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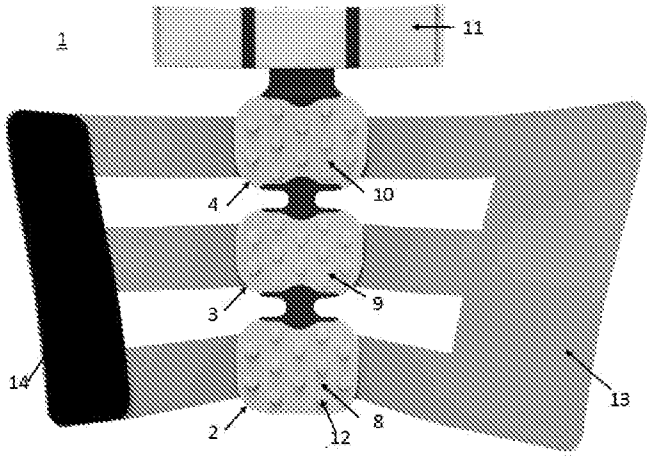
(54)	Title	**DEVICE FOR STIMULATING BLOOD CIRCULATION**
(56)	References Cited:	WO 2016/183460 A1, US 2003/083599 A1
(57)	Abstract	

A blood circulation stimulating device comprising at least two compression pads adapted to be attached to a limb and compressing the limb, each compression pad comprising at least one eccentric vibration element adapted to distribute eccentric vibrations to the limb; a control unit functionally connected to the at least one vibration element of each of the at least two compression pads; a power supply adapted to provide power to the control unit and the at least one vibration element of each compression pad; where the control unit being adapted to activating the at least one eccentric vibration element of each compression pad in sequential and cyclic order to provide eccentric vibrational stimulation of the blood circulation in venous flow direction.



DEVICE FOR STIMULATING BLOOD CIRCULATION

TECHNICAL FIELD

[0001] The present invention relates to devices for stimulating blood circulation. In particular by providing compression and vibrational stimulation to limbs, such as legs and forearms.

BACKGROUND

[0002] To stop venous disorders, such as thrombosis, phlebitis, varicose veins and edema, from developing or getting worse, it is required to increase blood circulation in affected limbs, such as legs and forearms. Other related disorders, such as restless legs syndrome (RLS) and repetitive strain injury (RSI), also benefit from increased blood circulation. In addition, many of these disorders also require pain relief, or distractions, in order for persons affected by them to function normally.

[0003] One common method of increasing the blood circulation as well as providing pain relief for RLS is to apply the affected limbs with compression dressings or bandages. However, the body quickly adapts to the applied compression and the pain or tingling returns.

[0004] Transcutaneous electrical nerve stimulation (TENS) uses electronic current to stimulate the nerves through the skin where it blocks pain signals to the brain. TENS only works to alleviate pain.

[0005] Vacuum socks apply vacuum in a sequential and cyclic order in order to pump blood in the venous flow direction. These systems are however complex and expensive.

[0006] Symmetric vibratory stimulation device has been found to help persons with RLS to improve their sleep. However, for many users the body quickly adapts to the applied symmetric vibratory stimulation and the pain or tingling returns.

[0007] It is a need for a simple and inexpensive device that is increasing the blood circulation as well as providing pain relief over a longer time period.

[0008] The prior art includes WO 2016/183460 A1, which describes a method, system and device for enhancing muscle training and performance by accelerating blood flow to the muscles and enhancing flow in the lymphatic system, incorporating mechanical stimulation and in some cases electrical stimulation of the muscle. A muscle recovery apparatus includes an active compression device and an electrical stimulation device, where the active compression device is configured to be disposed about a user's muscle

and to mechanically compress the user's muscle to facilitate muscle recovery, and where the electrical stimulation device is coupled to an inner surface of the active compression device, such that the electrical stimulation device can be placed in contact with the user to electrically stimulate the user's muscle.

[0009] The prior art also includes US 2003/0083599 A1, which describes a device and a method of vibratory massage. The device produces acoustic vibrations of variable frequency in a frequency range of 250-350 Hz to stimulate fast-adapting mechano-receptors in muscles, tendons and joints, that have a peak of vibrating sensitivity at these frequencies. The device has a flexible vibrating pad mounted on a housing. The housing contains a mechanical vibrator and an electronic circuit and power supply that generate the low frequencies and cause the vibrations of the mechanical vibrator. According to the method, a flexible vibrating pad is applied to a tissue in one of two ways, tangential or normal.

SHORT SUMMARY

[0010] A goal with the present invention is to overcome the problems of prior art.

[0011] It is thus provided a blood circulation stimulating device, comprising
- at least two compression pads adapted to be attached to a limb and compressing the limb, each compression pad comprising at least one eccentric vibration element adapted to distribute eccentric vibrations to the limb,
- a control unit functionally connected to the at least one vibration element of each of the at least two compression pads,
- a power supply adapted to provide power to the control unit and the at least one vibration element of each compression pad,
the control unit being adapted to activating the at least one eccentric vibration element of each compression pad in sequential and cyclic order to provide eccentric vibrational stimulation of the blood circulation in venous flow direction.

[0012] The eccentric vibration element may be an eccentric rotating mass vibration motor. In one embodiment, the device further comprises a wireless communication unit functionally connected to the control unit, and adapted to synchronize the activating of the at least one eccentric vibration element of each compression pad between a plurality of identical devices.

[0013] Each compression pad may comprise a contact surface comprising a plurality of protrusions. In one embodiment, the device further comprises an elastic material adapted to attach and compress the at least two compression pad against the limb. The device may

further comprise a hook-and-loop fasteners strap adapted to attach and compress the at least two compression pad against the limb. The power supply may be a re-chargeable battery or a replaceable battery. The limb may be a leg or a forearm.

[0014] The invention solving the above mentioned problems is a device for stimulating blood circulation according to the independent claims.

[0015] The device is simple to manufacture and inexpensive, and may therefore be accessible for a larger number of people that may benefit from improved blood circulation, as explained above.

[0016] Further, the device may provide pain relief over a longer time period.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Fig. 1 illustrates a front view of an embodiment of a device for stimulating blood circulation.

[0018] Fig.2 illustrates a back view of the embodiment of Fig. 1.

[0019] Fig. 3 illustrates a front view of an alternative embodiment of a device for stimulating blood circulation.

[0020] Fig. 4 illustrates a back view of the embodiment of Fig. 3.

[0021] Fig. 5 illustrates a side view of the embodiment of Fig. 3.

EMBODIMENTS OF THE INVENTION

[0022] In the following description, various examples and embodiments of the invention are set forth in order to provide the skilled person with a more thorough understanding of the invention. The specific details described in the context of the various embodiments and with reference to the attached drawings are not intended to be construed as limitations. Rather, the scope of the invention is defined in the appended claims.

[0023] The embodiments described below are numbered. In addition, dependent embodiments defined in relation to the numbered embodiments are described. Unless otherwise specified, any embodiment that can be combined with one or more numbered embodiments may also be combined directly with any of the dependent embodiments of the numbered embodiment(s) referred to.

[0024] With reference to Fig. 1 and Fig. 2, the invention is in a first embodiment a blood circulation stimulating device 1 comprising three compression pads 2, 3, 4, adapted to be

attached to a limb and compressing the limb. Each compression pad comprising one eccentric vibration element 5, 6, 7 adapted to distribute eccentric vibrations from the at least one eccentric vibration element 5, 6, 7 to the limb. The compression pad may be provided with more than one eccentric vibration element. A control unit, exemplary positioned in a control box 11, is functionally connected to the at least one eccentric vibration element 5, 6, 7 of each of the at least two compression pads 2, 3, 4. A power supply, exemplary positioned in the control box 11, is providing power to the control unit and the at least one eccentric vibration element 5, 6, 7 of each compression pad 2, 3, 4. The control unit is adapted to activating the at least one eccentric vibration element 5, 6, 7 of each compression pad 2, 3, 4 in sequential and cyclic order to provide eccentric vibrational stimulation of the blood circulation in venous flow direction. In one embodiment the device 1 is attached to a leg, i.e. the crus, then the control unit would first activate the lower vibration element 5, then the middle vibration element 6 and finally the upper vibration element 7. Then the control unit would activate the lower vibration element 5 again and so on. The control unit may continue the cycle for a predetermined period of time, such as 15 minutes, 30 minutes, 45 minutes or 60 minutes. The predetermined period of time may be selected by the user. Alternatively, the user may stop the device manually by pressing a start/stop button.

[0025] The compression of the limb by the compression pads in itself stimulates increased circulation and normalization of veins in the case of venous disorders. The cycling of the vibrational stimulation increases the circulation significantly and controls the circulation in the right direction. The combination of compression and the vibrational stimulation increases the effect of the treatment considerably, leading to shorter treatment period, and increased comfort and wellbeing.

[0026] The body quickly adapts to applied symmetric vibratory stimulation, thereby reducing the effect as pain relief and/or distraction and the pain or tingling in the limb returns. The use of eccentric vibrations elements reduces the body's adaption to the vibratory stimulation and provides a prolonged effective effect. In one embodiment that can be combined with any of the other embodiments, the vibration element is an eccentric rotating mass (ERM) vibration motor. In one exemplary embodiment, the ERM vibration motor is of coin type with a diameter of 8 – 13 mm.

[0027] Treatment of legs is more effective when both legs are treated simultaneously. In one embodiment that can be combined with any of the other embodiments, the device further comprising a wireless communication unit functionally connected to the control unit, adapted to synchronize the activating of the at least one eccentric vibration element of each compression pad between a plurality of identical devices. One device is attached to

each leg of a user. When the first of two devices is activated, e.g. by pressing a start button, the first device communicates wirelessly with the second device such that, in the exemplary embodiment shown in Fig. 1 and Fig. 2, the control unit would first activate the lower vibration element 5 of both devices, then the middle vibration element 6 of both devices and finally the upper vibration element 7 of both devices. Any suitable wireless communication standard may be used, particularly low power standards, in example, in the industrial, scientific and medical (ISM) radio bands.

[0028] In one embodiment that may be combined with any of the other embodiments, a contact surface 8, 9, 10 of at least one of the compression pads 2, 3, 4 comprises a plurality of protrusions 12. The protrusions 12 provides increased transfer of eccentric vibrations to the limb. The protrusions may be dome shaped as shown in Fig. 1, but other shapes may be contemplated, such as pyramids, cones, squares etc.

[0029] The compression pads 2, 3, 4 may be attached to the limb by different fastening means. In one embodiment that may be combined with all of the embodiments above, the device further comprising an elastic material 13 adapted to attach and compress the at least two compression pad against the limb. In Fig. 2 the elastic material 13 is attached to the backside of the compression pads. In use, the elastic material is tightly wrapped around the limb to compress the pads against the limb. In Fig. 2 the elastic material 13 is provided with hook-and-loop fasteners 14 adapted to secure the ends of the elastic material 13 together. In an alternative embodiment, the elastic material may be in the form of a sock encompassing the compression pads such that the device is pulled over the leg like sock.

[0030] In one embodiment that may be combined with any of the above embodiments, the device is provided with a power supply that is a re-chargeable battery or a replaceable battery. The re-chargeable battery or a replaceable battery may be positioned within the control box 11.

[0031] With reference to Figs. 3, 4 and 5, the blood circulation stimulating device 20 in an alternative embodiment comprises two compression pads 15, 16, adapted to be attached to a forearm and compressing the forearm. Each compression pad comprising one eccentric vibration element (not shown) adapted to distribute eccentric vibrations from the at least one eccentric vibration element to the forearm. The compression pad may be provided with more than one eccentric vibration element. The device 19 has a control unit and power supply as described with reference to Fig. 1 and Fig. 2. The control unit is adapted to activating the at least one eccentric vibration element of each compression pad 15, 16 in sequential and cyclic order to provide eccentric vibrational stimulation of the

blood circulation in venous flow direction. When attached to a forearm the control unit would first activate the vibration element in the lower compression pad 15, then the vibration element in the upper compression pad 16. Then the control unit would activate the vibration element in the lower compression pad 15 again and so on. The control unit may continue the cycle for a predetermined period of time, such as 15 minutes, 30 minutes, 45 minutes or 60 minutes. The predetermined period of time may be selected by the user. Alternatively, the user may stop the device manually by pressing a start/stop button.

[0032] A contact surface 17, 18 of at least one of the compression pads 15, 16 may comprise a plurality of protrusions as described in further detail above with reference to Fig. 1.

[0033] The device 20 is particularly suited to prevent and treat repetitive strain injury (RSI). The combination of the compression and the vibrators increases the blood circulation in the affected area, thus reducing the time to recovery. The combination of the compression, the vibrators and underarm support of the device provides alleviates the symptoms of RSI in work situations, leading to shorter time to recovery, and increased comfort and wellbeing.

[0034] The compression pads 15, 16 may be attached to the forearm as described above by an elastic material that wraps around the forearm and the device 20. In an alternative embodiment the device 20 is provided with a hook-and-loop fasteners strap (not shown) adapted to attach and compress the at least two compression pad 15, 16 against the forearm. The strap is mounted in strap mounts 21, 22.

[0035] In the exemplary embodiments, various features and details are shown in combination. The fact that several features are described with respect to a particular example should not be construed as implying that those features by necessity have to be included together in all embodiments of the invention. Conversely, features that are described with reference to different embodiments should not be construed as mutually exclusive. As those with skill in the art will readily understand, embodiments that incorporate any subset of features described herein and that are not expressly inter-dependent have been contemplated by the inventor and are part of the intended disclosure. However, explicit description of all such embodiments would not contribute to the understanding of the principles of the invention, and consequently some permutations of features have been omitted for the sake of simplicity or brevity.

[0036] Reference list:

1	Device
2, 3, 4	Compression pads
5, 6, 7	Eccentric vibration element
8, 9, 10	Contact surface
11	Control box
12	Protrusions
13	Elastic material
14	Hook-and-loop fasteners
15, 16	Compression pads
17, 18	Contact surface
19	Control box
20	Device
21, 22	Strap mount

CLAIMS

1. A blood circulation stimulating device (1, 20), comprising
- at least two compression pads (2, 3, 4, 15, 16) adapted to be attached to a limb and compressing the limb, each compression pad comprising at least one eccentric vibration element (5, 6, 7) adapted to distribute eccentric vibrations to the limb,
- a control unit functionally connected to the at least one vibration element of each of the at least two compression pads,
- a power supply adapted to provide power to the control unit and the at least one vibration element of each compression pad,
the control unit being adapted to activating the at least one eccentric vibration element of each compression pad in sequential and cyclic order to provide eccentric vibrational stimulation of the blood circulation in venous flow direction.

2. The device according to claim 1, wherein the eccentric vibration element is an eccentric rotating mass vibration motor.

3. The device according to any of the preceding claims, further comprising a wireless communication unit functionally connected to the control unit, and adapted to synchronise the activating of the at least one eccentric vibration element of each compression pad between a plurality of identical devices.

4. The device according to any of the preceding claims, wherein each compression pad comprise a contact surface comprising a plurality of protrusions.

5. The device according to any of the preceding claims, further comprising an elastic material adapted to attach and compress the at least two compression pad against the limb.

6. The device according to any of the preceding claims, further comprising a hook-and-loop fasteners strap adapted to attach and compress the at least two compression pad against the limb.

7. The device according to any of the preceding claims, wherein the power supply is a re-chargeable battery or a replaceable battery.

8. The device according to any of the preceding claims, wherein the limb is a leg.

9. The device according to any of claims 1 – 7, wherein the limb is a forearm.

PATENTKRAV

1. En blodsirkulasjons-stimuleringsanordning (1, 20), omfattende
- minst to kompresjonsputer (compression pads) (2, 3, 4, 15, 16) tilpasset for å bli festet til et lem og komprimere lemmet, og hver kompresjonspute omfatter minst ett eksentrisk vibrasjonselement (5, 6, 7) tilpasset for å distribuere eksentriske vibrasjoner til lemmet,
- en styringsenhet funksjonelt tilkoplet til det minst ene vibrasjonselementet i hver av de minst to kompresjonsputene,
- en kraftkilde tilpasset for å gi kraft til styringsenheten og det minst ene vibrasjonselementet i hver kompresjonspute,
og styringsenheten er tilpasset for å aktivere det minst ene eksentriske vibrasjonselementet i hver kompresjonspute i sekvensiell og syklisk rekkefølge for å gi eksentrisk vibrasjonsstimulering av blodsirkulasjonen i venøs strømningsretning.

2. Anordning i henhold til krav 1, der det eksentriske vibrasjonselementet er en vibrasjonsmotor med eksentrisk roterende masse .

3. Anordning i henhold til et hvilket som helst av de foregående kravene, videre omfattende en trådløs kommunikasjonsenhet funksjonelt tilkoplet til styringsenheten, og tilpasset for å synkronisere aktiveringen av det minst ene eksentriske vibrasjonselementet i hver kompresjonspute mellom et flertall av identiske anordninger .

4. Anordning i henhold til et hvilket som helst av de foregående kravene, der hver kompresjonspute omfatter en kontaktflate som omfatter et flertall fremspring.

5. Anordning i henhold til et hvilket som helst av de foregående kravene, videre omfattende et elastisk materiale tilpasset for å festes på og komprimere de minst to kompresjonsputene mot lemmet.

6. Anordning i henhold til et hvilket som helst av de foregående kravene, videre omfattende en krok-og-løkke festestropp tilpasset for å bli festet til og komprimere de minst to kompresjonsputene mot lemmet.

7. Anordning i henhold til et hvilket som helst av de foregående kravene, der kraftkilden er et oppladbart batteri eller et utbyttbart batteri.

8. Anordning i henhold til et hvilket som helst av de foregående kravene, der lemmet er et ben.

9. Anordning i henhold til et hvilket som helst av kravene 1 – 7, der lemmet er en underarm.

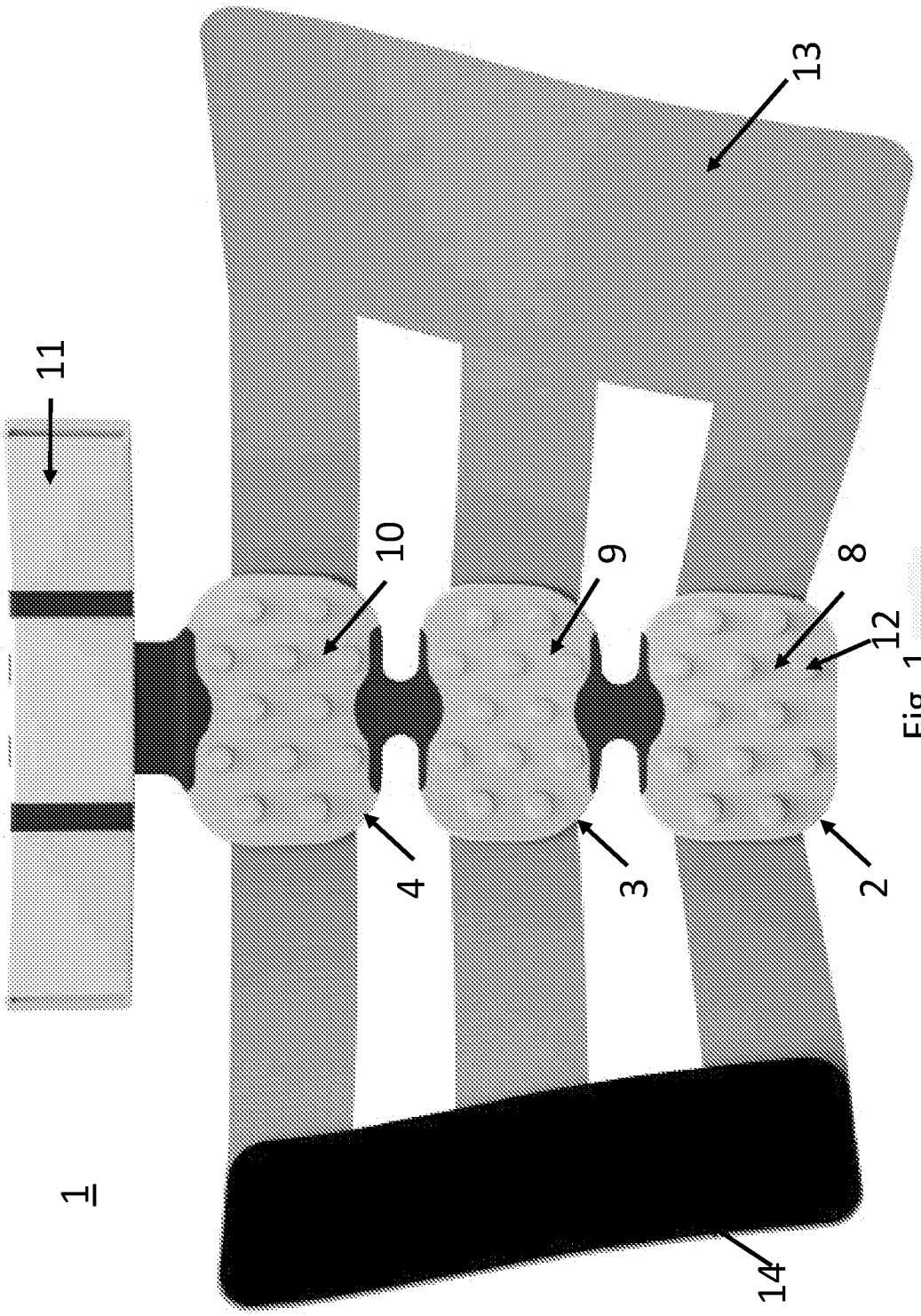


Fig. 1

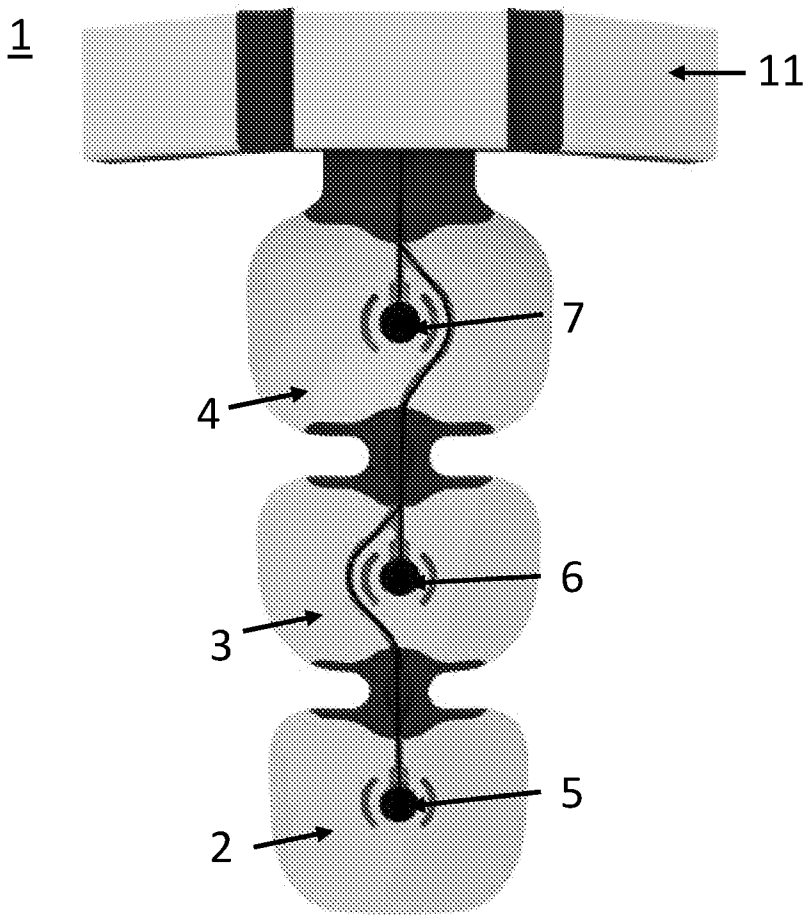


Fig. 2

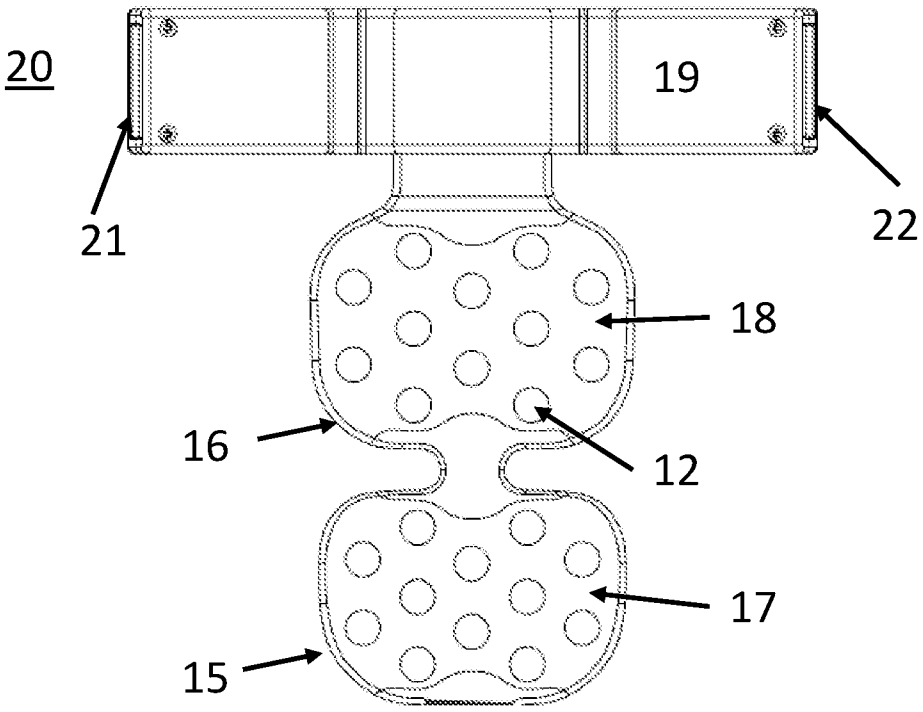


Fig. 3

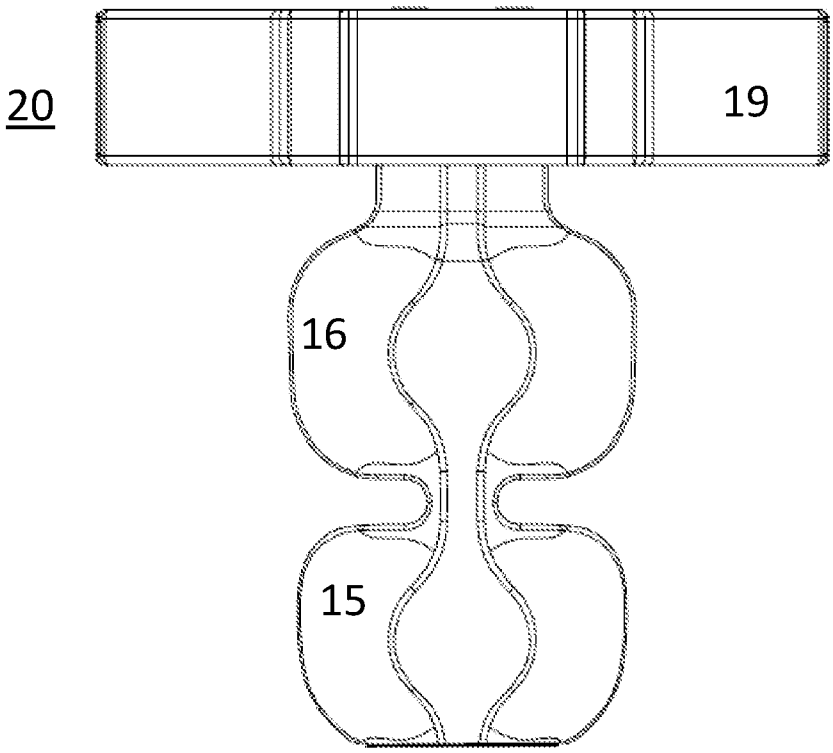


Fig. 4

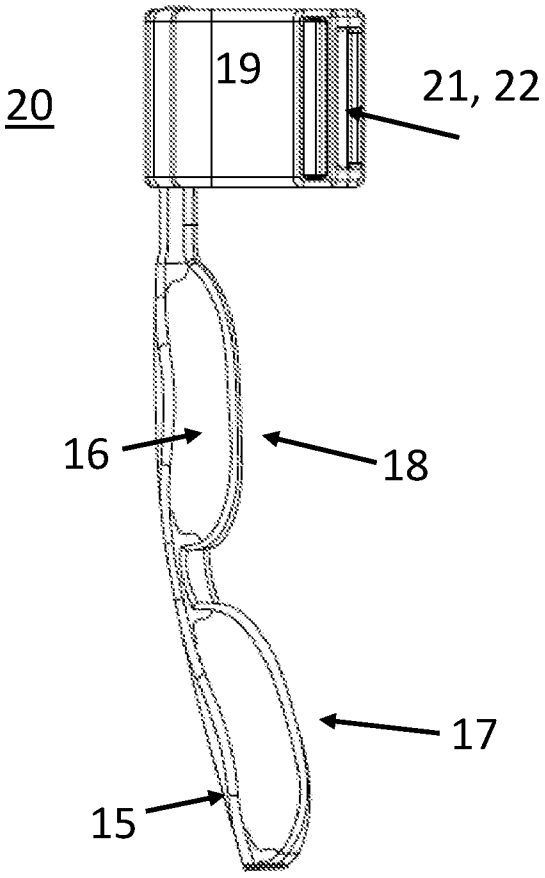


Fig. 5