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(54) EXERCISE APPLIANCE FOR ABDOMINAL MUSCLES AND METHOD OF USING SAME

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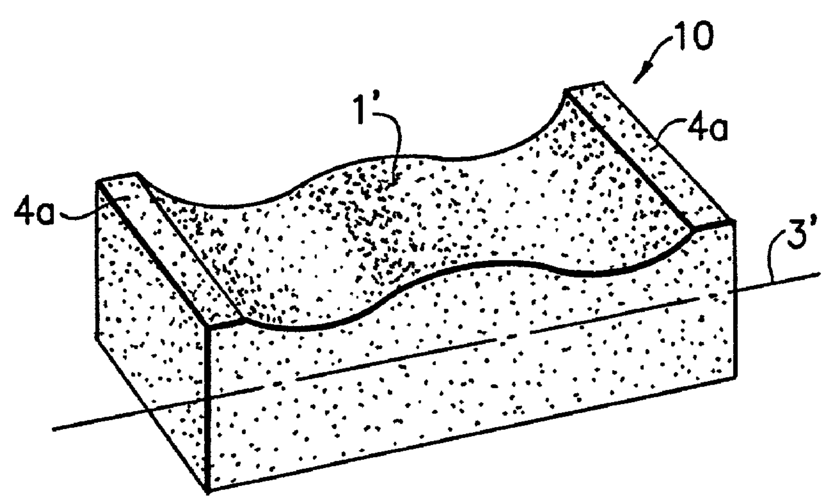
(57) **ABSTRACT**

An exercise appliance for conditioning the abdominal muscles of an individual includes an elastically resilient structure presenting a yieldable contact surface which provides a restoring force against a force applied thereto. The contact surface has a contour suitably sized and shaped to be at least partially fittable in the space formed between a support surface and a static lordotic curve of a lumbar back of an individual positioned with a remaining portion of the back of the individual in contact with the support surface. By positioning the resiliently yieldable portion of the appliance in the space formed between a support surface and the lumbar back, subsequent attempts by the individual to straighten the lumbar curvature by contraction of the abdominal muscles, forces the lumbar spine to flatten against the counter-force provided by the appliance, conditioning the abdominal muscles responsible for the action. In a further embodiment, the exercise appliance allows selection of the degree of resistance provided by the contact surface, allowing efficient use by individuals of varying levels of physical conditioning.



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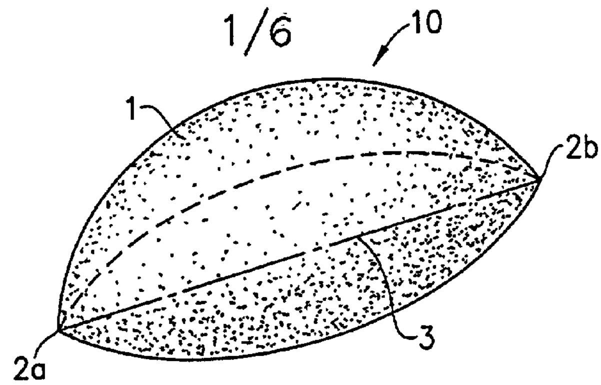

FIG. 1

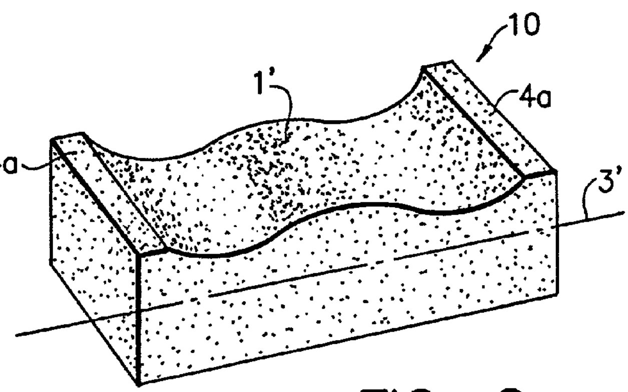

FIG. 2

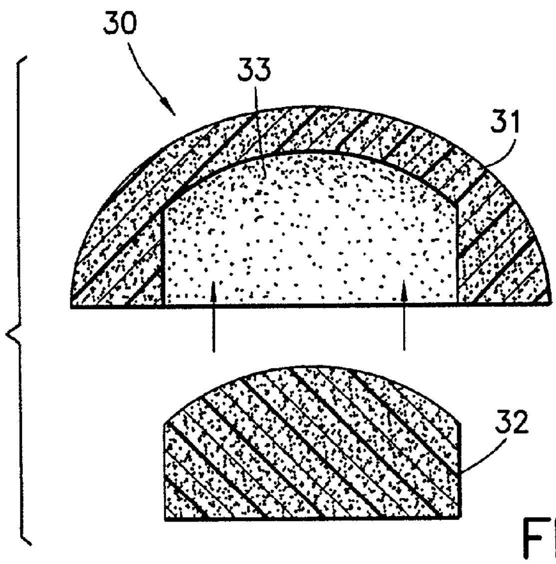

FIG. 7

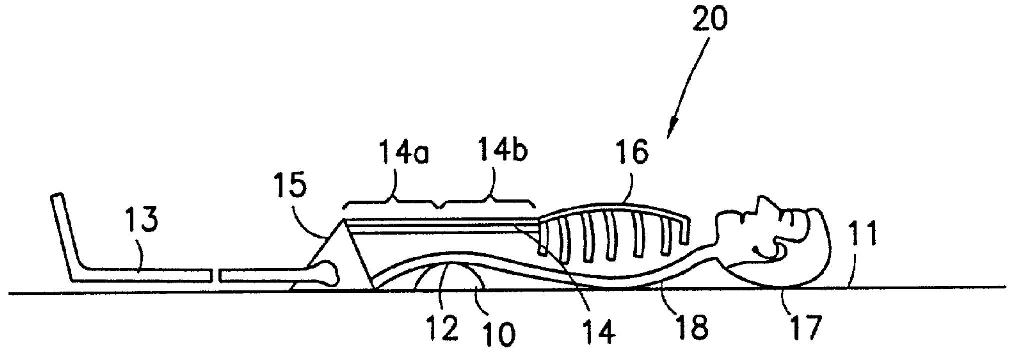

FIG. 3

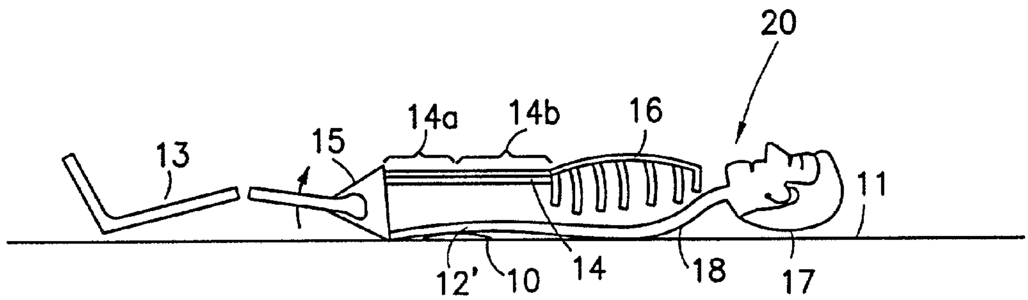

FIG. 4a

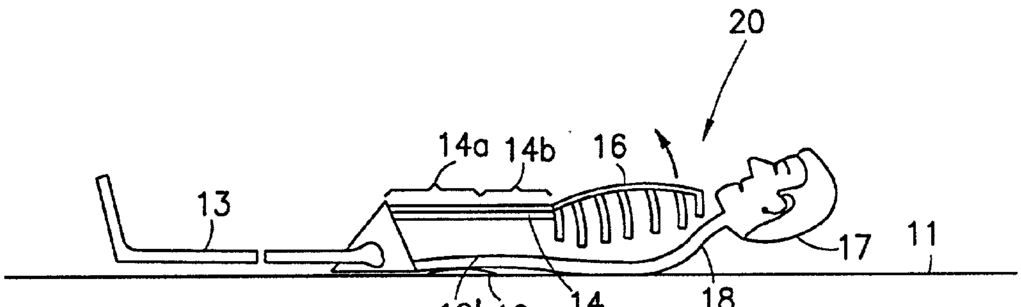

FIG. 4b

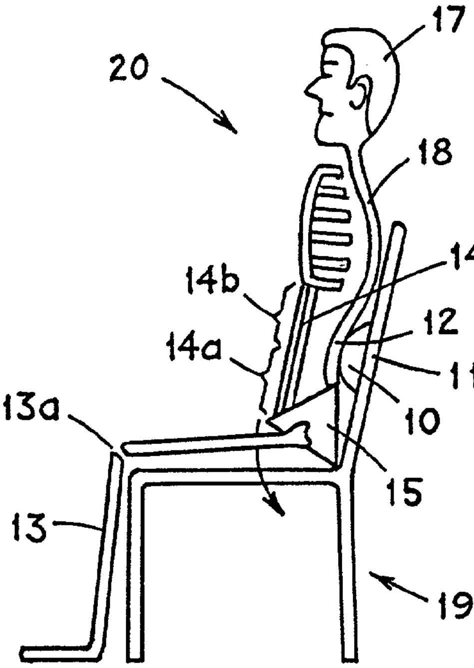

FIG. 5

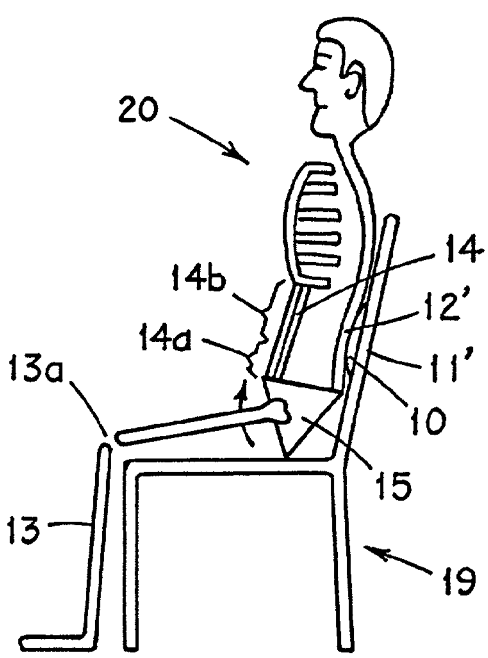

FIG. 6a

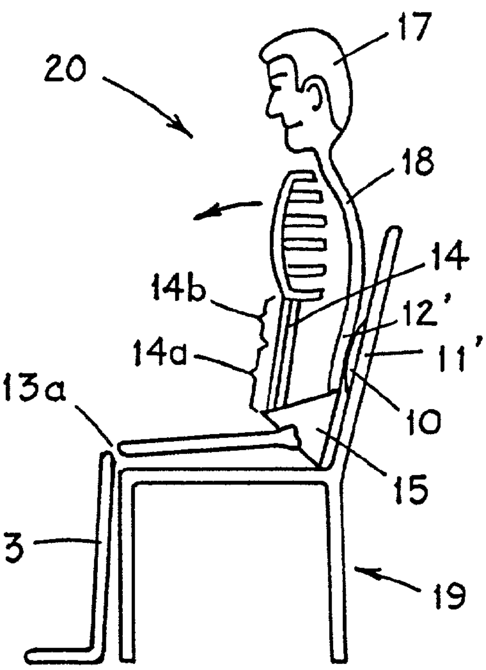

FIG. 6b

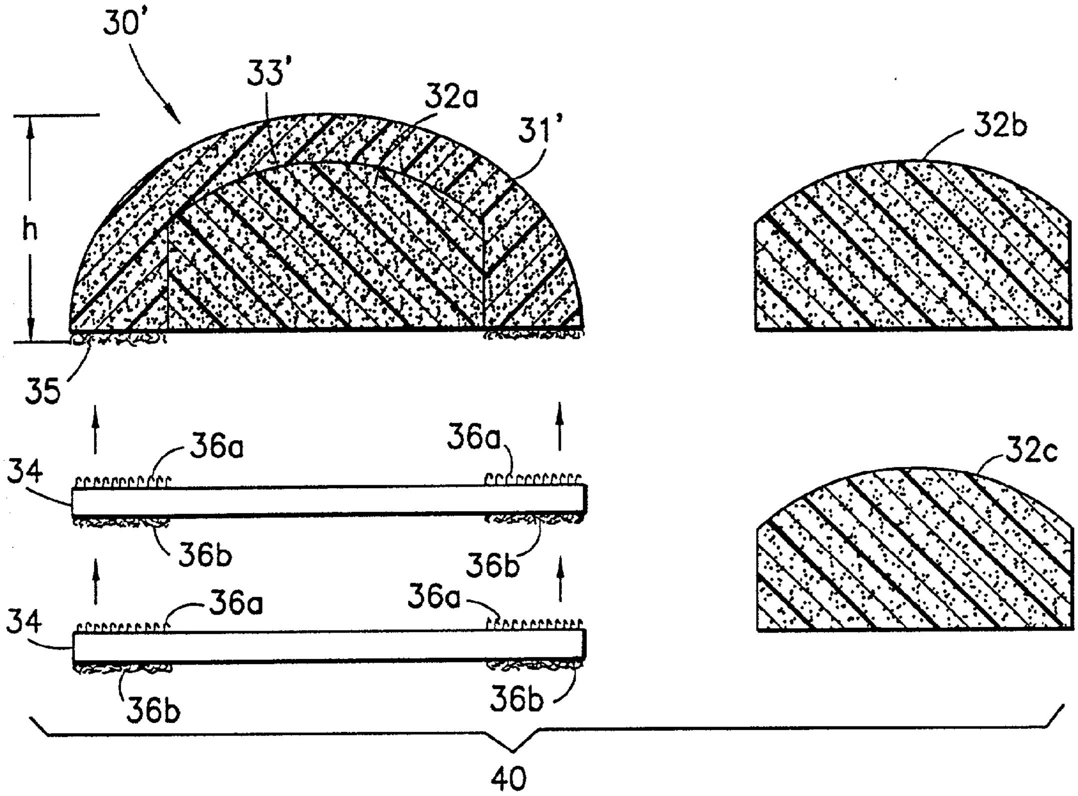
30'
33'
32a
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FIG. 8

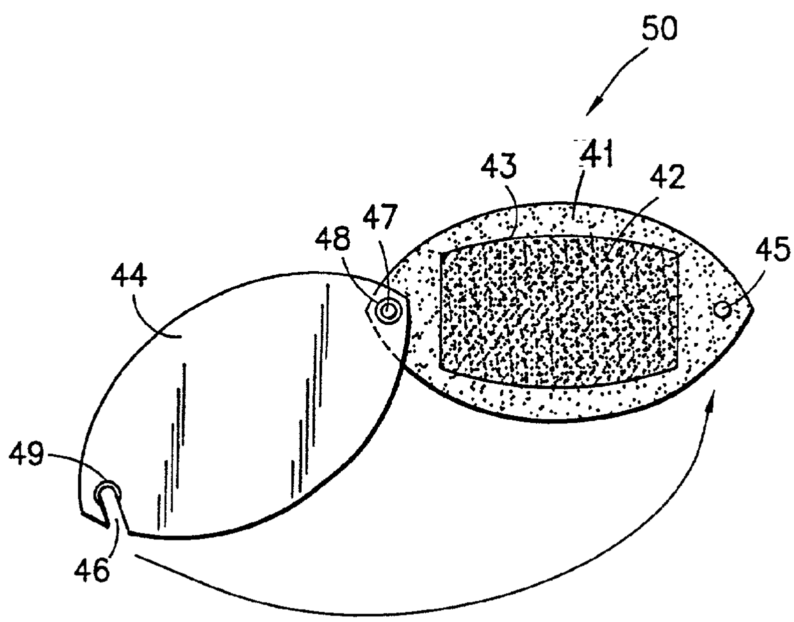
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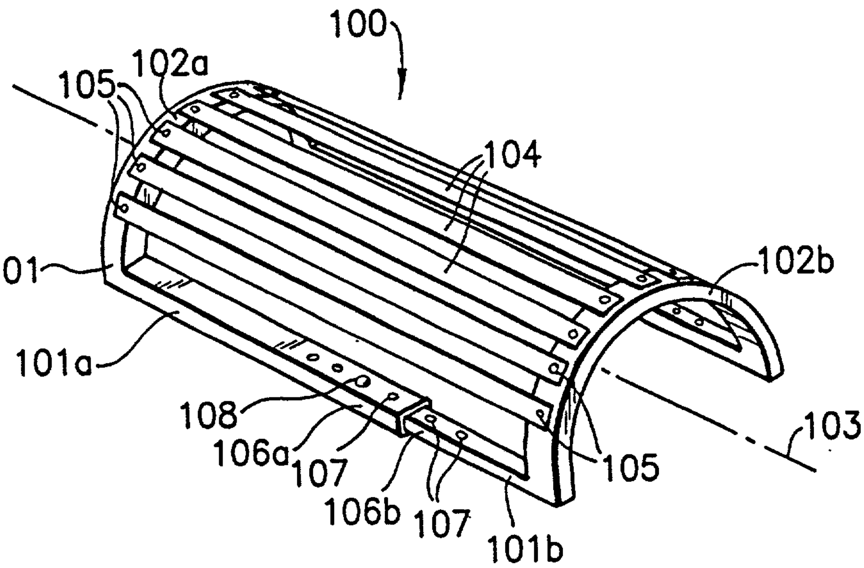
FIG. 9


100
105
102a
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102b
101a
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106a
107
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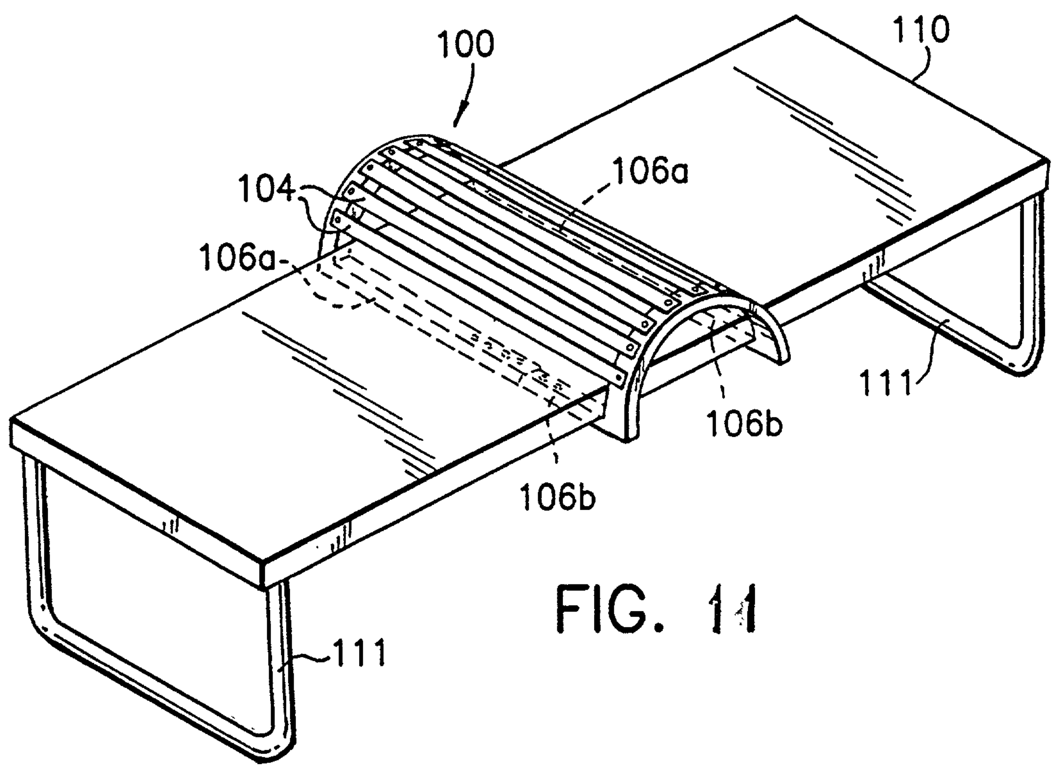
103
106b
107
101b

FIG. 10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106b
106b
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FIG. 11

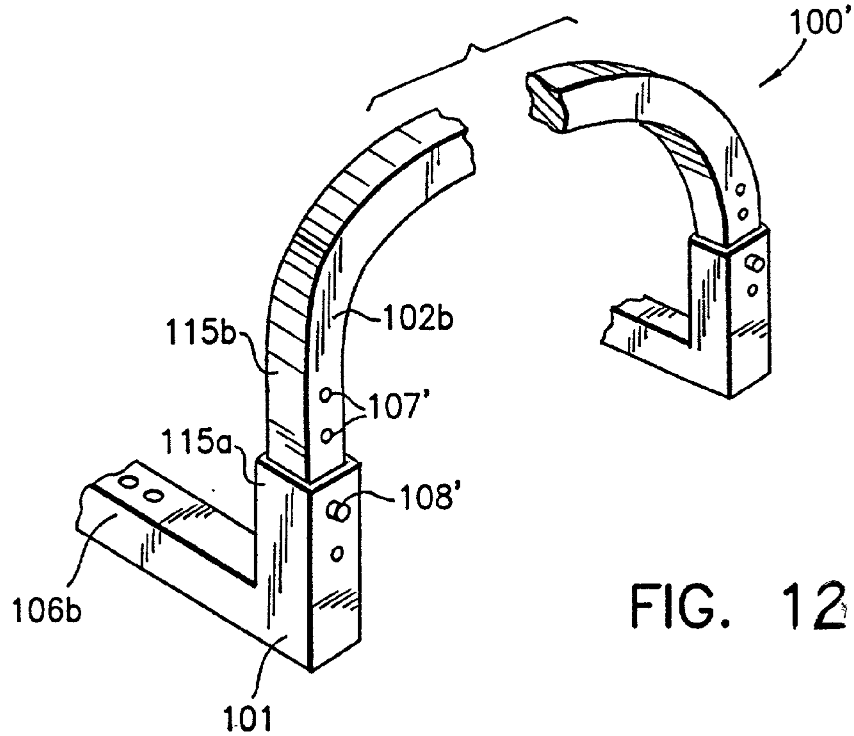

FIG. 12

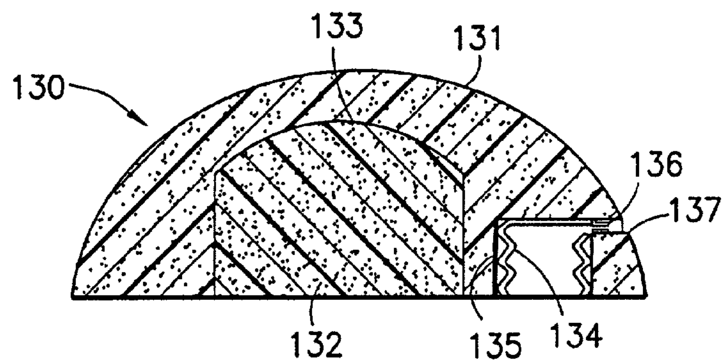

FIG. 13

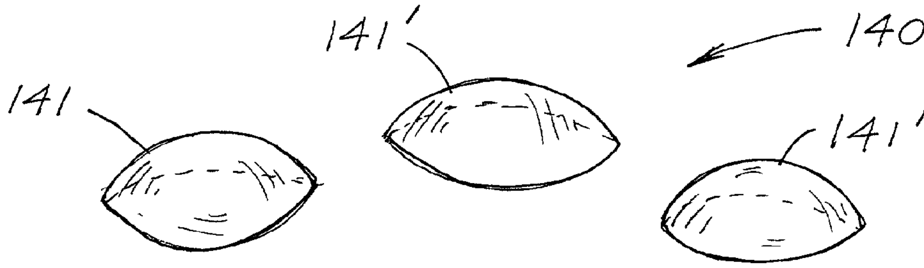

FIG. 14

EXERCISE APPLIANCE FOR ABDOMINAL MUSCLES AND METHOD OF USING SAME

REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation-in-part of co-pending application Ser. No. 08/442,182 filed May 16, 1995 entitled EXERCISE APPLIANCE FOR ABDOMINAL MUSCLES AND METHOD OF USING SAME.

BACKGROUND OF THE INVENTION

[0002] The present invention relates to an exercise appliance and a method of using the same for strengthening the abdominal muscles of a user.

[0003] Proper conditioning of the abdominal muscles, and primarily the rectus abdominous, is important not only for purposes of cosmetic appearance, but for maintaining integrity of the lower back by inhibiting hyperextension of the lumbar vertebrae. Weakness of the rectus abdominous results in an inability to flex the spine, making it particularly difficult to raise the head and upper trunk from a supine position. Uncorrected, this weakness can result in an increased lordotic curve and may become a source of chronic pain.

[0004] An understanding of the anatomical structure of the human spine, as well as the actions of associated muscle groups, is important to the development of an exercise appliance effective in isolating involvement to the rectus abdominous, and which limits the deleterious effects on the vertebrae caused heretofore.

[0005] The human spine, when viewed from the side, has three basic physiologic curves along its mobile length, each curve associated with a particular region thereof. Occupying the uppermost position along the spine is the cervical region, having a lordotic curvature, i.e. one having anterior convexity. Below the cervical spine is the thoracic region having a curve which is convex posteriorly, referred to as the thoracic or dorsal kyphosis. The next, and lowest curve, is the lumbar region. The lumbar curve is lordotic and of greater curvature than the thoracic curve. Each of the curved regions meets along a midline center of gravity to balance against gravity and provide a stable, upright posture.

[0006] The mobility of the three regions of the spine are determined by posterior vertebral articulations, the structure of which differs for each region. Specifically, the articulating surfaces in the thoracic region permit rotation but sharply limit flexion and extension. In contrast, the structure of the vertebral articulating surfaces in the lumbar region inhibits rotation, but allows excellent freedom of extension and adequate flexion. Extension of the lumbar spine well beyond the normal, or static, lumbar lordosis is therefore possible. However, flexion of the lumbar region will at most result in a flattening of the normal lordotic curve, since the geometry of the lumbar vertebrae does not safely permit sufficient flexion to produce kyphosis.

[0007] The entire spine is balanced at its base on the sacrum, and pivotally connected to one another through the lumbosacral joint. The sacrum and ilia move as one unit and comprise the pelvis, which in turn is connected to the legs via the hip joints.

[0008] Movement of each region of the spine is controlled by a particular muscle or muscle group. The rectus abdominous is responsible for flexion of the lumbar vertebrae, and when toned properly, assists in supporting the lower back against hyper-extension. It is attached at the top to the costal cartilage of the 5th, 6th and 7th ribs and the xiphoid process of the sternum, and below to the pubic bone of the pelvis. Contraction of the rectus abdominous increases the thoracic curve and flattens the lumbar curve by approximating the thorax and pelvis anteriorly. However, since flexion/extension of the thoracic spine is sharply limited, most of the shortening between the thorax and pelvis effected by contraction of the rectus abdominous is attributed to flexion of the lumbar spine. It is believed that this trunk flexion occurs primarily at the lumbosacral joint, accounting for as much as 75% of the total flexion. Additional flexion occurs between the remaining lumbar vertebrae and is limited to a reversal of the static lordosis to a flattened position. Any attempt to go beyond this point, at which the normal lordotic curve is flattened, will place undue stress on the lumbar spine.

[0009] Well known in the prior art, the sit-up type exercise has long been relied upon to condition and strengthen the muscles in the abdominal area, and in particular the rectus abdominous. In such exercises, by forcing the rectus abdominous to contract to shorten the distance between thorax and pelvis, the weight of the upper body acting against gravity provides a resistance against the contraction, in turn conditioning the muscle.

[0010] Originally, the standard full sit-up was performed by raising the trunk to a sitting position from a supine position, with legs either fully extended or bent at the knees. This motion, however, by applying forces tending to urge the lumbar vertebrae into flexion beyond a flattening of the lordotic curve, was found to exert undue stress on the region of the lower back, often resulting in trauma. Full sit-ups practiced over a prolonged period may lead to degenerative changes resulting in low back mechanical instability, chronic pain or even disability.

[0011] To overcome this negative limitation, this type of abdominal conditioning exercise evolved into the well known "crunch" style sit-up, in which an individual in a supine position, with legs bent, raises the head and shoulders a sufficient distance to curl the trunk and tense the abdominal muscles. Although alleviating the traumatic effects to the lower back caused by the traditional full sit-up by eliminating the offending range of motion, the "crunch" style sit-up has been less than perfect in providing efficient conditioning of the rectus abdominous.

[0012] Another drawback in prior art abdominal strengthening exercises involving trunk raising is the failure to isolate against involvement of other muscles, and in particular the iliopsoas. The iliopsoas is a powerful muscle component of the hip flexors, the group of muscles responsible for rotation of the pelvis about the hip joints, which attaches within the abdomen on the lumbar vertebrae across the pelvis onto the proximal femurs. Bending motion at the waist is accomplished by a combination of actions of the rectus abdominous and hip flexors. When bending at the waist with legs extended, for example in an attempt to touch one's toes in the performance of a full sit-up, trunk flexion effected by contraction of the rectus abdominous alone would not be sufficient to complete the action, since most of the bending of the spine anteriorly is confined to a straightening of the lordotic curve in the lumbar spine. Rotation of the pelvis about the hip joints is therefore necessary to accomplish further bending, which requires contraction of the iliopsoas.

[0013] The iliopsoas connects at its upper termination to the anterior lumbar spine. While an individual is standing, or in a supine position with legs fully extended, the pull of the iliopsoas applies mild anterior tension on the lumbar spine, and maintains the static lordotic curve of the lumbar spine.

[0014] In a desire to eliminate involvement of the iliopsoas during trunk raising, it has long been suggested that the situp type exercise be performed with legs bent at the knees. By bending the knees, the hips are also flexed, and the iliopsoas is passively shortened. It was thought that placing the muscle in this slackened state would remove its involvement while performing trunk raising. However, subsequent studies have suggested that passively shortening the iliopsoas by flexing the hips in the bent knee position does not eliminate their involvement during performance of the sit-up type exercise. On the contrary, researchers believe the iliopsoas, in a mechanically less effective position when shortened, is loaded to a greater degree than if the trunk raising were to be performed with legs extended and the iliopsoas in a more elongated state. Exercising the iliopsoas through a short arc of motion, as while in the bent knee position with hips flexed, may over time result in over-strengthening and an undesirable shortening of the hip flexors.

[0015] Bending the knees and hips while performing a sit-up type exercise also introduces another undesirable effect. When feet are in contact with the floor, bending of the knees flexes the femurs. As a consequence, the pelvis tilts posteriorly, and the lordotic curvature is flattened. The effectiveness of any abdominal exercise performed while in this position, including full and "crunch" sit ups, would be severely limited, since most of range of motion affected by contraction of the rectus abdominous is confined to a straightening of the static lordotic curve of the lumbar spine, of which as much as 75% is due to tilting of the pelvis with respect to the interspace between the fifth lumbar vertebra and the sacrum, which has already been accomplished without using the rectus abdominous. In the bent knee position, the lower abdominal muscles are passively shortened, placing them in a weakened state, and preventing maximum contraction. Moreover, exercising them over the short arc of motion remaining may lead to lower abdominal bulging or an undesirable shortening thereof.

[0016] Another exercise, the leg lift, has also been practiced in the prior art in a desire to bring about a strengthening of the rectus abdominous, particularly over the lower region thereof. The classical form of this exercise was performed from a supine position, and consisted of raising both legs, with knees maintaining a straight leg position.

[0017] Generally this exercise has been contraindicated, except for extremely well-conditioned individuals, and for the following reasons. During leg raising with both legs fully extended, approximately the first 30 degrees of motion is accomplished by the iliopsoas. Because of the weight of the legs and the poor mechanical advantage, contraction of the iliopsoas in an attempt to elevate the legs instead generally causes an undesirable hyperextension of the lordotic curve, rather than resulting in upward movement of the legs. In addition, the individual may frequently hold his breath during performance of the exercise, which may cause other undesirable effects.

[0018] Numerous abdominal exercise appliances have been provided in the prior art, in an attempt to condition and strengthen the rectus abdominous. However, in many ways these have failed to adequately address the need for a portable, lightweight appliance which when used, effectively isolates and safely exercises the rectus abdominous and other abdominal muscles.

OBJECTS AND SUMMARY OF THE INVENTION

[0019] Accordingly, it is an object of the invention to provide an exercise appliance and a method of using the same for strengthening the abdominal muscles of a user, particularly the rectus abdominous, which overcomes the drawbacks of the prior art.

[0020] It is a further object of the invention to provide the exercise appliance and a method of using the same which isolates the abdominal muscles and minimizes involvement of the hip flexors.

[0021] It is a still further object of the invention to provide the exercise appliance and a method of using the same which exercises the rectus abdominous over a wider range of motion, firing the muscle at a higher intensity, for enhanced strengthening and conditioning, while reducing lumbosacral mechanical stress.

[0022] It is a still further object of the invention to provide the exercise appliance and a method of using the same which is effective for training an individual to maintain correct posture by teaching the motion of the posterior pelvic tilt.

[0023] It is a yet further object of the invention to provide the exercise appliance which is suitable for use by individuals of various degrees of physical conditioning, and in a form which is operationally reliable, economical, lightweight, compact and portable.

[0024] Briefly stated, there is provided an exercise appliance for strengthening and toning the abdominal muscles of an individual which includes a resiliently yieldable structure presenting a contact surface, such structure providing a restoring force against a force applied to the contact surface. The contact surface has a contour suitably sized and shaped to be at least partially fittable in the space formed between a support surface and a static lordotic curve of a lumbar back of an individual positioned with a remaining portion of the back of the individual in contact with the support surface. The yieldable structure of the appliance in accordance with embodiment of the invention advantageously provides elastic resiliency to conformably adapt to selectively applied force by permitting deformation of the contact surface. As used herein, the terms "elastic resiliency" and "elastically resilient" refer to a structure or material which yieldably resists deformation, a surface of such structure or material experiencing differential movement of area portions relative a remainder of the surface in response to confined force applied to such area portions against the restoring force. Such term is intended to embrace, for example, any of a foam mass, an inflated balloon or other flexible confining structure in which is received a compressible gas or other substance, a tensioned elastic band or plurality of bands extending between supports, or any other suitable structure or material exhibiting like characteristics. In accordance with embodiment of the invention, movement of at least a portion of the yieldable structural portion of the appliance is restricted relative the support surface.

[0025] A method for strengthening the rectus abdominous using an exercise appliance in accordance with embodiment of the present invention includes placing the elastically resilient, yieldable portion of the appliance in the space formed between a support surface and a normal lordotic curve of an individual positioned with a back of the individual in contact with the support surface. The support surface may be a floor, table top or exercise bench, in which case the individual lies in a supine position. Alternatively, the support surface may be a vertical wall, and the individual in an upright posture, stands with his back in contact with the wall. Still further, the individual may be in sitting position on a chair or other structure providing back support, placement of the appliance serving to restore static lordotic curvature to the lumbar region otherwise straightened by the relaxation of the pull of the iliopsoas on the anterior lumbar spine brought about by flexion of the hips while in the sitting position. Following placement of the appliance, the individual attempts to straighten the lumbar curvature by a contraction of the rectus abdominous and other abdominal muscles, including the internal and external obliques and transverse abdominous, which action causes the lumbar spine to flatten against the counter-force provided by the appliance. Because of the anatomy of the rectus abdominous, two types of contractions may be performed to accomplish a flattening of the lordotic curve. The rectus abdominous is thought to act as a two joint muscle, i.e. providing contraction over two regions thereof, to effect different motion. The two regions include the lower rectus abdominous below the navel to where it connects to the pubic bone of the pelvis, and the upper rectus abdominous from above the navel to its connection to the lower end of the rib cage. Contracting both the lower and upper regions together results in a contraction referred to as simultaneous or countercurrent. A more effective practice is to perform the contractions of each region in sequence, known as a concurrent contraction, which fires the muscle more powerfully for more efficient conditioning. Therefore, advantageously, conditioning of the rectus abdominous may be divided into two exercises, each performed separate from the other, directed to one of the upper and lower abdominal regions. To concentrate on conditioning the lower abdominal, the individual will posteriorly tilt the pelvis by actively contracting the rectus abdominous primarily over its lower region. If instead the individual wishes to concentrate on the upper abdominal region, the head and shoulder blades are raised by a contraction the rectus abdominous an amount sufficient to cause a flattening of the lordotic curve, and a compression of the compressible mass of the exercise appliance, which provides resistance against the contraction. With both exercises, the degree of conditioning is most effective with hips extended rather than flexed. In carrying out the method, a regimen of repeated contractions over an uninterrupted exercise time period of the abdominal muscles to effect straightening of the lumbar back against the elastic resiliency presented by the contact surface is deemed advantageous in achieving increased muscle fitness.

[0026] A structural embodiment particularly adapted to portable use provides the yieldable structure in the form of a compressible mass fabricated from a elastically resilient material, such as elastomeric foam, thereby providing inherent resistance against deformation of its original shape. One side of the compressible mass will advantageously be of a generally flattened shape to permit secure contact with the support surface. When placed in direct contact with the support surface, movement of the compressible mass comprising the yieldable structure is restricted, and substantially all applied forces are translated into compression of the mass. The other side is of a suitable curved shape to conform with the static lordotic curvature of the individual. Placement of the appliance in the space between the normal lordotic curve and the support surface provides a direct counter-force against an attempt by the individual to straighten the lordotic curve brought about by active contraction of the abdominal muscles, particularly the rectus abdominous. Performing repeated compression of the mass by a straightening of the lordotic curvature effectively conditions and strengthens the abdominal muscles by forcing them to contract against a resistance. In an advantageous embodiment, a kit provides the user with a plurality of such compressible masses, each having a different degree of compressive resiliency, from which the user selects a suitable one depending on the progressive level of physical conditioning applicable to the particular user. The appliance may also be provided with a sensor which can output an audible or other type feedback signal indicative of the degree of compression of the mass, to insure proper performance of the exercise by the individual.

[0027] In accordance with an alternative embodiment, the appliance includes a pair of spaced apart lateral supports between which one or more elastic members, conveniently in the form of elastic bands, extend. The bands are advantageously tensioned to provide a desired degree of elastic resiliency when acted upon by a lumbar back of an individual brought in contact therewith in a manner analogous with the previously described embodiment. Means are optionally provided to permit user-selectable tensioning of the bands.

[0028] The above, and other objects, features and advantages of the present invention will become apparent from the following description read in conjunction with the accompanying drawings, in which like reference numerals designate the same elements.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] **FIG. 1** is perspective view of an embodiment of the exercise appliance in accordance with the present invention;

[0030] **FIG. 2** is perspective view of another embodiment of the exercise appliance in accordance with the present invention;

[0031] **FIG. 3** is a schematic view of an individual prior to performing a method of strengthening the rectus abdominous using the exercise appliance of the present invention;

[0032] **FIG. 4***a* is a schematic view of an individual performing a method of strengthening the rectus abdominous using the exercise appliance of the present invention, with concentration on the lower abdominal region;

[0033] **FIG. 4***b* is a schematic view of an individual performing a method of strengthening the rectus abdominous using the exercise appliance of the present invention, with concentration on the upper abdominal region;

[0034] **FIG. 5** is a schematic view of an individual prior to performing a method of strengthening the rectus abdominous using the exercise appliance of the present invention in a seated position;

[0035] **FIG. 6*a*** is a schematic view of an individual performing a method of strengthening the rectus abdominous using the exercise appliance of the present invention while seated, with concentration on the lower abdominal region;

[0036] **FIG. 6*b*** is a schematic view of an individual performing a method of strengthening the rectus abdominous using the exercise appliance of the present invention while seated, with concentration on the upper abdominal region;

[0037] **FIG. 7** is cross-sectional view taken of another embodiment of the exercise appliance in accordance with the present invention, including replaceable inserts to vary a degree of resiliency;

[0038] **FIG. 8** is a cross-sectional view of an abdominal exercise kit;

[0039] **FIG. 9** is a bottom elevation of a further embodiment the exercise appliance in accordance with the present invention, including means for providing structural rigidity;

[0040] **FIG. 10** is a perspective view of another embodiment of the exercise appliance in accordance with the present invention;

[0041] **FIG. 11** is a perspective view of an alternate embodiment of the exercise appliance shown in **FIG. 10**, showing the exercise appliance mounted to an exercise bench;

[0042] **FIG. 12** is the embodiment of **FIG. 10** with the addition of a height adjustment mechanism, shown in detail;

[0043] **FIG. 13** is a cross-sectional view of a further embodiment of the exercise appliance in accordance with the present invention, including means for emitting an audible feedback signal in response to compression; and

[0044] **FIG. 14** is a perspective view of a kit providing a plurality of exercise appliances in accordance with embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0045] Referring now to the figures, and in particular **FIG. 1**, there is shown, generally at **10**, an abdominal exercise appliance, in accordance with the invention. Abdominal exercise appliance **10** of the preferred embodiment is made of a compressible, elastically resilient foam and formed in a shape suitable for placement between the lumbar spine of an individual and a support surface against which a remaining portion of a back of the individual is in contact. In the embodiment shown in **FIG. 1**., the shape is that of a longitudinally bisected football, having a curved upper surface **1** and opposed end poles **2*a*** and **2*b*** at the termination points of a longitudinal axis **3**. In this embodiment, abdominal exercise appliance **10** is designed to be positioned during use with longitudinal axis **3** oriented in a direction across the individual's back. The compressible foam from which abdominal exercise appliance **10** is formed is a resilient material which resists compression and which returns essentially to its original shape upon a release of an applied force. For example, urethane foams and the like having elastomeric properties perform satisfactorily in such application.

[0046] **FIG. 2** is another embodiment of the abdominal exercise appliance, in accordance with the invention, shown generally at **10'**. Abdominal exercise appliance **10'** is also fabricated or molded from a compressible foam material demonstrating elastic resiliency, and but is instead generally saddle shaped, having a longitudinal axis **3'** which is oriented in a direction across the individuals back during use. A curved upper surface **1'** is centrally located along longitudinal axis **3'**. A pair of lateral supports **4*a*** and **4*b*** are disposed on lateral ends of abdominal exercise appliance **10'** and contact the left and right sides of the individual, to provide stability during performance of the described method of strengthening the rectus abdominous which is discussed in detail below. For purposes of disclosure, it is noted that only two shapes have been shown. However many others may be developed without departing from the scope of the invention.

[0047] Referring now to **FIGS. 3, 4*a*** and **4*b***, a method of using the abdominal exercise appliance of the present invention will be described. An individual **20** lies, for example as shown, in a supine position on a support surface **11**. Support surface **11** may be a floor, a table, exercise bench or any suitable, relatively flat surface. Although a horizontal surface has been selected for purposes of disclosure, the described method may also be performed in an upright position, with the back of individual **20** in contact with a vertical wall. Tilted support surfaces are also feasible. Additionally, the individual may be in an upright sitting position in a chair in supported contact with a back thereof, the back of the chair being the support surface. Moreover, because effective use of abdominal exercise appliance **10** is gravity independent, it may find application in the weightlessness of outer space, requiring, however, that the individual be secured by straps or the like to the support surface during performance of the disclosed method.

[0048] Abdominal exercise appliance **10** is fittable between a lumbar spine **12** having a normal or static lordotic curve and support surface **11**, as shown in **FIG. 3**. Where used herein, a normal or static lordotic curvature refers to a degree of curvature generally present in a lumbar spine when an individual with normally healthy posture is in an upright position. It is noted that with legs **13** fully extended, as shown in **FIG. 3**, the static lordotic curve is maintained by the pull of the iliopsoas on the anterior lumbar spine, creating a space in which abdominal exercise appliance **10** is fittable. However, it is alternatively quite acceptable to bend the knees, relaxing the pull of the iliopsoas, passively straightening lumbar spine **12**. In fact, this action is unavoidable, when the exercise is to be performed in a sitting position in a chair, as described below with reference to **FIGS. 5, 6*a*** and **6*b***. Despite the straightening of lumbar spine **12**, abdominal exercise appliance **10** is still fittable between lumbar spine **12** and support surface **11**, since static lordotic curvature is restorable by effort on the part of the individual to anteriorly tilt the pelvis, designated by the numeral **15** in **FIG. 4*a***, i.e. in a direction opposite that indicated by the curved arrow shown. This notwithstanding, the resiliency of abdominal exercise appliance **10** once placed between lumbar spine **12** and support surface **11** is generally sufficient to restore and maintain static lordotic curvature of lumbar spine **12** otherwise straightened by the relaxation of the pull of the iliopsoas on the anterior lumbar spine **12** brought about by flexing the hips, for example while sitting or lying with knees bent. Bending the knees may actually be advisable for certain individuals having an overly developed lordotic curvature, for example where tight hip flexors exert undue anterior pull on lumbar spine **12**. These individuals would be advised to bend their knees at least an amount sufficient to release the excessive strain of the iliopsoas, reducing the lordotic curvature to a normal degree.

[**0049**] A rectus abdominous **14** includes a lower abdominal region **14***a* and an upper abdominal region **14***b*. Rectus abdominous **14** connects at its lower termination to the pubic bone of pelvis **15**, and at its upper termination to a lower part of a rib cage **16** (the costal cartilage of the 5th, 6th and 7th ribs and the xiphoid process of the sternum). In an advantageous embodiment of the present invention, abdominal exercise appliance **10** has a height, as measured from support surface **11**, that slightly exceeds the distance between the apex of the normal lordotic curve of lumbar spine **12** and support surface **11**. In this way, a gentle upward pressure is exerted against lumbar spine **12** by abdominal exercise appliance **10** prior to performing any action, however not enough to cause excessive hyperextension. Rectus abdominous **14** is placed in a condition of prestretch as a result of the pre-applied upward force on lumbar spine **12**. Studies have shown that moderate prestretching of a muscle immediately preceding a contraction thereof, enables it to contract more forcefully than if prestretching is not performed, increasing the rate of beneficial conditioning of the muscle during exercise, as well as preventing a shortening of the muscle.

[**0050**] It is noted that the rectus abdominous is thought to act much like a two-joint muscle. Capable of controlling two distinct body motions by separate contractions, two-joint muscles are not optimally effective if shortened over both joints simultaneously. Therefore, advantageously, an exercise directed to conditioning such muscles should ideally include contraction of each of the two regions, separate of the other. Similarly, to obtain the most forceful contraction, and hence the most concentrative conditioning in each of the two regions of contraction of the rectus abdominous, i.e. the lower part thereof, where it connects to the pelvis, and the upper part, where it connects to the rib cage, each region should be made to contract separately from the other. It must be noted, however, that the region not actively contracted still fires and is not completely silent.

[**0051**] Referring now to **FIGS. 4***a* and **4***b*, two actions are illustrated, one directed to the conditioning of lower abdominal region **14***a*, and the other to the conditioning of upper abdominal region **14***b*, respectively. Referring first to **FIG. 4***a*, a compression of abdominal exercise appliance **10** is accomplished by initiating contraction of lower abdominal region **14***a*. Individual **20** concentrates on tilting pelvis **15** posteriorly, i.e. in the direction as indicated by the curved arrow, by active contraction of rectus abdominous **14**, and in particular lower abdominal region **14***a*. At the same time, head **17** and shoulder blades **18** are maintained in contact with support surface **11**, which if lifted, would cause simultaneous contraction of upper abdominal region **14***b*, thereby weakening the contraction of lower abdominal region **14***a*. The normal lordotic curve of lumbar spine **12** is flattened by the contraction of lower abdominal region **14***a* to effect the tilting of pelvis **15** posteriorly, as illustrated in the figure (the flattened position of lumbar spine designated **12**' in **FIGS. 4***a* and **4***b*). The resisting force against compression of abdominal exercise appliance **10** provides loading on the contracting lower abdominal region **14***a*. Once compression of abdominal exercise appliance **10** is complete, individual **20** allows pelvis **15** to tilt anteriorly, returning it to its original position in **FIG. 3**, and relaxing lower abdominal region **14***a*. In this position, abdominal exercise appliance **10** returns to its original shape, and in accordance with the aforementioned advantageous embodiment, places rectus abdominous in prestretch, providing maximum conditioning from subsequent compression. The above described actions are performed for a desired number of repetitions to effectively condition lower abdominal region **14***a* of rectus abdominous **14**.

[**0052**] Turning now to **FIG. 4***b*, a compression of abdominal exercise appliance **10** is accomplished by initiating contraction of upper abdominal region **14***b*. Individual **20** now concentrates on moving head **17** and shoulder blades **18** away from support surface **11**, as indicated by the direction of the curved arrow, to curl the trunk, by active contraction of rectus abdominous **14**, and in particular upper abdominal region **14***b*. The normal lordotic curve of lumbar spine **12**, as shown in **FIG. 3**, is moved to flattened lumbar position **12**' by the contraction of upper abdominal region **14***b* to effect a curving of the trunk by pulling on the rib cage **16** where rectus abdominous **14** connects thereto, as illustrated. Ideally, care is taken not to allow pelvis **15** to tilt posteriorly by action of lower abdominal region **14***a* to assist in the flattening of lumbar spine **12**'. If such were permitted to occur, the simultaneous contraction of lower abdominal region **14***b* would hinder as forcible a contraction of upper abdominal region **14***b*. Head **17** and shoulder blades **18** are lifted only an amount sufficient to flatten the normal lordotic curve of lumbar spine **12**, as shown in **FIG. 3**, to flattened lumbar position **12**', and to compress abdominal exercise appliance **10**. At this point shoulder blades **18** should generally just clear support surface **11**. There is no beneficial reason for going beyond this point since lumbar spine **12** does not safely permit sufficient flexion to produce kyphosis. The resisting force against compression of abdominal exercise appliance **10** provides loading on the contracting upper abdominal region **14***b*. Once compression of abdominal exercise appliance **10** is complete, individual **20** lowers head **17** and shoulder blades **18** back to contact with support surface **11**, returning to the original position in **FIG. 3**, and relaxing upper abdominal region **14***a*. In this position, abdominal exercise appliance **10** returns substantially to its original shape, as with the previously described method embodiment. The above described actions are performed for a desired number of repetitions to effectively condition upper abdominal region **14***a* of rectus abdominous **14**.

[**0053**] Referring now to **FIGS. 5**, **6***a*, and **6***b*, use of the abdominal device when a user is in a seated position is described. Individual **20** sits on a suitable chair **19** advantageously having a secure chair back **11**' which serves as a support surface. As mentioned herein, bending of knees **13***a* of legs **13** of individual **20** when normally seated in upright-back chair passively straightens lumbar spine **12** by relaxing the pull of the iliopsoas on pelvis **15**. Therefore, as noted, and as depicted in **FIG. 5**, prior to performing a repetition in accordance with an embodiment of the invention, before individual **20** restores the lordotic curvature of lumbar spine **12** by anteriorly tilting the pelvis, i.e. in the direction indicated by the curved arrow, creating a space in which exercise appliance **10** is fittable. Generally, once placed, the restoring force provided by exercise appliance **10** is sufficient to assist in restoring the curvature to lumbar spine **12** for subsequent repetitions. From this position, two exercises targeted respectively to the lower and upper abdominal regions **14***a* and **14***b*, shown in **FIGS. 6***a* and **6***b*. The exercises are performed in an analogous manner to those described with reference to **FIGS. 3, 4***a* and **4***b* performed in a supine position. For exercise targeted to the lower abdominal region, as shown in **FIG. 6***a*, individual concentrates on tilting pelvis **15** posteriorly in the direction of the curved arrow. Alternatively, as shown in **FIG. 6***b*, individual **20** concentrates instead on moving head **17** and shoulder blades **18** away from support surface (chair back) **11**'. In both cases, once compression of abdominal exercise appliance **10** is complete, individual **20** returns to the starting position depicted in **FIG. 5**, and the described actions are performed for a desired number of repetitions to effectively condition rectus abdominous **14**.

[**0054**] Although the above methods are described with reference to their benefits associated with the rectus abdominous, other abdominal muscles will benefit from performance of the described exercises. Among these, for example, are the internal and external obliques which also play a role in flexing the vertebral column to approximate the thorax and the pelvis when acting bilaterally, will be strengthened when forced to contact against the resisting force of the exercise appliance of the present invention. It is further noted, that although the advantageous embodiments described above are directed to performance of exercises which stress a concurrent contraction of each of the upper and lower regions of the rectus abdominous, benefit to the abdominal muscles will still be derived from performance of a simultaneous contraction, and is contemplated to be within the scope of the invention as claimed herein.

[**0055**] **FIG. 7** is a cross-sectional illustration of another embodiment of the abdominal exercise appliance, in accordance with the invention, adapted for portable use, which allows selective alteration of degrees of resistance, and is shown generally at **30**. Abdominal exercise appliance **30** includes a body **31** and a series of removable inserts **32**. Only one of inserts **32** is shown since the dimensions for each are uniform. Body **31** is molded or fabricated from a compressible foam material, and has an external shape and physical characteristics in conformance to those discussed with regard to the embodiments of **FIGS. 1 and 2**. A cavity **33** is formed for captively receiving a selected one of inserts **32**, for example, having an opening thereof in the lower surface of body **31**. In an advantageous embodiment, inserts **32** have external dimensions slightly larger than the internal dimensions of cavity **33**, requiring inserts **32** to be press fit into cavity **33**, thereby holding body **31** in joined relationship to the selected one of inserts **32**. Inserts **32** are made of a foam material, each member of the set having a different density from remaining ones of the set, to present a different modulus of elasticity, i.e. degree of compressive resiliency, of abdominal exercise appliance **30** based on which insert **32** is installed in body **31**. It is noted that by disposing the opening of cavity **33** such that inserts **32** are inserted from the flat side of body **31**, i.e. the side designed to contact the support surface, the effect of the density of the insert selected on the compressibility of the overall abdominal exercise appliance **30** by orientation in direct relation to the compression forces generated by a straightening of the lumbar lordosis is maximized. Physical alignment with the direction of the applied compressive force also provides better mechanical stability of abdominal exercise appliance **30** during use.

[**0056**] It will be understood by those skilled in the art that although only foam inserts have been shown for purposes of disclosure many other suitable possibilities exist for accomplishing the same result. For example, instead of varying foam density, springs having various compression characteristics may be imbedded within a uniform density foam insert, each insert for insertion into the body. Or, by way of further example, air or hydraulic pressure may be varied within a bladder located within the body to accomplish variance of degree of compressibility of the abdominal exercise appliance.

[**0057**] The present invention will find application among a large cross-section of the population. Lordotic curve varies with the individual, and consequently so too the space between the lumbar spine and the support surface, within the meaning of the term static lordotic curve as used herein. In addition, each individual will differ as to their level of conditioning and strength. Therefore, the present invention may be conveniently produced and supplied in kit form, providing the individual with practical means for selectively altering the various parameters of the abdominal exercise appliance, including height and resiliency. Referring to **FIG. 8, a** customizing exercise kit is shown generally at **40**. Included in customizing exercise kit **40** is abdominal exercise appliance **30**' and inserts **32***a*, **32***b*, and **32***c*. As in the previously described embodiment, exercise appliance **30**' is comprised of a body **31**' and a cavity **33**' formed therein for receiving a selected one of inserts **32***a*, **32***b*, and **32***c*. In the figure, insert **32***a* is shown inserted within cavity **33**' in body **31**'. The minimum height h of abdominal exercise appliance **30**' is selected based upon a statistical minimum lordotic curve of the population, since its height may only be increased over minimum height h. Body **31**' and inserts **32***a*, **32***b*, and **32***c* are of the same shape and material as those described prior with regard to the embodiment shown in **FIG. 7**.

[**0058**] Customizing exercise kit **40** further includes at least one height adjustment spacer **34** (two are shown). Height adjustment spacers **34** are flat, conveniently having a perimeter matching in shape that of body **31**', and are made of a compressible foam material having similar characteristics to those from which body **31**' and inserts **32***a*, **32***b* and **32***c* are produced. One consideration, however, is that the foam used to make height adjustment spacers **34** should not be so resilient as to resist compression entirely, and prevent complete flattening during use, nor should they be too soft so as to prematurely collapse when used in conjunction with a more resilient one of inserts **32***a*, **32***b* and **32***c*. Disposed on the lower surface of body **31**' are means for mechanically interconnecting body **31**' with a height adjustment spacer **34** placed adjacent thereto. In an advantageous embodiment, an attachment layer **35** is made of one of the component elements of a gripping fabric such as for example the type manufactured under the trade name VELCRO, and is fixed to the lower surface of body **31'** with the gripping surface facing outwardly. Height adjustment spacers **34** also have spacer attachment layers **36***a* and **36***b*, attachment layer **36***a* being made of the component element adapted to cooperate with the element of attachment layer **35**, and attachment layer **36***b* made of the same component element as attachment layer **35**. As a result, any number of height adjustment spacers **34** may be removably added to body **31'** to increase the height of abdominal exercise appliance **30'** in excess of minimum height h as required to obtain proper fit to the individual.

[0059] Referring now to **FIG. 9**, another embodiment of the abdominal exercise appliance, in accordance with the invention is shown, generally at **50**. This further embodiment includes a feature particularly useful when performing the exercise on a padded surface, for example an exercise mat, as is often desirable insofar as there is reduced danger of trauma to various portions of the body in contact with the support surface. A body **41**, fabricated from a compressible foam material, and having an external shape and physical characteristics in conformance to those discussed with regard to the embodiments of **FIGS. 1 and 2**, includes a cavity **43** formed therein, having an opening in a lower surface of body **41**, i.e. the flattened surface facing the support surface during use, for captively receiving an insert **42**, selected from a set of inserts (not shown) having varying density, as has already been addressed herein. When performed on a mat, the exercise method performed in accordance with the invention may result in an uneven distribution of forces causing an undesirable deformation of the mat itself below the exercise appliance, particularly when the mat is softer than the particular degree of resilient counterforce selected for the exercise appliance. Consequently maximum conditioning is prevented. Addressing this consideration, an embodiment of abdominal exercise appliance **50** includes means for providing rigidity in a plane parallel to and proximate with the support surface, provided, for example, in the form of a plate member **44**. Plate member **44** is constructed of any suitable material which can provide rigidity to abdominal exercise appliance **50** and thereby allow even distribution of pressure in the direction of the support surface applied by a straightening of the static lumbar lordotic curvature during performance of the exercise. Plate member **44** is fastened to the lower side of body **41** by suitable means. In the embodiment as described, for example, plate member **44** is swivelably attached at one end thereof to a corresponding end of body **41**. A rivet **47** affixed to body **41** pivotably holds plate member **44** to body **41**, a head of which is retained within a countersunk portion **48** recessed below a surface of plate member **44**, preventing the head of rivet **47** from protruding beyond the surface of plate member **44**, which would otherwise adversely affect stability of abdominal exercise appliance **50**, when placed on a rigid support surface, for example when not being used on a compressible mat. Shown in its opened position in **FIG. 9** which allows replacement of insert **42**, plate member **44** may be subsequently closed by pivoting thereof in a direction of the curved arrow. A rivet **45**, affixed to body **41** at an end thereof opposed to rivet **47**, is received within a receiving groove **46**. Continued rotation of plate member **44** causes a head of rivet **45** to snap into a countersunk receiving portion **49** recessed below a surface of plate member **44**. The head of rivet **45** is separated from the lower surface of body **41** a distance approximately equal to the thickness of plate member **44** within the region of countersunk receiving portion **49**. Consequently, plate member **44** is maintained in closed position unless pivoted in a direction opposite the arrow, while simultaneously exerting pressure in the region of the countersunk receiving portion in a direction against body **41**. It is noted that plate member **44** may have a shape substantially matching a perimeter of body **41**, may be slightly smaller, or may be larger, extending even substantially beyond the perimeter of body **41**. It is further noted, that plate member **44**, in addition to providing rigidity, further provides means for retaining insert **42** captively within cavity **43** of body **41** independent from those already described in the prior embodiments, obviating the need for press-fit engagement.

[0060] With regard to the appliance in accordance with the invention, it is noted herein that any elastically resilient structure for providing a direct counterforce to a straightening of the static lordotic lumbar curve, the force being directed from behind the individual, is contemplated within the intended scope of the appended claims. For example, although the appliance of the above embodiment conveniently provides the counterforce in the form of a compressible foam mass, an exercise appliance in accordance with the invention may alternately take the form of an inflatable pillow of suitable shape to be fittable between a support surface and the static lordotic curve of the individual. Compressibility of the trapped air would provide a restoring force to counter a deformation of the pillow. In a further embodiment, as detailed below with reference to the figures, the exercise appliance need not in fact be a confined mass, including rather a structure presenting a curved elastic surface providing resistance to deformation thereof, as described below.

[0061] Referring now to **FIGS. 10 and 11**, there is shown, generally at **100**, an alternate embodiment of an abdominal exercise appliance, in accordance with the invention. Abdominal exercise appliance **100** includes a frame **101** fabricated from a suitable rigid material. Frame **101** is comprised of a pair of interconnected frame sections **101***a* and **101***b*. Frame **101** includes a pair of arcuate portions **102***a* and **102***b* carried on frame sections **101***a* and **101***b* respectively. Arcuate portions **102***a* and **102***b* are disposed laterally, arranged crosswise a longitudinal axis **103** of abdominal exercise appliance **100**. A series of elastic band members **104** are attached at their opposed ends to each arcuate portion **102***a* and **102***b*, and are tensioned therebetween, collectively defining a resiliently deformable surface configuration of a shape corresponding to a locus of their connection points **105**, shown conveniently as rivets in the figures, on arcuate portions **102***a* and **102***b*. For example, since the locus of points in the present case is semi-circular, the surface defined by elastic band members **104** is that of a longitudinally bisected cylinder. Means for tensioning the series of elastic band members **104** is provided to permit selection of the degree of resistance against deformation of the surface configuration, to provide ideal conditioning to individuals of varying degrees of fitness. In the embodiment as shown, for example, frame sections **101***a* and **101***b* are provided with correspondingly sized slide portions **106***a* and **106***b* extending from the ends of arcuate portions **102***a* and **102***b*, to allow reception of one within the other. Slide portions **106***a* and **106***b* function as a base for frame **101**, enabling secure contact with a support surface. Slide portion

106*a* is tube shaped, having a generally rectangular cross section, and is sized to receive a smaller, correspondingly shaped slide portion **106***b* for slidable engagement therein. A series of alignment holes **107** are provided through each of slide portions **106***a* and **106***b*, which when aligned, allow frame **101** to be locked in position by inserting a locking pin **108**, thereby maintaining a desired tension setting. Arcuate portions **102***a* and **102***b* are sufficiently laterally spaced from one another to permit an individual, during performance of the above described abdominal exercise, to lie between arcuate portions **102***a* and **102***b*, with elastic band members **104** oriented crosswise to the back of the individual, conforming to the static lumbar curvature. Preferably, slide portions **106***a* and **106***b* are of flattened configuration to present a reduced vertical profile, such that they are not raised significantly above the support surface where they would interfere with the back of the individual when the static curvature is straightened. In this regard, however, if the individual is uncomfortable, a pair of mats may be butted against slide portions **106***a* and **106***b* from either side, essentially raising the support surface to be even with, or above, the top surfaces of slide portions **106***a* and **106***b*. This is not an issue when abdominal exercise appliance **100** is used in combination with an exercise bench, a use for which the present embodiment is particularly suited, and which is described below.

[0062] Referring to **FIG. 11**, abdominal exercise appliance **100** is attached to an exercise bench **110** by any suitable conventional clamping means (not shown) or is permanently welded thereto at a point thereon which will not interfere with the slidable tension adjustment means described with regard to the preceding embodiment. Whatever mounting means are employed, it is preferable to allow selective placement of abdominal exercise appliance **100** at a position along the length of exercise bench **110**, to compensate for anatomical differences among individuals. Further, the mounting means would, in the preferred case, allow raising and lowering of abdominal exercise appliance **100** with respect to exercise bench **110** to permit the height of the curved elastic surface above the surface of exercise bench **110** to be selectively altered dependent upon the degree of static lordotic curvature of the particular individual. Exercise bench **110** is raised above the floor by a pair of support members **111**, the top surface of exercise bench **110** providing the support surface for the individual lying in a supine position. In this application, slide portions **106***a* and **106***b* are oriented below the exercise bench (shown by broken lines in **FIG. 11**) and therefore cannot in any way interfere with the back of the individual, particularly when elastic band members **104** are compressed.

[0063] It is further noted that means for adjusting the height of the curved elastic surface configuration above the support surface may be provided when the above embodiment is used separate from a bench. **FIG. 12** illustrates an abdominal exercise appliance **100'**, detailing a slide mechanism, similar in structure to slide portions **106***a* and **106***b*, for connecting arcuate portions **102***a* and **102***b* to frame **101**. (Note that the detail shows only arcuate portion **102***b*, but the corresponding structure of arcuate portion **102***a* is analogously configured). A tubular frame slide portion **115***a* of rectangular cross section, is sized to receive therein, in sliding engagement, a correspondingly shaped, smaller arcuate slide member **115***b*. A series of alignment holes **107'** are provided through each of slide portions **115***a* and **115***b*, which when aligned, allow frame **101** to be locked in position by inserting a locking pin **108'**, thereby maintaining a desired height setting of abdominal exercise appliance **100'**.

[0064] It is still further noted, that an abdominal exercise appliance in accordance with the invention may be constructed which includes an elastic layer tensioned between lateral support portions of a frame as detailed above, which instead of including elastic band members, employs an elastic fabric sheet, attached on opposed sides to corresponding lateral support portions, forming a curved elastic surface. Additionally, the support frame need not include arcuate shaped portions. It is only necessary that the locus of connecting points to lateral portions of the support frame create a deformable elastic surface of suitable shape for contact with the lumbar back region, and that the lateral support portions be separated sufficiently so as not to interfere with body motion during exercise. It will also be recognized that many suitable means for varying the tensioning of the stretched elastic layer alternative to those described above may be employed, without departure from the invention.

[0065] In addition to its use in conditioning the abdominal muscles, the present invention will also find utility in teaching the posterior pelvic tilt. The posterior pelvic tilt is a practice useful in improving posture and maintaining integrity of the lower back by reducing the lordotic curvature of the lumbar spine, however the mechanics of its performance are often difficult for a patient to learn. In yet another embodiment in accordance with the invention, directed in part to this teaching application, an abdominal exercise appliance is shown in **FIG. 13** which includes means for audible feedback during performance of the above described abdominal exercise, generally designated **130**. The structure of abdominal exercise appliance **130** is equivalent to that already described with reference to **FIG. 7**, and includes a body **131** and a cavity **133** formed therein for receiving a selected one of a set of inserts of varying compressibility, for example including an insert **132**, shown inserted within cavity **133**. Means for providing feedback responsive to a compression of abdominal exercise appliance **130** are provided, conveniently for example in the form of a bellows **134** received within a receiving hole **135**, a compression of bellows **134** expelling air through an outlet passage **137** communicating with an exterior of abdominal exercise appliance within which a reed **136** is disposed. Compression of abdominal exercise appliance **130** thereby produces an audible feedback signal in response thereto, indicating proper performance of the abdominal exercise or posterior pelvic tilting.

[0066] It is noted that any number of other possible arrangements are contemplated which can alternately provide the desired feedback. For example, electronic means sensing and emitting means may be provided as part of any of the embodiments within the scope of the invention to effect emission of a feedback signal in response to application of a compression force brought about by a straightening of the static lumbar lordosis. The feedback signal produced thereby may be audible or any other suitable detectable type. Further, the above selected means may additionally include a means for varying the level of feedback relative to the degree of compression, to further indicate effectiveness of the performance of the exercise by the individual.

[0067] Turning now to **FIG. 14, a** kit is depicted, generally designated **140**. Kit **140** includes a plurality of appliances in accordance with the invention, each providing a dedicated degree of compressive resiliency. For purposes of depiction, appliances of the type depicted in **FIG. 1** are conveniently shown as kit members **141, 141**' and **141**", each being comprised of material progressively more resistive to compression. This can be conveniently accomplished for example by altering the degree of foaming of the material such that the amount of trapped air, and hence the density, is regulated. Such kit could alternatively include any of the embodiments contemplated herein without departure from the intended scope of the invention. Such kit, as with the appliances previously described with reference to **FIGS. 7, 8** and **9**, provides means for progressively increasing a level of exercise as muscular development is accomplished by repeated use of a preceding appliance.

[0068] Having described preferred embodiments of the invention with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of the invention as defined in the appended claims.

What is claimed is:

1. An exercise appliance for strengthening and toning the abdominal muscles, comprising:

a pair of lateral supports sufficiently spaced apart to permit reception of the individual therebetween; and

an elastic layer tensioned between said lateral support structure.

2. The exercise appliance according to claim 1, further comprising in combination:

an exercise bench to which said exercise appliance is mounted.

3. The exercise appliance according to claim 1, further comprising means for selectively varying a degree of tension of said elastic layer.

4. A method of strengthening and toning the abdominal muscles of an individual, comprising the steps of:

providing an elastically resilient structure presenting a yieldable contact surface adapted to fit between a static lumbar lordosis of a back of the individual and a support surface when a remaining portion of the individual's back is positioned against the support surface;

positioning said structure between the support surface and the static lumbar lordosis such that the individual's lumbar back is contactable with at least a portion of said contact surface;

supporting at least a portion of said structure in fixed relation with the support surface such that motion of said structure in response to applied force is substantially limited to that attributable to deformation thereof;

straightening the static lumbar lordosis against said resistive counterforce;

returning the static lumbar lordosis at least partially to said static lumbar lordosis; and

repeating said steps of straightening and returning a sufficient number of times to progressively strengthen and condition the abdominal muscles.

5. The method according to claim 4, wherein said step of straightening is accomplished by a contraction of one of a lower and upper region of a rectus abdominous, substantially independent of a remaining one.

6. The method according to claim 4, wherein said yieldable contact surface is a portion of an exterior of a resiliently compressible envelope of shape.

7. The method according to claim 6, compressible envelope of shape is a mass comprised of a resiliently deformable material.

8. The exercise appliance according to claim 7, wherein said resiliently deformable material includes elastic foam.

9. The exercise appliance according to claim 5, wherein said envelope of shape is an inflated balloon.

10. An abdominal exercise kit for use in strengthening abdominal muscles of a user, said kit comprising:

a plurality of resiliently compressible bodies at least partially fittable between a support surface and a static lumbar lordosis of the user, members of at least a portion of said plurality of bodies each including a different modulus of elasticity.

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