United States Patent

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[54] EXERCISING APPARATUS

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[52] **U.S. Cl.** ..... **128/71**, 128/75, 272/79 R

[51] **Int. Cl.** **A61f 5/00**

[58] **Field of Search** 128/71, 75; 272/79, 82, 83, 272/80

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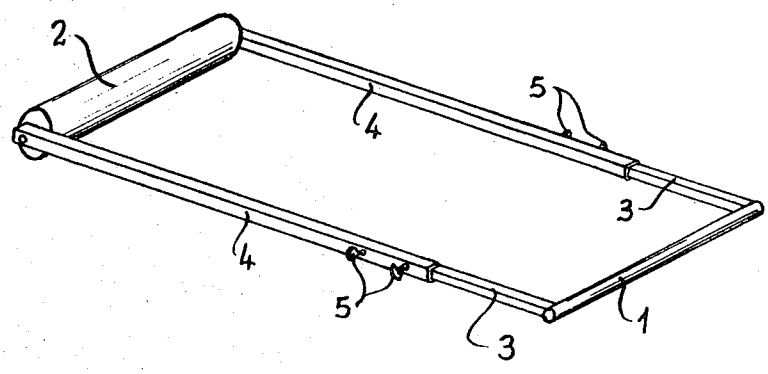
[57] **ABSTRACT**

An exercising device particularly for stretching the vertebral column which includes a bar grippable by the user and a second bar or surface engageable in the region between the users thighs and torso, the spacing between the two bars may be variable. The bars may be supported on a table.

18 Claims, 11 Drawing Figures



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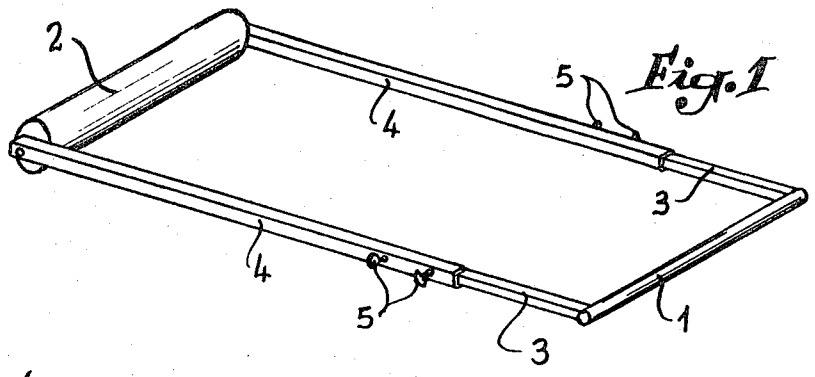


Fig. 1

Fig. 2

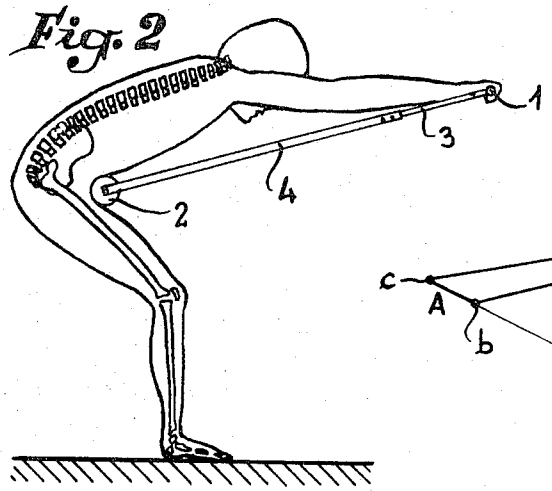


Fig. 4

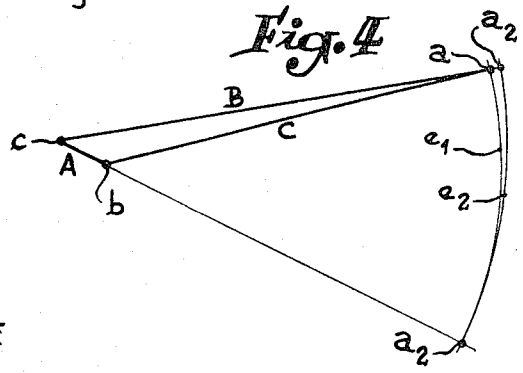
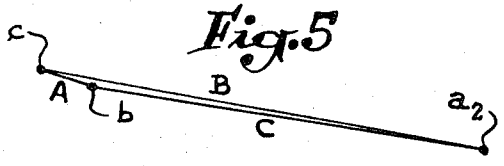


Fig. 5



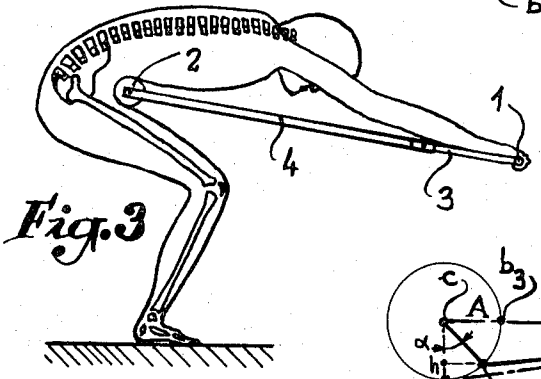
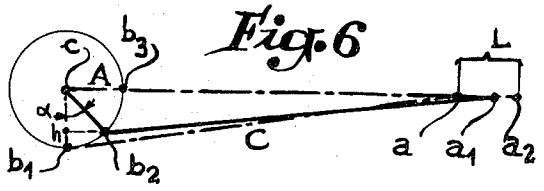


Fig. 3

Fig. 6



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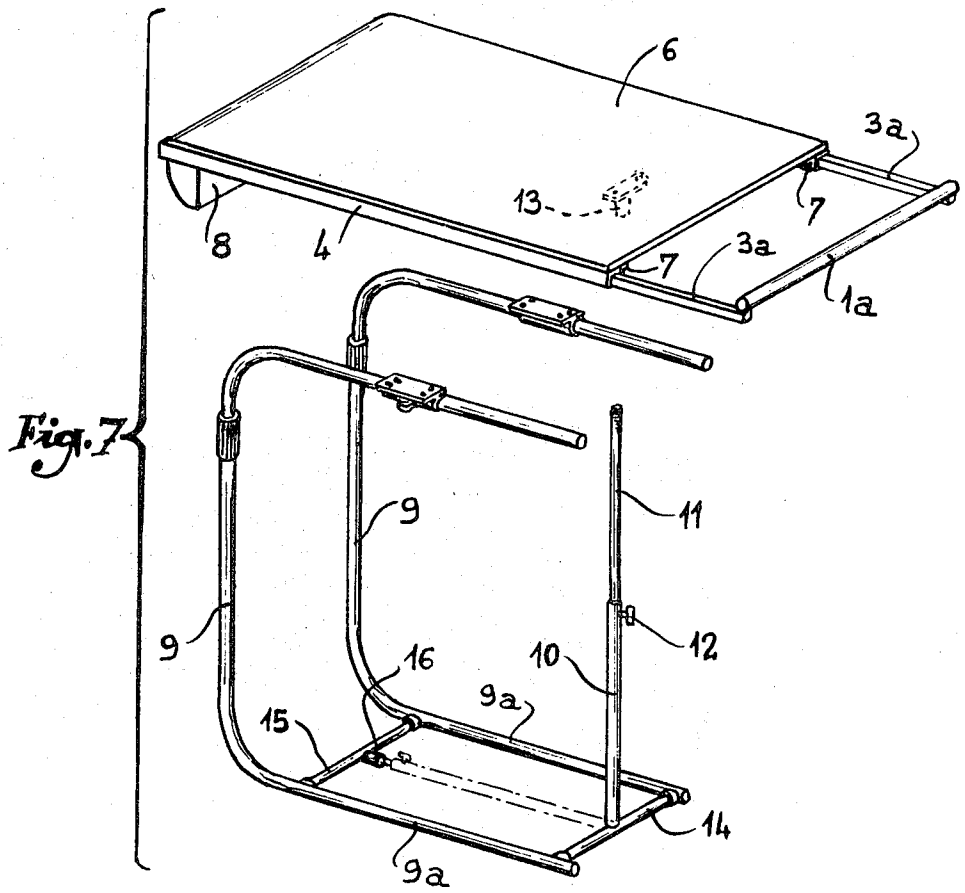

Fig. 7

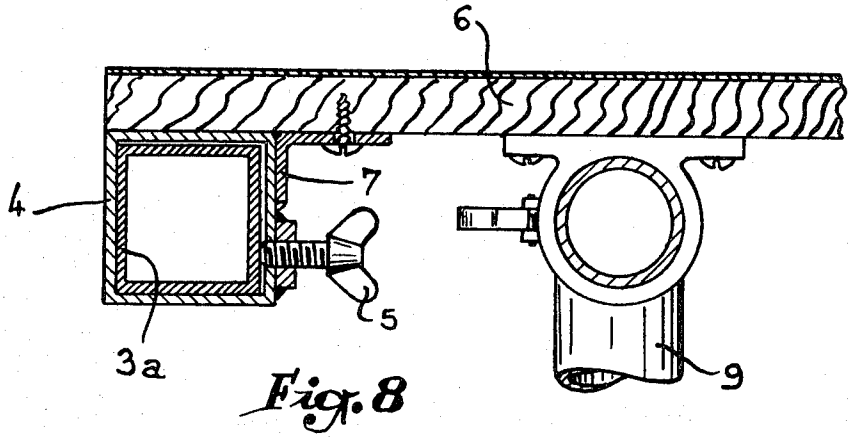

Fig. 8

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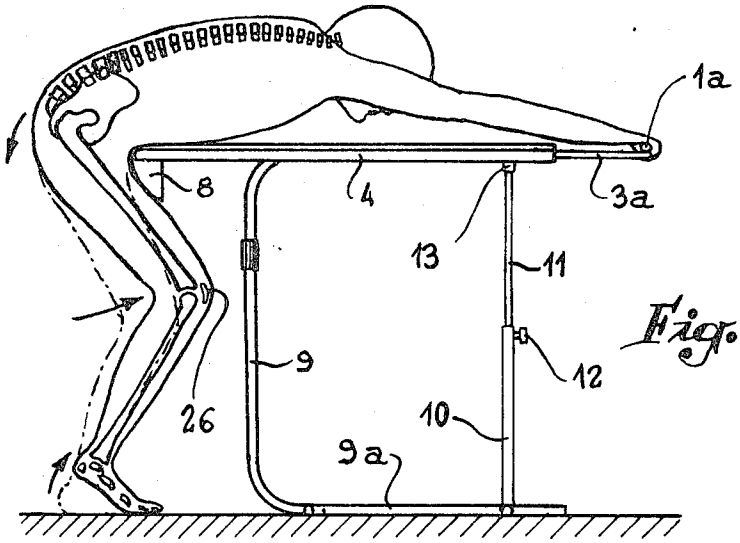

Fig. 9

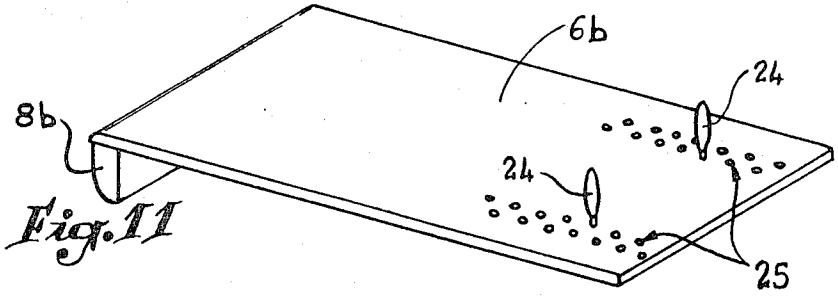

Fig. 11

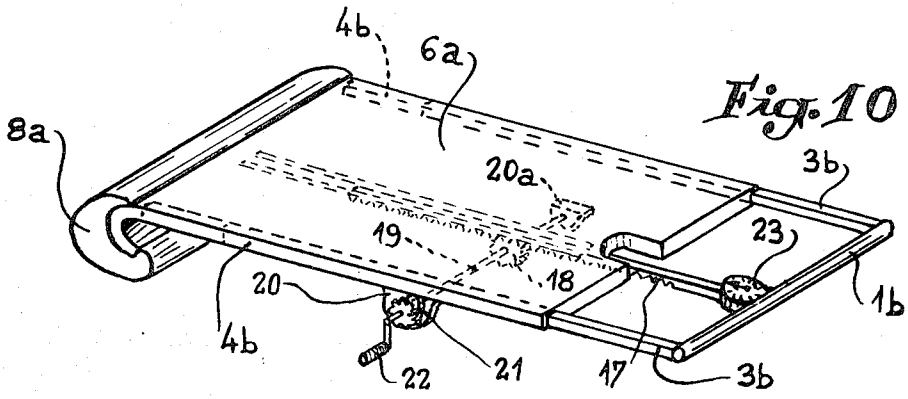

Fig. 10

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EXERCISING APPARATUS

This invention relates to a device for effecting stretching of the vertebral column, in particular of the dorsal and lumbar vertebrae, treatment of the muscles, gymnastics and relaxation of the body.

Known such devices generally comprise a table, on which the patient is placed, and two harnesses, connected with the movable parts of a stretching mechanism, one of which is secured under the patients arms and the other to his pelvis, an operator actuating the stretching mechanism until the desired effect is obtained. In such a device the patient undergoes a stretching determined arbitrarily by the operator and he is not able in any way directly to stop this stretching if it is excessive which, in particular when the stretching device is a hydraulic device of substantial power may cause him permanent damage.

In certain cases, particularly in kinesitherapy, it is sometimes enough to attach the patient vertically by his hands to a horizontal bar while relying on weight to ensure a certain elongation of his vertebral column. Assuming that the total weight of the patient is 60kg, it may be estimated that the maximum traction force which may thus be exerted on the vertebrae concerned does not exceed 50 kg, for the first dorsal vertebrae and decreases as it descends towards the lumbar vertebrae which, nevertheless, given the structure of the vertebral column, would require much greater stretching forces than the first dorsal vertebrae to effect unlocking. The traction force due to the simple weight of the legs, as regards the last lumbar vertebrae, would only be of the order of 20 kg or less.

However, in practice, it has been noticed that such slight traction is insufficient for obtaining the desired separation, especially in the case of lumbar vertebrae.

The work of DE SEZE and LAVERNIEUX has shown that it is possible to obtain, by traction, vertebral spacings of 1.5 mm without damage to the muscular tissue.

According to MASTURZO a traction force of 100 daN (deca Newton is required to obtain a spacing of 1 mm.

LEHMAN and BRUNNER have established that, on young subjects, after 5 minutes traction at 135 daN they obtained on average a spacing of 1.5 mm from the fifth to the sixth lumbar vertebrae and 1.3 mm from the third to the fourth lumbar vertebrae, and that the return to the normal spacing takes place within 30 minutes.

Thus most exponents are agreed in stating that a traction of 135 daN can be readily supported and that it actually separates the lumbar vertebrae.

It is an object of the present invention to obviate or mitigate the disadvantages of previous devices and to enable the patient to effect by himself and quite alone an effective vertebral elongation without danger to himself such that he can always stop the stretching immediately if the stretching force should become excessive.

The device according to the invention, is characterized in that it comprises a separating wedge including, on the one hand, gripping means which the patient may hold with each of his hands — his arms being extended parallel to the extension of his chest — and, on the other hand, counter-bracing means spaced by such a distance from the aforesaid gripping means that the patient may place them in the angle that his thighs, bent approximately at right angles under his chest, form with the latter and that — his arms always remaining extended in the extension of his chest — he may, by decreasing the angle subtended by his thighs and chest around the said counter-bracing means, stretch his vertebral column between his pelvis and his shoulders by a lever action of his thighs on the counter-bracing means.

Such a device may be used as a gymnastic device without any support relative to the ground.

It may be constituted by a simple rigid and lightweight frame, two opposing sides of which serve, one as the gripping means in the form of a transverse bar which the patient may grip with his hands and the other as a counter-bracing means for his thighs.

These counter-bracing means are advantageously arranged so as to provide a substantial surface, preferably rounded and padded, uniformly shaped to follow approximately the shape of the thighs which press against them. They may be mounted to pivot between the adjacent sides of the frame formed by the device, and in particular may be constituted by a roller which pivots between these sides.

Since the distance between the gripping means and the counter-bracing means is very important, it is appropriate to make it so that it can be accurately adjusted. Moreover, this adjustment is necessary if it is desired that people of different heights may use the same device. In the majority of cases, it is sufficient to have an adjustment ranging from a minimum distance of 100 cm to a maximum distance of 150 cm.

If the device is constituted by a frame, it is convenient to make the sides of it telescopically adjustable in length and to provide means for locking the inner telescopic member in the outer member of each of the sides, for example by tightening-screws, screwed into the outer member. When the patient wishes to achieve more comfortable stretching of the vertebral column while remaining in a guaranteed stable, balanced position it is preferable to include a table with the device, whilst mounting between the outer members of the telescopic sides a rigid panel provided with feet and on which the patient may lean relative to the ground.

It is appropriate to make these feet adjustable in height, for example by making them telescopically extensible and by providing them with locking means which may be of any type generally used for this purpose.

Preferably the table may be used for other uses in the home, in particular as a tea table, bar table side table and preferably as an all-purpose table for a bed-ridden person.

For this purpose, it is appropriate for the table to comprise a base with at least one leg open laterally and the lower part of which, which rests on the ground, may be slid laterally under a bed, the upper panel or plate of the table being adjustable in height and in inclination on this base.

In order to improve still more the stability of the table constructed in this way when it is used as a device for stretching of the vertebral column, there may be added to this base, on the opposite side to the leg which is open laterally at least one additional, detachable telescopic upright.

According to one advantageous embodiment, this additional, detachable upright of the table panel pivots about a horizontal shaft in the lower part of the base which comprises means for securing the upright in a substantially horizontal retracted position within the overall dimension of this lower part.

According to another embodiment, the device comprises, between the gripping and counter-bracing means respectively, a telescopic rod for adjusting the distance and provided with a locking means.

The latter is advantageously constituted by a ratchet wheel operated by a crank which may be freely rotated in the direction which increases the distance between the means in question.

It may be advantageous to mount, between one of the sliding members of the telescopic rod and either the gripping or counter-bracing means, a dynamometric indicator with a small control stroke and which, preferably, is of the type indicating the maximum compression reached during the elongation operations.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 shows diagrammatically and in perspective a device for vertebral stretching constructed according to the invention;

FIGS. 2 and 3 show diagrammatically two extreme positions for use of this device;

FIGS. 4, 5 and 6 are diagrams of the kinematics common to various types of devices constructed according to the invention;

FIG. 7 shows diagrammatically and in exploded perspective another embodiment of the device;

FIG. 8 shows in section and on a larger scale a detail of the device of FIG. 7;

FIG. 9 shows diagrammatically and in elevation the manner according to the invention of using the device shown in FIG. 7;

FIGS. 10 and 11 show devices constructed according to two other variations according to the invention.

According to one of the most simple embodiments the device according to the invention is constituted by a frame, the two opposite sides of which provide the gripping means, namely a transverse bar 1, and the counter-bracing means for the thighs of the patient, which means is constituted by a roller 2 or any other suitably rounded or uniformly shaped member provided, if necessary, with appropriate padding.

The two other sides of the frame are arranged so that their length can be adjusted between 100 cm and 150 cm.

In FIG. 1, the latter sides are constituted by telescopic rods, the internal members 3 of which are integral with the bar 1 and the outer members 4 are secured to the shaft or pivots of the roller 2. The adjustment of the distance between the bar 1 and the roller 2 is effected by a greater or lesser telescopic elongation (under the circumstances between 100 cm and 150 cm) of the rods 3 and 4, the internal members 3 of which may be locked in position in the outer members 4 by locking screws 5.

When the user has suitably adjusted the distance which separates the bar 1 from the roller 2, he must be able, on taking hold of the bar 1 with his two hands, to place the roller 2 in the angle that his thighs, folded approximately at right angles under his chest form with the latter, without his arms, extended in the extension of his chest, bending, to decrease the angle subtended by his thighs and chest around the roller 2 passing from the position shown in FIG. 2 to that shown in FIG. 3 and thus to stretch his vertebral column between his pelvis and his shoulders by a lever effect of his thighs on the roller 2.

In the diagram shown in FIG. 4;

a represents the axis of the bar 1,

b that of the roller 2, and

c the articulation of the femur on the pelvis of the user.

C which is the distance between *a* and *b* is a fixed length:that predetermined by the device.

A which is the distance between *b* and *c* may also be considered as a fixed length whereas B which is the distance separating the user's hands from the pivot of the femur on the pelvis is a length which, between the positions shown in FIGS. 2 and 3, must be able to be slightly extended, which causes the desired corresponding elongation of the vertebral column.

It will be understood that the maximum elongation that can be obtained is reached when C has pivoted about *b* until it is located in the extension of A, a position which the user has almost reached in FIG. 3. The triangle A–B–C is flattened to form a straight line $\overline{ca_2}$.

The extension thus obtained by a lever effect can be shown by tracing around *b* a circle e_1 of radius $\overline{ba_2}$ and around *c* a circle c_2 of radius $\overline{ca_1}$. The extension of B cuts e_2 at a_2 and the extension obtained L_1 is equal to the distance separating *a* from a_2 that is to say $L_1 = \overline{aa_2}$.

It will be understood that if the user could bend still more in the same direction, he would not obtain an additional elongation but, on the contrary, a shortening of the length B.

It is interesting to consider the elongation obtained in the light of the diagram shown in FIG. 6.

It will be understood that the maximum useful angle α, through which the user may theoretically bend his thighs relative to the chest about the roller 2, is 90°, since it is naturally necessary that he starts from a position in which the roller remains locked against the upper part of his thighs.

Consequently, it can theoretically be considered that this point of application of the roller against the upper part of the user's thighs may pass from the position b_1 to the position b_3, passing at 45° through the position b_2. Referring on this diagram (FIG. 6) to the corresponding positions of the points *a* and a_2 separated by the extension L, it can be seen that the point a_1 corresponding to the position b_2 is clearly nearer to the point a_2 than the point *a*.

It will be understood that by considering the angle α at *c*, between the straight lines *cb*, and cb_2, we may write:

$$\text{Sin } \alpha = \frac{hb_2}{cb_2} = \frac{hb_2}{A}$$

and since $hb_2 = \Delta L$. then $\Delta L = A \cdot \sin \alpha$

We may consider the following example:

For the first 10° of α ΔL = sine 10° = 0.17 whereas for the last 10° ΔL = sine 90° sine 80° = 1 - 0.99 = 0.01.

This means that the extension obtained over the last 10° of bending corresponds to approximately only 6 percent of that obtained over the first 10° envisaged or even that a user, capable of developing a force of 10 daN over the first 10° of movement, if by an accurate adjustment he was led to effect the same force over the same distance corresponding to the last 10° would exert, due to reduction, a force 17 times greater, i.e. 170 daN.

The result is the advantage that there exists in adapting the length of the device to the exact height of the user.

Tests carried out with the help of a dynamometer have shown that with a prototype of the device, users had exerted on the latter a compression force between 112 and 171 daN which as has been seen above is quite adequate for obtaining the desired elongation.

If the device in the form shown in FIG. 1 is quite suitable for certain uses, in particular as a device for gymnastics, physical exercises and kinesitherapy, it is preferable, for patients for vertebral re-education and suffering with lumbage, sciatica, back trouble, slipped discs, rheumatism, dorsal troubles, arthrosis etc, to include with the device a table, supported relative to the ground at the desired height, on which the patient may rest in a stable manner with the upper part of his body.

It is thus important that the table can be adjusted in height, so that it can be accurately adapted to the height of the patient.

Indeed, as can be seen on FIG. 9, the desired stretching force is thus obtained by bringing the knees up under the table. In order to achieve this upwards movement of the knees, the table is adjusted to a height such that the user may bend his knees under the latter, when his heels rest on the ground. The user obtains the desired stretching by raising his heels and by pushing his knees forwards and upwards, whilst keeping the front of his feet on the ground.

In most cases it is appropriate to provide the adjustment in height of the table between a minimum height of 60 cm and a maximum height of 100 cm.

It can be seen in FIG. 9 that the distance from the neck of the femur to the support bar 8 is approximately five times smaller than the distance from this support bar to the knee 26. There thus exists a lever of the first class where the resistance is in fact the locking of the body by the hands of the user whereas the active force is obtained by the pivoting of the foot which, when raised onto the ball constitutes another lever allowing the knees to move up under the table and to pivot the femur about the support bar 8.

It is thus adequate to obtain a thrust at each knee of 15 daN in order to impose a traction force of 150 daN at the vertebral column (15×2×5 = 150 daN).

In order to obtain accurate adjustment of the height of the table, it is provided with at least one telescopic leg, which may be locked in position by any known suitable system.

In order to transform the device shown in FIG. 1, into a table, it is sufficient to attach the outer parts 4 of the telescopic sides along the sides of a rigid panel 6, for example of wood, by means of angle-irons 7, as shown in FIG. 8, and possibly to replace the roller 2 by a curved support bar 8 with a surface area adequate for ensuring a comfortable support.

The table advantageously arranged in such a way that it can serve for other uses, namely as an all-purpose table for a bed-

ridden person. It comprises a leg structure **9** with feet which structure opens laterally and the lower part of which, which rests on the ground, may be slid laterally under a bed.

According to a particularly advantageous embodiment, the leg structure comprises on the opposite side to the telescopic leg **9** of the base, at least one additional telescopic leg **10**, the inner part **11** of which, can be locked by a locking screw **12** screwed into the outer part **10**, and is threaded at the end in order to be able to be screwed into a tapped sleeve **13** fixed under the panel **6** of the table.

The outer part **10** of the additional leg is mounted to pivot about a horizontal shaft **14** in the base of the leg structure, an opposing cross-piece **15** of which has another tapped sleeve **16** into which there may be screwed the end of the inner part **11** of the telescopic leg in the position shown in dot-dash lines in FIG. **7**, in which this leg is retracted within the overall dimensions of the lower part of the base.

The shaft **14** and the cross-piece **15** may constitute the only struts of the base and may be secured in a detachable manner by their two ends into tapped sleeves with opposite threads and integral with the side-pieces **9***a* of the base. If it is desired, in manner known per se, that the base can be removed from the so-called table, it can be dismantled as will the realized on examining FIG. **7**, into four parts, i.e. two members **9** — **9***a*, a part **15** and a part **10, 11, 12, 14** which are all flat and, consequently lend themselves to a very compact stowage arrangement when the table is not in use.

Obviously numerous variations can be envisaged.

According to one of the latter, shown in FIG. **10**, there is provided for adjusting the distance between a bar **1***b* and a curved member **8***a*, a rod **17** integral with the bar **1***b* and which can be locked in position telescopically, in a guide member provided under the panel **6***a* of the table, by means of a locking bolt which makes it possible to pull the bar **1***b* while separating it from the panel **6***a* but prevents it from returning without interfering with an unlocking member.

In this case, the rod **17** is constituted by a rack which co-operates with a pinion **18** integral with a shaft **19** which rotates under the table in bearings **20** and **20***a*, co-operates with a ratchet wheel **21** and terminates on the side of the table in a crank **22**.

It will be realized that with such a table, which may be mounted to be adjusted in height on any appropriate base, the adjustment of the length may take place quite simply for example by a third person operating the crank **22** and who may possibly apply his muscular force to increase the stretching, especially if this has to be used on a person with small muscles.

It will be noted that, due to the construction of the device, there is no danger for the patient who, in the case of a traction which becomes too great obviously lets go of the bar **1***b* which safeguards him from any risk resulting from an inexperienced action.

It will be noted that on this table the inner telescopic parts **3***b*, integral with the ends of the bar **1***b*, slide freely in their outer parts **4***b* serving solely as guides and therefore are devoid of any locking system.

Moreover, it may be an advantage to insert, between the bar **1***b* and the rack **17**, a dynamometer **23** which is preferably of the type indicating the maximum compression reached and the needle of which, after each measurement has to be returned manually to the zero position. There may also be provided a totalisator indicating the total of tractions carried out.

FIG. **11** shows a table **6***b* constructed according to another embodiment and on which the gripping means provided to be gripped by the user are constituted by separate hand-grips **24**, fixed vertically in the table in a series of holes **25** located at variable distances from the curved member **8***b*.

What is claimed is:

1. A device for effecting stretching of the vertebral column, and comprising a separating frame including gripping means which the user may grip with each of his hands, and counter-bracing means spaced by such a distance from the gripping means that the user may place same in the angle that his thighs, bent approximately at right angles under his chest subtend with the latter, the arrangement being such that the user, his arms always remaining extended in the extension of his chest, may by decreasing the angle that his thighs subtend with his chest around the couter-support means stretch his vertebral column between his pelvis and his shoulders by a lever action of his thighs on the counter-bracing means.

2. A device according to claim **1**, in which the gripping means and counter-support means are adjustable in the distance from one to the other.

3. A device according to claim **1**, comprising a frame opposing sides of which form the gripping means in the form of a transverse bar, the counter-support means for the thighs of the patient.

4. A device according to claim **3**, in which the sides of the frame connecting the bar to the opposite counter-support means are telescopically adjustable in length.

5. A device according to claim **4**, in which the locking of the telescopic elements one inside the other is obtained by locking screws screwed into the outer member of the telescopic sides of the frame.

6. A device according to claim **4**, in which the outer tubular members of the telescopic sides of the frame and the support means are part of a single rigid panel forming a support table for the chest of the patient.

7. A device according to claim **6**, characterized in that the rigid panel comprises on the side remote from the bar, the counter-support for the thighs of the patient in the form of a relatively thick part.

8. A device according to claim **7**, in that the relatively thick part of the counter-support is constituted by a rounded bar.

9. A device according to claim **6**, in that the table is supported by at least one leg which is height adjustable.

10. A device according to claim **9**, in which the leg has a base and is laterally open, the base being slidable under a bed.

11. A device according to claim **10**, in which the base comprises, on the side opposite the leg at least one additional detachable telescopic leg.

12. A device according to claim **11**, in which the additional, detachable leg is pivotal within the base and has means for securing it in a substantially horizontal position, in which it is at least approximately withdrawn within the overall dimensions of this base.

13. A device according to claim **2**, comprising, for the adjustment of the distance between the gripping means and counter-bracing means at least one telescopic rod provided with a locking means.

14. A device according to claim **13**, in which the locking means is constituted by a ratchet wheel operated by a crank which may be rotated freely in the direction which increases the distance between the gripping and counter-bracing means.

15. A device according to any one of claims **13** and **14** comprising a dynamometric indicator with a small control stroke, mounted between one of the sliding member of the telescopic rod and the gripping or counter-bracing means with which the member is to be made integral.

16. A device according to claim **15**, in which the dynamometric indicator is of the type indicating the maximum compression reached, with a control which has to be re-set to zero after each measurement.

17. A device according to claim **3**, in which this counter-support part for the thighs of the user is mounted to pivot between the adjacent sides of the frame formed by the device.

18. A device according to claim **17**, in which the counter-support bar for the thighs of the user is constituted by a roller which pivots in the adjacent sides of the frame.

* * * * *