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(54) Benevnelse **STIMULATION DEVICE HAVING AN EXTENSION**

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**EP 3 267 960 B1****Description**

**[0001]** The present invention relates to a stimulation device with an appendage for erogenous zones, in particular for the clitoris, a system with a stimulation device, as well as a method for stimulation of body parts.

**[0002]** The erogenous zones of the human body can be stimulated with a plurality of aids. By way of example, this is why vibrators are used, in order to exercise an excitement of a specific skin area by means of direct contact. This also comprises means of stimulation for insertion in the human body, such as, for example, dildos.

**[0003]** The direct stimulation of the clitoris, for example, with a contact vibrator, is frequently tied to problems. The clitoris is generally the most sensitive erogenous zone in women. The entire clitoris is heavily endowed with nerve ends, whereby the same are especially sensitive to the touch and receptive for sexual excitation. The clitoral glans, in particular, in which the nerve fibers of the two thighs meet, are to be highlighted. In this way, on the one hand, with frequent use of a contact vibrator for direct stimulation, this results in habituation effects or alternatively in a conditioning of the stimulated erogenous zone, whereas, on the other hand, the first time use of such a device requires a certain practice or alternatively familiarization. It is also possible that an indirect stimulation of the female erogenous zones might not be sufficient, or alternatively it may be desired to intensify the stimulative effect.

**[0004]** Moreover, medical studies carried out in the year 2006 have demonstrated that the female clitoris determines the decisive starting point of the female climax and for the first time have neurologically documented the various qualities of perception of clitoral and vaginal orgasms. The clitoris as well as also the vagina are therefore capable of bringing about an orgasm.

**[0005]** The sensitivity of the human erogenous zones, for example, of the clitoris, the inner and outer labia or the nipples, is also very different from individual to individual. It is also possible that the sensitivity of the corresponding zone can change greatly from situation to situation or even during a sexual act. Furthermore, a fast and strong stimulation of different erogenous zones is often desired.

**[0006]** There are various direct and indirect stimulation forms that are likewise common practice, such as for example, vacuum pumps or dildos.

**[0007]** For indirect stimulation of erogenous zones and in particular of the clitoris, conventional vacuum devices are used to stimulate the erogenous zones of the person concerned without direct contact of the main area to be stimulated. Vacuum pumps for the female primary or secondary sexual organs are, for example, known, which pumps usually have a suction cup to be placed and a hand pump. The negative pressure exerted on the clitoris with this type of device generates, for example, a negative pressure in the clitoris itself, which pressure is usually lower than the systolic blood pressure. This pressure difference leads to an expansion of the clitoris and/or stimulates the blood flow in the affected area. This surge in clitoral vascular blood serves both to promote pleasure through an increase in sensitivity as well as optical and haptic manipulation. The better blood circulation also leads to an increased leakage of vaginal moisture, which makes the stimulation more pleasant. However, manual operation of the hand pump is often cumbersome or bothersome. In addition, it can also come to habituation effects in this category of devices in the case of longer-term or alternatively continuous application of negative pressure, which limit the effectiveness of the device in the long term.

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**[0008]** Instead of a manually operated vacuum pump, electrically driven vacuum pumps are increasingly used. By way of example, WO 2006 / 05 82 91 A2 discloses a device for sexual therapy, wherein the arrangement consists of a tube-shaped suction chamber for the clitoris, an electric source of a vacuum (vacuum pump) and a plurality of air flow openings. Through the operation of the vacuum pump, a continuous air flow or alternatively air exchange in the region of the clitoris is generated in the chamber. In so doing, the vaginal moisture, which arises increasingly due to the negative pressure, is disadvantageously aspirated, which is why a drying effect of the stimulated skin parts occurs. The aspirated moist air likewise leads to contamination of the downstream flow vacuum arrangement, for example, of the vacuum pump. Such arrangements with vacuum pumps can therefore be problematic as regards hygiene since vacuum pump and the associated valves or alternatively the air-technical components often comprise dead spaces or alternatively dead angles and/or are difficult to clean. The device moreover is intended for the therapy of the blood vessels of the clitoris, and not for stimulation to reach sexual climax.

**[0009]** US 6 464 653 B1 discloses therapeutic devices and methods which generate a surge in clitoral blood by means of a vacuum generated by a vacuum pump to support the treatment of disorders of the clitoris, for example, of incontinence. With the help of a control valve or alternatively of a modulator, which can respectively be covered with the finger, the magnitude of the vacuum in the suction chamber is manually adjusted or varied. This requires the attention of the user and under certain circumstances may be bothersome or distracting. This relatively complex device with further valves also has the above-explained disadvantages as regards hygiene and dehydration, wherein the device serves long-term therapeutic purposes and not short-term sexual stimulation.

**[0010]** The devices of the prior art therefore have the common disadvantage of a degree of complexity of the negative pressure-generating, or alternatively positive pressure-generating arrangements that is elevated and whereby said device could comprise hygienic problems. In addition, there is the problem of the manageability of the devices; wherein these devices are often haptically uncomfortable and/or require getting used to.

**[0011]** The devices of the prior art, moreover, have the further disadvantage in common that habituation effects occur in the case of longer lasting, or alternatively in the case of continuous or frequently recurring applications of negative pressure.

**[0012]** Another disadvantage of some of the vacuum devices described above consists in that, firstly, the negative pressure must be limited by means of a control valve or a vacuum pump, and secondly, the negative pressure would need to be relieved by means of a manual opening of a release valve before the suction cup is released from the skin. Were one of the valves to have a technical defect and/or were the user to operate the device incorrectly, under certain circumstances there could be a risk of injury.

**[0013]** In light of the problems described above, it is therefore the underlying task of the invention to provide a stimulation device which has a simple construction and is simple and safe to use, and has a strong stimulative effect.

**[0014]** The underlying task of the invention is solved by the stimulation device according to claim 1. Advantageous further developments and embodiments are the subject matter of the further subsidiary and dependent claims.

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**[0015]** According to the invention, a pressure field generating arrangement of the stimulation device comprises at least one first chamber and at least one second chamber having at least one opening for placement on a body part or alternatively on the erogenous zone and at least one connection element, which connects the first chamber to the second chamber.

**[0016]** This configuration, according to the invention, of chambers communicating fluidically via at least one connection element makes it possible to generate a pressure field in the second chamber in a simple manner by changing the volume of the first chamber, which is temporarily directed to the skin area to be stimulated.

**[0017]** A pressure field in the sense of the invention is a temporally varying field of media pressures, which temporarily has positive pressures and temporarily has negative pressures, wherein a negative pressure is a media pressure which is below the reference pressure, and a positive pressure is a media pressure which is above the reference pressure. Ultimately, the medium flows back and forth in the pressure field according to the invention. In this way, a (largely) intermittent exchange of the same medium can preferably take place.

**[0018]** The medium is generally gaseous, preferably air, but may be, for example, alternatively or additively a liquid medium, for example, water or a commercially common lubricant. By way of example, the lubricant can be filled into the chambers according to the invention before use of the stimulation device. In this way, the stimulation of the corresponding skin area can also be accomplished with a suitable skin-friendly liquid, instead of air, which liquid may be desired depending on the individual preference of the user. As another example, the stimulation device can also be used under water with water as a medium (for example, in the bathtub). In so doing, the stimulation device is configured to be waterproof.

**[0019]** The reference pressure is generally the ambient pressure with respect to the stimulation device at the beginning of the application (which is to say, before the placing of the stimulation device on the skin area to be stimulated). In the preferred application of the stimulation device with air, the reference pressure is the current air pressure or alternatively the normal pressure. By way of example, the reference pressure can be approximately 1 bar when using the device under standard conditions, wherein a negative pressure according to the invention could be, for example, 0.7 bar and a positive pressure according to the invention could be, for example, 1.3 bar.

**[0020]** By means of the pressure field according to the invention, the skin area to be stimulated is excited on the one hand by blood flow, whereas on the other hand it is massaged indirectly. In this manner, two beneficial effects are combined. Due to the increased blood flow, the erogenous zone of the person concerned is more sensitive, whereas a massage effect is also created, which serves to stimulate the erogenous zone, for example, for sexual arousal until reaching the climax. The massage effect is created by the kinetic energy of the medium flowing from the first chamber through the connection element against the surface of the skin area to be stimulated. In this manner, the massage effect created by the pressure field is generated indirectly, thus without direct contact of the skin portion to be stimulated by a solid body, for example, by a vibrator.

**[0021]** By the exemplary use on the clitoris of the temporally changing pressure fields according to the invention, an excitation thereof, which usually takes place during sexual intercourse, is replicated by the pressure field. A changing excitation of the clitoris is also generated by the movement of copulation. Thus, it is a lifelike imitation of the natural act of copulation, wherein medical statements confirm that the use of the pressure field according to the invention leads

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neither to habituation effects nor to dependency. This is due in particular to the alternating use of negative and positive pressures (or alternatively also in the non-continuous use of only one type of pressure).

**[0022]** Furthermore, the maximum applicable pressure is regularly limited by the maximum resiliency of the skin area to be stimulated. Thus, for example, an overly high negative pressure, especially in erogenous zones, involves the risk of painful injuries. It is usually exclusively stimulation devices operating with negative pressure that are limited to this maximum. In contrast, according to the invention, an extended working range of the stimulation-triggering pressure field or alternatively effect is achieved by the combination of positive and negative pressures, inasmuch as the working range of the pressure can now be exploited to the maximum in both the positive and negative range.

**[0023]** By the alignment of the at least one connection element on the skin area to be stimulated, the pressure field can act immediately, wherein the pressure field is significantly influenced by the configuration of the at least one connection element and the at least one opening from the connection element into the second chamber, and thus depending on the use, the stimulation device is adjustable. In this way, the at least one opening of the connection element can be located opposite, preferably directly opposite, the body part to be stimulated. By way of example, in a stimulation device intended for the clitoris, the connection element may comprise a single through-opening between the first and the second chamber with nozzle action on the clitoral glans. Alternatively, the at least one connection element may consist of a plurality of, for example four, through-openings between the chambers, if a larger skin area is to be stimulated.

**[0024]** Furthermore, after placing the half-sided or alternatively partially opened second chamber on the skin area to be stimulated, a self-contained system of media or alternatively air flow is created in the pressure field generating arrangement. Thus, the medium or alternatively the air is substantially moved back and forth between the chambers, whereas an exchange with media or alternatively with air from outside the system is at least largely avoided. Thus, the first chamber is preferably exclusively connected via or alternatively by the connection element to the second chamber. In this manner, there are no connections of the first chamber other than those for the second chamber; for example, there is no direct connection of the first chamber with the environment of the device via a pressure valve or via an air discharge channel.

**[0025]** By way of example, the temperature of the air in the flow system according to the invention will quickly adapt to the skin temperature, whereas the bothersome supply of new (for example, cold) air from outside the system is avoided, as can be the case in the prior art when using, among others, vacuum pumps. Drying actions are moreover avoided, inasmuch as in a closed system, no or hardly any removal of stimulation-promoting fluids, for example, bodily fluid, takes place.

**[0026]** The pressure field generating arrangement according to the invention moreover has the advantage of increased hygiene and improved ability to be cleaned due to the simple construction. The present invention foregoes valves or pumps/compressors with potential dead spaces and areas that cannot be cleaned. Thus, the pressure field generating arrangement according to the invention is easy to clean. By way of example, a cleaning of the stimulation device can be carried out in a simple manner by filling a first chamber with a cleaning liquid and activating the pressure field. Alternatively, the second chamber can be interchangeably arranged, which also facilitates the cleaning of both chambers. Further, the chambers according to the invention and the connection element of the pressure field generating arrangement can

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be produced as a single unit, wherein for example, these consist of a single plastic molding (for example, of rubber). As a further alternative, the first chamber, the second chamber and the connection element may be executed as a single unit.

**[0027]** In addition, the construction according to the invention leads to the avoidance of complex flow elements, such as, for example, valves, which leads to a simplification of manufacturing.

**[0028]** The stimulation device according to the invention furthermore comprises a drive unit, which changes the volume of the first chamber in such a way that a pressure field is generated in the second chamber by means of the connection element, which pressure field serves to stimulate the erogenous zone, and a control device that drives the drive unit.

**[0029]** The volume of the medium transported between the chambers is limited by principle to the maximum volume of the first chamber. The transported volume can, moreover, be further structurally limited by the maximum possible change in volume which is brought about by the drive unit.

**[0030]** As a result, the maximum positive pressure or alternatively negative pressure that the stimulation device can build up in the second chamber is limited due to the dimensioning of the components of the pressure field generating arrangement and the drive. In particular, the maximum positive pressure or alternatively negative pressure can be limited to a magnitude that minimizes or precludes a risk of injury to the skin area to be stimulated. By way of example, this makes superfluous the need for a safety valve according to conventional prior art or a manual intervention of the user in the stimulation process, for example, by opening a release valve.

**[0031]** Furthermore, the temporal change of the pressure field or alternatively the modulation of the pressure field is substantially automatically controlled by the control device. The modulation of the pressure field, for example, its intensity, its temporal course or sequence can be pre-programmed in the control device. Preferably, the temporal change of the pressure field may comprise regular or alternatively recurring (stimulation) patterns, for example, impulses with a predetermined cycle time or regularly alternating impulse sequences. In this way, the interaction of the user with the stimulation device can be limited according to the invention to the switching on and off of the stimulation device and the choice of the stimulation pattern, whereas the stimulation device automatically carries out the preferred stimulation pattern. In this way, the complexity of use of the stimulation device according to the invention, is lesser when compared to the conventional (medical) vacuum stimulation devices. Alternatively or additionally, the user can individually configure the stimulation pattern of the stimulation device during or before operation.

**[0032]** In addition, (at least) one appendage is provided in the stimulation device according to the invention. This appendage can be used, on the one hand, as a handle to be able to easily and comfortably hold onto the stimulation device, and on the other hand, the appendage can also be used as a direct or alternatively indirect means of stimulation for insertion into the human body or also for placing on the human body.

**[0033]** If the appendage is inserted into the human body, it serves to directly stimulate the affected body parts. In this way, it complements the indirect stimulation effect of the pressure field generating arrangement. A direct and indirect stimulation of several erogenous zones can thereby take place simultaneously or alternately. By way of example, the appendage can be inserted into the female vagina, while a stimulation of the clitoris can simultaneously or alternately be carried out by means of the pressure field according to the invention. The

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principle according to the invention of combined direct and indirect stimulation can correspondingly also be applied to other body parts or their erogenous zones. By way of example, the appendage can be placed on the clitoris of a woman, while the pressure field generating arrangement stimulates the clitoris of another or the same woman.

**[0034]** The stimulation device with appendage can therefore be used for the stimulation of several erogenous zones of only one person or also of two different persons.

**[0035]** The combination of direct and indirect stimulation leads to an improvement of the stimulation effect and to a wide-ranging applicability of the stimulation device. By means of the stimulation device with appendage according to the invention, there are also other, alternative types of play during the sexual act.

**[0036]** According to the invention, a stimulation device with a plurality of cumulative orgasmic or alternatively stimulation-triggering effects is provided, which stimulation device is suitable for the stimulation of a plurality of erogenous zones, in particular of the female clitoris. A device is moreover provided which prevents the drying out of the erogenous zones to be stimulated, which is hygienic and which avoids habituation effects.

**[0037]** According to a further development of the invention, the appendage is movable with the pressure field generating arrangement, for example connected by means of a joint at one end of the appendage. The stimulation device can thus be adapted to the respective anatomy of the human body and to its use. By way of example, the appendage can be inserted into the female vagina, in order to then have the angle between the pressure field generating arrangement and the appendage adjusted such that the opening of the second chamber can be placed precisely above the clitoris. As a consequence, the body region between the clitoris and the vagina is stimulated from both sides, wherein the effects of direct and indirect stimulation mutually reinforce each other.

**[0038]** If the appendage is used as a handle to hold the stimulation device, the angle between the handle and the opening of the second chamber can be adjusted according to the preferences of the user of the device.

**[0039]** According to a further development of the invention, the appendage is a means of stimulation, which is shaped in such a way that one can insert the appendage for direct stimulation in the human body, for example in the vagina. The appendage is preferably configured in the form of a dildo. In so doing, this avoids, in particular, sharp edges. The appendage is preferably configured in such a way that it can be easily inserted into body openings, and/or remains inserted in the same.

**[0040]** According to a further development of the invention, the appendage 140 is an elongated, lenticular or pillow-shaped body, which is adapted such that the appendage can be smoothly inserted into the female vagina. This improves the direct stimulation effect.

**[0041]** According to a further development of the invention, the appendage is mounted on the pressure field generating arrangement in such a way that the stimulation device is configured uniformly. Uniformly means, in particular, that the stimulation device with appendage and pressure field generating arrangement is configured as an integrated, coherent device. The transitions between the appendage and pressure field generating arrangement are preferably hereby configured to be seamless. This improves the hygiene and usability of the stimulation device.

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**[0042]** According to a further development of the invention, the appendage comprises a vibration device. This vibration device can be operated in such a way that the appendage vibrates, as is known in electromechanically-operated dildos. The vibration can be activated either independently of the other parts of the stimulation device, or the vibration can be controlled by means of the control device, which then also drives the drive unit of the pressure field generating arrangement. The vibration can preferably be controllable in a conventional known manner in strength, duration and sequence. The vibration enhances the direct stimulation effect.

**[0043]** According to a further aspect of the invention, a system having the stimulation device according to the invention is proposed according to claim 20, which stimulation device has a remote control device arranged separately from the stimulation device, wherein the control device of the stimulation device is remotely controlled by the remote control device. A conventional wireless (for example, via radio frequency) or wired remote control can thereby be used to remotely control the modulation of the stimulation device or its activation by another user.

**[0044]** According to another aspect of the invention, methods for stimulating body parts, in particular the clitoris, are proposed according to claims 21 to 25. The associated beneficial effects and impacts are elucidated in more detail above in reference to the pressure field and the appendage.

**[0045]** According to another aspect of the invention, the use of the stimulation device according to the invention as a sex toy for stimulating the female clitoris is proposed according to claim 19. As initially elucidated, the female clitoris is a particularly sensitive erogenous zone of the woman, which is why the use of an indirect massage according to the invention in combination with a negative pressure stimulation for this body part appears to be particularly advantageous for stimulation until reaching orgasm.

**[0046]** In the present invention, the methods are used to stimulate erogenous zones for sexual pleasure, as a consequence, the methods are not used for medical, for example, therapeutic purposes.

**[0047]** The features and functions of the present invention described above, as well as further aspects and features, will be described below with a detailed description of preferred embodiments with reference to the accompanying figures.

**BRIEF DESCRIPTION OF THE DRAWINGS**

**[0048]** Wherein:

- |        |   |
|--------|---|
| Fig. 1 | shows a frontal view of a first embodiment of the stimulation device according to the invention with an appendage in straight position; |
| Fig. 2 | shows a side view of the first embodiment of the stimulation device according to the invention with the appendage in angled position;   |
| Fig. 3 | shows a schematic cross-section through the stimulation device of the first embodiment according to the invention;                      |

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- Fig. 4 shows a cross-section through a pressure field generating arrangement of a first aspect of the present invention in the first state;
- Fig. 5 shows a cross-section through a pressure field generating arrangement of a first aspect of the present invention in the second state;
- Fig. 6 shows a cross-section through a pressure field generating arrangement of a first aspect of the present invention in the third state;
- Fig. 7 shows a cross-section through a pressure field generating arrangement of a second aspect of the present invention;
- Fig. 8 shows a cross-section through a pressure field generating arrangement of a third aspect of the present invention;
- Fig. 9 shows a cross-section through a pressure field generating arrangement of a fourth aspect of the present invention;
- Figs. 10a through c show a cross-section through a pressure field generating arrangement of a fifth aspect of the present invention;
- Fig. 11 shows a partial cross-section through a second embodiment of the stimulation device according to the invention;
- Figs. 12a through f show various lower and side views of further aspects of a second chamber of the present invention;
- Fig. 13 shows a block diagram of an embodiment of the present invention;
- Figs. 14a through c show diagrams of various patterns of the pressure modulation of the present invention

**DESCRIPTION OF PREFERRED EMBODIMENTS**

**[0049]** A first embodiment will be elucidated below with reference to Fig. 1, Fig. 2 and Fig. 3. A front view of the first embodiment of the stimulation device 1 according to the invention is shown in Fig. 1 with an appendage 140 in the straight position, wherein a side view of the stimulation device 1 further shown in Fig. 2 with the appendage 140 in an angled position and wherein a cross-section of the stimulation device 1 of the first embodiment according to the invention is shown in Fig. 3.

**[0050]** The first embodiment of the stimulation device 1 is a preferably portable, electric or small device, which comprises a housing 8, a pressure field generating arrangement 2, an optional on/off switch 74 and an optional light 9.

**[0051]** The housing 8 is preferably configured ergonomically in such a way that it can be comfortably held with one hand and it has no sharp or pointed edges. The housing 8 may moreover be made of a plastic, for example, polycarbonate (PC) or acrylonitrile butadiene styrene (ABS). In addition, the grip areas or even the entire housing can be supplemented with a haptically advantageous silicone or can consist thereof. The housing 8 is preferably at least

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water-repellent or splash-proof, for example, rated as having an ingress protection class IP 24. The dashed line of Fig. 2 further indicates an optional side edge of the housing 8.

**[0052]** The optional on/off switch 74 is used to activate and deactivate the stimulation device 1. This on/off switch 74 can, for example, be a push button, which with prolonged pressing, switches the stimulation device 1 on or alternatively off, or an engaging slide switch. Alternatively, the stimulation device 1 can be switched on and off by remote control.

**[0053]** The pressure field generating arrangement 2 of a first embodiment comprises a first chamber 3 inside the stimulation device 1, a second chamber 4 for placing on a body part 11 to be stimulated, and a connection element 5 which connects the first chamber 3 to the second chamber 4.

**[0054]** A drive unit 6, for example, an electric motor, drives the first chamber 3 via an axle 61 and by means of a cam 62 (or alternatively by means of a connecting rod) in such a way, that the volume of the first chamber 3 is changed according to rotation of the axle 61 of the drive unit 6. For this purpose, it is noted that in the stimulation device 1 all drive types can, in principle, be used that bring about a deflection of the wall 31 of the first chamber 3 to change the volume. By way of example, this can be done hydraulically, pneumatically, piezoelectrically, mechanically or electromagnetically. Examples will be further elucidated later.

**[0055]** A control device 7 controls the drive unit 6, optional operating elements 71 and at least one optional display 72. The control device 7 and the drive unit 6 are supplied with power, for example, from the internal battery 76 and/or the external power supply 73.

**[0056]** The stimulation device 1 further comprises at least one appendage 140. This appendage 140, which is preferably a component of the housing 8, is optionally movable or bendable relative to the housing part, in which the pressure field generating arrangement 2 is accommodated. The appendage can be bent or twisted by means of a joint 141. The joint 141 may be configured, for example, as a plastically deformable plastic part, as a setting adjusting joint or as a hinge. Fig. 2 shows an example of an angled position of the appendage 140 relative to the portion of the housing 8 of the stimulation device 1, in which the pressure field generating arrangement 2 is accommodated. Alternatively, the appendage can also be rigidly or alternatively inflexibly configured.

**[0057]** The appendage 140 is preferably a means of stimulation for insertion into the human body, for example into the vagina or other body orifices. The appendage 140 is shaped, for example, like a common dildo. Alternatively, the appendage may be formed in such a way that it is adapted to the human anatomy of another body opening, for example the mouth. In addition, the appendage 140 may be formed in such a way that it can also be used as a handle to comfortably hold the stimulation device 1.

**[0058]** In addition, the appendage 140 may optionally comprise a vibration device 142, which can be switchable and/or controllable. The vibration device 142 sets the appendage into mechanical vibrations, which supports the direct stimulation effect of the appendage 140.

**[0059]** Optionally, the appendage 140 is mounted to the portion of the housing 8, which receives the pressure field generating arrangement 2, in such a way that the (whole) housing 8 of the stimulation device 1 is configured uniformly. The housing 8 thereby gives the impression that it is monolithic or one-piece, for example by means of flexible and/or seamless connection

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elements of the housing 8. Alternatively, the housing 8, including the appendage 140 may comprise a silicone coating.

**[0060]** In a straight or alternatively non-angled orientation of the appendage 140, as shown in Fig. 1, the stimulation device 1 can be comfortably held or even easily inserted into body openings. If the appendage 140, as shown in Fig. 2, is angled, for example after insertion, the opening 42 can be guided in this way out of the body part 11 to be stimulated. In this angled position of the stimulation device 1, both direct and indirect stimulation of at least one erogenous zone of the body can take place simultaneously. The body part 11 to be stimulated is hereby located between appendage 140 and pressure field generating arrangement 2.

**[0061]** Furthermore, an optional light 9 may be provided on or in the housing 8. In this, the light 9 is preferably used for the illumination of the interior of the second chamber 4. The light 9 can either be switchable by the user or automatically activated when the stimulation device 1 is activated. The light 9 may moreover be formed of energy-saving light-emitting diodes. The illumination can serve, for example, as an orientation aid for the user of the stimulation device 1 in the dark or as an additional optical stimulation.

**[0062]** With reference to Fig. 4, Fig. 5 and Fig. 6, the construction and function of a first aspect of the pressure field generating arrangement 2 of the stimulation device 1 will be elucidated in more detail below.

**[0063]** Fig. 4 shows the pressure field generating arrangement 2 in a first state, wherein the second chamber 4 is placed on the skin area to be stimulated or alternatively on the body part 11. The first state of the pressure field generating arrangement 2 is characterized by a neutral deflection of the first chamber 3, which is to say, no external force, for example from the drive unit, acts on the first chamber 3. The volume  $V_1$  of the first chamber is hereby the standard volume of this chamber 3.

**[0064]** The body part 11 to be stimulated is a skin area of the body, wherein by way of example, a particularly sensitive erogenous zone, the clitoris 12, is illustrated here. In this way, the use of the present invention is however not limited to the female clitoris 11, but rather the stimulation device 1 can be applied to all body parts or erogenous zones (for example, the inside of the thighs, the loins, neck, nipples, etc.), which can be stimulated by means of media or alternatively air pressure massage and/or negative pressure.

**[0065]** By placing it on the body part 11 to be stimulated, the second chamber 4 forms a chamber which is largely or completely closed off from the outside of the pressure field generating arrangement 2 and which is now only in communication with the second chamber via the connection element 5, wherein ideally the edges of the chamber 4 tightly seal with the surface of the body part 11. In this way, two communicating chambers 3 and 4 are formed, wherein, in the event of a change in volume of one of the chambers 3 or 4, a corresponding pressure equalization takes place between the chambers 3 and 4 via the connection element 5.

**[0066]** A wall 31 of the first chamber 3 is fixed by means of a holder 32. The holder 32 is, in turn, fixed to the housing 8. The wall 41 of the second chamber is further attached to the holder 32. Two openings aligned with each other in the wall 41 of the second chamber and the holder 32 together form the connection element 5, which connects the first chamber 3 and the second chamber 5. In this, the wall 31, the holder 32 and the wall 41 are preferably bonded together in a media- or alternatively air-tight manner. Alternatively, these can also be press-fitted or

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screwed together (for example, with the help of sealing regions between the housing 8 and the respective part). The holder 32 may, for example, also be bonded or screwed to the housing 8.

**[0067]** The wall 31 of the first chamber 3 consists preferably of a flexible, media- or alternatively air-impermeable material, for example rubber. The holder 32 consists preferably of a rigid plastic, which is likewise media- or alternatively air-impermeable. The wall 41 of the second chamber is preferably manufactured of a flexible, skin-friendly material, such as silicone or rubber.

**[0068]** Fig. 5 shows the pressure field generating arrangement 2 of Fig. 4 in a second state, wherein, once again, the second chamber 4 is placed on the body part 11 to be stimulated. The second state is characterized in that a force A acting on the first chamber 3 brings about an expansion of the chamber 3. In this embodiment, the force A, in detail, pulls the wall 31 of the first chamber 3 in a direction directed away from the second chamber 4.

**[0069]** The volume  $V_2$  of the chamber 3 is thereby increased, which is to say,  $V_2 > V_1$ . In order to compensate for the resulting pressure difference between the chambers 3 and 4, the medium or alternatively the air now flows from the second chamber 4 into the first chamber 3.

**[0070]** Assuming that in the first state the pressure that is present in the chambers 3 and 4 corresponds to the currently prevailing external reference pressure (for example, the air pressure), the total pressure present in the second state will now be lower than the external reference pressure. This negative pressure is configured in such a way that it is preferably lower than the usual systolic blood pressure in the blood vessels of the body part 11. This increases the blood flow in this area and the clitoris 12 is better supplied with blood in the second state.

**[0071]** Fig. 6 shows the pressure field generating arrangement 2 in a third state, wherein, once again, the second chamber 4 is placed on the body part 11 to be stimulated. The third state is characterized in that a force B acting on the first chamber 3 brings about a reduction in volume or alternatively a compression of the chamber 3. In detail, the force B is opposite in its direction to the direction of the force A and deforms the wall 31 of the first chamber such that the resulting volume  $V_3$  of the chamber is smaller than the volume  $V_1$ . The compression of the chamber 3 brings about a positive pressure in the chamber 3, which pressure is compensated by a media or alternatively an air flow through the connection element 5 in the direction of the second chamber 4.

**[0072]** This media flow is now preferably directed by the orientation of the opening 51 and/or the connection element 5 onto the body part 11 to be stimulated, in particular on the clitoral glans 12. The indirect (pressure) massage according to the invention is carried out by the medium flowing onto the body part 11. The size of the opening 51 is thereby dimensioned in such a way that in relation to the volume displaced in the first chamber 3 this size is sufficiently small to accelerate the medium for a noticeable massaging effect.

**[0073]** The type of flow can be advantageously influenced not only by the size and orientation of the opening 51, but moreover also by the internal configuration of the connection element. By way of example, helix-shaped grooves in the connection element 5 can cause a swirl of the flow according to the invention, wherein the flow profile of the flow develops a "softer" or more turbulent impact on the body part to be stimulated. Alternatively, the pressure field resulting in the second chamber 4 can be adjusted by means of a plurality of openings 51 that are commensurate with the use.

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**[0074]** In the arrangement illustrated in Fig. 4 through Fig. 6, it is advantageous that this is hygienically unproblematic (for example, by means of the avoidance of dead spaces) and simple in manufacturing. By way of example, no valves or other openings in or on the first chamber 3 are required.

**[0075]** Fig. 7 shows a second aspect of the present invention with an alternative construction of the pressure generating arrangement 2. In this way, the walls 31 and 41 of the first and the second chambers 3 and 4 can engage in such a way that, as in the first aspect of the construction of the pressure generating arrangement 2, these form two communicating chambers with a connection element 5. A separate holder is thereby omitted, whereas the second chamber 4 is interchangeable. In addition, the connection element 5 may be configured integrally or as one piece with the wall 41 of the second chamber. An interchangeable chamber 4 presents the advantage that, in this way, various shapes of the chamber 4, each adapted to the respective body part, can be used (a more detailed explanation of this can be found later) without needing to replace the entire stimulation device 1. Alternatively, the second chamber 4 can also be attached to the housing 8 by means of a plug connection (not further illustrated). The wall 31 of the first chamber 3 may, for example, be bonded or screwed to the housing 8.

**[0076]** Also, as illustrated in more detail in Fig. 7 by the dashed line and the double arrow C, the expansion and compression of the first chamber 3 can be carried out by a force effect which lies perpendicular to the axial direction of the connection element 5. In principle, the force exerted directly or indirectly by the drive unit 5 on the first chamber 3 can be carried out from any direction. The only decisive factor here is that the volume of the first chamber 3 can be increased and reduced by the drive unit 6.

**[0077]** Fig. 8 shows a third aspect of the invention with a monolithic or alternatively one-piece construction of the pressure field generating arrangement 2. In this, an elastic material, for example silicon or rubber can be used for the material of the chambers 3 and 4. It is advantageous that possibly hygienically questionable gaps are avoided and manufacturing complexity is kept low. Also in this case, the pressure field generating arrangement 2 may be bonded or screwed to the housing 8. A change of the volume of the first chamber 3 occurs here in a manner analogous to that described in connection with Fig. 7.

**[0078]** Fig. 9 shows a fourth aspect of the invention with an alternative construction of the pressure field generating arrangement 2. In this, the second chamber 4, a plurality of connection elements 5 as well as partial sections of the wall 31 of the first chamber 3 are configured as one piece. Alternatively, the pressure field generating arrangement 2 can also be constructed of two or a plurality of parts in a manner similar to that illustrated in Fig. 4 or Fig. 7 while maintaining the geometric model of Fig. 9.

**[0079]** The volume change of the first chamber 3 takes place here in a manner similar to a piston pump, however all existing valves are missing here. A piston 63 is therefore moved back and forth by the drive unit, for example an electric motor or an electromagnet, in the directions of the double arrow D. This type of drive has the advantage that the volume of the first chamber 3 can be reduced in a simple manner to zero or alternatively almost zero, and thus the first chamber 3 can be almost completely emptied.

**[0080]** The configuration of the connection element 5 with a plurality of channels 52 and openings 51 leads to a distribution of the pressure field to a plurality of points of concentration. Whereas the configuration of the connection element 5 with only one channel, as described in connection with Fig. 6, leads to the formation of a strongly concentrated media or alternatively

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air flow towards a target region, the media or alternatively air flow can be distributed over a plurality of target areas in the configuration illustrated in Fig. 9 of the connection element 5. By way of example, the clitoris 11 can therefore not only be blown upon its glans, but rather evenly from a plurality of sides. This distribution of the concentration of air flow over a plurality of areas can help to avoid overstimulation and/or help to increase the stimulation area depending on the application.

**[0081]** Fig. 10a through Fig. 10c show a fifth aspect of the invention with (partial) cross-sections of a construction of the pressure field generating arrangement 2 with a bending element 64 as a drive for changing the volume of the first chamber 3. The bending element 64 can, for example, be a conventional piezoelectric bending element, which deforms or alternatively bends after application of a voltage. In this aspect of the invention, the wall 31 of the first chamber 3 is inflexibly or alternatively rigidly constructed, whereas the bending element 64 is suitably tightly fitted on the sides of the first chamber 3. The transition points between the bending element 64 and the wall 31 are sealed (for example, elastically bonded). In this construction, the drive for the pressure field generating arrangement 2 is already integrated into the same and an external drive is omitted. By way of example, an electric motor with a cam is omitted. In so doing, possible other disturbing natural oscillations brought about by the eccentric movement of the stimulation device are reduced.

**[0082]** In detail, Fig. 10a shows the pressure field generating arrangement 2 with the bending element 64 in neutral position. The volume of the first chamber 3 with the bending element 64 in neutral position is therefore the standard volume. Fig. 10b further shows the first chamber 3 with an excited and in succession a bending element bent outward, which is why the volume of the first chamber 3 is increased; and in succession there is a vacuum in the pressure field generating arrangement 2. Fig. 10c shows a bending element of the first chamber 3 which is excited in the opposite direction compared to Fig. 10b, which is why the volume of the first chamber 3 is reduced; and as a result, there is a positive pressure in the pressure field generating arrangement 2.

**[0083]** Fig. 11 shows a second embodiment of the invention with a spatially separated arrangement of the chambers 3 and 4 of the pressure field generating arrangement 2. The chambers 3 and 4 are thereby connected via an extended connection element 5 which can be a longer flexible hose or a rigid pipe. By way of example, the length of the connection element 5 can be 0.5 m. It is thereby possible to hold the housing 8 in one hand, while the other hand holds the second chamber 4 on the body part to be stimulated 11; or one can simply put the housing 8 aside while the user only holds the second chamber 4 in their hands. Alternatively, the appendage 140 may be inserted into a body part, wherein it is no longer necessary that the stimulation device 1 is held in the hand.

**[0084]** Fig. 12a through Fig. 12f show different lower and side views of further aspects of the second chamber 4 of the present invention. In detail, Fig. 12a shows a lower view of a circular second chamber 4 having a centrally arranged opening 51; Fig. 12b shows a lower view of a triangular second chamber 4 having a centrally arranged opening 51; Fig. 12c shows a lower view of an oval second chamber 4 with a centrally arranged opening 51; and Fig. 12d shows a lower view of a second chamber 4 with an approximately figure-eight shape with two openings 51 arranged offset to the center. Fig. 12e further shows a side cross-section of a second chamber 4 according to the invention, wherein the second chamber 4 additionally has an extended skin contact surface 43 or alternatively a support part 43 to improve the closing/sealing function of the second chamber 4 on the skin. The extended contact surface 43 may also have grooves or projections that further yet improve the sealing function. Fig. 12f

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shows a side cross-section of a second chamber 4 with a plurality of separate connection elements 5 and an extended contact surface due to the support part 43.

**[0085]** The shape of the second chamber 4 can therefore basically be adapted to the anatomy of the erogenous zone to be stimulated. In this, the shape of the chamber 4 of Fig. 12a is adapted, for example, to the round shape of the breast, whereas the shape of the chamber 4 of Fig. 12c is better adapted to the shape of the female vulva. The shape of the second chamber 4 moreover also determines the characteristic of the pressure field according to the invention. In this way, the size of the second chamber 4 in relation to the volume displaced by the first chamber 3, determines the magnitude of the achievable negative or positive pressure. The intensity of the massage effect according to the invention can, moreover, be determined by means of the proximity of the opening 51 of the connection element 5 to the skin area to be stimulated. With a plurality of openings 51 (*cf.* Fig. 12d), the massage effect can also be spread out to a plurality of areas. By way of example, the clitoris can thereby be stimulated to a lesser degree immediately at the very sensitive clitoral glans (*cf.* Fig. 12e), but stimulated more in the areas surrounding the clitoral glans to avoid overexcitation of the clitoris.

**[0086]** Fig. 13 shows a block diagram of an example of a functional construction of an embodiment of the present invention with a control device 7, a drive unit 6, a light 9, an on/off switch 74, operating elements 71, a battery 76 and an external power supply 73.

**[0087]** The control device 7, which comprises, for example, a microcontroller or is hardwired, first of all controls the power supply of all the consumers of the stimulation device 1, as well as optionally a charging and discharging process of the battery 76 and/or a battery management system. In particular, the control device 7 controls the excitation of the drive unit 6, for example, the magnitude of the deflection, the frequency, the modulation, etc.

**[0088]** Optionally provided operating elements 71 are used to set the operating mode of the device, which is to say, to set the modulation pattern of the pressure field. The operating elements 71 may be configured, for example, as at least one push button, as at least one rotary switch, or as at least one touch-sensitive switch. The operating elements 71 may moreover provide an optical feedback for actuation, for example, by means of light-emitting diodes (LEDs) integrated in the switch.

**[0089]** An optional display 72 serves to inform the user about the state of the device and/or the state of adjustment. The display 72 may be configured, for example, using a plurality of LEDs or as an LCD display. The information displayed may, for example, be the state of charge of an optional battery or the current setting of the modulation pattern.

**[0090]** The control device 7 may moreover have a memory in which at least one modulation or alternatively stimulation pattern (these are further elucidated in reference to Fig. 14a through Fig. 14c) is stored. The drive unit 6 can now be controlled in its excitation according to the preferences of the user of the stimulation device 1 by means of the operating elements 71 according to these pre-stored stimulation patterns. The stimulation patterns of the pressure field can optionally be created and stored individually by the user by means of the operating elements.

**[0091]** A socket (not shown in further detail) can serve the external power supply of the stimulation device 1 by means of an external plug, which is connected, for example, to an external power adapter. In order to ensure the splash water resistance of the stimulation device

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1, instead of the socket, a magnetic-inductive transformer can also be provided that allows power transmission into the stimulation device 1 without an electrically conductive contact.

**[0092]** Preferably, the stimulation device 1 moreover comprises a battery, by way of example a nickel-metal hydride rechargeable battery (NiMH), for wireless operation. Alternatively, a (longer) power supply cable may be led out of the stimulation device.

**[0093]** Fig. 14a shows the temporal course of a total pressure  $p$  in the pressure field generating arrangement 2 when the same is used for stimulation. The dashed line indicates the reference pressure, for example the currently prevailing atmospheric pressure, which is present outside the pressure field generating arrangement 2. If the second chamber 4 is now placed on the body part 11 to be stimulated, the initially prevailing ambient pressure of the pressure field generating arrangement 2 is more or less maintained. It is now assumed that the second chamber 4 is substantially placed closely on the body part to be stimulated. After activation of the stimulation device, the drive unit 6 is controlled or excited by the control device 7 according to a pre-stored stimulation pattern. The volume of the first chamber 3 and thus the total pressure in the pressure field generating arrangement 2 will change correspondingly, wherein the pressure changes are modulated to the reference pressure. The pressure or stimulation pattern shown by way of example in Fig. 14a develops a pulsed, regular pressure field. In phases of the increase of the pressure, the erogenous zone to be stimulated is blown upon or massaged, whereas in the times when there is a negative pressure, the blood circulation of the body part 11, for example, the clitoris is promoted. According to the invention, there are therefore time periods (referenced in Fig 14a with reference character I)), in which there is a negative pressure, during which the clitoris is simultaneously indirectly massaged.

**[0094]** Fig. 14b shows three examples of alternative stimulation patterns. In the area marked with II), a pulsed stimulation pattern with great amplitude is shown. In the area marked with III) a pulsed stimulation pattern with lesser amplitude is shown. In the area marked with IV), there is moreover a stimulation pattern shown that is irregular or alternatively asymmetric in the temporal sequence and in the amplitude. The patterns can be varied depending on the physical impact/use and individual wishes.

**[0095]** Fig. 14c shows another example of an alternative stimulation pattern. The strength of the pressure can therefore increase over time to adapt to the state of excitement of the user.

**[0096]** The invention permits further design principles in addition to the described embodiments. Various arrangements or alternatively constructions of the first chamber 3 can therefore be combined at will with different designs of the second chamber 5 or of the connection element 5. By way of example, the first chamber 3 can be combined with the drive of the Figures 10 with the second chamber of Fig. 12f.

**[0097]** Notwithstanding that only one first chamber 3 is shown in all embodiments, two or more first chambers 3 may also be present, which first chambers are then respectively driven simultaneously or time-shifted to one another in such a way that they change their volume, in order to build up a pressure field according to the invention.

**[0098]** Notwithstanding that only one opening is shown in all embodiments from the first chamber 3 to the connection element 5, it is also possible that a plurality of openings for a connection element 5 or a plurality of openings for a plurality of connection elements 5 may be present in the first chamber 3.

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**[0099]** A stimulation device 1 may comprise a plurality of pressure field generating means 2. By way of example, two pressure field generating arrangements may be present to simultaneously stimulate two erogenous zones.

**[0100]** The stimulation patterns according to the invention may differ from the patterns shown in Fig. 14a, Fig. 14b and Fig. 14c as long as they have a temporal sequence of negative and positive pressures. By way of example, at the beginning or alternatively after activation of the device there can initially be a relatively long-lasting negative pressure that is built up (for example, 3 minutes) to effectively increase the blood flow to the zone to be stimulated, whereinafter there follow pulses of negative and positive pressures which have slowly increasing amplitude.

**Reference character list:****[0101]**

- 1 Stimulation device
- 2 Pressure field generating arrangement
- 3 First chamber
- 4 Second chamber
- 5 Connection element
- 6 Drive unit
- 7 Control device
- 8 Housing
- 9 Light
- 11 Body part
- 12 Clitoris
- 31 Wall of the first chamber
- 32 Holder
- 41 Wall of the second chamber
- 42 Opening of the first chamber
- 43 Contact surface
- 51 Opening from the connection element to the second chamber
- 61 Drive shaft
- 62 Cam
- 63 Piston
- 64 Bending element
- 71 Operating element
- 72 Display
- 73 Power supply
- 74 On/off switch
- 76 Battery
- 77 Control board
- 140 Appendage
- 141 Joint
- 142 Vibration device

**PATENTKRAV****1.** Stimuleringsanordning (1) for stimulering av erogene soner, med:

ett trykkfeltgenererende arrangement (2) for indirekte stimulering av klitoris  
5 med:

ett første kammer (3); og

ett andre kammer (4) med en åpning (42) for plassering på klitoris  
(12); og

ett koblingselement (5) som forbinder det første kammeret (3) med det  
10 andre kammeret (4); og

en styreenhet (6) som varierer volumet til det første kammeret (3) slik  
at et stimulerende trykkfelt genereres via koblingselementet (5) i det  
andre kammeret (4); og

en kontrollanordning (7) som aktiverer styreenheten (6);

15 hvori kontrollanordningen (7) omfatter minst ett betjeningselement (71) for  
justering av moduleringen av trykkfeltet, og

et hus (8) som rommer det trykkfeltgenererende arrangementet (2); og

et vedheng (140) for direkte stimulering av skjeden, hvori vedhenget (40) har  
en dildoform som kan settes inn i skjeden;

20 hvori trykkfeltet generert i det andre kammeret (4) består av et mønster av  
negative og positive trykk, modulert til normalt trykk; og

hvori det første kammeret (3) er koblet via koblingselementet (5) utelukkende  
til det andre kammeret (4); og

hvori huset (8) og vedhenget (140) er forbundet med hverandre og kan

25 beveges i forhold til hverandre for å passe til den menneskelige anatomien slik

at åpningen (42) til det andre kammeret (4) kan plasseres over klitoris for

indirekte stimulering, mens vedhenget (140) samtidig kan settes inn i skjeden

for direkte stimulering, slik at kroppsområdet mellom klitoris og skjeden kan  
stimuleres av den kombinerte direkte og indirekte stimuleringen.

**2.** Stimuleringsanordning (1) ifølge krav 1,

30 hvori den ene åpningen (51) til det ene koblingselementet (5) er motsatt kroppsdelen  
(11) som skal stimuleres og er rettet mot kroppsdelen (11) som skal stimuleres.

**3.** Stimuleringsanordning (1) ifølge krav 1 eller krav 2, hvori det andre kammeret (4)

35 er laget av et fleksibelt materiale og/eller er laget av et i det minste delvis  
gjennomsiktig materiale og/eller er tilpasset formen til de vaginale indre

kjønnsleppene slik at de vaginale indre kjønnsleppene er fullstendig dekket av åpningen til det andre kammeret (4).

5 **4.** Stimuleringsanordning (1) ifølge ett av kravene 1 til 3, hvori det andre kammeret (4) er laget i ett stykke med koblingselementet (5) og det første kammeret (3).

10 **5.** Stimuleringsanordning (1) ifølge hvilket som helst av kravene 1 til 3, hvori det andre kammeret (4) til stimuleringsanordningen (1) er arrangert for å være utskiftbart, hvori det andre kammeret (4) er anordnet separat fra stimuleringsanordningen (1), og koblingselementet (5) er en slange eller et rør.

15 **6.** Stimuleringsanordning (1) ifølge hvilket som helst av kravene 1 til 5, hvori det andre kammeret (4) har en tettende støttedel (43) for å forstørre kontaktflaten til det andre kammeret (4) på huden.

**7.** Stimuleringsanordning (1) ifølge hvilket som helst av kravene 1 til 6, hvori stimuleringsanordningen (1) har et lys (9) for belysning av det andre kammeret (4).

20 **8.** Stimuleringsanordning (1) ifølge hvilket som helst av kravene 1 til 7, hvori koblingselementet (5) har en indre form og en åpning til det andre kammeret (4) som er utformet slik at trykkfeltet moduleres i retning og intensitet.

25 **9.** Stimuleringsanordning (1) ifølge hvilket som helst av kravene 1 til 8, hvori stimuleringsanordningen (1) er en håndholdt anordning.

**10.** Stimuleringsanordning (1) ifølge hvilket som helst av kravene 1 til 9, hvori vedhenget (140) er forbundet via en skjøt (141) til delen av huset (8) som rommer det trykkfeltgenererende arrangementet (2).

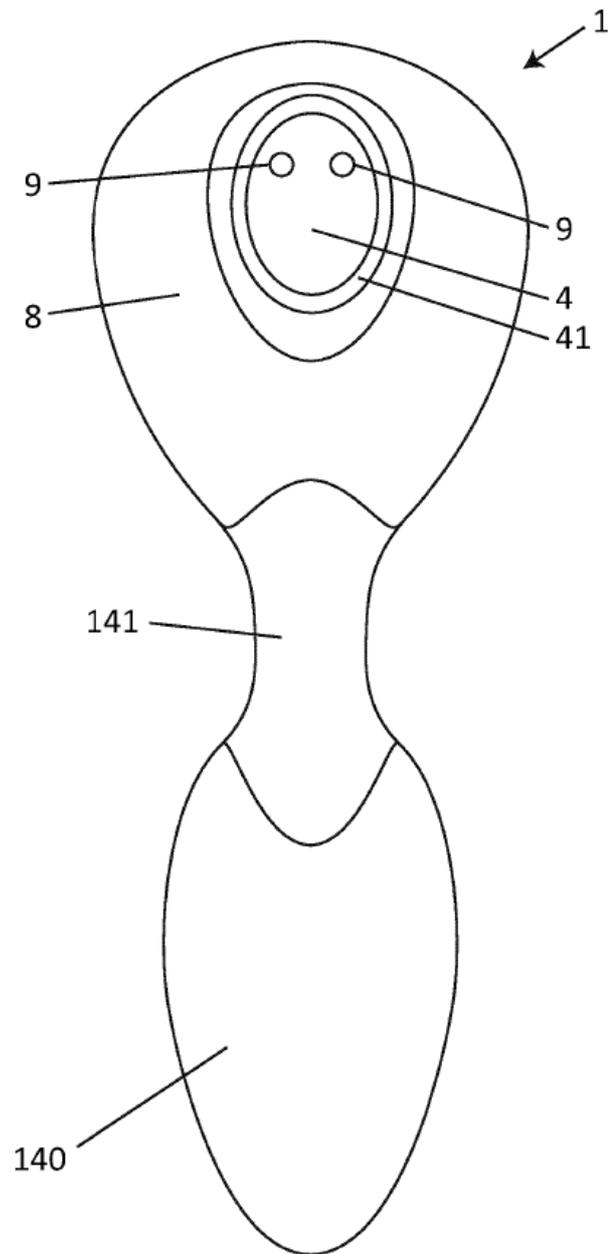
30 **11.** Stimuleringsanordning (1) ifølge hvilket som helst av kravene 1 til 10, hvori vedhenget (140) har en vibrasjonsanordning (142).

35 **12.** Stimuleringsanordning (1) ifølge ett av kravene 1 til 11, hvori vedhenget (140) er montert på delen av huset (8) som rommer det trykkfeltgenererende arrangementet (2), slik at huset (8) av stimuleringsanordningen (1) er enhetlig i form.

- 13.** Stimuleringsanordning (1) ifølge hvilket som helst av kravene 1 til 12, hvori vedhenget (140) er et langstrakt, linseformet legeme som er tilpasset slik at vedhenget (140) kan settes inn i den kvinnelige skjeden.
- 5 **14.** System med en stimuleringsanordning (1) ifølge ett av kravene 1 til 13, med: en fjernkontrollanordning anordnet separat fra stimuleringsanordningen (1), hvori styreanordningen (7) til stimuleringsanordningen (1) kan fjernstyres av fjernkontrollenheten.

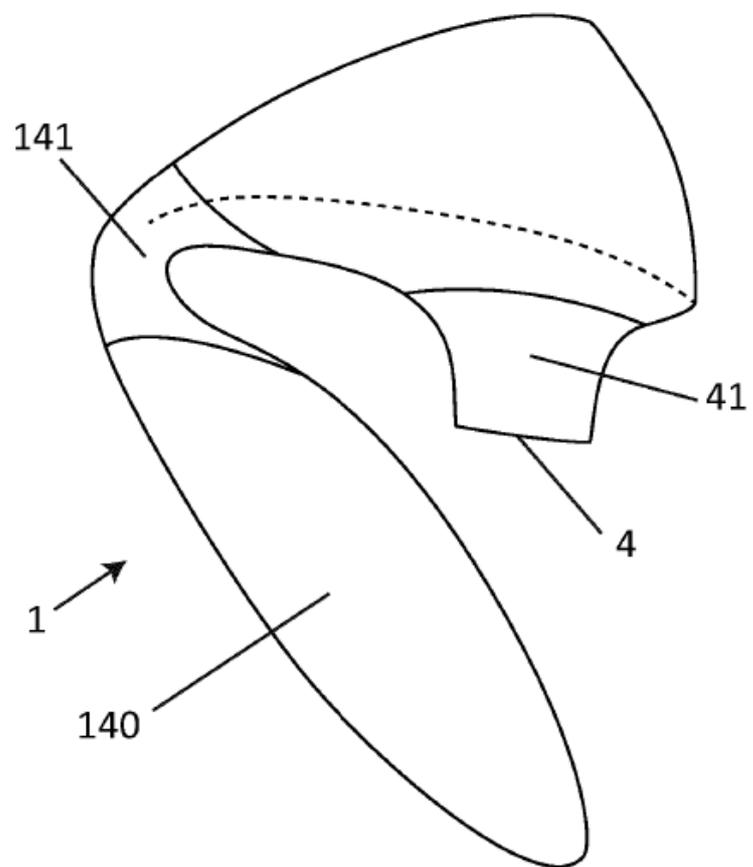
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Fig. 1



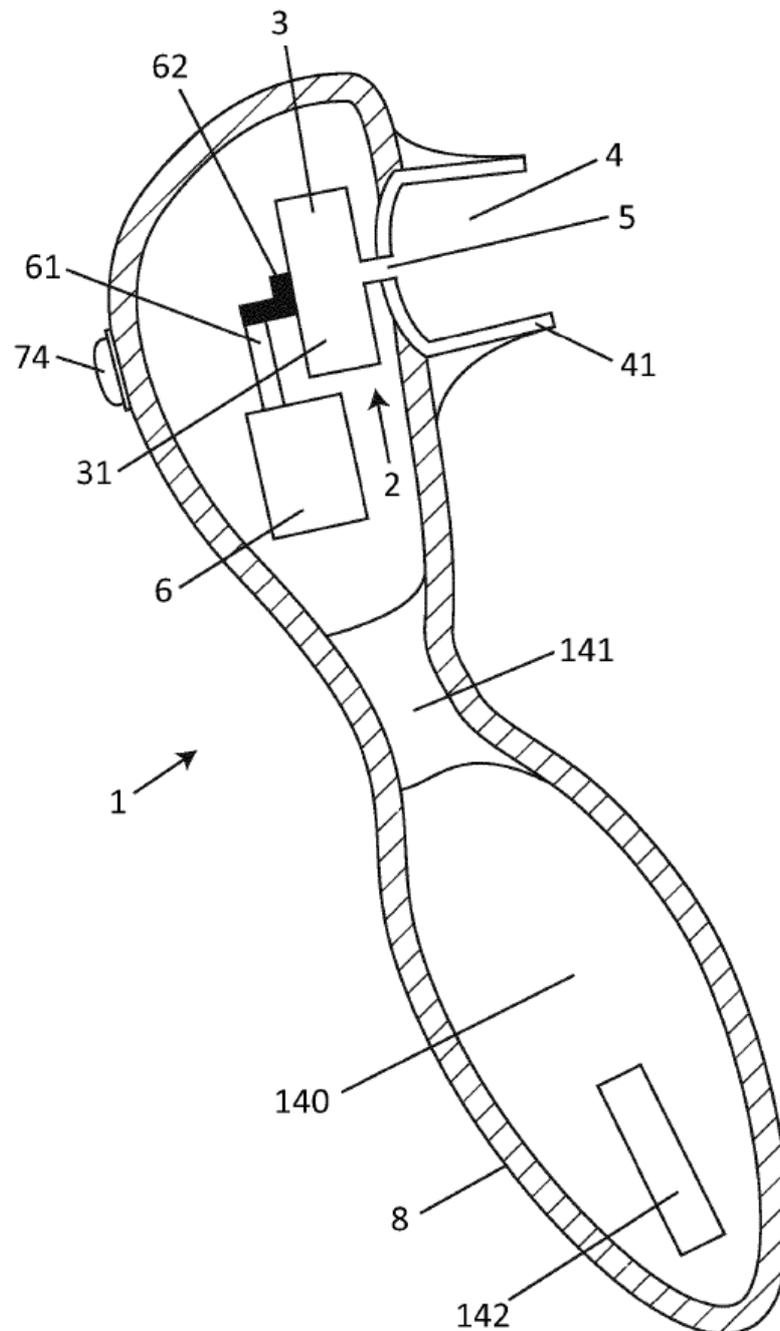
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Fig. 2



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Fig. 3





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Fig. 7

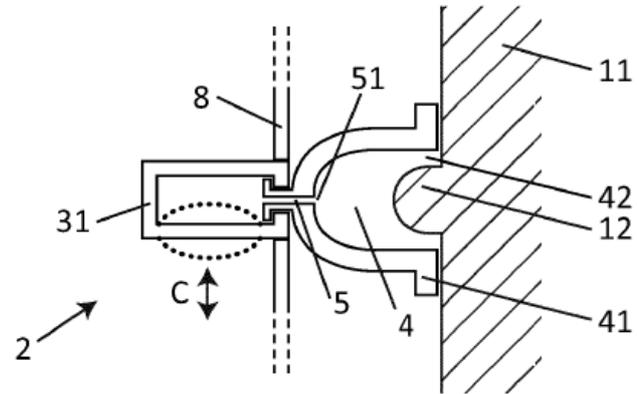


Fig. 8

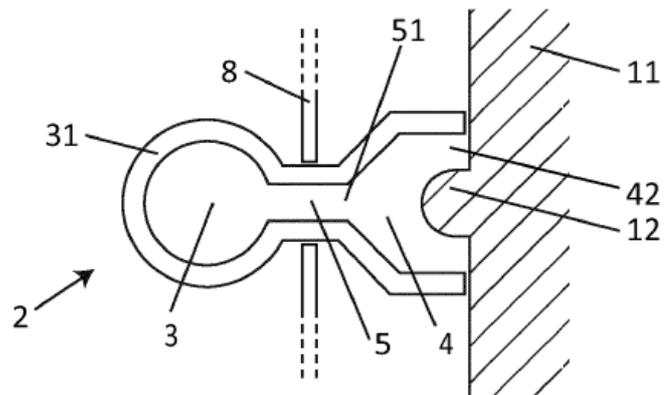
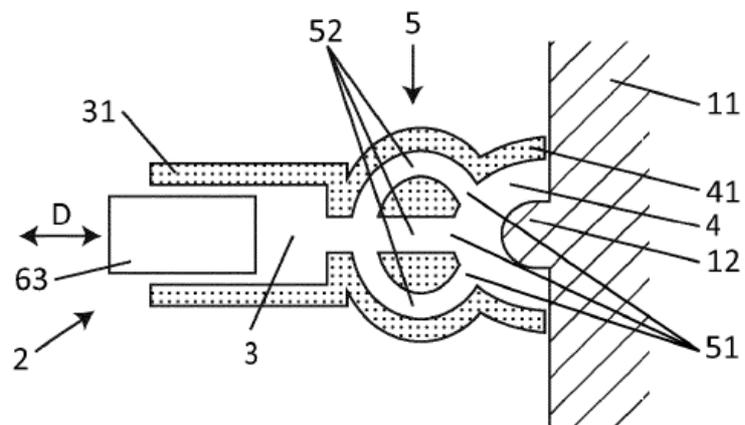


Fig. 9



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Fig. 10a

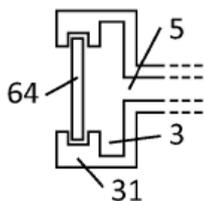


Fig. 10b

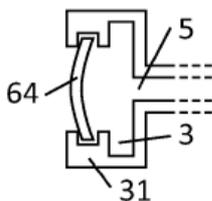


Fig. 10c

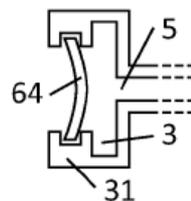


Fig. 11

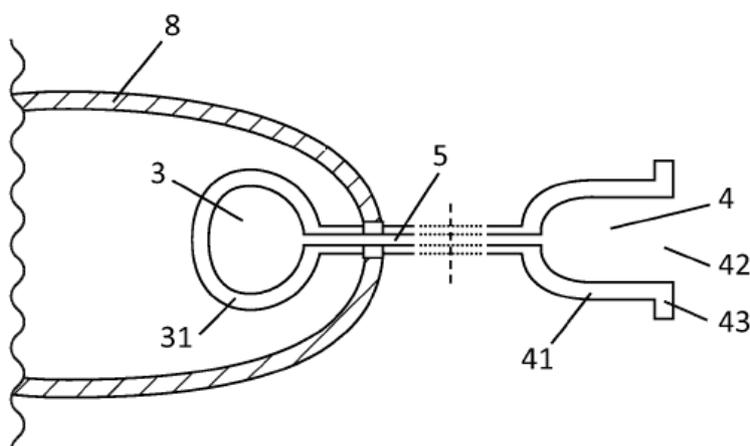


Fig. 12a

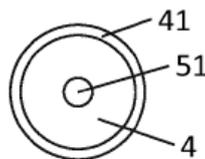


Fig. 12b

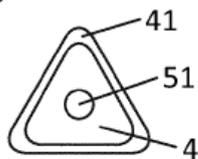


Fig. 12c

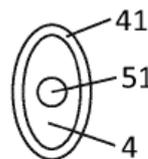


Fig. 12d

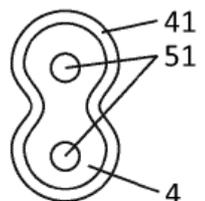


Fig. 12e

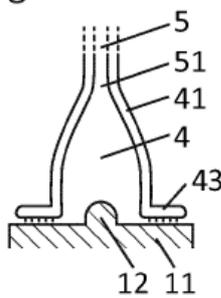


Fig. 12f

