

Apparatus For Nuclear Magnetic Resonance Therapy

5 Description

Field of the invention

10 The invention relates to a device for nuclear magnetic resonance therapy and a process for the control of the device. The invention relates in particular to a device for the treatment of degenerative changes in the skeletal and musculoskeletal system, damage to ligaments, muscles, sinews and nerves, pathological changes in spinal discs and
15 vertebrae, sports injuries and injuries caused by accidents, pathological changes in the bony structures, and for the treatment of patients with arthrosis.

Background to the invention

20 Devices for nuclear magnetic resonance therapy are known. In particular, the document DE 10 2009 060 544 B4 shows a device for the creation of nuclear magnetic resonance in the tissue due for treatment.

25 This is a device which creates a magnetic field with a uniform field strength in a treatment area. This magnetic field is overlaid by an alternating field irradiated at right angles to the magnetic field. A "sweeping" of the
30 first field in the form of minor changes in the field strength, for example in the form of a saw tooth, produces a resonance condition at every cycle. It has also been shown that this so-called sweep frequency, via which a

rapid adiabatic resonance is achieved, contributes to the success of the treatment.

Contrary to imaging magnetic resonance scanners, devices
5 which create nuclear magnetic resonances for therapeutic or cosmetic purposes generally work with relatively low field strengths, in particular with field strengths which lie in the mT area.

10 In contrast to the processes for nuclear magnetic resonance therapy mentioned above, other processes are known in which a part of the body to be treated is placed inside an air-core coil whereby a pulsating direct current flows through the air-core coil. The magnetic field is therefore uniform
15 inside the coil. In particular, alternating magnetic field is present. Thus in devices according to this principle, which is also known as the "PST process" (PST = pulsating signal therapy), this is a different field of activity and application in which nuclear magnetic resonance therapy is
20 fundamental.

Object of the invention

In contrast to the prior art described earlier, the
25 invention is based on a device for the further improvement of nuclear magnetic therapy.

One particular object of the invention is to enhance therapeutic outcomes, particularly in the case of
30 degenerative changes in the skeletal and musculoskeletal system, damage to ligaments, muscles, sinews and nerves, pathological changes in the spinal discs and vertebrae, sports injuries and injuries caused by accidents,

pathological changes in the bony structures as well as for the treatment of patients with arthrosis.

Summary of the invention

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The object is solved by a device for the purpose of nuclear magnetic resonance therapy, by a module, particularly for the creation of a cyclical or permanently metered stretching of a user, as well as by a process for the control of a device with the purpose of nuclear magnetic resonance therapy according to one of the independent claims.

The preferred embodiment and development of the invention can be taken from the subject matter of the dependent claims.

The invention relates to a device for nuclear magnetic resonance therapy. This comprises an entity for the creation of an alternating magnetic field as well as an entity for the creation of a field running transversely to the alternating magnetic field, in particular a sweep field.

The device for the creation of an alternating magnetic field comprises in particular a coil. The coil can, for instance, be arranged below a table on which the user lies during the treatment.

In order to create a sweep field the apparatus can comprise in particular two coils arranged in a Helmholtz configuration. The spools are activated in such a manner that the magnetic field created internally which is uniform

has a basic value which is periodically raised and lowered. It is obvious that in the case of this configuration it is also possible to create the basic value wholly or partially by the incorporation of permanent magnets.

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In particular the apparatus takes such a form that the sweep field is modulated in the form of a saw tooth profile in which the alternating field is switched on during the falling flanks of the sweep field.

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The device according to the invention also comprises an apparatus which provides a static stretching or an impulsed stretching of a user which can preferably be set in a metered or controlled manner. An apparatus for stretching a user is understood to be an entity by means of which a tractive force, in particular a pulsed or permanently constant force, is imposed in a longitudinal direction on parts of a patient's body.

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The apparatus to stretch the user particularly comprises preferably differently shaped straps and fastenings which can be applied, as well as at least one pulling device for at least one strap.

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According to one embodiment of the invention at least one strap is equipped with an electrical or mechanical release system or rapid release system. The release procedure can be signaled by an acoustic signal or an optical message to the technical staff or the doctor treating the patient.

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The strap is released when a maximum force determined by the design and/or an adjustable maximum force is reached.

In this way an unintentional over-stretching of the user can be avoided.

A further safety release can be achieved by means of sensors applied to the skin of the back or via other
5 measuring devices, for example by measuring the muscle contraction.

According to one embodiment of the invention, the pulling device is electrically powered and is therefore able to
10 automatically apply, particularly, a pulsating and/or controlled permanent tractive force to the user, preferably at an impulse frequency range of 0-1 kHz, in three directions or on three planes. The degree of the displacement can be displayed by means of an acoustic or
15 optical feedback.

As primarily the lumbar vertebrae and the cervical vertebrae are reported to respond to treatment in the event of herniated discs, the individual reclining surfaces can
20 be adjusted to meet these requirements. In an embodiment which can have up to five or more than five individual reclining surfaces, a transversely arranged bearing point or bearing post is positioned in the middle of each board so that the individual boards of the reclining surface can
25 be moved mechanically or electrically. In this way a part of the spinal column, or particularly individually affected vertebrae, can be specifically reached in the best possible quality and intensity of the stretching for the affected vertebra.

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The apparatus for stretching is particularly designed such that by means of the apparatus according to one embodiment the patient's spinal column can be moved and/or stretched

in three planes In order to achieve this, the apparatus comprises straps which can be fastened around the upper body and hips as well as the feet and head area of the user. Certain straps are equipped with an electrical or
5 mechanical release or rapid release system whereby an unintentional over-stretching of the user can be avoided.

In a further embodiment of the invention the apparatus is configured to stretch the user's legs. To achieve this, the
10 apparatus includes a strap which is placed around the hips as well as straps and loops which can be placed around the user's ankles.

The tensioning movement can also be executed mechanically
15 or electrically in three planes or directions by means of a spindle drive.

Thus vertebral displacements or muscular tension can be included in the therapy program.

20

Injuries to the vertebrae or muscles that occur frequently in sports injuries or accident injuries can also be treated by this means.

25 Archived necessary therapeutic movement sequences during the treatment by the movement and supporting apparatus can be implemented safely, effectively and without problems in this way.

30 It is also possible to stretch the patient's entire body in which a strap retaining system is fastened in the area of the head, forehead and chin or a strap is secured round the upper body and two further straps round the ankles.

It is evident that the straps can have any form and that, in particular, solid components that can be placed around the body can also be used.

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The knowledge is fundamental to the invention that particularly in the treatment of degenerative changes of the skeletal and locomotor system, damage to ligaments, muscles, sinews, tendons and nerves, pathological changes
10 in the spinal discs and vertebrae, sports injuries and injuries caused by accidents, pathological changes in the bony structures as well as for the treatment of patients with arthrosis, there is a synergy effect concerning the creation of nuclear magnetic resonances in the region of
15 the tissue to be treated, in particular in the regions of the bones, cartilage, muscles, tendons and nerves to be treated as well as in disorders of or damage to the spinal column, at the same time as contemporaneous mechanical stimulation by permanent or pulsating vibrations in the
20 area of 0-1 kHz as stretching in the parts of the body that are affected and that this effect leads to a distinctly faster regeneration of affected tissue.

Thus vertebral displacements or muscular tension can be
25 included in the therapy program.

Injuries to the vertebrae or muscles that occur frequently in sports injuries or accident injuries can also be treated by this means.

30 Archived necessary therapeutic movement sequences during the treatment by the movement and supporting apparatus can be implemented safely, effectively and without problems in this way.

More recent investigations and studies show that as a result of the nuclear magnetic resonance effect disrupted cycles of the circadian rhythm of cells are resynchronized, pathological conditions are beneficially influenced and the ATP as well as the oxygen level in the cells are increased, all of which provides major beneficial support to cell metabolism.

10 Mechanical pre-tensioning by traction or pulsating vibrations during and as a supplement to nuclear magnetic resonance treatment very significantly increases the piezo-electrical effects in joints and areas of the bones by tensioning and pressure (movement) and thus increases the metabolic process in the affected tissue.

In an embodiment of the invention the apparatus for stretching the user includes one or at least one board which can be moved in a linear direction by a spindle which in an embodiment can be moved in three planes or three directions to stretch the user.

The apparatus for stretching the user comprises in particular at least one board which can be moved in a linear direction and which can also be moved by one or more spindles vertically and/or horizontally or moved in in a linear direction in three planes or three directions as a movable head part, middle part, foot part or front part of the reclining area to stretch the user.

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As it is said that particularly the lumbar vertebrae and the cervical vertebrae respond to treatment in the event of a herniated disc, the individual reclining areas can be

adjusted to suit these requirements. In an embodiment which can have up to five or more than five possible individual reclining surfaces, a transversely arranged bearing point or bearing post is positioned in the middle of each board so that the individual boards of the reclining surface can be moved mechanically or electrically round the axis of the support point. In this way a part of the spinal column, or particularly individually affected vertebrae, can be specifically reached in the best possible quality and intensity of the stretching for the affected vertebra. A section of a reclining surface can be made available by the board. The board is, in particular, provided with holding or retaining points or other retaining facilities such as eyelets through which a strap can be threaded.

It is particularly anticipated that for the purpose of nuclear magnetic resonance therapy the device comprises at least two or more boards which in one embodiment can be moved vertically and/or horizontally or in three planes, of which at least one board can be moved by one or more spindles in a linear direction manually, mechanically or by means of electrically powered motors.

In one embodiment of the invention the board/boards are positioned using the spindles by at least one activating device at the head or foot end or at one side of the reclining or traction module.

The tensile force of the traction is controlled by a pressure cell, a strain gage or tensile force measuring device. The tensioning or stretching length can be set in the range from 0 to 30 cm or more via an analogue or digital measuring scale.

According to one further embodiment of the invention the tensile force, the twist points, the length of the extension, the torsion and/or the impulse frequency can be controlled in particular using an electronic chip card reader. In particular, several servomotors or step motors can be activated and program cycles saved. In addition, information concerning the torsion, the length of the path or tension and the angle of traction, a tensile force of the traction from 0 - 60 kg, a pulsating traction movement between 0-1 kHz, time sequences, protective safety devices and an emergency stop switch, ergonomic changes in the reclining surface and/or the changes in height in the foot and the head part can be saved in the control device. Each of these can be allocated to patient data stored in the memory. Thus individual treatments can be easily guaranteed.

The values before and/or during the treatment can be set, amended and controlled via a control computer preferably with a display.

In a preferred embodiment these values can be established automatically before the treatment by means of sensors on the patient who is about to be treated and the corresponding data saved automatically via the device's electronic system or the chip card relevant to the treatment.

The data about the settings for the above-mentioned values are saved for each patient in an electronic memory or on a chip card; this ensures that the settings can be reproduced before and during the treatment and the course of the

treatment. Consequently the device can be switched off manually and electronically via sensors.

5 The user can, for instance, be secured on a board, in particular a central board, in particular with adjustable fixing devices, for example at the hips. On a different board the user can be secured either at the legs or shoulders or head.

10 In addition, the device according to the invention includes a retaining strap system designed to be applied to the forehead or head. This can be a collar which is applied to the chin and forehead and which secures the head and enables tension to be applied via the cervical vertebrae.

15 By means of a displacement of one board compared with other boards the user can be stretched either permanently or in pulses either with or without the nuclear magnetic resonance system.

20 The boards are preferably provided with padding, in particular with foamed plastic.

25 One or more protective joint components below or between the boards, e.g. in the form of rubber or plastic lips or bellows, can ensure that no dirt can fall through the gap between the boards and into the treatment device positioned underneath.

30 The location and position of the movable boards can be changed, in particular by means of one or more drives on the end.

In particular, provision is made for a drive with a threaded spindle by means of which the position of one board can be changed and/or moved either manually or by means of an electric motor, particularly permanently or in pulses, in a linear direction in different planes or directions.

In one embodiment of the invention the drive, particularly a threaded spindle or a bar to move the movable board is arranged at least in sections under a different and non-movable board.

It is particularly anticipated that the drive is arranged on the front, that is to say in front or at the rear or on one of the longitudinal sides on the device for nuclear magnetic resonance therapy whereby a central or one or more end boards can be moved by a mechanism arranged under a fixed board.

In this way an operating device can be advantageously provided which is arranged at the front or the rear of the device for nuclear magnetic resonance therapy, that is to say at the side from which the user is stretched and also from which the strap is normally applied.

In a development of the invention the device for stretching the user takes the form of a module capable of being positioned on a casing.

According to a further embodiment of the invention the board of the foot part is connected to an air bag, plastic bag or bellows which can be filled with air or liquid by electrical or mechanical means to lift the foot part

vertically by between 1 and 60 cm compared with the rest of the reclining surface.

5 A corresponding mechanical, electrical or electronic device can be provided for this purpose.

This function can also be achieved by means of, for example, a mechanical scissor lift, a telescopic arrangement or similar lifting system that can specifically
10 raise the foot part.

This device relieves the load on the spinal column in the event of a disorder or injury of a spinal disc.

15 In this way no other supports such as cube-shaped pads or similar are needed during treatment, thus significantly increasing the patient's comfort while he/she is lying down.

20 According to a further embodiment the head part can be raised by an air bag, plastic bag or bellows which can be filled manually or by means of a mechanical or electric air or liquid pump. The head area can be supported in this way. The volume of air for lifting the head or foot can be
25 controlled and monitored by an electronic or mechanical manometer or other pressure measuring system

According to one embodiment of the invention a module is provided which comprises a frame to which at least one
30 movable board is allocated.

In this way that device for stretching the patient can be supplied as a retrofitting set which replaces the pad of the device or which is placed under the pad of the device.

- 5 In particular the device for stretching the patient takes such a form that a periodically changing force can be created by a pulling device.

10 By means of a periodically changing force which, for example can be created by an electrical drive and corresponding control system, a vibration is concentrated on the regions of the body to be treated and the cartilage and tissue is stimulated by nuclear magnetic resonances during the treatment in such a manner that the division
15 rate and therefore the formation of body cells is significantly improved in the most varied types of tissue to be treated

The frequency of the periodically changing force is
20 particularly between 0.01 and 1 kHz.

In a development of the invention the device for stretching the user comprises an actuator for creating a vibration applied to the pulling device.

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This embodiment of the invention therefore relates to a device having a pulling device for creating a force and a further actuator for concentrating vibrations which are superimposed on the force created by the pulling device.

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Mechanical eccentric discs with lifting rods are possible for creating the traction.

In this embodiment the traction speed can be controlled electrically, mechanically or electronically.

5 Actuators are provided which include a weight that can be magnetically stimulated to vibrate. Moving coil actuators can, in particular, be used.

It is certainly also possible to create a periodically changing force using an electrically powered device.
10 However, a change of force with a very high frequency can be created in a much simpler manner using an actuator without the danger that this is severely weakened by attenuation within the pulling device.

15 This applies in particular if the actuators are installed relatively close to the straps for the user or are integrated into the straps. The distance of the actuator from the strap is preferably less than 50 cm.

20 The actuator is particularly designed to vibrate with a frequency of between 0.1 and 1 kHz, preferably between 1 and 200 Hz

In a development of the invention the device comprises a
25 control device for the entity to create the alternating magnetic field and for the sweep field which is also designed to control the device for stretching the user at the same time.

30 All treatment parameters can in this way be easily entered via a single control device and, if necessary, automatically entered e.g. by means of chip cards or storage devices.

It is also possible that there is a beneficial effect on the success of the treatment if the frequency with which the force used to stretch the user is modulated and
5 synchronized to the frequency of the sweep field. By this it is also understood that the frequency with which the stretching force is modulated is a full multiple or a fraction of the frequency of modulation of the sweep field.

10 It is particularly anticipated that the force for stretching the user is modulated in such a manner that this force increases or decreases always in the falling flanks of the sweep field.

15 In a preferred embodiment of the invention the device for the nuclear magnetic resonance therapy is designed as a table whereby two side parts are arranged at the side of the table, each of which include a coil. These coils positioned at the side are arranged in a Helmholtz
20 configuration and create the sweep field. An alternating magnetic field is irradiated transversely into the sweep field by at least one coil under the table.

The invention also relates to a module for stretching a
25 user which can be used in particular for a device for nuclear magnetic resonance therapy as described above.

The module particularly takes the form of a retrofit set capable of being positioned on a casing of a device for
30 treatment with nuclear magnetic resonances.

The module comprises a frame capable of being positioned on a casing with at least two boards, preferably three boards,

which form a reclining surface whereby one of the boards can be moved in relation to the other board or boards by means of a drive.

5 In a further embodiment the module comprises three or more than three and in particular five boards whereby at least one central or front board or each of the boards can be moved, in particular on rails which are arranged on the frame, in particular by means of a drive having a spindle
10 or bar running at least in sections under a fixed board.

A strap can be attached to the movable board and to at least one of the other boards.

15 The user can then be stretched in measured amounts by the displacement of the one board compared with the other boards.

In one embodiment the module comprises at least two boards
20 whereby one, particularly a central board or several boards, can be moved.

According to another embodiment one or more end boards can be moved.

25 In particular in the embodiment with a central movable board, it is possible for a part of the drive, in particular a device for measuring force, to be located under one of the non-movable boards. In this way a compact
30 configuration is achieved.

The movable board or boards can be moved in particular on rails which are arranged on the frame.

A spindle drive is particularly used as the drive.

5 The length of the stretching and the force of the impulses
and/or the tensile forces can be preferably monitored and
checked by suitable measurement and control devices; a
status display in an acoustic and/or optical form is
possible and provided in specific embodiments.

10 The invention also relates to a process for the control of
a device for nuclear magnetic therapy, in particular of a
device described above.

15 An alternating magnetic field and a static sweep field
transverse to the alternating field are created by a
control device. Nuclear magnetic resonances are created in
the tissue of a user by means of these magnetic fields. At
the same time the user is stretched by a pulling device
activated by the control device during the creation of the
20 nuclear magnetic resonances.

The control device is programmable in particular with
regard to the duration of the treatment, the frequency of
the modulation of the sweep field and, optionally, also the
25 frequency of the modulation of the force exercised by the
device to stretch the user.

In particular, provision is made for the automatic
termination of the treatment. The pulling device is also
30 preferably switched off automatically

Provision is also made in particular for the coordination
of the frequency of the modulation of the force used to

stretch the user with the frequency of the modulation of the sweep field, for example in the form of a whole number fraction or a multiple.

5 Brief description of the drawings

The intention is to describe the invention in more detail below with reference to the embodiments by referring to the drawings Fig. 1 to Fig. 10.

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Fig. 1 shows a perspective view of an initial embodiment of a device for nuclear magnetic resonance therapy.

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Fig. 2 shows a further perspective view of a variant of the embodiment which also comprises actuators for concentrating a vibration on the pulling device.

Fig. 3 is a detailed representation of Fig. 2.

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Figures 3 to 6 show a further embodiment of the invention in which the device for stretching the user is shown as a module which can be retro-fitted.

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Fig. 4 is a perspective view of the device fitted with the module for nuclear magnetic resonance therapy.

Fig. 5 is a sectional view along the main direction of stretching.

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In a perspective view Fig. 6 shows the module that can be retrofitted.

A further embodiment of a device according to the invention for nuclear magnetic resonance therapy is shown in more detail in Figures 7 to 10.

5 Fig. 7 is a perspective view.

Fig. 8 is a plan view and a side view including a detailed representation of a scale.

10 Fig. 9 is an axial sectional view of the device.

Fig. 10 shows an exploded representation of the components of the module which is used for stretching the user and represented in Figures 7 to 10.

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In a further exploded drawing Fig. 11 shows the components of the module used for the device represented in Figures 7 to 10 for stretching the user in which the stretching can be set in three planes or directions.

20

Detailed description of the drawings

Fig. 1 shows a diagrammatic perspective representation of a device for nuclear magnetic resonance therapy 1.

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The device for nuclear magnetic therapy 1 comprises a table 2 on which the user can lie and rest his head on the head support 4.

30 The device includes the two side parts 5 and 6 which in this embodiment are curved in shape and which are arranged at the edge of the table 2.

Table 2 and side parts 5 and 6 are arranged on a support 7 on which a control device 8 is also arranged.

5 A coil is located in each of the side parts 5 and 6. The sweep field is created by these coils. The coils (not represented) are activated by the control device.

10 A further coil (not represented) is arranged under the table 2 and creates an alternating magnetic field which overlays the sweep field at a right angle.

The device for nuclear magnetic resonance therapy also includes a device for stretching the user 3. This comprises a strap 9 which is positioned around the user's hips and a
15 strap 10 which is positioned under the shoulders and around the upper part of the user's body.

The strap 9 is connected via a connecting strap which runs over pulleys 13 at the end of the table with a pulling
20 device 12 which is powered by a motor.

It is to be understood that the connecting straps 11 can have any design and that ropes or chains are possible.

25 The pulling device 12 is also activated by the control device 8. The straps 9 and 10 can be pulled in opposing directions and thus exercise a force on the user's spinal column 3.

30 In this embodiment of the invention the strap 10 is also connected to a further pulling device (not represented) via a connecting strap 11 which runs over pulleys. However, it

is to be understood that one pulling device is sufficient to apply a force.

5 The use of the pulleys has the advantage that the pulling device 12 does not have to be mounted on or directly adjacent to the table.

10 In particular it is also possible in the case of a pulling device with a compact form that the pulleys 13 are not needed and the pulling device can be located at the end of the table.

15 The control device 8 includes an operator interface or a slot for a chip card by means of which a treatment can be started and executed automatically. At this time the control device 8 controls both the sweep coils located in the side parts 5 and 6 and the coils for creating the alternating magnetic field as well as the pulling device 12.

20 Thus, a periodically changing force can be created in particular by means of the pulling device 12. This force can in particular be synchronized with the modulation frequency of the sweep field.

25 Fig. 2 shows a variant of the embodiment which corresponds to Fig. 1 except for the differences described below.

30 Unlike Fig. 1, the user's legs are stretched in the representation in Fig. 2. In order to achieve this, the device for stretching comprises the strap 9 which is fastened around the user's hips and the straps 14 which are fastened around the user's ankles.

The side parts 5 and 6 are now arranged in the region of the user's legs.

5 It is also possible in particular that the side parts 5 and 6 are arranged so they can be moved in relation to the table. In this way the device can be altered to treat legs or the spinal column.

10 It is to be understood that an alternating coil must be located under the legs. In order to achieve this, it is conceivable that either the alternating coil must be designed to be movable or that several alternating coils are to be provided under the table.

15 Fig. 3 shows a detailed representation of Fig. 2 in which it can now be seen that the connecting strap 11 includes actuators 15 which are arranged directly next to the straps 14 which are fastened around the ankles.

20 It is also conceivable that the actuators 15 can be integrated into the straps (not represented).

25 Seen from the pulling device 12, the actuators are consequently arranged after the pulleys and thus close to the user.

The actuators 15 operate for example on the electromagnetic principle and are for example arranged as moving coil actuators. A periodically varying force can be created by
30 the actuators by periodically moving a weight to and fro; this force is overlaid with the force of the motorized pulling device 12.

To achieve this, in this embodiment the actuators 15 are connected with the control device (8 in Fig. 11) via the pulling device 12. In particular, vibrations of a higher frequency can be created via the actuators to modulate the force. On the one hand this would be more difficult via the pulling device 12 which is powered by a motor and in particular in the case of higher frequency vibrations there would be the danger that as a result of damping effects in the connecting straps 11 the modulation of the force would no longer reach the straps 14.

In a perspective drawing Fig. 4 shows a device 1 for nuclear magnetic resonance therapy 1. In this embodiment the table of the device for nuclear magnetic resonance therapy is formed by the boards 17a to 17c.

The central board 17b is designed to move in relation to the other boards 17a, 17c.

It is to be noted that the boards 17a to 17c can include a padding which is not shown here.

In an embodiment shown in Figure 5 which comprises not only the boards 17a to 17c which are explicitly shown but can also comprise up to five or more boards as possible individual boards, thus two or more additional boards but which are not shown in Figure 5 for the sake of simplicity, a transverse bearing point 44 or bearing post 44 is provided in particular at a right angle to the longitudinal direction of the boards 17a to 17c in order to enable a displacement, in particular a tilting of the individual boards of the table around the axis of the bearing point 44 and hence in a positive or negative direction of the arrow

X shown in Figure 5 by mechanical or electrical means. In this way it is possible to specifically reach a portion of the spinal column and in particular to reach individually affected vertebrae in the best possible quality and
5 intensity of the stretching for the affected vertebrae.

In order to make tilting of this nature possible, the assemblies located under the module 30 or the table 1 can be positioned somewhat lower than shown in the drawings and
10 in this way do not have to be in the way of the tilting.

Because of the sweep field this is not important for the overall resultant field configuration and the success of the treatment being sought.

15

In this embodiment of the invention the device for nuclear magnetic therapy 1 comprises the side parts 5 and 6 which are arranged on a movable carriage.

20 Coils capable of creating a magnetic field extending transversely to the table are again to be found in the side parts 5, 6.

A further coil (not represented) is located in the carriage
25 16 under the table. An alternating field is directed by this coil into the treatment zone which runs transversely to the field and which is created by the coils located in the side parts 5, 6.

30 In order to stretch the user, the boards 17b and 17c have eyelets through which straps can be passed.

In an embodiment of the invention it is also envisaged that one of the boards is provided with an elevation, particularly an elevation in the form of a wedge (not represented) on which the user can elevate his feet.

5

In order to stretch the user, the middle board 17b can be moved horizontally by activating a drive 19 arranged on the end.

10 The drive is preferably designed in such a way that the distance of movement is restricted to less than 50, preferably less than 5 cm to ensure that the device 1 is safe even in the event of errors by the user.

15 In this embodiment the mechanism for stretching the user is designed as a module which can be retrofitted and which comprises a frame 27 with the boards 17a to 17c which can be placed on the casing 15 of the device 1 for nuclear magnetic resonance therapy.

20

Fig. 5 is a sectional view along the main direction of stretching of the device for nuclear magnetic resonance therapy 1 shown in Fig. 4.

25 In particular the three boards 17a to 17c arranged behind each other can be seen; of these three, the middle board 17b can be moved horizontally.

The movable carriage with the side parts and a coil 31 for
30 creating an alternating magnetic field can also be moved.

The board 17b can be moved to and fro by means of the drive 19 arranged on the end.

Figure 6 is a perspective view of the module 30 which comprises a frame 27 which can be placed on a casing.

- 5 The front and rear board (17a and 17c in Fig 5) have been omitted from this view.

The center board 17b comprises guides 20 by means of which the center board 17b can be moved along the frame 27 on
10 rails 26.

The rails 26 are mounted on the frame.

The drive 19 is mounted on a strut 29 of the frame in order
15 to move the center board 17b.

The drive 19 comprises a spindle 28 by means of which a carriage 22 can be moved.

20 The carriage 22 which is located under the front board (17c in Fig. 5) is linked to the center board 17 by means of a connector 24 via a bar 25.

Thus the carriage 22 is moved by the drive 19 and then
25 itself moves the movable board via the bar 25.

The module 30 also comprises a force measurement device.

In this embodiment the force sensors 23, in particular
30 formed as S-shaped load cells, are mounted on the carriage 22.

The force measurement device is therefore preferably also placed under a board (17c).

5 The force measured by the force sensor 23 is shown on a display 21.

The display 21 can take the form of a force display and/or a position display.

10 In particular, the upward movement by which the center board 17b is moved can be determined by the display 21.

It is also possible to provide the display 21 with an operating device via which, for example, a program can be
15 started which periodically moves the board 17b by means of a drive powered by an electric motor.

A control device (not represented) for the drive can in particular also act in conjunction with the force sensor
20 23, for example in such a way that the upward movement is controlled as a function of the force.

Fig. 7 shows in a perspective drawing a device 1 for nuclear magnetic resonance therapy which comprises side
25 parts 6 corresponding to the embodiments described earlier.

The opposite side part has been omitted in this view to improve clarity.

30 The device 1 for nuclear magnetic resonance therapy is also modular in design and comprises a table composed of the pads 32a and 32b.

The table is therefore divided into two areas which can be moved in relation to each other to stretch the user.

A strap 9 is positioned under the pad 32a.

5

Two straps 10 which are spaced apart from each other lie over the pad 32b.

10 The pads 32a and 32b are part of an attachable module which is represented in a plan view and a side view in Fig. 8.

The module 30 includes the rails 34a and 34b on which the pads 32a and 32b are arranged.

15 It is possible to move the rail 34b and thus pad 32b, along with the straps, in relation to the pad 32a by means of a drive 19, shown in this embodiment as a manual drive.

20 In this embodiment the drive 19 can be positioned on the narrow end of the module 30.

As can be seen in the detailed representation of area A below on the right, a scale 33 is positioned at the edge from which the movement of the carriage, which is
25 positioned on the rails 34b, can be read

Thus the stretching of the user can be read off via the scale 33.

30 Fig. 9 is an axial sectional view of the module 30.

The board 36b is positioned on the rails 34b over the bearing 35 such that it can be moved in a linear direction.

The board 36b can thus be moved with the pad 32b.

Fig. 10 is an exploded representation of the components of
5 the module.

The rails 34a are part of a frame on which a head part with
the pad 32a and the board 36a can be placed.

10 In this embodiment this head part is connected rigidly with
the remainder of the device for nuclear magnetic resonance
therapy and is therefore not moved for stretching the user.

On the other hand the board 36b is movable along the main
15 stretching direction on the bearings 35 in an axial
direction; in this embodiment this movement is achieved by
means of the spindle drive 19.

The two parts with the pads 32a and 32b which can be moved
20 compared with each other are connected to each other by
means of the link 37 as shown in Fig. 8. The link 37 can,
for instance, take the form of a concertina-like foldable
plastic part which permits movement in several planes and
directions in relation to the other movable parts. The link
25 37 closes the gap between the parts which occurs during the
stretching in such a way that dirt and foreign bodies
cannot penetrate to the device underneath.

Although not shown explicitly in the Figures, a link of
30 this nature can be arranged between all the boards,
preferably in the longitudinal direction of the module 30
or the table 2.

Reference is made below to Fig. 11. In a further exploded representation this shows the components of the module which are used for the device represented in Figures 7 to 10 for stretching the user and in which, however, the stretching can be set in three planes or directions.

By means of further bearings 38 the head part with the pad 32a and the board 36a can be moved vertically in relation to their longitudinal direction, and thus in the linear direction of the arrow Y. By means of the bearings 39 and 40 the board 36b can also be moved vertically in relation to its main stretching direction and thus in the linear direction of the arrow Y

By means of the bearings 39 and 40 it is also possible to rotate the board 36b round in the direction of rotation indicated by arrow 40 at least in small angular ranges, particularly through a non-identical movement using the bearing 39 relative to the bearing 40. In the framework of the present disclosure it is possible to arrange the board 36b on a rotatable bearing in addition to or as an alternative to the bearings 38 and 39 in order to permit larger angles in the direction of rotation indicated by arrow 43.

25

The board 36b can be lifted or lowered in the direction of the arrow z with additional linear translators 42 at its distal end. If the linear translators 42 are activated differently, it is also possible to rotate the board in the direction indicated by the arrow 41.

30

Thus the board 36b can be moved independently in at least three directions of the space: the first direction is to be

understood as the direction along its longitudinal axis,
and the second direction the direction represented as
direction y in Figure 11, running horizontally and
transversely to its longitudinal axis, in particular
5 running horizontally to its longitudinal axis under a
vertical angle of 90° , and the third direction as the
direction indicated by the arrow Z in Figure 11 running
vertically and transversely to its longitudinal axis, in
particular under a vertical angle of 90° , whereby in this
10 direction preferably only the distal end of board 36b is
raised on which the linear translators 42 are arranged and
hereby the board 36b can be raised and lowered at its
distal end and thus its foot end.

15 In addition, the board can be moved independently also in
at least two directions which are orthogonal to each other.
These are the directions indicated by the arrows 41 and 42.
In avionics the direction of rotation indicated by the
arrow 41 is, for instance, also called a "roll" or "roll
20 direction" and the direction indicated by the arrow 40 is
also called "yawing" or "yaw direction".

In sum, the board can therefore be moved independently in
three orthogonal spatial directions, in particular defined
25 and set in their position.

It is in the framework of the present disclosure that
although the most preferred embodiment offers all the above
possibilities of movement, nevertheless all subordinate
30 combinations of the present disclosure which only present
one or a part of the possibilities of movement mentioned
above are included.

In particular, success in the treatment of patients with arthrosis can be significantly improved by the invention.

Reference number list

	1	Device for nuclear magnetic resonance therapy
5	2	Table
	3	User
	4	Head support
	5	Side part
	6	Side part
10	7	Support
	8	Control device
	9	Strap
	10	Strap
	11	Connecting strap
15	12	Pulling device
	13	Pulley
	14	Strap
	15	Casing
	16	Carriage
20	17a-17c	Board
	18	Eyelet for a strap
	19	Drive
	20	Guide
	21	Display
25	22	Carriage
	23	Force sensor
	24	Connector
	25	Bar
	26	Rail
30	27	Frame
	28	Spindle
	29	Strut
	30	Module that can be retrofitted

	31	Coil
	32a	Pad
	32b	Pad
	33	Scale
5	34a	Rail
	34b	Rail
	35	Bearing
	36a	Board
	36b	Board
10	37	Connection
	38	Bearing
	39	Bearing
	40	Bearing
	41	Arrow indicating a direction of rotation
15	42	Linear translator
	43	Arrow indicating a direction of rotation
	44	Bearing point or bearing bar
	X	Arrow indicating a direction, particularly a direction of tilt
20	Y	Arrow indicating a direction, particularly a direction of movement
	Z	Arrow indicating a direction, particularly a direction of movement
25		

Claims:

1. Device for nuclear magnetic resonance therapy,
comprising a device for creating an alternating
5 magnetic field, a device for creating a magnetic field
running transversely to the alternating magnetic
field, in particular a sweep field, as well as device
for stretching a user.
- 10 2. Device for nuclear magnetic resonance therapy
according to the above claim, characterized in that
the device for stretching the user comprises straps
for use as well as at least one pulling device for a
belt.
- 15 3. Device for nuclear magnetic resonance therapy
according to one of the above claims, characterized
in that the device for stretching the user comprises
a movable board, particularly a board taking the form
20 of a movable middle or end part.
4. Device for nuclear magnetic resonance therapy
according to the above claim, characterized in that
the board can be moved by a drive on the narrow end,
25 in particular a drive with a threaded spindle.
5. Device for nuclear magnetic resonance therapy
according to one of the two above claims,
characterized in that the device for stretching the
30 user takes the form of a module which can be placed
on a casing.

6. Device for nuclear magnetic resonance therapy
according to one of the above claims, characterized
in that by means of the device for stretching the
user a periodically changing force can be created,
5 particularly by a pulling device.
7. Device for nuclear magnetic resonance therapy
according to the above claim, characterized in that
the frequency of the periodically changing force is 5
10 to 1 kHz.
8. Device for nuclear magnetic resonance therapy
according to one of the above claims, characterized
in that the device for stretching the user comprises
15 an actuator for creating a vibration on a pulling
device.
9. Device for nuclear magnetic resonance therapy
according to the above claim, characterized in that
20 the actuator is designed to vibrate with a frequency
of between 1 and 500 Hz, preferably between 30 and 80
Hz.
10. Device for nuclear magnetic resonance therapy
25 according to one of the above claims, characterized
in that the device includes a control device for the
device for creating an alternating magnetic field and
for controlling the sweep field as well as
controlling the device for stretching the user.
- 30 11. Device for nuclear magnetic resonance therapy
according to the above claim, characterized in that a
frequency created by a pulling device is connected to

a frequency of the sweep field by means of the control device.

- 5 12. Device for nuclear magnetic resonance therapy
 according to one of the above claims, characterized
 in that the device for nuclear magnetic resonance
 therapy comprises a table for the user whereby two
 side parts each with a coil are arranged at the side
 of the table and form part of the device for creating
10 the sweep field and/or that the device for stretching
 the user includes a force measurement device.
13. Module for stretching a user, in particular for a
 device for nuclear magnetic resonance therapy
15 according to one of the above claims, having a frame
 which can be placed on a casing and having at least
 two boards which form a table, whereby one of the
 boards can be moved in relation to the other board by
 means of a drive.
- 20 14. Module for stretching a user according to the
 above claim, characterized in that the module
 comprises three or more than three, in particular
 also five boards whereby at least one middle or front
25 board or each of the boards can be moved, in
 particular on rails which are arranged on the frame,
 in particular by a drive which comprises, at least in
 sections, a spindle or bar running under one of the
 non-movable boards.
- 30 15. Module for stretching a user according to one of
 the two above claims in which at least one of the
 boards, preferably more than one of the boards, can

be moved independently in three spatial directions, whereby in one direction, preferably the vertical direction, the distal end of the board can be lifted, on which preferably linear translators are arranged and hereby the board can be raised and lowered at its distal end, consequently its foot end.

16. Module for stretching a user according to one of the three above claims in which at least one of the boards can be rotated also in at least two directions orthogonal to each other and independently of each other.

17. Module for stretching a user according to one of the four above claims in which the boards comprise in particular up to five or more individual boards, preferably each of them with a transverse bearing point or bearing bar arranged at right angles to the longitudinal direction of the board in order to enable a movement, in particular a tilting of the individual board or the table round the relevant axis activated mechanically or electrically.

18. Process for controlling a device for nuclear magnetic resonance therapy, in particular a device for nuclear magnetic resonance therapy according to one of the above claims, whereby an alternating magnetic field and a static sweep field transverse to the alternating field are created, by means of which nuclear magnetic resonances are created in the tissue of a user, whereby the user is stretched by means of a pulling device activated by a control device during the creation of the nuclear magnetic resonances.