

604929

FORM 1

SPRUSON &amp; FERGUSON

## COMMONWEALTH OF AUSTRALIA

## PATENTS ACT 1952

## APPLICATION FOR A STANDARD PATENT

Siemens Aktiengesellschaft, incorporated in the Federal Republic of Germany,  
of Wittelsbacherplatz 2, D-8000 Munich 22, FEDERAL REPUBLIC OF GERMANY, hereby  
apply for the grant of a standard patent for an invention entitled:

Hearing Aid with Printed Circuitry

which is described in the accompanying complete specification.

Details of basic application(s):-

Basic Applic. No:      Country:

G8708894.0

DE

Application Date:

26 June 1987

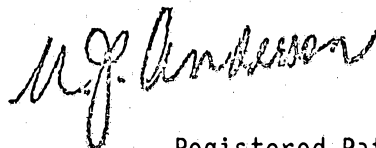
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DATED this TWENTY FOURTH day of JUNE 1988

Siemens Aktiengesellschaft

By:



Registered Patent Attorney

TO: THE COMMISSIONER OF PATENTS  
OUR REF: 55693  
S&F CODE: 61890

5845/2

APPLICATION ACCEPTED AND AMENDMENTS

ALLOWED ..... 25-9-90 .....

REPRINT OF RECEIPT  
3000549 24/06/88

DECLARATION IN SUPPORT OF A  
CONVENTION APPLICATION FOR A PATENTIn support of the Convention Application made for a  
patent for an invention entitled:AUSTRALIA  
CONVENTION  
STANDARD  
& PETTY PATENT  
DECLARATION

Title of Invention                      Hearing Aid with Printed Circuitry

I/We      Fraser Patison Old

Full name(s) and  
address(es) of  
Declarant(s)      Care of      Spruson & Ferguson  
St Martins Tower, 31 Market Street,  
Sydney, New South Wales, Australia

do solemnly and sincerely declare as follows:--

Full name(s) of  
Applicant(s)

1. ~~I am/We are the applicant(s) for the patent~~  
(or, in the case of an application by a body corporate)
1. I am/We are authorised by  
Siemens Aktiengesellschaft  
the applicant(s) for the patent to make this declaration on  
its/~~their~~ behalf.
2. The basic application(s) as defined by Section 141 of the  
Act was/~~were~~ made

Basic Country(ies)                      in              Federal Republic of Germany

Priority Date(s)                      on              26 June 1987

Basic Applicant(s)                      by              Siemens Aktiengesellschaft

Full name(s) and  
address(es) of  
inventor(s)

3. ~~I am/We are the actual inventor(s) of the invention referred  
to in the basic application(s)~~  
(or where a person other than the inventor is the applicant)
3.  
EHRENFRIED ERBE  
of      Baechl 3, 8521 Effeltrich,  
Federal Republic of Germany

(respectively)

is/~~are~~ the actual inventor(s) of the invention and the facts upon  
which the applicant(s) is/~~are~~ entitled to make the application are  
as follows:Set out how Applicant(s)  
derive title from actual  
inventor(s) e.g. The  
Applicant(s) is/~~are~~ the  
assignee(s) of the  
invention from the  
inventor(s)The said applicant is the assignee of the  
actual inventor.

4. The basic application(s) referred to in paragraph 2 of this  
Declaration was/~~were~~ the first application(s) made in a Convention  
country in respect of the invention(s) the subject of the application.

Declared at      Sydney      this      24th      day of      June      19 88

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(12) PATENT ABRIDGMENT      (11) Document No. AU-B-18382/88  
(19) AUSTRALIAN PATENT OFFICE      (10) Acceptance No. 604929

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(54) Title  
HEARING AID WITH PRINTED CIRCUITRY

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(56) Prior Art Documents  
US 4639556  
US 4354065

(57) Claim

1. A hearing aid comprising:  
a housing containing a flexible printed circuit board folded to form two facing side lobes;

at least one control element comprising support means to retain the printed circuit board at said one control element and to prevent relative displacement of the circuit board toward said housing; and

at least one control element being configured as a spacer element disposed between said side lobes.

3. A hearing aid as claimed in claim 1 or 2 having control elements that include a switch and a potentiometer, one or both of which serve to assist in retaining the printed circuit board.

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FORM 10

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COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE:

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Complete Specification Lodged:

Accepted:

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Priority:

Related Art:

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Complete Specification for the invention entitled:

Hearing Aid with Printed Circuitry

The following statement is a full description of this invention, including the best method of performing it known to me/us

ABSTRACT

HEARING AID WITH PRINTED CIRCUITRY

1  
5 A hearing aid comprises means (17 to 20, 30) to  
secure control elements (3, 4) to a housing (2), these  
means being additionally used to hold a printed circuit  
foil (10). The printed circuit foil (11, 12) has two  
10 spaced apart layers and the control elements, such as a  
switch (4) and a potentiometer (3), are arranged between  
the layers such that the necessary spacing between the  
layers is maintained.

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# HEARING AID WITH PRINTED CIRCUITRY

The present invention relates to a hearing aid with printed circuitry.

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In the design of hearing aids the very small space available for installation in the hearing aid housing should be utilised as economically as possible. The arrangement of the components, such as a sound transducer, energy source, switch and amplifier circuit board for instance, plays an extremely important part in this. Moreover, care must be taken to ensure that the devices for retaining the individual elements take up as little space as possible.

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DE-GM 85 27 362 describes, for instance, a behind-the-ear hearing aid with a box-shaped plastic receptacle which is provided with control elements. This receptacle is combined with further plastic parts to form a single component arranged between the amplifier circuit board and the housing. Since the component comprises retaining devices both for the amplifier circuit board and for the housing, the amplifier circuit board is held secure against displacement relative to the housing. The single component is very economical in its design as it also holds the control elements.

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In order to save space, amplifier circuit boards can be arranged on two mounting planes. Also, the amplifier can be designed in the form of multi-layer flexible printed circuit foils provided with components. An arrangement of this type, however, does require additional retaining devices to maintain the spacing between the printed circuit foil layers. Such amplifier arrangements with additional spacing attachments are known from DE-GM 79 18 029 (= US Patent 4,354,065) and US Patent 4,444,318, for example.

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In order to regain the space take up by the spacing attachments, it has been suggested in DE-GM 83 28

734 (= US Patent 4,639,556) to grip the flexible printed circuit foil securely, at a point at which it is bent down, between an operating element and the housing. This solution does, however, have certain disadvantages, as the gripped surface of the printed circuit foil can no longer be used for other purposes. Moreover, with this arrangement, no safeguard against displacement, more particularly against rotation, is ensured for the printed circuit foil, even when the operating element is held secured against rotation.

It is desirable to hold the printed circuit foil secure against displacement in the hearing aid housing without using additional retaining devices or spacing attachments, in order thereby to save space in the hearing aid.

In accordance with the present invention there is disclosed a hearing aid comprising:

a housing containing a flexible printed circuit board folded to form two facing side lobes;

at least one control element comprising support means to retain the printed circuit board at said one control element and to prevent relative displacement of the circuit board toward said housing; and

at least one control element being configured as a spacer element disposed between said side lobes.

Using a control element for holding the printed circuit foil enables the foil to be held securely on the housing by means of supports already provided for the control element. No additional space is thus wasted with further holding means. The surface of the printed circuit foil used for holding may also simultaneously form the electrical connection of the control element and may thus serve an additional purpose. Furthermore, the control element serves at the same time to space the printed circuit foil lobes in two mounting planes.

For a better understanding of the present invention and to show how the same may be carried into



1 effect, reference will now be made, by way of example, to  
the accompanying drawings, in which:-

Figure 1 shows an exterior view of a hearing aid,  
to be worn behind the ear;

5 Figure 2 shows a side view of a printed circuit  
board provided with components and held in the hearing  
aid of Figure 1 by control elements;

Figure 3 shows the printed circuit board of Figure  
2 in cross-sectional line III-III; and

10 Figure 4 shows a plan view of a potentiometer  
arrangement of the hearing aid of Figure 1.

Figure 1 shows a hearing aid 1 to be worn behind  
the ear and having a housing 2 which contains electrical  
and electromechanical elements for processing acoustic  
15 signals. This processing may be influenced by several  
operating or control elements, accessible from the  
exterior, such as a volume control 3, an on/off switch 4  
and control element arrangement 5 (not visible). In  
addition, the hearing aid 1 comprises a battery case 6  
20 and at the opposite end a supporting hook 7. The  
processed acoustic signals are conveyed to the ear via a  
tube 8, attached to the supporting hook 7, and an ear  
fitting piece 9 adapted to the auditory canal of the  
person with impaired hearing.

25 Figure 2 is an enlarged view of the hearing aid 1  
of Figure 1 with the housing shell 2 cut away. Inside  
the hearing aid 1 there is, among other things, an  
amplifier arrangement comprising a flexible, folded,  
printed circuit foil 10 with two side lobes 11 and 12 and  
30 an arm 13 on which are located various circuit elements  
14. The side lobes 11 and 12 of the amplifier  
arrangement are folded round a support 15. The support  
15 is secured to the housing 2 by a snap connection. A  
small transverse rod 16 projecting from the housing 2  
35 into the interior serves this purpose.

This connection does not, however, secure the



1 printed circuit foil 10 against rotation or small  
displacement of the side lobes 11 and 12. To achieve  
this, the distal sides of the side lobes 11 and 12 are  
secured to the operating or control elements 3 and 4.

5 The on/off switch 4 comprises a small switch box  
having a region projecting into the interior of the  
housing 2. One side 23 of this region carries two small  
projections 17 and 18 which project transversely. The  
projections 17 and 18 are designed such that they bear  
10 against appropriately contoured housing projections 19  
and 20. As a result of this the switch 4 cannot be pulled  
out. The projections 17 and 18 in addition hold the side  
lobe 11 which is provided with appropriate apertures or  
eyes 21 and 22 at the distal end. The apertures 21 and  
15 22 are pulled onto the projections 17 and 18 before the  
switch 4 is positioned in the housing 2 on the  
projections 19 and 20. Since the switch 4 is unable to  
move relative to the housing, the printed circuit side  
lobe 11 is thereby also held secure against displacement.

20 As is indicated in Figure 3, the side lobe 12 at  
the opposite side 24 of the switch 4 is attached to the  
electrical connections of the switch 4 by means of  
soldering contacts 25 (only one of which is visible).  
This side lobe is thus also held secure against  
25 displacement.

Since part of the small switch box of the switch 4  
is located between the side lobes 11 and 12, these side  
lobes 11 and 12 cannot possibly come into contact with  
each other. The switch 4 thus acts as a spacer for the  
30 two side lobes 11 and 12.

The switch 4 on the housing shell is also secured  
against being pressed in (see Figure 2). Supporting  
shoulders 26 are located on the housing 2, which  
shoulders bound an opening 27 for the switch 4. The  
35 switch 4 has a frame 28 which rests on the supporting  
shoulders 26 when the switch 4 has been installed in the

1 housing 2.

Figure 2 also shows a potentiometer arrangement 3 which holds the outermost end 29 of the side lobe 11 secure against displacement. The connection between the potentiometer arrangement 3 and the side lobe 11 is, as in the case of the switch 4, designed as a plug/eye type connection. In this case a plug 30, which may be for example a threaded device such as a screw, is located on the potentiometer arrangement 3 and a corresponding eye 31 is provided in the side lobe. The plug 30 is simultaneously the axis of rotation and an electrical connection of the potentiometer arrangement 3. The eye 31 is accordingly provided with an electrical contact.

In Figure 4 the potentiometer arrangement 3 and the side lobes 11 and 12 are shown enlarged still further, in order to show more clearly the holding means between the potentiometer arrangement and the side lobes 11 and 12. Besides the plug/eye connection 30, 31, the holding means comprises a back plate 32 attached to the side lobe 11, in order to stabilise it in the region of the potentiometer arrangement 3. The back plate 32 comprises an opening 38 for the plug 30 of the potentiometer arrangement 3. It is further connected to a cap 33 for a rotatable knob 34 of the potentiometer arrangement 3. Located on the cap 33 is a crossbar 35 which corresponds in width to the distance between the side lobes 11 and 12 and which thus acts as spacer for the outermost ends 29 of the side lobes 11 and 12. A hook 36 projecting from the crossbar 35 serves to hold the potentiometer arrangement 3 with respect to the housing and fits into a corresponding recess 37, shown in Figure 2, in the housing 2 of the hearing aid 1.

The claims defining the invention are as follows:

1. A hearing aid comprising:  
a housing containing a flexible printed circuit board folded to form two facing side lobes;  
at least one control element comprising support means to retain the printed circuit board at said one control element and to prevent relative displacement of the circuit board toward said housing; and  
at least one control element being configured as a spacer element disposed between said side lobes.
2. A hearing aid as claimed in claim 1 wherein a single control element comprises said support means and acts as said spacer element.
3. A hearing aid as claimed in claim 1 or 2 having control elements that include a switch and a potentiometer, one or both of which serve to assist in retaining the printed circuit board.
4. A hearing aid as claimed in claim 1 or 3, wherein said control element comprising said support means is provided with holding means for retaining the printed circuit board.
5. A hearing aid as claimed in claim 4, wherein the holding means comprises a co-operating projection and aperture with one being on the control element or the housing and the other on the printed circuit board.
6. A hearing aid as claimed in claim 5, wherein the projection also serves to mount the control element securely against displacement relative to the housing.
7. A hearing aid as claimed in claim 5 or 6, wherein the control element comprises a switch carrying two projections which extend through corresponding apertures in the printed circuit board and which bear against contoured parts of the housing.
8. A hearing aid as claimed in claim 7, wherein said contoured parts project from the housing.
9. A hearing aid as claimed in claim 7 or 8, wherein the switch is provided, on its side remote from that carrying the projections, with electrical connections for contact of the switch, the printed circuit board side lobes extending relative to the switch such that one side lobe is secured by the projections extending through the apertures and the other side lobe is secured by electrical connection to the electrical connections of the switch.



10. A hearing aid as claimed in any one of claims 7 to 9, wherein the switch comprises a frame which is partially inserted in a corresponding opening in the housing which opening has supporting shoulders serving to support the switch in relation to the housing.

11. A hearing aid as claimed in any one of the preceding claims, which comprises, as, a control element, a rotary potentiometer, on the axis of rotation of which is a projection extending through a corresponding aperture in the printed circuit board.

12. A hearing aid as claimed in claim 11, comprising a backing plate for the printed circuit board, the plate having a hook for securing it to the housing against rotation and displacement and having an opening through which the projection on the axis of rotation extends.

13. A hearing aid as claimed in claim 12, wherein the backing plate has a cross-bar serving to space the side lobes.

14. A hearing aid as claimed in claim 12 or 13, wherein the hook engages a corresponding recess at the interior of the housing.

15. A hearing aid substantially as hereinbefore described with reference to the accompanying drawings.

DATED this SIXTEENTH day of MAY 1990  
Siemens Aktiengesellschaft

Patent Attorneys for the Applicant  
SPRUSON & FERGUSON



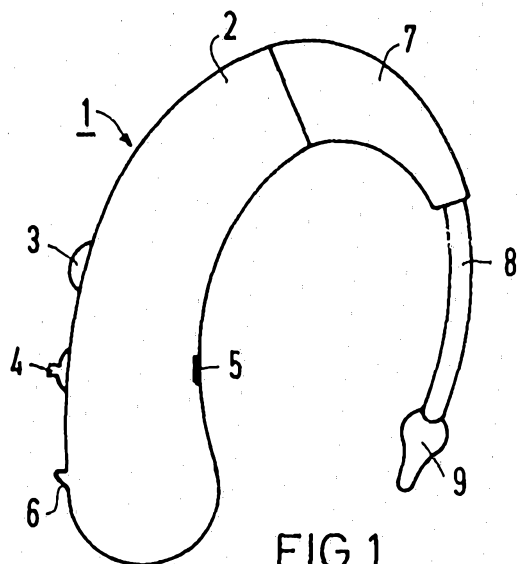


FIG 1

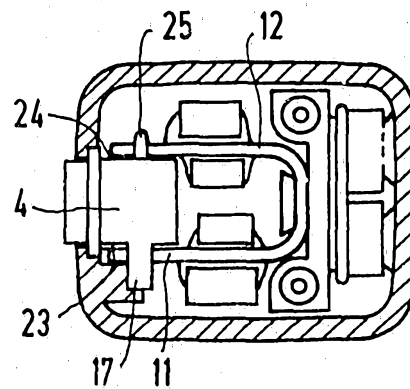


FIG 3

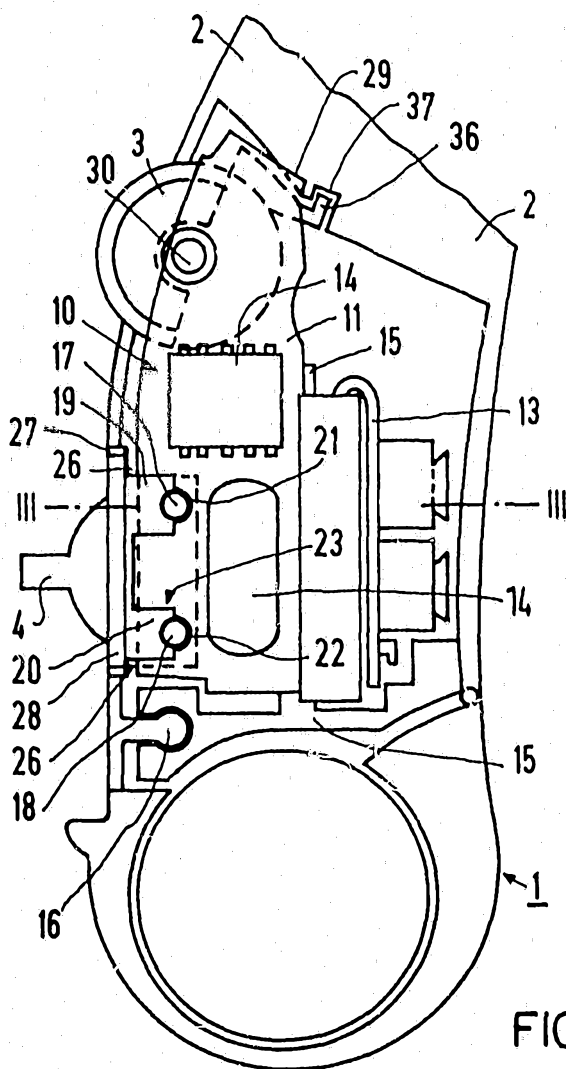


FIG 2

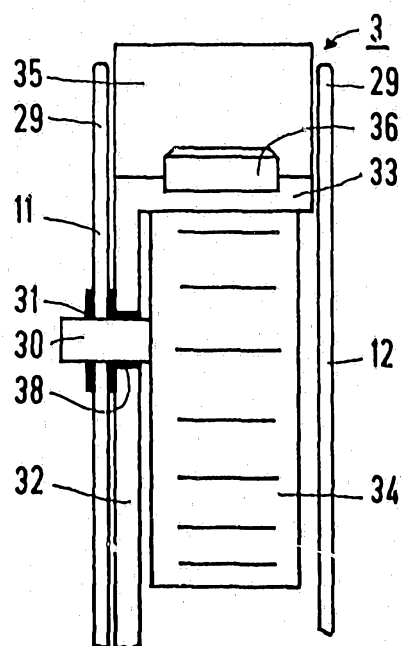


FIG 4