

# Understanding patent claims

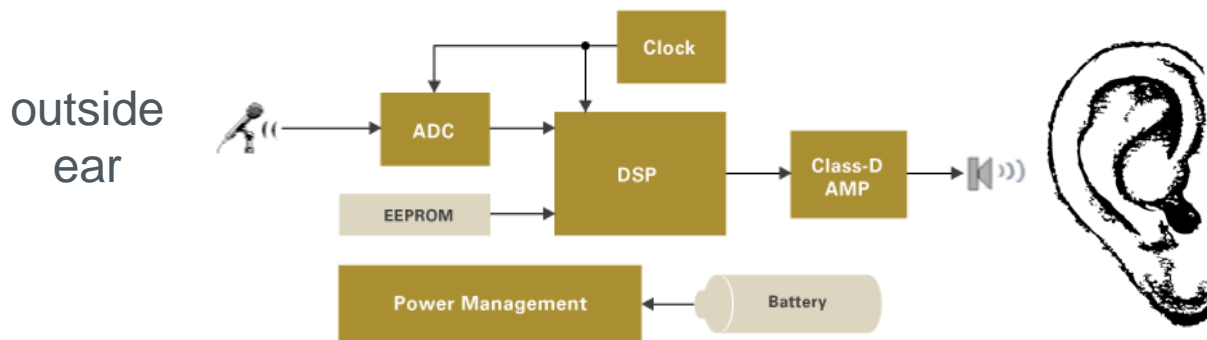
(g) Automatic power switch  
for a hearing aid



# Hearing aids

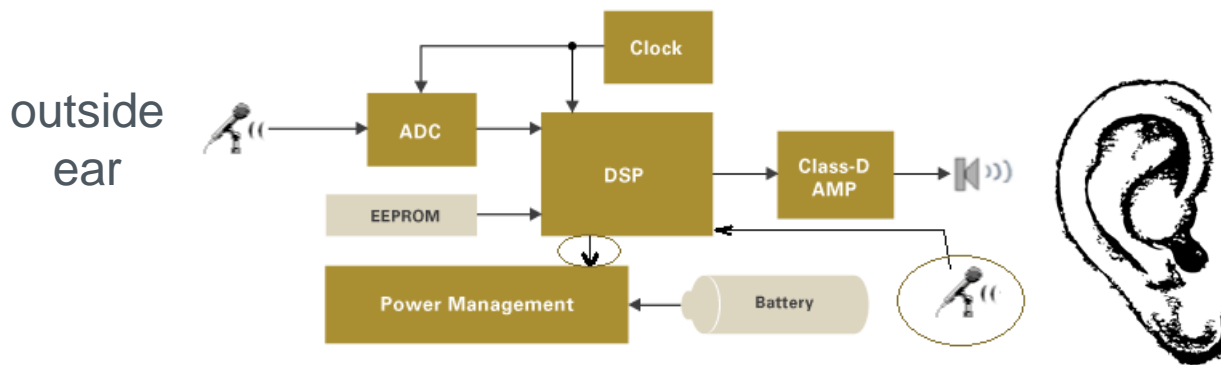
Basic configuration of hearing aids:

- power supply: battery
- audio circuit: microphone - DSP - loudspeaker



# The invention

A hearing aid has a second microphone for determining a sound pressure level inside the ear. The sound pressure is compared with a baseline level to determine if the hearing aid is inserted in or removed from the ear canal. If inserted, the gain is increased; if removed, the gain is reduced to save battery life.



How can you protect it from imitation?

- "convenient" → cannot be protected
- "saves battery life" = **technical function** → **patent**

# How to patent this invention: claim it!

~~Patent Claim: "A hearing aid which uses less battery."~~

Making a hearing aid "use less battery" is a technical problem. Problems cannot be patented - only solutions can.

What is the **technical feature** that makes the hearing aid use less battery?

## How to patent this invention: claim it!

Patent Claim: "A hearing **aid which** detects the insertion or removal of the hearing **aid** into **the ear**, comprising:

- a **loudspeaker**;
- **a** level detection circuitry **consisting of a bandpass filter and a level detector which** receives the electrical signal **input into the loudspeaker** and generates **an** intensity signal;
- a **microphone**;
- **another** level detection circuitry **consisting of a bandpass filter and a level detector which** receives the electrical signal **output from the microphone** and generates **another** intensity signal;
- and **digital** signal processing circuitry coupled to **both** the level detection circuitries and operable to receive the **two** intensity signals and compare **them** and determine whether the hearing instrument is inserted **or not** into the **ear**."

Advantage: claim is precise and easy to understand.

Disadvantage: claim is so precise that the patent would be easy to circumvent, for example by replacing the bandpass filter and level detector by some other level-detection means.

# How to patent this invention: claim it!

Patent Claim: "A hearing instrument apparatus for detecting the insertion or removal of a hearing instrument into a space, comprising:

- a first acoustic transducer configured to receive a first electrical signal and in response radiate acoustic energy (*=>loudspeaker*);
- first level detection circuitry coupled to the first acoustic transducer and operable to receive the first electrical signal and generate a first intensity signal;
- a second acoustic transducer configured to receive radiated acoustic energy and in response generate a second electrical signal (*=>microphone*);
- second level detection circuitry coupled to the second acoustic transducer and operable to receive the second electrical signal and generate a second intensity signal;
- and signal processing circuitry coupled to the first and second level detection circuitry and operable to receive the first and second intensity signals and compare the first and second intensity signals and determine whether the hearing instrument is inserted into the space or removed from the space based on the comparison."

Note: There is no mention of the fact that the microphone is placed inside the ear, or of what happens when removal is detected.

A prior art search will show whether the invention – **as claimed** – is actually **new**.

# Use of dependent claims to improve protection

The patent should include both BROAD and SPECIFIC claims.

**A broad (independent) claim helps prevent the patent from being circumvented.**

**Specific (dependent) claims are tailored to fit exactly to potential infringing products.**

**Broad claim**

**Specific claim 1**

**Specific claim 2**

# Application filed with the EPO

**CLAIM 1:** As above.

**CLAIM 2:** "The hearing instrument system of claim 1, wherein the signal processing circuitry is further operable to **reduce a gain** associated with the first acoustic transducer upon detection that the hearing instrument is **removed** from the space."

**CLAIM 3:** "The hearing instrument system of claim 2, wherein the signal processing circuitry is further operable to **increase the gain** associated with the first acoustic transducer upon detection that the hearing instrument is **inserted** into the space."

**The EPO will perform its own prior art search and then consider whether the invention AS CLAIMED is new and non-obvious.**



# Result of the prior art search

The search revealed US 4955729, "Hearing aid which cuts on/off during removal and attachment to the user", which discloses a similar invention.

## United States Patent [19]

Marx

[11] Patent Number: 4,955,729

[45] Date of Patent: Sep. 11, 1990

[54] HEARING AID WHICH CUTS ON/OFF DURING REMOVAL AND ATTACHMENT TO THE USER

[76] Inventor: Ginter Marx, G.-Caracciola-Strasse 10, 8035, Gauting, Fed. Rep. of Germany

[21] Appl. No.: 174,689

[22] Filed: Mar. 29, 1988

[30] Foreign Application Priority Data

Mar. 31, 1987 [DE] Fed. Rep. of Germany ... 8704763[U]

May 14, 1987 [DE] Fed. Rep. of Germany ... 3716162[U]

Dec. 16, 1987 [DE] Fed. Rep. of Germany ... 3742529

[51] Int. Cl.<sup>3</sup> ..... H04R 25/00

[52] U.S. Cl. .... 381/68; 381/69.2; 381/123; 623/24

[58] Field of Search ..... 381/68, 69.2, 123; 307/117; 338/22 R; 623/24

[56] References Cited

### U.S. PATENT DOCUMENTS

2,673,898 3/1954 Reichert ..... 381/69.2  
2,899,499 8/1959 Eichwald ..... 381/123  
3,227,836 1/1966 Renwick, Sr. .... 381/123  
3,491,203 1/1970 Shabad ..... 381/68

3,869,619 3/1975 Camillo ..... 307/117  
4,278,873 7/1981 Petrides ..... 307/117  
4,295,088 10/1981 Malchow ..... 307/310  
4,467,145 8/1984 Borstel ..... 381/123  
4,504,922 3/1985 Johnson et al. .... 307/117  
4,800,292 1/1989 Gillett ..... 307/117

### FOREIGN PATENT DOCUMENTS

3109049 9/1982 Fed. Rep. of Germany ..... 381/68  
54-39121 3/1979 Japan ..... 381/123  
55-165096 12/1980 Japan ..... 381/68  
878309 9/1961 United Kingdom ..... 381/69.2

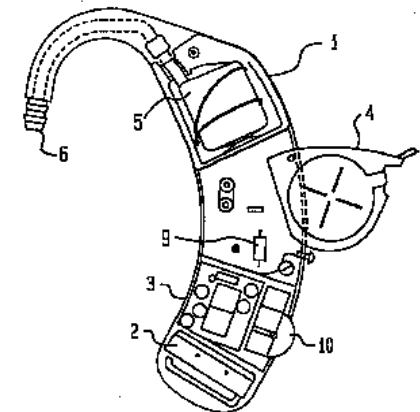
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### [57] ABSTRACT

A hearing aid includes an electronic amplifier, an electric power source and a switch for automatically breaking or making the connection between the amplifier and the power source depending on whether the hearing aid is in use or out of use. The switch is provided in such a manner so as to be responsive to switching criterion defined by a change of state such as change in temperature, moisture etc. The switch is disposed at a wall surface which is subjected to the change of state.

24 Claims, 2 Drawing Sheets

"The switch [is] responsive to switching criterion defined by a change of state."



2: microphone; 5: earphone;  
9: switch; 3: amplifier

# Result of the prior art search

In the description:

"... the adjoining arrangement of the microphone and the earphone ... easily creates acoustic feedbacks which are generated by airborne sound propagating from the earphone to the microphone or by vibrations transmitted from the housing to the microphone. The acoustic feedback ... may lead to a whistling of the hearing aid when the entire circuit is not suitably attenuated."

"... provide a switch 9 which is responsive to a feedback signal generated through acoustic feedback between microphone 2 and earphone 5 after removing the hearing aid."

"The switch 9 of the hearing aid is defined by a control element which responds to the increased sound level created by the feedback and converts the sound pressure into a voltage signal for switching off the hearing aid."

# Comparison of the two inventions

## Features of the claim

- hearing aid
- capable of detecting insertion
- loudspeaker
- level detection circuit for loudspeaker signal
- microphone
- level detection circuit for microphone signal
- DSP circuit: - compares 2 signals  
- determines whether hearing aid inserted or not

## Features of the prior art



### **EPO response:**

All the features are present in the prior art. The patent as claimed is NOT new.

**Please amend your claims if you want your invention protected!**

# Further analysis

Check the material revealed in the prior art searches:

- Does the invention have any features NOT disclosed in the prior art?
- What are the advantages of the invention compared with the prior art?

**How can the claims be amended** to reflect the invention in such a way that it is **new**?

Were any important features of the invention not included in the claims?

Applicant's reply: amendments to the application, explanation of the relationship between the invention and the prior art.

# Comparison of the two inventions

## Features of the claim

- hearing aid
- capable of detecting insertion
- loudspeaker
- level detection circuit for loudspeaker signal
- microphone
- level detection circuit for microphone signal
- DSP circuit: - compares 2 signals  
- determines whether hearing aid inserted or not
- **second microphone inside ear**

## Features of the prior art

✓

✓

✓

✓

✓

✓

✓

✓

**NO! → NEW**

## Advantages/technical result

**Removal of the hearing aid from the ear is detected even if feedback does not occur.**

# Result of the analysis

The second prior art document, US 2002076057, discloses the **temporary introduction of a second microphone inside the ear** in order to assess the acoustic seal (between the ear and the hearing aid) by measuring the difference in sound pressure → the **new feature (microphone inside ear) is known**.

However, although the individual elements of the invention are known, the **combination is not** and it produces a **new, unique benefit**.

Given knowledge of the prior art, it is not obvious to combine the elements to achieve these new effects → the **inventive step** requirement is fulfilled.

The claim must be changed to distinguish it from US 4955729 (insertion detection through feedback detection) and US 2002076057 (microphone inside ear).

# Amended claim

"A hearing instrument system for detecting the insertion or removal of a hearing instrument **into an ear canal of a hearing instrument user, the hearing instrument being configured to occlude the ear canal**, comprising:  
a first acoustic transducer configured to receive a first electrical signal and in response radiate acoustic energy;  
first level detection circuitry coupled to the first acoustic transducer and operable to receive the first electrical signal and generate a first intensity signal;  
a second acoustic transducer configured to receive radiated acoustic energy and in response generate a second electrical signal, **the second acoustic transducer being a microphone that is positioned to receive radiated acoustic energy from inside of the occluded ear canal of the hearing instrument user**;  
second level detection circuitry coupled to the second acoustic transducer and operable to receive the second electrical signal and generate a second intensity signal; and  
signal processing circuitry coupled to the first and second level detection circuitry and operable to receive the first and second intensity signals and compare the first and second intensity signals and determine whether the hearing instrument is inserted into the ear canal or removed from the ear canal based on the comparison."

- New
- Inventive step (new function of not having to depend on occurrence of feedback for the removal to be detected)

# The original description as filed with the EPO supports the amendments to the claims

## Background

Therefore, knowledge that the device has been removed can be used to lower the acoustical gain to prevent feedback and/or to reduce power consumption by switching the unit off or entering a low-power standby mode.

Supports  
inventive  
step:  
different  
technical  
result

[0004] Conversely, when the unit is re-inserted, knowledge that the device has been inserted can be used to automatically restore gain and power.

## Detailed description

By placing a pressure-sensitive microphone inside the sealed acoustic cavity, the frequency response can be measured as the loudspeaker is operating. ...

Different  
to patent  
US4955..

The intensity levels ID and IO are compared to determine if the loudspeaker 20 is driving into a sealed acoustic cavity. ... the ratio of these levels is used to decide if the loudspeaker 20 is driving into a sealed acoustic cavity. ...

Different  
to patent  
US2002..

The expected ratio of the signal levels ID and IO under the sealed and unsealed conditions is derived from knowledge of the electro-acoustic transfer function from the loudspeaker 20 to the microphone 30 under the various operating conditions.



# The patent is finally granted

**Response from EPO: granted!**

<p>(19)</p> 	<p>Europäisches Patentamt European Patent Office Office européen des brevets</p>	 <p>(11) <b>EP 1 465 454 A2</b></p>
<p>(12) <b>EUROPEAN PATENT APPLICATION</b></p>		
<p>(43) Date of publication: <b>06.10.2004 Bulletin 2004/41</b></p>		<p>(51) Int Cl.7: <b>H04R 25/00</b></p>
<p>(21) Application number: <b>04007975.8</b></p>		
<p>(22) Date of filing: <b>01.04.2004</b></p>		
<p>(84) Designated Contracting States: <b>AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR</b> Designated Extension States: <b>AL HR LT LV MK</b></p>	<p>(72) Inventor: <b>Ryan, Jim G.</b> <b>Glouster, Ontario K1W 1E1 (CA)</b></p> <p>(74) Representative: <b>Jones Day</b> <b>Rechtsanwälte, Attorneys-at-Law,</b> <b>Patentanwälte</b> <b>Prinzregentenstrasse 11</b> <b>80538 München (DE)</b></p>	
<p>(30) Priority: <b>01.04.2003 US 459565 P</b></p>		
<p>(71) Applicant: <b>GENNUM CORPORATION</b> <b>Burlington, Ontario L7L 5P5 (CA)</b></p>		
<p>(54) <b>System and method for detecting the insertion or removal of a hearing instrument from the ear canal</b></p>		