Title: EARPIECE FOR ELECTRICAL STIMULATION OF ACUPUNCTURE POINT

Abstract

The use of electrical stimulation in substitute for acupuncture is well known, this invention is designed to enable an unskilled person to attach an earpiece (20, 21, 22 and 23) to an ear of the user such that a conductive electrical pad (20) is consistently located in electrically conductive contact with the fossa of the anti-helix (16) of the ear of the user whereby electrical stimulation may be accurately delivered to the appropriate acupuncture point (Shenman point 17). A pad carrier (21) supports not only the pad (20) but also a retaining means (22) such that the spacing between the retaining means and the pad (20) is maintained for a variety of users. Also the pad and carrier are arranged so that the earpiece may be worn in either ear of the user.
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EARPIECE FOR ELECTRICAL STIMULATION OF

ACUPUNCTURE POINT

This invention relates to an earpiece suitable for applying electrical stimulation to a wearer and in particular for applying such stimulation to a portion of the ear known as the fossa of the anti-helix.

BACKGROUND

Acupuncture is a medical treatment method based on the ancient Chinese practice of inserting needles into specific body locations, known as acupoints, which it is thought induces bodily responses including pain relief, surgical anaesthesia and numerous therapeutic remedies.

A laterday alternative to the stimulus of needle puncture comprises the application of electric current to well known acupoints thereby avoiding the puncturing of the body. This type of stimulation is thought to stimulate the body to produce chemicals that result in the desired physiological effect via an electro-neural stimulation mechanism.

Such is the simple and safe operational nature of these electric current delivery devices, that users of electrical stimulation apply it themselves. Self placement however, requires the user to be knowledgeable and familiar with the location of each acupoint and of the physiological effect created when it is stimulated.

Some of the more difficult to locate acupoints of the body are within the ear and this invention addresses the need for a reliable way of locating one particular acupoint known as the fossa of the anti-helix by unskilled users, in particular by persons who would not normally use electrical stimulation techniques or who are knowledgeable of acupuncture.
Earpieces for locating sound transducers are well known and comprise a variety of means for directing sound energy into or towards the inner auditory ear canal of the wearer. The simplest earpiece comprises a cone shaped funnel which is inserted into the ear canal to frictionally engage therewithin. Various pliable and resilient materials are used so as to improve wearer comfort. Positional accuracy is assisted by the natural shape of the entrance to the ear canal which is the same for all persons and the funnel is self-centring to ensure that the sound energy is delivered into the appropriate portion of the ear.

In the alternative, ear pads are available which provide a more dispersed sound energy delivery means and which are designed by self enclosed means to ensure delivery and isolation of sound energy into the ear canal and which present a less intrusive means of sound delivery to the wearer's ears.

Earpieces for locating the delivery means for applying electrical stimulation are however unknown. Primarily, the design of such a device is dependent on the desired acupoint of interest. Furthermore accurate and repeatable location of the current delivery portion of the device to a wide variety of ear shapes and application by unskilled users are important considerations.

Not surprisingly, it has been found that the shape of the human ear varies considerably from person to person, therefore, even persons skilled in the art of providing stimulus or acupuncture to acupoints in the ear do not always successfully locate the appropriate point or portion.

This problem is more evident when lay and unskilled users, generally, people apply stimulus to themselves. Indeed, for people not conversant with the methods involved, this lack of skill becomes an impediment to successful treatment or application of the acupuncture techniques.
This invention primarily addresses the design of an earpiece which provides stimulus to a particular acupoint located in the fossa of the anti-helix of the ear.

It has been found that even though the inner auditory ear canal is an easily located reference point of the ear, the variance of distance between that point and the desired acupoint from one person's ear to another is too great for only one shape or design of earpiece to suffice for all people.

It has, however, been found that the variance for different ears of the distance between the portion of the ear which joins to the scalp and the desired acupoint is such as to be acceptable for the purposes of positioning a electrical stimulation to effect the desired electro-neural stimulation mechanism.

This finding is combined with the use of a pad which is conductive over its surface which is in contact with the skin of the wearer and when energised, passes current from the pad surface to a point on the skin surface which has least resistance. When the pad is in substantially the region of the acupoint the current is typically delivered to exactly the desired acupoint.

Therefore, it is an aspect of this invention to overcome the problems described and to provide a means which can reliably apply electrical stimulation to a particular portion of the ear namely the fossa of the anti-helix.

BRIEF DESCRIPTION OF THE INVENTION

In its broadest aspect the invention is an earpiece for applying electrical stimulation to the ear of a wearer via a conductive element electrically isolated from said earpiece and in contact with said wearer, comprising, a conductive
electrical stimulation pad, a carrier adapted to carry said pad being electrically isolated therefrom, and a retaining means attached to said carrier for retaining said earpiece on said ear, whereby said conductive electrical stimulation pad is spaced from said retaining means such that said pad is located in contact with the fossa of the anti-helix of said ear and said pad and conductive element form part of the electrical path of electrical stimulation applied to said ear.

In a further aspect of the invention the earpiece the retaining means comprises a hook, shaped so as to engage the ear and lie behind the helix of the ear substantially in the area of said ears abutment with the scalp of the wearer.

In yet a further aspect of the invention the retaining means is constructed of resilient material and maintains a predetermined spacing between said pad and said retaining means.

Yet a further aspect of the invention allows for the retaining means to carry the conductive element.

And in yet a further aspect of the invention the retaining means is conductive and forms part of the path of said electrical stimulation.

The invention further comprises an engagement means carried by said carrier arranged to provide engagement of said earpiece with said ear and provide lateral pressure on said pad against said ear wherein said engagement means comprises a ring of resilient material adapted to be locatable in the concha of said ear to thereby retain and engage said earpiece with said ear.
The invention may further have an aspect wherein said pad is adapted to have two conductive surfaces arranged so that said earpiece may be used on either ear of said wearer.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 depicts a number of acupoints on the ear,

Fig. 2 depicts the earpiece,

Fig. 3 depicts the earpiece in use,

Fig. 4 depicts an exploded view of the earpiece, and

DETAILED DESCRIPTION OF THE INVENTION

The outer surface of the ear 10 is irregularly concave, directed slightly forward and presents a number of eminences and depressions which are the shape of the fibro-cartilage 11 of the ear. The external prominent rim of the ear is the helix 12 and the curved prominences which runs parallel with and spaced inwardly is the anti-helix 13. The anti-helix prominence forks 14, 15 at its upper end and the narrow curved depression between the forks of the anti-helix and the helix is the fossa of the anti-helix 16. It is the acupoint 17 which is of interest in carrying out the treatment of a wearer of this invention and which is otherwise known as the SHENMEN point. It is thought that application of electrical stimulation to the SHENMEN point has the physiological effect of relaxation to the person being electrically stimulated with an appropriate signal.

As previously described the inner auditory ear canal 18 is easily located as is the concha region 19 of the ear which is defined by the curved cavity outwardly bounded by the prominence of the anti-helix 13, the antitragus 13a and
tragus 13b. These locations cannot serve as a reliable reference point for locating the point or area of stimulus as required because of the large variances between ear shape and size which therefore place the fossa of the anti-helix portion of the ear at a large variety of distances from the anti-tragus, tragus, ear canal and the concha region.

Referring now to Fig. 2 there is depicted an earpiece of the invention in use, which comprises a number of parts:

a conductive electrical stimulation applicator pad 20;

a pad carrier 21;

a retaining means in the form of a hook 22 for location above the ear 10, and

an engagement means in the form of a ring 23 attached to the carrier and to be located in the concha 19 of the ear.

The configuration of these parts and the method of application of the earpiece provide a means which reliably brings the pad 20 into contact with the fossa of the anti-helix 16 which is the area around the SHENMEN point 17. Preferably, the contact pressure provided by the earpiece is constant and the engagement means assists in providing this aspect of the invention.

The hook 22 is formed of flexible resilient material, and is arranged to engage over the ear in the area behind the helix where the ear abuts and joins the scalp, thereby, positioning the pad 20 for entry into the folds of the ear behind its frontal peripheral helix portion 12 and onto the area of the fossa of the anti-helix 16 which surrounds the SHENMEN point 17.
The resilience of the hook is preferable for ease of fitting and arranged such that the distance X between the centroid of the pad 20 and the inner side upper apex 24 of the hook is constant while the hook is in use. It has been found that the variance of distance between these points of the ear is least between a large variety of individuals. Likewise the distance Y between the centroid of the pad 20 and the inner side forward apex 25 of the hook is constant while the hook is in use.

The hook 22 is also preferably made of a conductive material and electrically isolated by the carrier 21 from the pad 20 so that it may be used as the return electrode for the current applied by the pad 20. However, the conductive portion of the arrangement may also be provided by a separate conductive element attached to the hook or other retaining means or provided separate from the earpiece for example adjacent the electrical stimulation device worn on the earpiece wearer's body.

If the carrier 21 and hook 22 only are used to locate the pad 20 over the fossa of the anti-helix 16 it has been found that there may be insufficient inward lateral pressure on the pad to bring its surface into constant conductive contact with the fossa area 16. The fossa area 16 is laterally displaced from the ear/scalp region and variably so with different individuals so preferably a further engagement means may be required to improve the consistency of the conductive contact of the pad with the fossa area 16.

In this embodiment, the engagement means comprises a resilient ring-like member 23, attached to the carrier and of suitable material to be frictionally engageable with the inner surface of the concha of the ear to thereby provide sufficient lateral pressure via the carrier 21 and anti-posed hook 22 to consistently force the pad 20 against the fossa area 16 of the wearer's ear 10.
The ring 23 is preferably constructed of elastomeric material, the resilience of which is such that it is not uncomfortable to the wearer, but, which also does not provide undue pressure to the surface of the concha and therefore discomfort to the wearer. Furthermore, the rubber must also have a texture which is not uncomfortable to the wearer. Additionally, it has been found that the shape must be such as to be comfortable for a majority of wearers since the shape of the concha is highly variable.

Ideally, of course, one size of ring 23 should fit all, however, it has been found that large, medium and small sizes are required.

As described previously the pad 20 is conductive so that electrical stimulation may be applied to the desired area and by way of the propensity of the electric current to take a path of least resistance, the charge will enter the body at the desired acupoint which in this example is the SHENMEN point 17. It is preferable that the pad is constructed of a conductive plastic which is durable and inert to the bodily secretions of the wearer.

It is desirable that the earpiece be used in either ear of the wearer. Therefore, it will be seen from Figs. 2, 3 and 4 that there exists symmetry about a central vertical plane through the earpiece.

To assist manipulation of the earpiece there is provided on the carrier a finger tab 26 as depicted in Fig. 2. The tab 26 may be grasped by the fingers of the wearer to rotate the hook into place and also provide inward lateral pressure to engage and locate the ring 23 in the concha of the ear of the wearer.
The tab is rotatable about an axis 27, shown in Fig. 4, so that it may be used when the earpiece is applied to either the left or right ear.

Fig. 4 depicts the previously described parts of the earpiece in a form ready for clipping together to create an article ready for use in conjunction with an electrical simulation generating device (not shown) but of conventional design.

Hook 22 has an intermediate portion of complementary outline shape to that of the pad carrier 21 and designed so that the hook and the pad may be clamped together. Tabs 28, 29 and 30 on the carrier reciprocate with ridges 28a, 29a and 30a in the body of the hook for clamping the parts together. However, before these two parts 22 and 21 are brought together, the ring 23 is located between them, so that the planar and parallel surfaces 31 and 32 (not shown) shaped so as to restrict rotational motion of the ring, are clamped between respectively shaped indentations 33 and 34 of the hook 22 and carrier 21 respectively.

Axle 35 of the finger tab 26 is rotatable about its longitudinal axis 27 within the confines of the axle bearing surfaces of the two halves 36 and 37 of the axle housing, formed when the hook portion 22 is clamped to the pad carrier 21. The finger tab can be rotated to either side of the earpiece so as to be easily grasped for application and engagement of the earpiece to the ear of the wearer.

The pad carrier 21 is constructed of non-conducting material and supports the previously described hook and tab portions and carries a conductive wire 38 to conduct the electrical stimulation signal to the pad 20.
Conductive wire 39 conducts the return electrical stimulation signal from the conductive hook portion via the ear to the electrical stimulation device, to complete an electrical circuit necessary for the operation of the device. It is to be noted that return current need not necessarily be captured in the region of the ear nor form any part of the construction of the earpiece, however, to simplify the apparatus in use this embodiment does so and uses the hook 22 for this purpose.

As further depicted in Fig. 4, an electrical stimulation signal delivery pad 20 is shown as having two identical halves bearing two pad surfaces 40 and 41 (not shown). The pad 20 comprises in this embodiment a unitary conductive part arranged so that in use, either conductive pad surface 40 or 41 is located into conductive contact with the fossa of the anti-helix 16 region of the ear.

The pad 20 has indents 42 and 43 (not shown) which are arranged to receive the post 44 which is located on the pad carrier 21 and thereby allow the pad to be removably clipped onto and off the post 44 as required, while also providing a means to clamp the bared wire of conductor 38 with the conductive pad 20. This particular configuration is advantageous in terms of cost and reliability since it does not require solder to electrically bond conductive parts of the device during construction and service.

The bared wire of conductor 39 contacts with the conductive hook portion of the device when parts 21 and 22 are clipped together when located between tab 50 on the carrier and the inside surface of the hook 22. Tension relief bulkhead 45 of the cable is also retained to the earpiece by ridges 46 and 47 bearing against reciprocally shaped ledges 48 and 49 of the carrier 21 and also the ridges 48a and 49a (not shown) of the hook portion 22.
Electrical stimulation signals are generated by electronic device of conventional design which provides adjustment means for the amplitude of the electronic stimulation signal, the pulse width of the signal and various other adjustments such as an on/off duty cycle.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An earpiece for applying electrical stimulation to the ear of a wearer, said earpiece comprising,
   a conductive electrical stimulation pad,
   a carrier adapted to carry said pad being electrically isolated therefrom, and
   a retaining means attached to said carrier for retaining said earpiece on said ear, whereby
   said conductive electrical stimulation pad is spaced from said retaining means such that said pad is located in electrically conductive contact with the fossa of the anti-helix of said ear and said pad forms part of the electrical path of said electrical stimulation applied to said ear.

2. An earpiece according to claim 1 wherein said retaining means comprises a hook, shaped so that said hook lies behind the helix of the ear substantially in the area of said ears abutment with the scalp of the wearer while maintaining said conductive electrical stimulation pad in electrically conductive contact with the fossa of the anti-helix of said ear.

3. An earpiece according to claim 1 wherein said retaining means is constructed of resilient material adapted to in use, maintain a predetermined spacing between said pad and said retaining means.

4. An earpiece according to claim 1 wherein said retaining means carries a conductive element which is electrically isolated from said earpiece and said conductive element forms part of a return path of said electrical stimulator.

5. An earpiece according to claim 1 wherein said retaining means is conductive and forms part of a return path of said electrical stimulation.
6. An earpiece according to claim 1 further comprising an engagement means carried by said carrier arranged to provide engagement of said earpiece with said ear and provide lateral pressure to bias said pad against said ear.

7. An earpiece according to claim 6 wherein said engagement means comprises a ring of resilient material adapted to be locatable in the concha of said ear to thereby retain and engage said earpiece with said ear.

8. An earpiece according to claim 1 wherein said pad is adapted to have two conductive surfaces arranged so that said earpiece may be used on either ear of said wearer.

9. An earpiece according to claim 1 further comprising a tab means rotatably attached to said carrier which in use assists the releasable attachment of said earpiece to either ear of said wearer.

10. An earpiece substantially as hereinbefore claimed and described with reference to the accompanying figures.
INTERNATIONAL SEARCH REPORT

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)  
According to International Patent classification (IPC) or to both National Classification and IPC
Int. Cl. A61N 1/18 A61H 39/00

II. FIELDS SEARCHED
Minimum Documentation Searched

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III. DOCUMENTS CONSIDERED TO BE RELEVANT

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t  "X" Document of particular relevance; the claimed invention is not similar to that described in such document in the sense that it would not have been obvious to a person skilled in the art to apply the invention as disclosed in the cited document on the cited invention
  "Y" Document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
t  "Z" Document member of the same patent family

IV. CERTIFICATION
Date of the Actual Completion of the International Search: 30 January 1992
Date of Mailing of this International Search Report: 12 February 1992 (12.02.92)

International Searching Authority: AUSTRALIAN PATENT OFFICE
Signature of Authorized Officer: J. HO

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