Jan. 24, 1967 V. R. MIKAN 3,299,886

TRACTION METHODS AND APPARATUS

Filed March 9, 1964 2 Sheets-Sheet 1

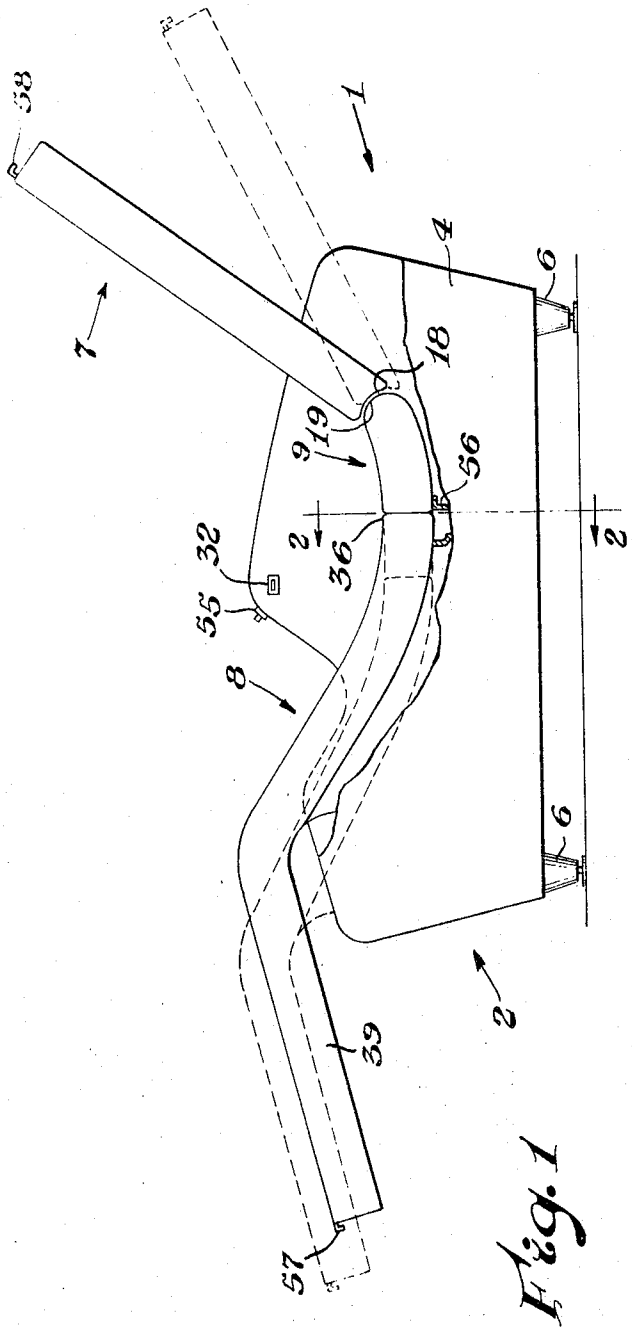

Fig. 1

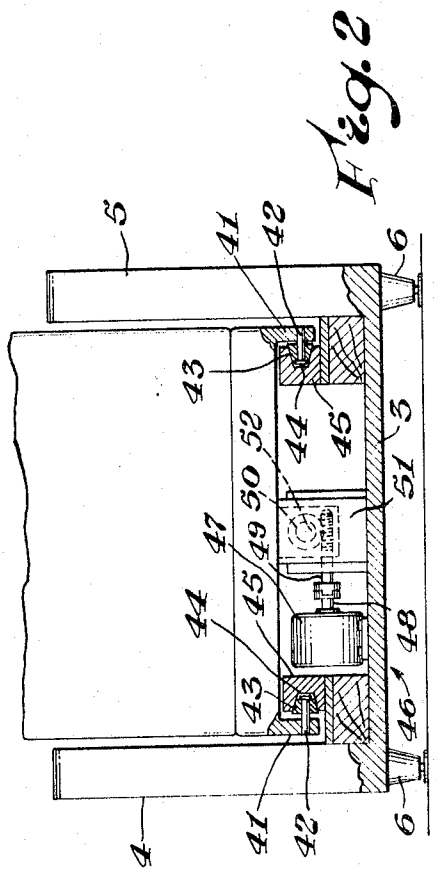

Fig. 2

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TRACTION METHODS AND APPARATUS

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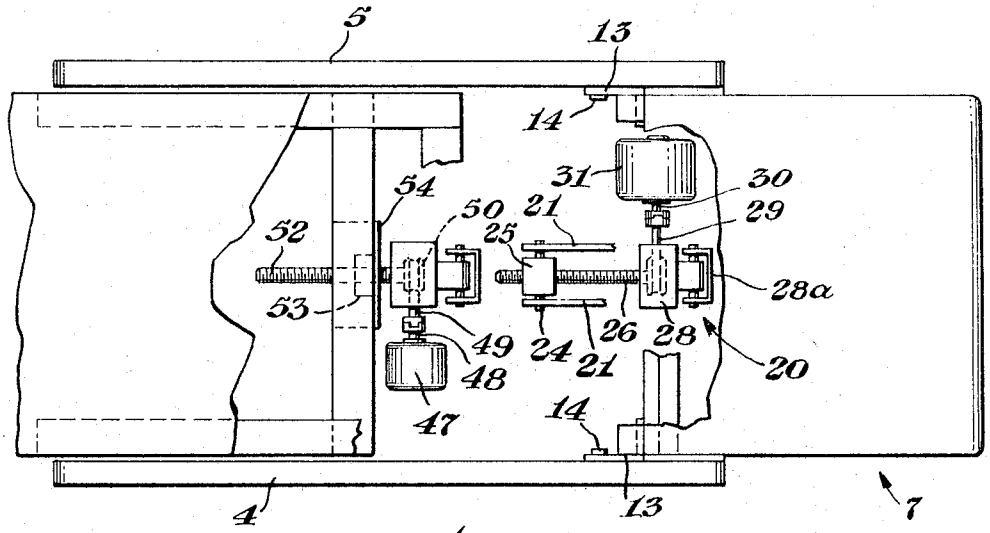

Fig. 4

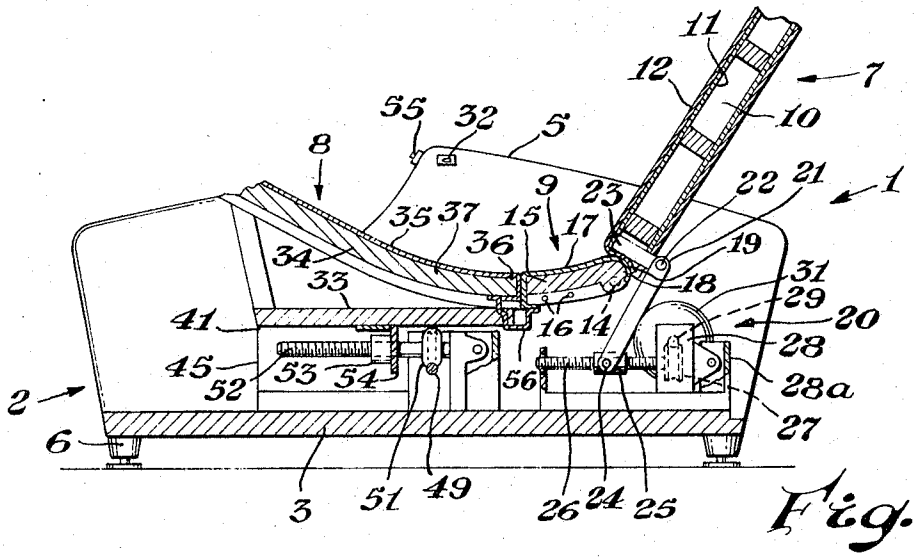

Fig. 3

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TRACTION METHODS AND APPARATUS

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This invention relates to traction methods and apparatus and more particularly to a chair that is particularly designed for a conservative treatment of lumbar spinal disorders and which combines the medically accepted treatment methods of flexion and traction.

In the treatment of low back conditions such as acute lumbo-sacral strain, spondylolisthesis, arthritis and disc syndrome, and the like, it is common practice among physicians to prescribe bed rest coupled with flexion of the lumbar spine and pelvic traction. These treatments frequently require hospitalization of the patient, in order that the patient may occupy a bed that can be so adjusted as to support the patient's back at an incline to the vertical and with his knees elevated with respect to his pelvis. Positioning a patient in this manner places the lumbar spine in flexion, i.e., the posterior concavity of the lumbar spine is reduced, resulting in enlargement of the intervertebral foramina and opening of the articular facets to relieve compressive or irritative forces on the nerve roots. Traction then is applied by means of a pelvic belt that may be connected to selected weights by means of ropes and pulleys.

Although traction often affords relief of the conditions for which it may be prescribed, the present methods of applying traction leave much to be desired. For example, it is difficult, if not impossible, to predict with any degree of accuracy the actual traction force that will be applied to a patient by a given weight. That is, use of a weight of 40 pounds does not necessarily mean that the force exerted on the patient's lumbar spine will be 40 pounds. The actual amount of force or pull exerted on the patient's spine by a given weight is influenced by the weight of the patient and by the resistance of his body against the surface on which his body is supported. In practice, therefore, the amount of weight applied to a patient often may be insufficient to provide adequate traction to the lumbar spine or, alternatively, may be so great as to be uncomfortable to the patient and intolerable for any sustained length of time.

In many instances the intermittent application of traction to the lumbar spine could be beneficial to the patient, but not all of those devices heretofore available for applying traction to a patient's lumbar spine have been capable of functioning intermittently without the services of an attendant. Requiring the services of an attendant, coupled with the inability of even the most skilled attendant to apply accurately a specific, predetermined traction force to the patient's spine, has prevented known treatment devices from being as effective as they otherwise might be.

Many different types of chairs that are claimed to be beneficial to persons having painful low back conditions have been proposed heretofore. Many such chairs have been the so-called lounge type that enables a person's back to be lowered and his knees elevated. In some of the known chairs, the seat may be inclined to the horizontal, whereas the seat and back of others are said to be shaped to conform to the natural curvature of the spine of the person sitting in the chair. Except for the chair disclosed in FIGURE 3 of Patent No. 3,124,389, it is believed that all such chairs have one common characteristic, namely, that of supporting a person in such manner that he sits directly on the tuberosities of the ischii. This positioning of the person is true regardless

of whether the back of the chair reclines, or whether the seat tilts or does not tilt. As long as a person is seated on the tuberosities of the ischii, significant anterior rotation of the pelvis is prevented and, therefore, there is no appreciable flexion of the lumbar spine. As a matter of fact, many of the chairs having supporting surfaces shaped to conform to the natural curvature of a person's spine produce an increase in the normal curvature, causing a lordotic or swayback condition, which is directly contrary to the spinal condition desired in the treatment of low back ache.

An object of this invention is to provide apparatus that is especially suited for the treatment of lumbar spinal conditions and which permits the combination of flexion and traction to be used.

Another object of the invention is to provide treatment apparatus of the character referred to and wherein the amount of traction which may be applied is variable under the control of the patient so as to enable him to determine for himself the most effective and tolerable traction force.

A further object of the invention is to provide lumbar spine treatment apparatus which enables the use of traction force to be applied steadily or intermittently as desired.

Another object of the invention is to provide a treatment device of the character referred to which assumes the form of a chair, thereby enabling lumbar spinal conditions to be treated without requiring a patient's being put to bed, and obtaining the benefits of a chair's greater mobility.

A further object of the invention is to provide a chair construction for treating lumbar spinal conditions and which is adjustable to promote patient comfort.

Another object of the invention is to provide a chair construction of the character described which may be manufactured to such dimensions as to be useful in the treatment of patients of greatly different height and size.

Other objects and advantages of the invention will be pointed out specifically or will become apparent from the following description when it is considered in conjunction with the appended claims and the accompanying drawings, in which:

FIGURE 1 is a somewhat diagrammatic, side elevational view of a chair constructed in accordance with the invention, certain parts being broken away for clarity;

FIGURE 2 is a vertical sectional view taken on the line 2—2 of FIGURE 1;

FIGURE 3 is a fragmentary, longitudinal sectional view; and

FIGURE 4 is a fragmentary, top plan view of the seat and back driving mechanisms.

Apparatus constructed in accordance with the invention comprises a lounge type chair **1** having a supporting frame **2** comprising a base **3** on which is mounted a pair of spaced apart, parallel, upstanding side members **4** and **5**. Suitable legs **6** may be secured in any desired manner to the frame **2**.

The chair includes a back member **7**, a movable seat section **8** and an optional, intermediate, fixed member **9** between the back and the seat. The overall construction and appearance of the members **7**, **8** and **9** conform generally to the construction and shape of the corresponding members of the chair construction disclosed in FIGURE 3 of Patent No. 3,124,389, and to which reference is made for a more detailed discussion of the principles underlying the particular form of the body supporting surfaces of the chair.

The back member **7** comprises a rectangular frame **10** having a substantially planar back-supporting surface **11** over which a leather-like or other suitable upholstery material and padding **12** may be secured. At its lower end, each side of the back frame **10** is provided with a right-

angle hinge **13** that is pivoted on a pin **14** fixed in the associated side frame **4** and **5**. The back member **7**, therefore, is capable of swinging about the axis of the pins **14** between raised and lowered positions, as is indicated by the full and chain lines in FIGURE 1.

The fixed, intermediate lower back member **9** is not an essential part of the construction, but is preferred. The member **9** comprises an elongated block **15** of wood or the like at each side of the chair, each block having a length fore and aft of about eight inches and a width such as to span up to half the distance between the side members **4** and **5**. The member **9** may be secured to the side members by means of suitable screws **16** or the like. The upper surface of each block **15** is upwardly concave and supports suitable upholstering and padding material **17**. The curvature of the blocks **15** may be formed on a radius of about one foot and the blocks are so positioned that their forward ends are located at a lower level than any other portion of its upper surface.

The rear end of the member **9** is rounded as at **18** on a radius having its center coinciding with the axis of the pivot pins **14**. The lower end of the back frame **10** is complementally curved, as at **19**, so as to permit swinging movement of the back member and, in all positions of the latter, enable the upper or body-supporting surfaces of the members **7** and **9** to merge smoothly with one another.

Means designated generally by the reference character **20** is provided for effecting swinging movements of the back member **7** and comprises a pair of parallel links **21**, one end of each of which is pivoted as at **22** to a bracket **23** that is fixed to the back frame **10**. The other end of each link **21** is pivoted as at **24** to a ball nut **25** of known construction that is mounted on a screw **26**. One end of the screw **26** is fixed to a worm wheel **27** mounted in a gear box **28** that is supported by a bracket **28***a* on the base **3**, the worm wheel being in mesh with a worm **29** that is coupled to the armature shaft **30** of a reversible electric motor **31**. The motor **31** is suitably supported on the base member **3**. The forward end of the bracket **28***a* rotatably receives the forward end of the screw **26** to stabilize the latter.

The construction and operation of the driving mechanism **20** are such that driving of the motor **31** in such direction as to impart rotation of the worm **29** in one direction effects lowering of the back member **7** from the position shown in full lines in FIGURE 1 toward the position shown in dotted lines. Driving of the motor **31** in the opposite direction effects raising of the back member. Switch means **32** of conventional construction may be mounted in the side member **5** in a location convenient to the occupant of the chair so as to enable him to adjust the height of the back member **7** as he wishes. At its upper and lower limits, the back member will be inclined to the horizontal at about fifty and twenty degrees, respectively. The upper and lower limits may be determined by limit switches connected in the motor circuit in the path of movement of the back, in a well-known manner.

The movable seat member **8** of the chair construction comprises a base frame **33** spanning the distance between the side members **4** and **5** and on which is supported a seat frame **34**. The frame **34** is covered by suitable upholstering and padding material **35**. The frame **34** terinates at its rearward end **36** in an upwardly concave buttocks-supporting portion **37**. The curvature of the portion **37** preferably is on substantially the same radius as the curvature of the block **15** and is such that the rearward end **36** of the seat frame merges smoothly with the forward end of the seat portion **15**. The curvatures of the portions **15** and **37** are such that the rearward edge **36** of the seat member **8** constitutes the low point of the seat portions **15** and **37**.

From the rear end **36** the seat portion **37** rises about 1⅝ inches in a distance of about 6 inches and then merges smoothly with a substantially planar thigh supporting portion **38** that is inclined upwardly and forwardly at an angle of about thirty-five degrees to the horizontal. The forward end of the thigh-supporting portion **38** terminates in a forwardly and downwardly inclined lower leg supporting section **39**, the section **39** forming a cantilever extending from suitable braces **40** and being inclined at about fifteen degrees to the horizontal.

The seat section **8** is mounted for reciprocating movement toward and away from the back member **7**. Means mounting the section **8** for reciprocating movement comprises downwardly extending flanges **41** at each side of the base frame **33** and on each of which is supported a number of spindles **42**. On each spindle is rotatably mounted a preferably frustoconical roller **43** that is received in a correspondingly shaped groove **44** formed in a rail **45** that is supported on the base member **3**. The arrangement is such that the member **8** is reciprocable longitudinally of the main frame **1** and is restrained against tipping and vertical movement by the cooperation of the rollers **43** in the associated grooves **44**.

Driving means designated generally by the reference character **46** is provided for reciprocating the seat section **8** and comprises a reversible electric motor **47** that is supported on the base **3** and has its armature shaft **48** coupled to a worm **49** that meshes with a worm wheel **50** which is supported within a gear box **51** mounted on the base **3**. The worm wheel **50** is keyed to a screw threaded shaft **52** that extends through a ball nut device **53** which is secured to a bracket **54** suspended from the frame **33**. A switch **55** mounted on the frame member **5** enables the occupant of the chair to control the operation of the motor **47**.

The construction and operation of the driving means **46** is such that rotation of the motor **47** in one direction effects rotation of the shaft **52** in a direction to move the seat section **8** forwardly or away from the back member **7** from the position indicated in full lines in FIGURE 1 to the position indicated in dotted lines. Rotation of the motor **47** in the opposite direction reverses the direction of movement of the seat section. The extent or stroke of movement of the section **8** may be controlled by suitable limit switches (not shown) located in the path of movement of the section **8** and connected in the circuit of the motor **47**, as will be understood.

Preferably, a flexible member **56** formed of synthetic or other suitable material is secured by snap fasteners or the like to the sections **8** and **9** so as to span the gap therebetween when the member **8** is moved forwardly. The member **56** is not necessary, but it is desirable to provide some means for preventing articles which fall out of a patient's pockets from falling below the level of the seat.

As has been stated hereinbefore, a chair constructed in accordance with the invention is designed to flex the lumbar spine of a person sitting in the chair. This is accomplished by positioning the patient in the chair in such manner that the superior crest of the ilium, i.e., the top of the hip bone, is at the low point **36** of the seat. When a person is so positioned, the intermediate member **9** is not a required part, but it preferably is included because it provides some support for the back and thus makes the chair more comfortable. As has been pointed out previously, the low point of the seat is at the rearward end of the movable seat section **8**. Inasmuch as the seat portion curves upwardly and forwardly from its low point **36**, the patient is not seated on the tuberosities of the ischii. Instead, the patient's pelvis is rocked so as to reduce the posterior concavity of his spine. Stated differently, the lumbar spine of the patient is flexed.

When a patient is seated in the chair in the manner disclosed, traction may be applied to the patient by means of a pelvic traction belt (not shown) to which one end of a strap may be fastened, the distal end of the strap being anchored to a bracket **57** that is fixed to

the foot of the chair. The pelvic belt and anchor strap maintain the patient's pelvis in the proper position relative to the seat and prevents slipping. Thus, when the driving motor **47** is operated to move the movable seat section **8** forwardly, the patient's pelvis moves with the seat section **8**. In order to prevent movement of the remainder of the patient's body in the direction of movement of the pelvis, a thoracic belt may be applied to the patient and be so arranged that the lower edge of the belt is close to the upper edge of the pelvic belt. The thoracic belt may be anchored by an adjustable strap (not shown) to a bracket **58** provided at the top of the back member **7**. With the pelvic and thoracic belts anchored to the chair, forward movement of the movable seat section **8** will apply substantial pelvic traction to the patient. Even without the use of belts, however, traction may be applied to a patient sitting in the chair, but the force in this instance will be less than if belts are used.

The application of traction may be steady or intermittent. That is, the seat section **8** may be advanced a desired distance by operation of the motor and the latter stopped, whereupon the section **8** will remain in its advanced position so as to apply a steady force to the patients' pelvis and thereby cause stretching or traction of the lumbar spinal structure. Alternatively, the section **8** may be successively advanced and retracted, under the control of the switch **55**, so as to apply intermittent traction to the pelvis.

Experimentation with chairs constructed in accordance with the invention and with a fairly large number of patients has resulted in a number of valid conclusions. For example, it has been found that the application of traction by the disclosed apparatus for treatment periods of thirty to forty-five minutes has been much more effective than treatment periods of several hours of bed traction. Moreover, the patient utilizing a chair of the present construction is more comfortable than a bed patient even though the patient may be subjected to considerably more traction force than is applied to him when he lies abed. In this connection, it has been noted that a patient many times would operate the chair in such manner as to impose maximum traction on the order of one hundred pounds. The application of the traction was either steady or intermittent, as the patient preferred.

The critical portion of the chair for purposes of obtaining flexion of the lumbar spine is the seat which, in the disclosed embodiment, comprises the rear end of the section **8**. Despite the critical nature of the seat, a single size chair can be used to treat patients of considerably different physical sizes. This is because there is not much difference in the pelvic length of an adult person, whether he be short or tall.

Apparatus constructed in accordance with the invention is not a panacea for all back conditions. For example, many patients suffering from low back pain will suffer a marked increase of pain when the lumbar spine is flexed. Moreover, some patients experience pain when only a small amount of traction is applied. Obviously, the chair of the present invention is not prescribed for treatment of such patients, but the knowledge that a patient cannot stand flexion or traction of the lumbar spine is of value to the physician in diagnosing the patient's disorder.

The disclosed embodiment is representative of a presently preferred form of the invention but is intended to be illustrative rather than definitive thereof. The invention is defined in the claims.

I claim:

1. A chair construction for supporting the body of a person, said construction comprising frame means having forward and rearward ends; an upwardly and rearwardly inclined back supporting member; means mounting said back supporting member on said frame means; an upwardly concave seat supporting member, and means mounting said seat member on said frame means for reciprocating movements relative to and toward and away from said back member.

2. The construction set forth in claim **1** including driving means connected to said seat member for moving the latter.

3. The construction set forth in claim **2** wherein said driving means comprises reversible motor means.

4. A chair construction for supporting the body of a person, said construction comprising frame means having forward and rearward ends; an upwardly and rearwardly inclined back supporting member supported on said frame means for movements between raised and lowered positions, an upwardly concave seat supporting member mounted on said frame means for movements relative to and toward and away from said back member, and driving means connected to said members for moving them.

5. The construction set forth in claim **4** wherein the driving means for moving said seat member and the driving means for moving said back member are independent of one another.

6. The construction set forth in claim **5** wherein the means for moving said seat member comprises reversible motor means.

7. The construction set forth in claim **5** wherein the means for moving said back member comprises reversible motor means.

8. A chair construction for supporting the body of a person, said construction comprising frame means having forward and rearward ends; an upwardly and rearwardly inclined back member mounted on said frame means and having a lower end; an upwardly concave seat member having a rear end; and means mounting said seat member on said frame means for fore-and-aft movement relative to and toward and away from said back member from a first position in which its said rear end lies adjacent the lower end of said back member, toward a second position in which said rear end of said seat member is forwardly spaced from said lower end of said back member, said rear end of said seat member constituting the lowermost portion of said seat member.

9. The construction set forth in claim **8** including driving means connected to said seat member for moving the latter from said first position toward said second position.

10. The construction set forth in claim **8** wherein said seat portion curves upwardly and forwardly from said rear end thereof and merges with a substantially planar, upwardly and forwardly inclined thigh supporting member.

11. The construction set forth in claim **8** including an intermediate member, means mounting said intermediate member between said seat and back members, said intermediate member having an upper surface formed on an upwardly concave arc corresponding substantially to the curvature of said seat portion to provide a smooth juncture between said back and seat members.

12. A chair construction for supporting the body of a person, said construction comprising frame means; a back member having a substantially planar supporting surface; means mounting said back member on said frame means; a seat member having an upwardly concave buttocks supporting portion at its rearward end and merging smoothly at its forward end with an upwardly inclined thigh support portion; an intermediate member; means mounting said intermediate member between the said lower end of said back member and the rearward end of said seat member, said intermediate member having an upper supporting surface that is concave upwardly to merge smoothly with said back member and with said seat member, the concavity of said buttocks supporting portion and said intermediate member being such that the rearward end of said seat member constitutes the lowest point of the supporting portions of said seat and intermediate portions; and means mounting said seat member on

said frame means for movements toward and away from said intermediate member.

13. The construction set forth in claim 12 including driving means for moving said seat member toward and away from said intermediate member.

14. The article set forth in claim 12 wherein said buttocks supporting portion and said intermediate member have their upwardly concave surfaces formed on an arc having a radius of substantially one foot.

15. The article set forth in claim 12 wherein the mounting means for said back member mounts the latter for swinging movements about a substantially horizontal axis, and including means connected to said back member for swinging the latter.

16. The article set forth in claim 12 including means on said back and seat members for anchoring body restraining means thereto.

17. A method of applying traction to a person's lumbar spinal structure comprising supporting the person's hips and lower extremities on one member and the person's back on another member with the person's pelvis rocked to a position to reduce its anterior convexity; and moving said members relatively to one another in a direction to stretch the lumbar spine while maintaining the pelvis in said position.

18. The method set forth in claim 17 wherein the movement of said members is under the control of the person.

19. The method set forth in claim 17 including moving said members relatively to one another in a direction opposite to the first mentioned direction to enable relaxation of the lumbar spine.

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