

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) IMPROVEMENTS IN HEARING AIDS

(71) We, BERNA INDUSTRIES LIMITED, a British Company, of Lancaster Road, High Wycombe, Buckinghamshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to miniature hearing aids such as are worn in the ear, on the ear, or otherwise supported at ear level. The invention concerns certain problems involved in such aids, particularly the fact that it is difficult to provide a reliable switch of suitably small dimensions for switching the aid on and off.

The object of the present invention is to overcome this problem.

According to the invention there is provided a hearing aid comprising an amplifier, a primary or secondary cell for energising the amplifier, and a switch controlling the flow of current from the cell to the amplifier, the switch being a reed delay switch enclosed within the casing of the hearing aid and disposed for being rendered open circuit by a magnet outside the casing.

Such a magnetic reed relay switch can be used as a means of doing away with the troublesome, conventional mechanical switch, by mounting a permanent magnet movably on the aid to act as a manually operable control for a reed relay switch. Thus the troubles associated with the unsealed contacts on conventional switches is avoided.

The reed relay switch can be arranged automatically to disconnect the amplifying circuits from the cell when the aid is removed from the head and placed in its receptacle, the switch being opened by a permanent magnet or coil fixed in the receptacle in a suitable position, when the aid is placed in the receptacle.

The cell or cells which can be incorporated in ear level aids are very small and therefore of limited capacity. It is known to use secondary cells which can be recharged each night but this requires the user to plug a charging

circuit into the aid and it is difficult to ensure that the cells get the correct charge each night. If the charge is insufficient the aid will fail the following day and if the charge is excessive the life of the cells is reduced.

The hearing aid can include a secondary cell and a coil connected to the cell through a rectifier circuit, whereby the cell can be charged by coupling the coil to another coil outside the aid. This obviates the need for any direct connections to the aid. The said other coil is arranged in the receptacle and is provided with a cable for connection to the mains supply. The two coils can have numbers of turns such that they act as a step-down transformer.

To recharge the cell the user places the aid in its receptacle. A reed relay switch can then be arranged automatically to disconnect the cell from the amplifier as described above. In order to match the period of charge correctly to the period of discharge, the aid is switched on all day, giving an average discharge period of 16 hours. The user has only a single control to operate, namely the volume control, which he turns right down when he does not want to use the aid. The charge period can consist of the whole of the remaining 8 hours of the day, although the receptacle can comprise a timer switch for adjusting the charge period to times less than that for which the aid is in its receptacle.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawing, in which:

Fig. 1 is a partially broken away perspective view of a hearing aid and its case, and

Fig. 2 is a partially broken away view of another hearing aid.

In Fig. 1 there is shown a miniature hearing aid 10, and a receptacle or case 12 for storing the hearing aid 10 when the aid is not in use. The case 12 contains charging apparatus to be described hereinafter and can be closed by a hinged lid 44.

The hearing aid 10 has a sound tube 11 and earmould 13 and is shown partly cut away to disclose some of its internal parts.

[Price 25p]

The hearing aid 10 includes an accumulator cell 14 housed in a cavity 16. A coil 18 has one of its ends 18a connected to one power supply terminal 14a of the accumulator 14 and to one supply terminal 20a of an amplifier 20 for the aid. A rectifier 22 has one terminal 22a connected to the other end 18b of the coil 18 and its other terminal 22b connected to the other terminal 14b of the accumulator and to one contact of a magnetically actuated reed relay switch 24. The other contact of the switch 24 is connected to the other supply terminal 20b of the amplifier 20. The switch 24 includes a permanent magnet (not shown) which, in use, biases the contacts closed to connect the accumulator 14 to the amplifier 20. The amplifier, microphone, speaker and a volume control 26, provided to enable the user of the hearing aid to adjust the volume to a convenient level, can be entirely conventional.

The case 12 includes a second coil 28 housed in a chamber 30 in the box. The coil 28 can be connected to the alternating voltage mains supply through a time switch 32 and a cable 34. When the time switch is switched on it is arranged to supply current to the coil 28 for a predetermined time and then automatically to switch off. The timer can be driven from the mains supply or it can be a clockwork device. An indicator lamp 42 is provided to indicate when the mains supply is connected to the coil 28.

The cover 36 for the chamber 30 is recessed to form a well 38 which is surrounded by the coil 28. The internal diameter of the coil 28 and the dimensions of the well 38 are sufficient to accommodate the lower end of the hearing aid 10 including the coil 18. Thus the coils 18 and 28 constitute the secondary and primary windings respectively of a transformer.

When the hearing aid is placed in the well a magnet 40 fixed to the cover 36 of the receptacle 12 effectively neutralises the magnetic field provided by the magnet in the reed relay switch 24 and the switch contacts open to disconnect the accumulator 14 from the amplifier 20.

In use, when the hearing aid is removed from the case 12 the switch 24 closes to connect the accumulator 14 to the amplifier 20 and the aid operates in the normal manner. The user cannot switch off the aid but can vary the sound level emitted by the speaker, using the volume control 26.

When the hearing aid 10 is not required, at the end of the day for example, the user places the lower end in the well 38 and switches on the timer 32. The magnet 40 causes the contacts of the reed relay switch to open and disconnect the accumulator from the amplifier. The alternating voltage induced in the coil 18 by the magnetic field due to the current flowing in the coil 28 is rectified by

the rectifier 22 and applied to recharge the accumulator 14.

As the user cannot switch-off the hearing aid, other than by returning it to its case, the average daily consumption of current from the accumulator 14 can be determined. The time required to recharge the accumulator can be calculated and the timer set accordingly. This prevents any excessive overcharging of the accumulator which would tend to shorten its life. However the timer may not be necessary if it is arranged that charging and discharging periods of 16 and 8 hours respectively will be appropriate.

The arrangement thus provides a convenient, safe and simple means for recharging the accumulator of a hearing aid and eliminates the need for the fragile, miniature plug and socket arrangements conventionally used.

An additional advantage of this arrangement is the much greater degree of reliability provided by hermetically sealed switch contacts without the rapidly wearing sliders or pivots associated with mechanically operated switches. If the user needs to shut off the output of the aid while wearing it this can be done with the aid of the volume control.

In an alternative arrangement where the user needs to be able to switch-off the hearing aid when it is removed from its case, the reed relay switch 24 can be actuated by a magnet arranged on the outside of the aid and manually operable, by sliding or swivelling for example, to provide the switching functions. In the embodiment shown in Fig. 2 the coil, rectifier and amplifier are not shown for simplicity. The switch 24 is shown in the casing with a permanent magnet 46 slidably mounted in a dovetail groove 47. The magnet is preferably embedded in a synthetic plastics coating with which a finger button 48 is moulded integrally. The magnet can thus be pushed from one end of the groove to the other and it is arranged (e.g. in conjunction with a second permanent magnet inside the casing) that, when the magnet 46 is at one end of the groove 47, the switch 24 is closed whereas the switch is open when the magnet is at the other end of the groove. The words ON and OFF can be engraved or moulded in the casing adjacent the respective ends of the groove. The groove 47 does not create an opening of any kind through the casing of the aid.

The means described herein for recharging the secondary cell 14 also form the subject matter of our application No. 15607/71 (Serial No. 1254018) divided out of the present application.

WHAT WE CLAIM IS:—

1. A hearing aid comprising an amplifier, a primary or secondary cell for energising the amplifier, and a switch controlling the flow of current from the cell to the amplifier, the

- switch being a reed relay switch enclosed within the casing of the hearing aid and disposed for being rendered open circuit by a magnet outside the casing.
- 5 2. A hearing aid according to claim 1, comprising a permanent magnet movably mounted on the outside of the casing for movement between two positions in which the switch is open and closed respectively.
- 10 3. A hearing aid according to claim 1, including a receptacle for holding the aid when not in use, and a magnet positioned in the receptacle to open the reed relay switch when the aid is placed in the receptacle.
- 15 4. A hearing aid according to claim 3, wherein the cell is a secondary cell, the aid includes an internal coil and rectifier for charging the cell and the receptacle includes another coil for supplying current to the internal coil inductively when the aid is in the receptacle. 20
5. A hearing aid according to claim 4, wherein the receptacle includes a time switch for controlling the supply of current to the coil in the receptacle. 25
6. A hearing aid according to claim 3, 4 or 5, wherein said magnet is a permanent magnet.
7. A hearing aid substantially as described with reference to and as shown in Fig. 1 of the accompanying drawings. 30
8. A hearing aid substantially as described with reference to and as shown in Fig. 2 of the accompanying drawings.

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FIG. 1 is a perspective view of a hand-held device 10, such as a mobile phone. The device features a display 24 and a keypad 46. The keypad 46 includes a numeric keypad 48 and a function key 47.