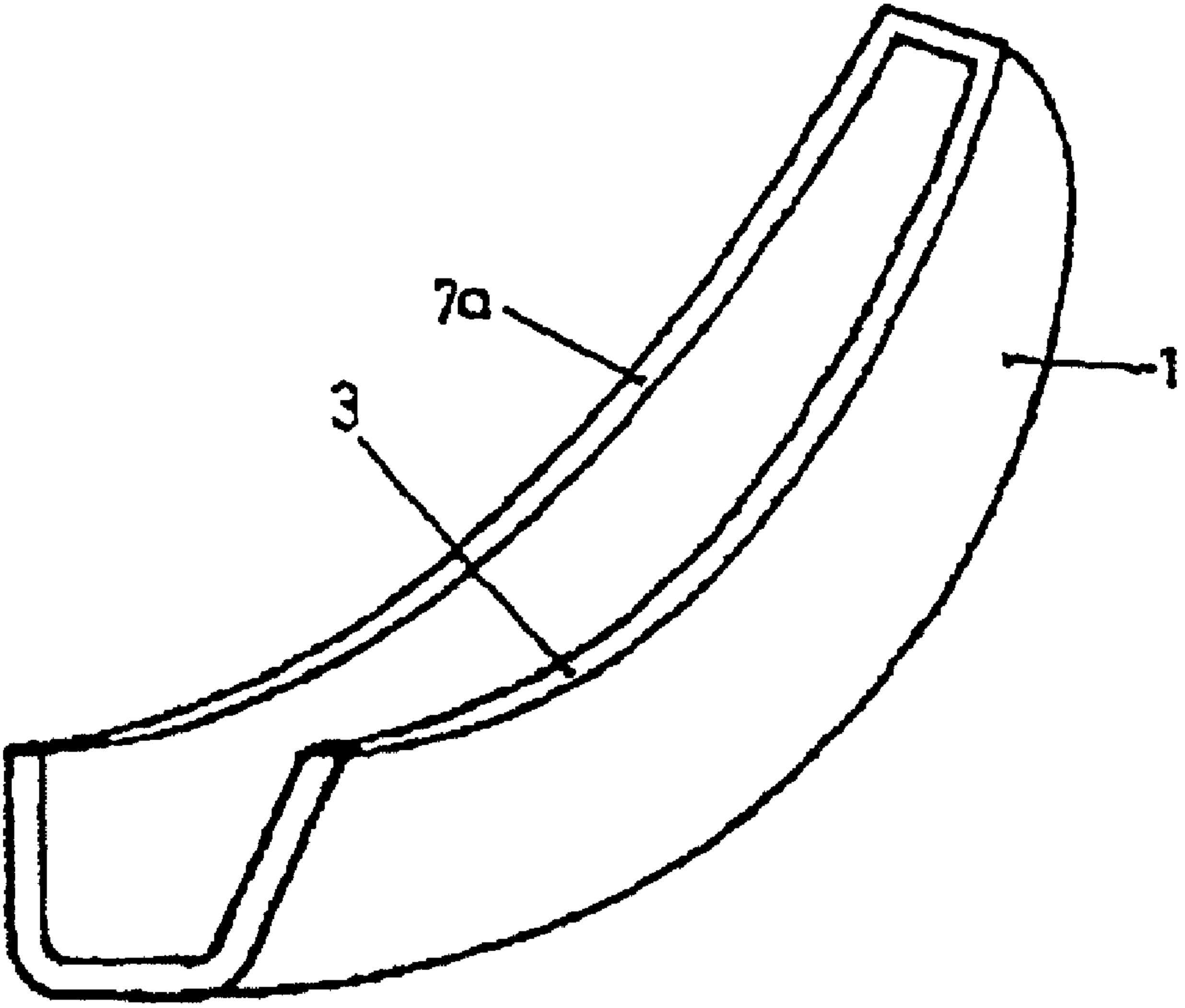


FIG.6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