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FORM 1

SPRUSON & FERGUSON

APPLICATION FOR PATENT AMENDMENTS
23. 11. 90

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, here'y
apply for the grant of a standard patent for an invention entitled:

A Hearing Aid using Printed Circuitry and a Hearing Aid
Coil for use Therewith

which is described in the accompanying complete specification.

Details of basic application(s):-

<u>Basic Applic. No:</u>	<u>Country:</u>	<u>Application Date:</u>
G8708892.4	DE	26 June 1987
G8708895.9	DE	26 June 1987

The address for service is:-

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DATED this TWENTY THIRD day of JUNE 1988

Siemens Aktiengesellschaft

By:

[Signature]
Registered Patent Attorney

TO: THE COMMISSIONER OF PATENTS
OUR REF: 56115
S&F CODE: 61890

5845/2

REPRINT OF RECEIPT
5000549 24/06/88

DECLARATION IN SUPPORT OF A
CONVENTION APPLICATION FOR A PATENTAUSTRALIA
CONVENTION
STANDARD
& PETTY PATENT
DECLARATIONIn support of the Convention Application made for a
patent for an invention entitled:Title of Invention A Hearing Aid using Printed Circuitry and a
Hearing Aid Coil for use TherewithI/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 and on 26 June 1987

Basic Applicant(s)

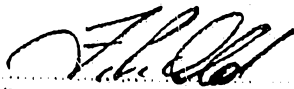
Both by Siemens Aktiengesellschaft

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.

of EHRENFRIED ERBE
Paechl 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 1988


Signature of Declarant(s)

(12) PATENT ABRIDGMENT (11) Document No. AU-B-18381/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 606960

(54) Title
A HEARING AID USING PRINTED CIRCUITRY AND A HEARING AID COIL FOR USE THEREWITH

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(56) Prior Art Documents
US 4710961
US 4638125
EP 140078

(57) Claim

1. A hearing aid having a printed board assembly and a hearing aid coil, characterized in that said hearing aid coil is divided into a plurality of individual windings which are electrically connected in series.

4. A hearing aid according to claim 1, 2 or 3, wherein a protective body holds the individual windings such that they are arranged at different locations on the protective body.

7. A hearing aid according to any one of the preceding claims, in which the individual windings are arranged parallel to one another.

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FORM 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

COMPLETE SPECIFICATION

amendment to the specification
of the invention and for
publishing

(ORIGINAL)

FOR OFFICE USE:

Class Int Class

Complete Specification Lodged:

Accepted:

Published:

Priority:

Related Art:

Name and Address
of Applicant:

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Complete Specification for the invention entitled:

A Hearing Aid using Printed Circuitry and a Hearing Aid
Coil for use Therewith

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

ABSTRACT

A HEARING AID USING PRINTED CIRCUITRY
AND A HEARING AID COIL FOR USE THEREWITH

A hearing aid (1) comprises a flexible printed circuit foil (18) with a printed circuit lobe (19) bent round a curve (25) and a hearing coil (10). To save space the hearing coil is preferably divided into two smaller coil windings (11, 12) connected in series. These may be arranged symmetrically in the hearing aid housing. Since the bending zone coinciding with the curve (25) is not suitable for the contacting of components, the hearing coil (11) is arranged in a protective body (13) radially above it. This produces a particularly space economical arrangement of the components (17) in the hearing aid housing (2).

- 1A -

A HEARING AID USING PRINTED CIRCUITRY
AND A HEARING AID COIL FOR USE THEREWITH

The present invention relates to a hearing aid using printed circuitry and a hearing aid coil for use therewith.

Because of its relative size, the arrangement of a hearing coil creates special problems in the design of hearing aids. Solutions offered hitherto are not satisfactory as the need to retain sufficient tolerances between the thick hearing coil and other components requires a considerable amount of space inside the hearing aid. Applying the hearing coil to the printed circuit board along with other components is disadvantageous as it takes up too much space which could be used for other components. In DE 83 27 115 (equivalent to EP 0 140 078 and US Patent 4,638,125) a holder is described which combines in a single component the hearing coil and a group of control elements. The printed circuit board of this hearing aid, however, is displaced by the holder in the direction of the housing shell. This means it can no longer be provided with components in an optimal manner. In the case of multi-layer amplifier circuit board arrangements, a whole layer is generally lost because the amplifier arrangement has to be built in asymmetrically with respect to the housing shells.

It is desirable to provide a hearing aid in which the hearing aid coil can be built into the hearing aid housing in a manner which is more space-saving than formerly and which nevertheless still retains the required tolerances.

According to one aspect of the present invention there is provided a hearing aid having a printed board assembly and a hearing aid coil, characterized in that said hearing aid coil is divided into a plurality of individual windings which are electrically connected in series.



1 ~~windings.~~

By dividing the coil winding into individual windings connected in series, each winding can be designed with a smaller diameter than has been standard hitherto. The diameter of the narrower windings may be adapted to the smaller heights of other components used in hearing aids. They can therefore be arranged alongside such components without an empty space being created above the latter.

10 According to another aspect of the invention there is provided a hearing aid coil comprising a coil winding divided into individual windings connected in series, the diameter of each individual winding being smaller than the diameter of standard coil windings of the same length.

15 In a preferred embodiment the hearing aid coil is divided into two windings and arranged on a printed circuit board such that the printed circuit board can be built into the housing symmetrically with respect to the housing shells. The symmetrical arrangement of the printed circuit board results in the saving of space, as facing surfaces of the printed circuit board can be provided with components.

20 In order to adapt printed circuit boards, particularly printed circuit foils, as accurately as possible to the shape of the hearing aid housing, it has proved advantageous to provide them with bending zones. As the bending zones have to be flexible, however, this region of the printed circuit board has until now been kept free of components (see e.g. DE-GM 84 28 488). This is again an unnecessary waste of the limited space inside the hearing aid.

25 By positioning the hearing coil above, and with its longitudinal axis extending approximately along, the bending zone of a flexible printed circuit board a region in the hearing aid which has hitherto remained unutilised



1 can now be used. This results in an additional saving of space in the hearing aid housing.

According to another embodiment, the hearing coil may be divided into two windings and a flexible printed circuit board be bent at two different zones, producing a symmetrical arrangement of the printed circuit board and the hearing coil with respect to the housing shell. A symmetrical arrangement such as this ensures optimum provision of components of the printed circuit board while simultaneously ensuring an optimum arrangement of the hearing coil.

For a better understanding of the present invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Fig. 1 shows an exterior view of a hearing aid, to be worn behind the ear, incorporating an embodiment of the invention;

Fig. 2 shows a cross-section through a protective body which is inserted into the hearing aid;

Fig. 3 shows the protective body of Fig. 2 in cross-section along line III-III;

Fig. 4 shows a side view of a printed circuit board, provided with components and inserted into the hearing aid housing, which printed circuit board holds the hearing coil arrangement of Fig. 2; and

Fig. 5 shows the printed circuit board arrangement shown in Fig. 4 in cross-section along line V-V.

Fig. 1 shows a hearing aid 1, to be worn behind the ear, the housing 2 of which contains electrical and electro-mechanical elements for processing acoustic signals. This processing may be influenced by several operating elements, accessible from the exterior, such as volume control 3, on/off switch 4 and control arrangement 5 (not visible). In addition, the hearing aid 1 comprises at one end region a battery charge 6 and at the

1 opposite end region 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
5 impaired hearing.

Fig. 2 shows the hearing coil arrangement 10 of
the hearing aid 1. It comprises two coils 11, 12 wound
onto respective different bodies 14, 15 and electrically
connected in series, and a protective body 13 which holds
the coils 11, 12. The protective body 13 is a moulded
10 piece approximately in the shape of a frame, which is
cast around the coils 11, 12. The hearing coils 11 and
12 are arranged on opposite sides of the protective body
13, equidistant from a centre line 16 running
longitudinally through the body 13. The hearing coils
15 11, 12 thus lie symmetrically relative to the centre line
16 and parallel to one another in the protective body.

The width of the protective body 13 approximately
corresponds to that of the interior of the housing 2. In
the described embodiment, this width, denoted D1 in Fig.
3, is about 6 mm. The height D2 of the protective body
20 13 is less than 2 mm. The hearing coil windings 11, 12
contained therein have respective diameters d of about
1.3 mm and their diameter is thus about half the diameter
d' of standard coil windings of the same length. A
25 typical value for d' is 2.6 mm.

Fig. 4 shows the protective body 13, together with
the hearing coils 11, 12, assembled in the housing 2 of
the hearing aid 1. The hearing coils 11, 12 and further
components 17 are held by a flexible element in the form
30 of a printed circuit foil 18 in which the electrical
connection lines for the components 17 are located. The
printed circuit foil 18 comprises two side lobes 19, 20
with printed circuitry and an extension 21, the side
lobes 19, 20 being folded round a support 22. The
35 support 22 is attached to the housing 2 by means of a

1 snap connection. A small transverse rod 23 projecting
from the housing 2 into the interior serves this purpose.

5 The hearing coil arrangement 10 is attached to the
printed circuit foil 18 by means of the extension 21
which is folded over the hearing coil arrangement 10 and
is fastened to a hook 24 connected to the support 22.

10 As is clear from Fig. 5, the two hearing coils 11,
12 lie directly over bending zones 25, 26 of the folded
printed circuit foil 18. Since no components can be
directly contacted on these bending zones because of
mechanical stress, it is particularly advantageous to
arrange the hearing coils 11, 12 radially above and along
the curves of these bending zones 25, 26 and thereby
utilize the space present there.

15 The symmetrical positioning of the hearing coil
arrangement 10 with respect to the centre line 27 of the
housing 2 is also advantageous for economically utilising
the small space available for installation. As is
clearly visible from Fig. 5, all four mounting planes of
20 the printed circuit side lobes 19 and 20 can be used for
further components 17.

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The claims defining the invention are as follows:

1. A hearing aid having a printed board assembly and a hearing aid coil, characterized in that said hearing aid coil is divided into a plurality of individual windings which are electrically connected in series.

2. A hearing aid as claimed in claim 1, in which said printed board assembly is a flexible element and can be bent to define at least one curved surface.

3. A hearing aid according to claim 1 or 2, wherein the windings are carried by respective spatially separated supports.

4. A hearing aid according to claim 1, 2 or 3, wherein a protective body holds the individual windings such that they are arranged at different locations on the protective body.

5. A hearing aid according to claim 4, wherein the individual windings are assembled in the protective body.

6. A hearing aid according to claim 5, wherein the windings are cast in the protective body.

7. A hearing aid according to any one of the preceding claims, in which the individual windings are arranged parallel to one another.

8. A hearing aid according to claim 7 when appended to claim 4, 5 or 6, wherein the protective body comprises a frame, symmetrical with respect to a centre line, and wherein there are two such individual windings arranged symmetrically about the centre line of the frame.

9. A hearing aid according to claim 8, wherein the printed board assembly is connected to the frame and has a centre line coextensive with that of the frame.

10. A hearing aid according to claim 8 or 9, further comprising a housing in which the frame, hearing aid coil and printed board assembly are located, the centre line of the frame being coextensive with an axis of symmetry through the housing.



1 11. A hearing aid according to claim 2 or any of
claims 3 to 10 when appended thereto, wherein the hearing
aid coil is arranged above and with its longitudinal axis
extending approximately along a bending zone of the
5 curved surface of the flexible element.

12. A hearing aid according to claim 11, wherein
the hearing aid coil is arranged at least approximately
radially above the curved surface.

10 13. A hearing aid according to claim 11 or 12
when appended to claim 4, wherein the hearing coil is
held over the curved surface by means of the protective
body.

15 14. A hearing aid according to any of claims 11,
12 or 13, wherein the flexible element carrying printed
circuitry comprises two side lobes bent to define two
respective curved surfaces, there being two such
individual windings one of which is arranged above one
curved surface and the other of which is arranged above
the other curved surface.

20 15. A hearing aid coil comprising a coil winding
divided into individual windings connected in series, the
diameter of each individual winding being smaller than
the diameter of standard coil windings of the same
length.

25 16. A hearing aid coil according to claim 15, in
which the diameter of each winding is about 1.3 mm.

17. A hearing aid substantially as hereinbefore
described with reference to or as shown in the
accompanying drawings.

30 DATED this TWENTY THIRD day of JUNE 1988

Siemens Aktiengesellschaft

Patent Attorneys for the Applicant
SPRUSON & FERGUSON

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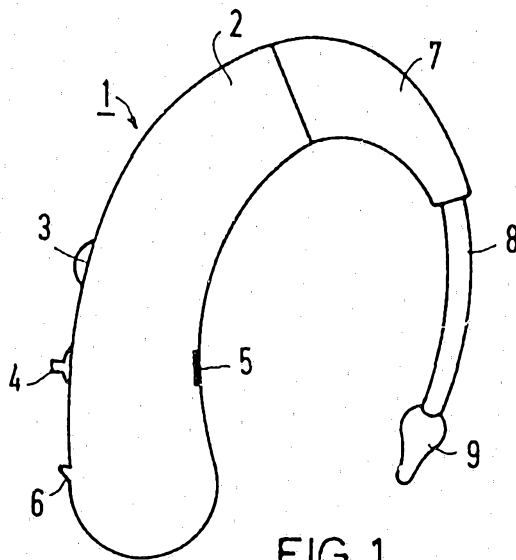


FIG 1

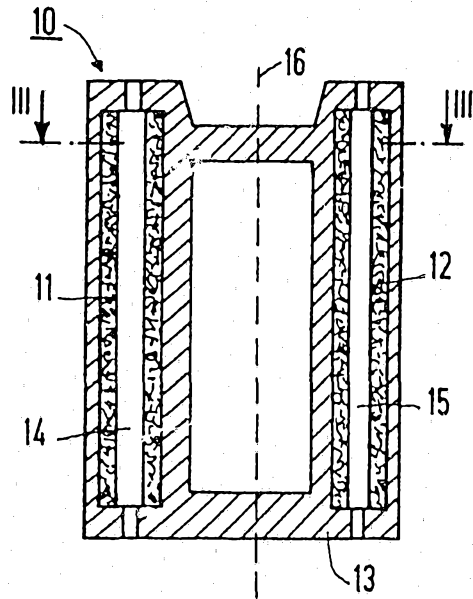


FIG 2

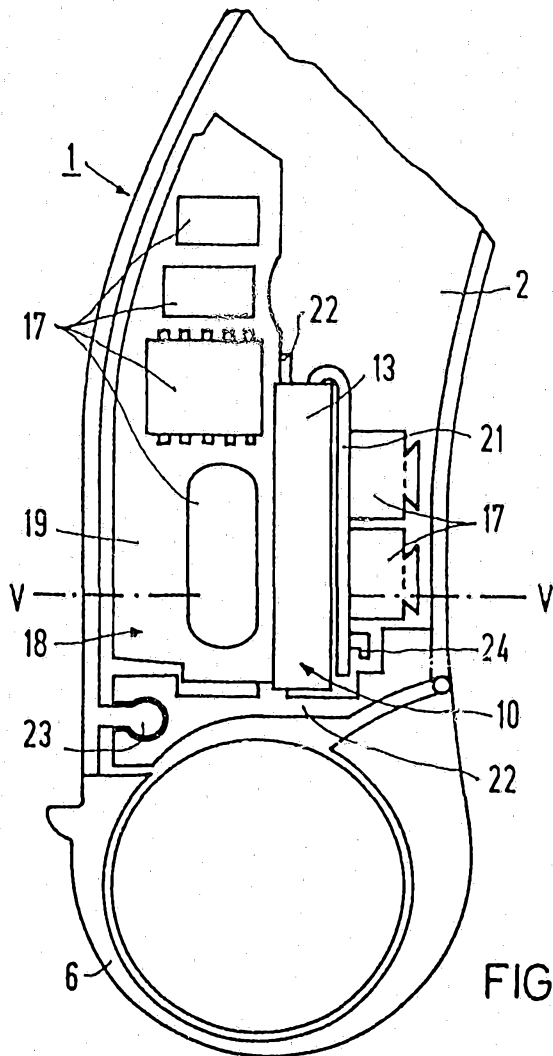


FIG 4

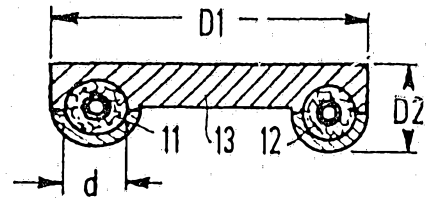


FIG 3

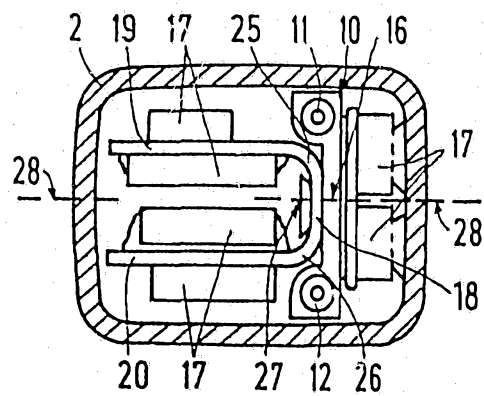


FIG 5