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54 **Therapeutic water bed.**

57 A therapeutic water bed with a top surface adjustable between a completely soft condition for relief from pressure for patients who lie in the same position for a considerable time to a firm condition for nursing care and other treatments of the patient. The therapeutic water bed comprises a water container (1) open on top, with a cover (4) of a flexible, elastic material and an additional detachable cover (4a) of the same material, which can be exchanged with other covers of a different thickness for a possible adjustment of the double cover (4, 4a) to a patient's physical condition and/or weight. An inflatable air mattress (4) with a flexible, elastic top and a flexible, inelastic bottom is devised under the top cover (4). The bottom is attached by means of inelastic tape loops (8a) and stretching tapes (8) to a stretching device (7, 8) for stretching the bottom (5a) and thereby regulating the softness/firmness of the top surface (the double covers (4, 4a)). Said attachment and stretching of the bottom (5a) of the air mattress (5) prevent the occurrence of waves and undesirable movements in the top surface of the water bed.

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THERAPEUTIC WATER BED

The present invention relates to a therapeutic water bed of the kind disclosed in the preamble to the following independent claim 1.

5 A therapeutic water bed of the disclosed kind is, inter alia, known from the applicant's own Norwegian Patent No. 135 508. Such therapeutic water beds give a maximum relief from pressure for patients who lie in the same position for a considerable time. Particularly exposed are patients who are fixated in the same
10 position because of rheumatic diseases, muscular atrophy, back injuries, anesthesia from recent surgery, paralysis, etc. The lower the patient's blood pressure is, the lower is the capillary pressure (the pressure of the small blood vessels in skin and muscles), and the less is the amount of pressure against the body
15 which will result in compression of the blood vessels and hence in reduced blood circulation. The lower the blood pressure is, the greater is the chance of bedsores.

In order to reduce the pressure of the underlying surface against
20 the body, the weight of the body must be distributed over as large a part as possible of the supporting area. This is theoretically best obtained by lowering the body in water, which gives maximum buoyancy and even pressure. In practice, approximately the same effect is achieved by means of a water mattress.

25 The flexible, elastic rubber cover on a water mattress, as mentioned in said Norwegian patent, smoothly follows the shape of the body at the same time as the rubber cover insulates the body from the water. In addition, the rubber cover gives some extra
30 buoyancy, so that the patient "sinks" less below the surface of the water. Since the rubber cover is attached in a watertight manner to the edge of the water container and the volume of water does not fill the container completely, the water will rise in said container when the patient is laid on the water
35 mattress, without creating a tension in the supporting surface/ rubber cover, such as in the traditional water beds where the water is enclosed in a flexible, inelastic plastic bag.

At pressure measurements performed on the known water mattress, it has become apparent that at low blood pressure the thickness of the water mattress must not exceed 5 mm, to prevent that the resulting pressure against the body will exceed the capillary pressure of the blood vessels in a lateral or sedentary position.

Experience from using the water mattress has also shown that at maximum relief from pressure, that is, a supporting surface of maximum softness, an almost involuntary relaxation occurs in the patient. The result of this relaxation has been examined and shows, inter alia, lower blood pressure, lower pulse and deeper breathing in the patient. The water mattress with a thin rubber cover is now also used as a relaxation method in the treatment of nervous disorders and in inter alia, the alleviation of muscle pain, headache and other psychosomatic diseases, in that the patient lies on the mattress for one hour two to four times a day and, for sleep problems, one hour before bedtime.

Maximum relief from pressure is achieved when the thickness of the rubber cover in the top surface is below 5 mm. This thin and soft surface creates no problem for patients who are unable to move and need help to turn around. However, for patients who are able to turn around by themselves and who use the water mattress because of other diseases than bedsores and for relaxation, the soft surface creates a problem. The surface yields too much and "clings" to the body, making it almost impossible to turn by oneself. This gives unpleasant sensations when the patient will change his recumbent position during sleep. Patients who can move and who use the mattress in connection with, for example, various back injuries, burns and rheumatic diseases, benefit from the even support of the body, but they have problems in sleeping on the mattress since they are unable to turn around. These patients do not need to sink so far down in the mattress to achieve the desired, even support of the body.

Experience has shown that, as a supporting surface, a rubber

cover with a thickness of 5.5 mm is the lower limit for being able to turn around unaided. A rubber cover of 5.5 mm and thicker gives such an added buoyancey and firmness that a person can turn around by himself on the mattress. This lower limit
5 applies to persons who weigh less than 80 kg. For persons above 80 kg. the thickness of the mattress must be increased to around 7 mm.

The experience mentioned above has shown that one must be able
10 to vary the thickness of the resting surface, that is the rubber cover, based on:

1. The general condition of the patient
2. The form of treatment
3. The weight of the patient.

15 On the known water mattress this can be done by changing the rubber cover to the correct thickness, as required. This change of the rubber cover must take place in a simple and rapid manner. Such facilities demand a complicated sealing device, and the
20 change of the rubber cover also leads to unnecessary spilling of water. In a hospital where the water mattress is used for different purposes with regard to treatments and nursing care, this repeated replacement of the rubber cover will lead to practical problems.

25 It is very difficult to take care of patients on the soft surface of a water mattress, and it is, furthermore, almost impossible to give treatments, such as heart massage, physiotherapy and forms of treatment using apparatuses and other facilities. Here
30 one needs a firm and steady surface. In the water mattress described in said Norwegian patent, this is achieved by stretching built-in, transverse stretching tapes which support the mattress surface. In order to prevent that the surface becomes too hard, with the danger of bedsores at lengthy nursing care and treatment,
35 an air mattress, placed between the stretching tapes and the rubber cover, is inflated. Thus, one obtains a surface approximately like a foam rubber mattress on the bottom section of a regular bed. This air mattress lies loosely between the stretching tapes and the rubber cover and can also be inflated

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to increase the buoyancy when especially heavy patients shall sit on the mattress in bed. The greatest depth in the water container is here estimated for persons up to 120 kg.

5 In combining a water mattress with an adjustable support from an air mattress, which also can be inflated, possibly completely deflated, as desired, the water mattress can be used for relaxation therapy with a surface of maximum softness. The water mattress can thus be used for relaxation at fixed time periods during the day and by inflating the air mattress it will support 10 the soft surface and make it firmer so that the mattress can be used to sleep on at night with a somewhat reduced relaxation effect. This possibility leads to a greater utilization of the water mattress.

15 The experience from the known water mattress shows that the loose, inflated air mattress creates a firmer surface, but the surface becomes too unstable. The least movement will easily create uncomfortable and long-lasting waves in the mattress, and rolling lateral movements will easily occur. The air 20 mattress cannot, in this known water mattress, be tightly fastened to the sides of the water container, since it shall sink to the bottom when it is not in use in its deflated state. To attach the air mattress to the stretching tapes for the stretching device does not stabilize the air mattress either, 25 when the stretching tapes are slack. By stretching the stretching tapes to stabilize the air mattress, the stretching tapes will support the air mattress at those points which protrude most deeply into the water because of the load, while the rest of 30 the air mattress flows freely and follows the movements in the water.

The purpose of the present invention is to remove or reduce the above-mentioned disadvantages of the known water mattress, 35 viz., to prevent said uncomfortable and long-lasting waves in the water mattress and make it easier to vary the thickness of the rubber cover on the water container to achieve the desired support pressure in the flexible, elastic rubber cover on the

water container, the rubber cover constituting the supporting surface for the body.

This is achieved according to the present invention by means
5 of the characteristics which are stated respectively in the characterizing clause of the following independent claim 1 and in the characterizing clauses of the following dependent claims.

In the therapeutic water bed the problem of lessening or avoiding
10 undesirable movements in the top surface is solved in that the bottom of the air mattress also serves as the firm support for the top surface by fastening the stretching tapes used for the stretching directly along the side of the bottom of the air mattress. In inflating the air mattress, the top area is raised
15 straight up with minimum contraction (shrinking) of the air mattress in lateral and longitudinal direction because of the special construction which is disclosed in the characterizing clause. During the stretching by means of the stretching tapes, the air mattress will support the total top surface since
20 the stretched bottom will press the rest of the mattress upwards.

In this construction where the stretching device and the air mattress are executed as one unit, one can make a surface of maximum softness firmer and simultaneously steady by inflating
25 the air mattress and subsequently stretching the stretching tapes. At those points on the patient which protrude most deeply into the surface, such as head, shoulders, buttocks and heels, the pressure will be distributed along the bottom of the air mattress and distributed to several stretching tapes, and
30 one thus achieves a steadier mattress both in a lateral and longitudinal direction.

Because one can use the therapeutic water bed both for relaxation while awake, which proves to have the greatest effect,
35 and for sleeping at night, the bed is highly suitable for use, for example, in polyclinical treatments of various psychosomatic and nervous disorders, in that the patient can have the bed at home and use it regularly for relaxation and go to polyclinical

examinations and conferences with the attending staff.

The disclosure in the characterizing clause of the dependent claim 3 solves the problem of varying the thickness of the rubber cover by using two rubber covers, of which the bottom one, a 2 mm thick cover, is attached with a watertight seal to the upper edge of the water container and the top one is detachably fastened to the outer sidewalls of the container by means, for example, of a Velcro fastener. This second top cover can be comprised of neoprene rubber which is nylon reinforced on both sides. This second cover is available in different types of thickness and can easily be changed so that one in a simple way can get the correct total thickness on the top surface for the different purposes.

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Another advantage in using two rubber covers is the fact that it simplifies the cleaning of the surface since the upper cover can easily be changed and sent to the laundry and the dry-cleaning establishment if it becomes soiled by urine, defecation, pus from wounds or similar matters. The detachable cover can also be sterilized so that one more easily can provide a sterile top area which is necessary with large burns, wounds and the like.

Through these novel structural solutions according to the invention, viz. a two-piece surface area and a combination of stretching/air mattress, the therapeutic water bed according to the invention has become a simpler and better solution than the previously known water mattress at the same time as its area of utilization has become considerably enlarged, especially in that the therapeutic bed can be used for relaxation therapy in the homes.

The therapeutic bed can therefore become an important aid both for the purpose of treatment and for the prevention of, inter alia, diseases caused by mental stress.

An embodiment form of the invention will be described below,

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with reference to the figure, which shows an embodiment example of the therapeutic water bed in cross-sectional perspective.

The therapeutic water bed, as shown in the figure - without a
5 frame and/or legs - comprises a water container 1, for example cast in polyester plastic, reinforced with fiberglass, with water inlet/outlet comprising a faucet 2 with rapid coupling. The bottom 3 of the water container 1 is longitudinally and laterally shaped in such a way that it approximates the back
10 longitudinal and crosswise contour of a person in a reclining position, which leads to the use of a reduced volume of water in relation to the usual water mattresses and thus a saving in weight. The opening of the water container 1 is covered with a cover 4 of preferably a thin, nylon reinforced elastic rubber
15 material, as used in diving suits, for example neoprene rubber, with a thickness of, for example, 2 mm. The cover 4 is attached to the sidewalls 3a of the water container 3 by means of a clamping band 4b, attached to the sidewalls 3a of the water container in a conventional manner, for example by means of
20 screws which engage with screws in the sidewall 3a.

On top of the cover 4 a second, detachable cover 4a of the same material has been devised, the second cover being attachable to the sidewalls 3a of the water container 3 by, for example,
25 Velcro fasteners or other suitable means. Inside the water container 3 an inflatable air mattress is devised with a valve (not shown) projecting out of the water container 3 for respectively supply/discharge of air. The air mattress 5 comprises a bottom 5a of a flexible, inelastic material with
30 a top 5b of a flexible, elastic material. The bottom 5a and the top 5b are connected with each other via sidewalls 5c of a flexible, inelastic material and spacing tapes 5d of preferably the same length, which are fastened to the inside of respectively the bottom 5a and the top 5b and evenly distributed
35 over these areas. (Such an air mattress is described in the applicant's Norwegian Patent Application No. 850346). The bottom 5a of the air mattress 5 is at its two longitudinal sidewalls furnished with fastening means in the form of, for

example tape loops 8a for engaging with a rod 9 mounted in a longitudinal groove 3b on the inside of the sidewall 3a of the water container. The groove 3b is furnished with hollows in the sidewall facing the interior of the container and in the
5 bottom for accommodating said tape loops 8a after they are strung on the rod 9, which is placed in the groove 3b. A corresponding groove 3b is devised along the inside of the opposite sidewall 3a of the water container 3 for engagement with stretching tapes 8 fastened to the other longitudinal side area of the
10 bottom 5a. The stretching tapes 8 run across a rod 9 placed in said groove 3b and down to a rotatable axle 6 mounted in the ears 6a in the sidewall 3a of the water container 1, near the bottom 3. The axle 6 passes in a watertight manner out through the sidewall 3a of the end section of the water container
15 1 and is furnished with a driving device 6 in the form of a worm with a handle (not shown) for manual use or possibly a driving motor with a control device.

The therapeutic water bed is further supplied with an air valve
20 10 positioned, for example, at the lower edge of the sidewall 3a of the water container 1 and with an air duct ending inside the water container 3 in approximately the same height as the upper edge of the sidewall 3a. Thereby it is possible, with the air valve 10 in open position, to void all air in the
25 water container 1 through the valve 10 during the filling-up of water, and also to let out possible formations of steam/air in the water container 3 during usage through the valve 10 by opening this. The valve 10 is of course closed during regular use of the therapeutic water bed. In the water container 1, it
30 is further devised an electric heating element 11 and preferably also a thermostat for heating and maintaining the water at the desired temperature.

After filling water in the water container 3 up toward the
35 upper edge of the sidewalls 3a and forcing out possible air through the air valve 10, the therapeutic water bed is ready for use. In this condition, without an inflated air mattress

and with slack stretching tapes 8, the top area will display maximum softness and pressure distribution between the body of the person lying on the therapeutic water bed and the flexible, elastic cover 4 with an additional cover of the same material. This maximum softness can be changed somewhat by changing the thickness of the outer cover 4a depending upon the condition of the patient, as further explained in the descriptive introduction. In order to increase the firmness of the top surface, the air mattress 5 can subsequently be inflated, so that it floats up through the water and comes to rest against the double cover 4, 4a. The firmness can thereby be regulated by means of the volume of air in the mattress. Since the top surface of the air mattress 5b also is of a flexible, elastic material, it will follow and conform to the different shapes of the double cover 4, 4a which are produced by the patient's lying on the mattress. The top area can subsequently be made even firmer by stretching the stretching tapes 8, in that the stretching axle 6 is turned by means of the driving device 7 until the desired pull on the stretching tapes 8 is achieved, said pull being transferred to the flexible, inelastic bottom 5a and further to the tape loops 8a which are attached to the rod 9 at the opposite sidewall 3a of the water container 1. By this means a completely firm and steady support for the patient can be obtained, which is of great importance during nursing care or other treatment of the patient or during the performance of different exercises as mentioned in the descriptive introduction.

Because of the bottom 5a of the air mattress 5 being fastened at its opposite longitudinal sides by means of said tape loops 8a and stretching tapes 8, one prevents in an efficient manner both transverse and longitudinal movements of the air mattress due to movements or waves in the water of the water container 1, which movements may be produced in connection with the movements of the patient.

By means of the above described therapeutic water bed a mattress surface can be provided with all degrees of softness from maximum

softness for complete relaxation of the patient to a completely hard and steady top surface for nursing care and treatment of the patient. Because of the special design of the water container 1, a relatively small volume of water is used, whereby
5 the therapeutic water bed becomes lighter than the generally available water mattresses and can therefore be placed anywhere without considering the present floor constructions.

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P a t e n t C l a i m s

1. A therapeutic water bed with a top surface adjustable between a completely soft condition for maximum relief from pressure for patients who lie in the same position for a considerable time to a firm condition for nursing care and other treatments of patients, comprising a water container (1) open at the top, with inlet/outlet for water and whose bottom (3) is preferably shaped to approximate the longitudinal contour of the back of the patient, a flexible, elastic and watertight cover (4) attached with a watertight seal to the sidewalls (3a) of the container, an inflatable air mattress (5) positioned inside the container (1) and having inelastic spacing tapes (5d) spaced apart and distributed over the top and bottom areas of the air mattress (5), supported by a supporting device positioned inside the container (1) and capable of being raised and lowered from the outside of the container, said device comprising flexible, inelastic tapes (8) running transversely in the container (1) and capable of being stretched/slackened by suitable means (6, 7) devised at one of the longitudinal sides of the container (1), characterized in that the tapes (8) are attached to the bottom (5a) of the air mattress (5) along one of its longitudinal sides, its other longitudinal side being rigidly attached to the other longitudinal side of the container (1), and that the bottom (5a) of the air mattress (5) is composed of a flexible, inelastic material whereas its top (5b) is composed of a flexible, elastic material.

2. A therapeutic water bed according to Claim 1, characterized by the placement above the cover (4) of a second elastic cover (4b) detachably fastened along the edges (3a) of the container (1), for example by means of Velcro fasteners.

3. A therapeutic water bed according to Claim 1, characterized by a groove (3b) open at the top, running along the inside of the two longitudinal sidewalls (3a) of the container (1), with hollows (3c) in the bottom of the groove and

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the sidewall facing the interior of the container for accomo-
dating a rod (9) for fastening loops (8a) of tape from one
longitudinal side of the air mattress (5) and for conveying the
stretching tapes (8) from the other longitudinal side down to
5 a, per se, known rotatable stretching axle (6) mounted (6a)
inside the container (1).

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