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(54) **MULTIFUNCTIONAL EXERCISE APPARATUS FOR POSTURE CORRECTION**

(57) The invention relates to the field of therapeutic-athletic exercise apparatus. The claimed exercise apparatus comprises a vertical guide rail that has a support for sliding. Disposed on the guide rail are: a movable horizontal crossbar which is connected to a pivoting roller unit and to fasteners for cables, and can be moved along the length of the guide rail and fastened in various positions, and which also has places for attaching athletic accessories; a pull-up bar mounted at the top, having a place for attaching athletic accessories and having guide rollers for cables; a pivoting arm connected through its axis of rotation to the lower part of the vertical guide rail such that the arm is capable of both pivoting and being fastened in various positions, moreover, mounted on the end of the arm is a horizontal crossbar having a place for fastening athletic accessories and having guide rollers for cables. The claimed exercise apparatus is suitable for both general exercises and for therapeutic purposes related to posture correction, thus making the exercise apparatus universal.

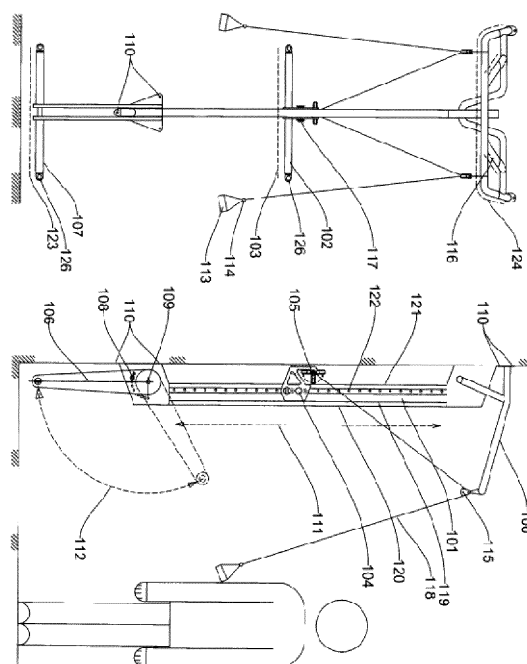


FIG.1

Description

Technical field

[0001] The invention relates to the field of medical and sports multi-functional exercisers. More precisely, the invention relates to the field of exercisers intended for both general developmental physical exercises and therapeutic exercises for posture correction.

Prior Art.

[0002] Impaired posture is one of the most common symptoms associated with functional disorders of the musculoskeletal system. The main signs are spinal curvature, asymmetric deviation of head position, the pelvis and other parts of the body relative to the central spine axis. Most often, the impaired posture is formed as a result of incorrect working posture, marked skeletal muscle weakness and congenital pathology of the musculoskeletal system. Such disorders adversely affect the general state of health, the appearance and attractiveness of a person. The lack of correct treatment aimed at correcting posture defects may lead to the development of complex degenerative-dystrophic diseases of joints and spine, the deterioration of functional and adaptive capabilities of respiratory, cardiovascular, digestive and central nervous systems. Therefore, posture correction is an important task. One of treatment methods (Epifanov V. A., Epifanov A. V., Restorative treatment of spine diseases and injuries // M.:MEDpress-inform. - 2008. - T. 384.) is the use of special therapeutic exercises and physical therapy.

[0003] The high efficiency of physical therapy exercises was shown in a number of scientific papers (Nasb M. et al. Sling Suspension Therapy Utilization in Musculoskeletal Rehabilitation //Open Journal of Therapy and Rehabilitation. - 2016. - T. 4. - No. 03. - P. 99.; Moe K., Thom E. Musculoskeletal problems and physical activity. Results from a long-term study //Tidsskrift for den Norske laegeforening: tidsskrift for praktiskmedicin, nyraekke. - 1997. - T. 117. - No. 29. - P. 4258-4261.; Lee S. B. Cho W. J. The effect of sling exercise on sagittal lumbosacral angle and intervertebral disc area of chronic low back pain patients //Journal of Exercise Rehabilitation. - 2016. - T. 12. - No. 5. - P. 471.).

[0004] Many different exercisers have been developed and are used for the purposes of such treatment. There is a known method to increase the efficiency of prevention and treatment of spine deformities and degenerative diseases and a device for the implementation of said method (patent RU 2355372 C2, publ. on 10.07.2007), or a Spinal curvature correction device (US patent 5176706 A, publ. on 05.01.1993), or a Multi-function chiropractic treatment table (US patent 6547809 B1, publ. on 15.04.2003). There are known "special" rotating exercisers for the treatment of back diseases, such as the Tilting inversion exerciser having a foot safety foot retaining device (US

patent 9089468 B2, publ. on 28.07.2015). There are also known highly specialized recumbent exercisers for medical institutions, for example, a multifunctional back exercise device (patent TW 201100140 A, publ. on 01.01.2011) or sporting equipment for the lower part and trunk of the body (patent KR 20140021920 A, publ. on 21.02.2014).

[0005] However, all abovementioned solutions are highly specialized. Much more preferable is the concept of the exerciser, with the use of which, in addition to physical therapy exercises, there would be a possibility to perform general developmental and strength exercises - the concept of a multifunctional exerciser.

[0006] The applicant is not aware of a multi-functional exerciser applicable for posture correction.

[0007] At the same time, a number of general purpose exercisers are known in the prior art and theoretically, for which, it is possible to develop exercise programs for posture correction, but all of them are not intended for this purpose directly.

[0008] The closest prior art is the general-purpose exerciser that is structurally closest to the claimed invention is the wall-mounted home fitness training equipment (disclosed in US patents group 2014031182 A1 of 2014; 2011195822 A1 of 2011; 2010048368 A1 of 2010 and others). This is a wall mounted exerciser (i.e. fixed to a wall as an ostensible "Swedish ladder"), thereby ensuring its compactness and the possibility of use in houses and apartments, and not only in medical institutions or gyms. The base of the exerciser is a support beam fixed to the wall, ending at the top with a pull-up bar. The elements of standard fittings are parallel bars with a stop, stand, and plate, mounted on a support beam with the possibility to move along it and to fix position on it. A number of other standard fittings are fixed on the exerciser elements.

[0009] The exerciser described above allows performing a number of general developing and strength exercises due to modularity, flexibility and a large number of standard fittings.

[0010] However, a number of significant drawbacks are revealed when such an exerciser is considered to solve the posture correction problem. Thus, the absence of a one-piece support surface for the back does not allow performing many important exercises for posture correction, since the beam on which the fitting is placed is an obstacle in this case. As a result, it is impossible to perform exercises associated with sliding along the wall. The use of removable bars can be considered as a disadvantage when performing sets of exercises for posture correction, since their dismantling takes significant time, not allowing to quickly move from exercises based on cross-bar support to other exercises and vice versa. The design of the exerciser does not allow performing exercises with weights (with fixed force). Also, it may be noted that it is not possible to fix the central block, which does not allow shortening or lengthening the cable coming through the blocks or suspensions or elastic elements without inter-

fering with the exercise for the back.

[0011] Thus, such an exerciser cannot become the basis for performing a full-fledged set of exercises for posture correction.

Summary of the invention

[0012] The purpose of the present invention is to develop an exerciser which can be used to perform general developmental or strength exercises, as well as full-fledged exercise complexes for posture correction. At the same time, an important requirement for the exerciser is its compactness and accessibility, which implies it to be used not only in sports centers or medical institutions, but also in apartments and houses, as well as in office premises. Another important requirement is to ensure a quick change of fittings with no loss of training pace.

[0013] The essence of the invention is that the exerciser contains a vertical guide rail, on the back side of which the horizontal crossbar moves with the ability of being fixed, and the front side of the guide is in a form of a support for a human back. The guide rail in the upper part is connected to the cantilever pull-up bar. The guide rail in the lower part is connected to a swivel bar equipped with the horizontal crossbar. The horizontal crossbar is equipped with a swivel block with rollers through which the cables pass. The cables can be fixed with clamps, also located on the horizontal crossbar. The cable rollers can also be located on the pull-up bar and on the swivel bar. The swivel bar has the possibility of free rotation and fixation with angle increment relative to the guide rail. Additional elements, such as elastic cables, handles, loops, belts, blocks, rollers and others may be included in the exerciser kit.

[0014] All of the above-described features and advantages of the present invention will be described in more detail below, with reference to the figures of drawings.

Brief description of drawings

[0015]

Fig. 1 - perspective view of the exerciser. on the left - full frontal view, on the right - side view.

Fig. 2 - the exerciser's view wherein the cables being pulled through the swivel bar. On the left - full frontal view, on the right - side view.

Fig. 3 - the exerciser's view wherein the cables being fixed in the area of horizontal crossbar, on the left - full frontal view. On the left - full frontal view, on the right - side view.

Fig. 4 - the exerciser's view wherein the independent cables or elastic elements being fixed on the swivel bar, in the horizontal bar area and on the pull-up bar, on the left - full frontal view. On the left - full frontal view, on the right - side view.

Fig. 5 - the exerciser's view wherein the elastic elements being fixed on pull-up bar and swivel bar, on

the left - full frontal. On the left - full frontal view, on the right - side view.

Fig. 6 - the exerciser's view wherein the elastic elements passage from pull-up bar upwards through swivel bar. On the left - full frontal view, on the right - side view.

Fig. 7 - the exerciser's view wherein working with weights on the turning plate, which is in the free rotation mode, when the cables pass downwards from it through the pull-up bar. On the left - full frontal view, on the right - side view.

Fig. 8 - the exerciser's view wherein the cables are coupled in the central part and pass through the turning crossbar from the pull-up bar. On the left - full frontal view, on the right - side view.

Fig. 9 - the view of various accessory types for the claimed exerciser.

Fig. 10 - an example of the exercise "Bilateral shoulder retropulsion".

Fig. 11 - an example of the exercise "Asymmetric retropulsion of shoulder with abduction".

Fig. 12 - an example of the exercise "Extensional mobilization of the upper thoracic spine".

Fig. 13 - an example of the exercise "Extensional mobilization of the upper thoracic spine".

Fig. 14 - an example of the exercise "Spinal traction with one-sided increase of intervertebral foramen diameter".

Fig. 15 - an example of the exercise "Asymmetric traction bar for the correction of shoulder girdle muscle imbalance in the frontal plane".

Fig. 16 - an example of the exercise "Asymmetric traction at 45 degree angle to the sagittal and frontal plane for the correction of shoulder girdle muscle imbalance".

Fig. 17 - an example of the exercise "Increased traction of thoracic and lumbar spine sections along vertical stand".

Fig. 18 - an example of the exercise "Asymmetric extension of upper limbs and shoulder girdle along vertical guide rail".

Fig. 19-23 - an approximate view of a software interface for exercises.

Terms and definitions

[0016] It is necessary to define the following notions for clear understanding of further description of the invention and the scope of the protection.

[0017] Posture - is a habitual pose that a person unconsciously takes while standing or in motion without applying excessive muscular tension. The main criteria determining correct posture is the symmetrical distribution of the body parts relative to the spine due to uniformly distributed muscle tone. Shape of physiological spine curvature, head position, shoulder and pelvic girdle and pelvic tilt change in the case of posture disorder, which can later lead to complex diseases of the musculoskeletal

system.

[0018] Physical therapy, or exercise therapy - is a method of complex functional therapy that uses physical exercises as means of maintaining the patient's body in an active state, stimulating the patient's internal reserves, preventing and treating diseases caused by involuntary physical inactivity.

[0019] Exerciser -in the present description refers exclusively to sports and / or medical exercisers - the devices for performing certain exercises or exercise series.

[0020] Pull-up bar (crossbar) - gymnastic equipment, consisting of a round steel (or of other material) bar, fixed in horizontal position on stands.

[0021] Elastic cables - in the context of the description - the cables made of elastic material. At the same time, the cables must withstand a certain load, not only a one-time load, but also periodic, without significant wear. Such cables are also referred to as sports (rubber) harnesses in some sources. The aim of such cables is to sustain load due to their elastic properties.

[0022] Cables - as opposed to the elastic cables, the concept of the cables in the present description wherein non-tensile (or almost non-tensile) cables; the aim is to transfer the load with its application direction change. Such cables are also known in a number of sources as cables for strength exercisers or force cables. Cables must ensure reliability and resistance to stress and abrasion.

[0023] Belts, straps and loops - allow fixing the body parts in different initial positions for performing exercises using a person's own weight or with additional external weights.

[0024] Exercises on unstable supports - at the support on unstable bases, the requirement for sensorimotorics and muscle control increases, allowing to use deep muscles that are not involved in a usual training.

[0025] Rotational exercises on block roller allow combining exercises with own body weight and spiral-diagonal movements with torso and limb rotation. The above help to increase the scope of movements in major joints, actively strengthen torso rotating muscles. Thus, help to stabilize the spine and joints.

[0026] The hanging exercises on the pull-up bar strengthens the muscles of the shoulder girdle and torso.

[0027] The exercises with the elastic cables are designed to strengthen the pectoral girdle and correct posture without axial load on the spine and joints.

[0028] The training balance allows to activate the vestibulotonic and postural reflexes and to activate the maximum number of muscle groups. It allows for partial load or graduated load of exercises directed at different parts of the musculoskeletal system.

[0029] Stretching is a type of aerobics aimed at stretching skeletal muscles, developing flexibility and increasing mobility in the spine and joints.

[0030] Isometric exercises in special poses to relax the muscles in hypertension and strengthen hypotonic muscle groups. They allow balancing body segments in re-

lation to each other.

[0031] Plyometric exercises are high-intensity hopping movements that allow developing an explosive way of performing the exercises. They are effective to increase maximum strength and functional ability of the muscles.

[0032] Exercises on an exercise ball ('fitball') allow to activate the vestibulotonic and postural reflexes and make the maximum number of muscle groups to work. It allows for partially load or graduated load of exercises to direct at different parts of the musculoskeletal system.

[0033] Exercises while lying on a mat allow to perform movements in easy conditions for the spine and joints. This gymnastics helps to maximally relieve the musculoskeletal system and form a powerful pectoral girdle for the spine.

[0034] The guide roller is understood in a broader definition of this term in the present description as it also includes swivels or latch hooks. In this case, the important function is the possibility to transfer load by means of cable with change in direction by load application direction or the possibility of securing or maintaining the elastic cable for the same purpose. The specific implementation is not essential for the character of the present invention.

[0035] When the term vertical axis is used in the present description, it is meant that the axis is connected with the vertical guide rail. When the term horizontal axis is used, it is meant the axis, perpendicular to the vertical axis.

Implementation of the invention

[0036] The exerciser in the preferred embodiment is a wall exerciser - this ensures high compactness of the solution, as well as ease of installation, as part of the load is redistributed to the wall. At the same time, the embodiment wherein the exerciser is installed on the wall is not the only possible embodiment.

[0037] In the preferred embodiment, the exerciser (Fig. 1) is fastened to the wall with fasteners 110, preferably in four places - in the cantilever horizontal pull-up bar 100 area and in three places in the area of swivel bar 106. Such a fastening would be quite sufficient to ensure a reliable fixation. The fastening can be directly provided by any method known in the field of construction, for example, using anchor bolts or other similar elements. The base of the exerciser, as it was already mentioned, is the vertical guide rail 101, which is rigidly connected at the top with cantilever horizontal pull-up bar 100 by any known method, for example, screwing. Guide rail 101 is connected at the bottom with the swivel bar 106 through rotation axis 109 of the swivel bar.

[0038] The horizontal pull-up bar 100 represents a cantilever (outlying) horizontal pull-up bar. This is necessary to ensure the comfortable use of the pull-up bar so that the vertical guide rail 101 would not interfere with the exercises. In addition to main crossbars, the pull-up bar 100 can also have additional crossbars 116, which are applicable for grip during pull-up. Guide rollers 115 are

preferably placed on the main crossbar of pull-up bar 100, for force transmission by means of the cables 118 or elastic cables 125 or their fastening. Rollers 115 can be installed on pull-up crossbar 100 in fixed positions at the edges, but the preferred option is when they are made with the possibility of displacement along individual sections of pull-up crossbar 100 at the right and left, or, in another embodiment - along the entire pull-up crossbar. This possibility can be easily realized by the known means, for example, by performing the fastening of rollers 115 as movable along the pull-up crossbar 100 with the possibility of fixation, or, in a simpler version, by providing a series of hooks (catches) on the pull-up crossbar surface 100, on which rollers 115 are fixed. In the latter case, there are several separate fixed positions of rollers 115. This implementation allows adjusting the angles of force transmission directions relative to the vertical axis, if necessary. The pull-up bar 100 is used both for its intended purpose and as a console for accessories fastening, for which there is a zone 124 for the accessory attachment.

[0039] The vertical guide rail 101 is the central element of the exerciser. The guide rail has an outer side 119 on which an ergonomic back rest 120 is installed, which repeats the shape of the back and is designed to allow for the back rest to be pressed against the vertical guide rail 101 in a series of exercises, and for back sliding along the guide rail 101 surface in a number of other exercises. For these purposes, the support 120 surface is made of smooth materials such as, for example, wood or plastic. On the inner side 121, the vertical guide 101 is, preferably, of rail form, along which the horizontal crossbar 102 moves together with cable clamp 104 and swivel block with rollers 105 with the possibility of fixation in different positions. The fixation can be fulfilled both by spring clamps, and, in another embodiment - by movement lock 117, which is inserted into one of a series of openings on an element 122 or by any other known method. The block of the movable crossbar 102 together with rollers block 105, cable clamp 104 moves as a whole along the guide rail 101 by means of the element 122. The swivel block 105 with rollers is designed in such a way that the block rotation axis coincides with the horizontal axis, and the block itself can be rotated and fixed with a clamp, for example, or by some other known method. The swivel block 105 is used to transmit force through cables 118, when they are fixed on other elements of the exerciser, for example, on pull-up bar 100 parts and simply to pass through the central part of the exerciser with force transmission angle change. Rollers 105 of the block are also used for cable adjustment. All manipulations with the block and crossbar 102 movements in the preferred embodiment are performed without additional tools with the use of manual locks and manually operated elements, which will allow to quickly reconfigure the exerciser moving from one group of exercises to another group without losing training pace. The crossbar 102 width preferably matches the person's shoulder width. There are lugs at

its ends for exerciser accessory fixing with the use of latch hooks to perform a series of exercises. Clamps of the cable 104 allow to quickly move from exercises with rotational loads to exercises with the fixed cables 118.

5 The movement range of the horizontal movable crossbar 102 along guide rail 101 by means of element 122 is limited in the lower part by the swivel bar 106 installation location, and in the upper part - by the cantilever pull-up bar 100. In the preferred embodiment the corresponding stops are provided on the element 122 of the guide rail 101 to ensure safe use and to avoid possible breakages. In addition to the cable 104 clamps there is also a zone 103 for the fastening of the accessories on the crossbar 102.

10 **[0040]** The swivel bar 106 is the lower end of the exerciser. The swivel bar is fixed on the vertical guide rail 101 by the axis 109. In the preferred embodiment the rotation axis 109 is also connected with the lower wall fastening 110, which is the second connection to the wall. The swivel bar 106 can operate in two modes - a free rotation mode and fixation modes in a certain position at a certain angle relative to the vertical axis. Preferably, the fixation, for example, is made with the spring-loaded or the removable locking element 108, as well as a group of openings made in the part of the wall mount 110 connected to the vertical guide rail 101 so that each of the openings shall correspond to a certain angle between the swivel bar 106 and the guide rail 101 to perform a specific exercise. In other embodiments, the other locking element 108 options are also possible. The swivel bar 106 has a limited range of the rotation 112, corresponding to all the required exercises. The free rotation possibility of the swivel bar 106 allows to perform dynamic exercises (described below in detail), and the fixation in arbitrary position depending on the height, allows using the swivel bar 106 for various purposes in different exercises, for example, as a stop, support, stand or grip. The swivel bar 106 in its lower position, coinciding with the vertical axis, is located in the close proximity to the floor, which allows it to be used as a footrest. In an average, horizontal position the swivel bar 106 has a similar outreach compared to the pull-up bar 100 cantilever, which allows performing a series of exercises with the elastic elements that compensate for the weight, or facilitate additional force. There are also intermediate positions for the swivel bar 106. The swivel bar 106 itself is provided with a perpendicular crossbar 107, on which there is a zone 123 as on the horizontal movable crossbar 102, similar to the zone 103 of the crossbar 102 for installation of various accessories. Lugs 126 used in fastening the accessories with the latch hooks are fitted at the ends of the crossbar 107.

45 **[0041]** There are many possibilities for a handgrip due to the accessories mounted on the extendable pull-up bar 100 cantilever in the zone 124, the movable 102 and swivel 107 crossbars in the zones 103 and 123 at the height from floor to the pull-up bar 100, the availability of blockrollers 130, adjustable foot rest, the function of

which is performed by the swivel bar 106, as well as the crossbar 102. In particular, it is possible to transfer force from any height and at any angle, to smoothly adjust the length of the cables 118 and the elastic elements 125, to create pre-tension and / or pre-force, to perform exercises with rotation and twisting, to implement various load patterns that allow to complicate or simplify the exercises, as well as to build up exercises involving long kinematic chains. The vertical sliding support 120 for the spine and the space to the wall in the preferred embodiment (or the space to a different surface or another exerciser in other embodiments) allows the creation of the sets of exercises for posture correction and further development of muscle as a result. The posture correction exercises for the claimed invention are performed with controlled body position, which build up the correct posture unlike existing exercisers, intended to strengthen and reinforce individual muscle groups with no prior posture correction, which results only in asymmetry or existing curvature consolidation. This exerciser is compact and can be used at home for people with any level of physical fitness.

[0042] The fastening on the cables 118 is made possible by the latch hooks or loops 114 of handles 113 that are convenient for holding. The handles should be preferably secured with slings, but any other option is possible.

[0043] The above-mentioned accessories include the handles 113, loops 131, the straps for convenient grip or fixation 132, the cables of various length 118 for force transfer, the block rollers 130 to change force direction and to create rotational movements, the elastic elements 125 to create additional and increased loads and load decrease for weight-compensation, as well as latch hooks 134, loops 135, the straps 132 and other elements to fix the accessories and set up the necessary work patterns.

[0044] An approximate list of accessories may be as follows.

[0045] The elastic cables 125. It is an elastic element, predominantly in the form of a tube or solid cord with the ability to be extended without damage and return to the initial position, ending at the ends with the latch hooks. It can be used in conjunction with a posture corrector with static cable and block rollers, sports bar, balancing pad, fitball and any other unstable platforms and fixation devices on different body parts;

Soft loops 136 and the loops with handle 113 are intended for support using hands and legs in different initial positions;

The suspensions 132 (of different widths) are designed for head, torso, legs and arms support. They allow to create a good basis for doing exercises in closed and open kinematic chains, as well as stretching and unloading exercises;

Cuffs 137 for arms and legs. They allow securely attaching the training block to limbs and to perform high-intensity strength exercises, extension or stretching exercises;

Fitball, balance cushion, balance platform and any other device that can be used as an unstable base for exercises;

Sports bar and any other devices for connection with elastic and static cables to perform exercises with different grips;

Hinged pendulum and any other device operating through support swivel. They allow performing exercises on the development of coordination, flexibility and endurance;

The block roller 130 and the loop 135 allows the elastic cables to be connected to static cables in various configurations;

The set of different weights 138 is fixed on the pivot crossbar to perform strength exercises in different initial positions;

Special floor mats and wall linings with metric markings to obtain primary data on the musculoskeletal system condition and dynamics recording after the completed training course;

The following list is open and exemplary. The ability to use other accessories will be obvious to the person skilled in the art.

[0046] The upper cantilever 100, the movable crossbar 102 and the lower movable crossbar 107 have special (i.e., made in a certain way for appropriate fastenings) fasteners to fix the suspensions 131, the unstable supports, the elastic cables 125, the block rollers 130 with the cables 118, and free weights.

[0047] The upper cantilever 100 shall be preferably made of thin-walled steel pipe. The guide rail 101 and the swivel bar 106 shall be preferably made of aluminium. Most of exerciser elements are also made of aluminium alloys for weight reduction for delivery by postal service.

The zones 124, 103, 123 are covered with anti-friction wear-resistant and elastic coating, for example, plastisol. At the same time, other acceptable materials are possible for the manufacturing of these elements.

[0048] This embodiment is not the only one possible despite the fact that the wall-mounted exerciser is described as the preferred embodiment. Other embodiments are also possible when the claimed exerciser is, for example, united with another similar exerciser by a common frame. It is possible to use fastening to floor and ceiling, for example, at the top and bottom parts of the exerciser instead of wall mounting. There are other possible embodiments based on the level of technology that will be obvious to the person skilled in the art.

[0049] Various exercise options that may be performed using the claimed exerciser, as well as other features of its use will be described in more detail later, with quoted examples.

The use of the invention

[0050] As mentioned above, numerous problems are associated with impaired posture, from childhood to old age.

[0051] All shoulder joint movements which allow orienting the upper limb, take place from some initial position (posture), which serves as a fixation point. The shoulder position is attained by preliminary shoulder girdle displacement; it depends on the body position and is subject to individual variations in accordance with the constitution of the body.

[0052] A shoulder blade is normally oriented at a 45 degree inclination angle when a person is in a steady initial position in the intermediate plane between the sagittal and frontal planes. An arm lifting in this plane is of the greatest importance for the shoulder joint function. The possible amplitude of the arm rising depends on the organizational conditions of this movement. The arm rising requires coordinated shoulder girdle and scapular-shoulder muscle contraction. The imbalance between these muscle groups distorts the shoulder blade movement and impairs the coordination of the entire arm movement, limiting the movement range.

[0053] For example, when raising the proximal part of the shoulder requiring sufficient scapular mobility, if the muscles driving the scapula are in a pathologically stretched condition or in hypertension, when at the rise of shoulder there is no interchange in shoulder and scapula position, which changes the glenoid cavity orientation, this contributes to capitellum rise and subacromial space contraction. The compression of the supraspinatus tendon occurs as a result of repetitive pathological movements, which causes chronic tendon injury and severe pain.

[0054] Very often a situation occurs at the attempt of self-correction when a person cannot fix the correct spine and shoulder girdle position, which prevents him/her from performing corrective (healing) movements. For example, at the attempt to straighten and raise straight arm at the enlarged thoracic kyphosis, the movement is accompanied by the increase in thoracolumbar lordosis and thoracic cage antipulsation. The thoracic kyphosis is practically not straightened during this movement and the scapular abduction takes place along the increased thoracic kyphosis curvature plane, respectively, impairing the relationship between the shoulder and scapula. If a person is asked to do the same movement in a habitually stooped position, he/she will not be able to raise his/her arm so high.

[0055] The base of the posture corrector - the claimed exerciser is 20 cm away from the wall (or any other obstacle, depending on the location of the installation), which allows the use of independent movements that are very difficult to perform in case of spinal curvature and muscle imbalance. For example, it is very difficult to perform complete shoulder retropulsion, achieved as a result of adductor muscles (middle and lower portion of the trapezius muscle) contractions that approximate the scapula to spine axis in case of enlarged thoracic kyphosis and shoulder joint flexure muscles contraction. But if a person stands with his/her back to the posture corrector - the claimed exerciser, his/her spine will be brought to

a neutral position, and the exercises will be aimed at extending the shoulder farther than the frontal plane of the shoulder joint axis, it will allow to bring the scapula to the spine axis, reduce scapular sagittalization and will help to develop the correct shoulder and the shoulder blade movement pattern.

[0056] The following exercises may be particularly effectively performed using the claimed exerciser:

Spine traction with unilateral increase in foraminal (intervertebral) hole diameter (Fig. 14):

Initial position -stand with your back to the exerciser. The left foot is parallel to the wall, and the right foot is perpendicular to the wall. Lumbar vertebrae and the maximum possible number of thoracic vertebrae are pressed against the vertical guide rail 101 in the support 120 area. Arms are lowered along the body, palms pointing forward, fingers slightly touching the wall. Slowly raise the straight arms along the sides to the horizontal position, without taking the fingers off the wall, trying to lower the clavicles as far as possible. Keeping the back in contact with the vertical guide rail 101, start to tilt the spine to the left, the arms remain perpendicular to the spine vertical axis plane, the knees are straightened. Continuing the lateral tilt with the observance of the specified conditions, stop when you feel the pronounced stretching of the left side of the body. Lower the left arm and pull it down, slightly touching the foot with the palm. Stretch the right shoulder girdle and supraclavicular zone muscles with no movement of the torso and head. Raise the right straight arm through the side and pull it along the vertical guide rail 101, increasing the stretching of the right half of the thoracic cage. Bend the cervical spine, slightly burying the chin in the neck. Gently turn head to the right, without straightening the cervical spine, and look at the right hand for a few seconds. Slowly perform all the described movements in reverse order and return to the starting position.

[0057] The claimed exerciser allows the performance of many unique exercises in contrast to the closest prior art known to the applicant. The exerciser allows additionally performing symmetrical and asymmetrical exercises to correct muscle imbalance at the impairment of muscle coordination.

[0058] The following exercises may serve as an example of such exercises (Fig. 18): starting position with the back to the exerciser. Head, thoracic spine and pelvis are pressed against the vertical guide rail 101 in the support 120 area. The arms shall be spread to the sides at shoulder level, the palms down. Keeping the original body position, one arm should be raised and the other lowered. When both arms are in a vertical plane, slowly pull the arms in different directions, that is, the upper arm shall be pulled conditionally up, in the direction of the pull-up bar 100 and higher, and the lower arm shall be pulled conditionally down in the direction of the lower swivel bar 106 and below, lingerat maximum extended position for a few seconds. Allow the upper arm shoulder blade to move up and strain the upper portion of the tra-

pezius muscle. Try to lower the shoulder blade when the highest point is reached. At the same time, the trapezius muscle will relax and the shoulder base will be lowered.

[0059] In contrast to a known prior art, the claimed exerciser, also allows careful spine stretching along the vertical stand in combination with exercises to strengthen deep muscles that are close to the joints.

[0060] The following exercises may serve as an example of such exercises (Fig. 17): starting position with the back to the exerciser. Head, thoracic spine and pelvis are pressed against the vertical guide rail 101 in the support 120 area. Legs are shoulder-width apart, slightly bent at the knees. Hold the loops 136 on the upper cantilever 100 with the hands without detaching the lower back from the guide rail (pre-adjusted for personal height, for example, by means of the block 105 rollers). Crouch slowly, holding the loops 136 tightly and keeping the spine fixed to the guide rail. Continue sacrum sliding down along the guide rail 101 and pressing the maximum number of thoracic and lumbar vertebrae against it, feel pelvic and humeral girdle separation from one another. Perform several deep breaths by drawing in and relaxing the abdominal muscles as much as possible when comfortable extension is reached.

[0061] In particular, the exerciser allows performing the exercises to develop the correct movement pattern to support the natural spinal curves and to restore the correct posture.

[0062] The following exercises may serve as an example of such exercises (Fig. 12): starting position with the back to the exerciser. Head, thoracic spine and pelvis are pressed against the vertical guide rail 101 in the support 120 area. The arms are straightened in front of the chest at shoulder level. Press the lumbar vertebrae against the vertical guide. Then, slowly raise the arms until the phalanges of the thumbs touch the vertical guide rail 101 above the head, stretch the arms upwards to the maximum with the palms tightly pressed against each other, the lower back is tightly pressed against the guide rail. Start to crouch slowly while maintaining this position, feel the pelvic back tilt strengthening and spine stretching. Crouch as low as possible while observing the specified conditions, linger in this position for 3-10 seconds, carrying out full deep breathing.

[0063] In contrast to the known prior art, the exerciser also allows performing exercises aimed at eliminating local muscle dysfunction during musculoskeletal pain by coactivating deep muscle stabilizers with superficial muscles.

[0064] The exerciser also allows:

Combining isometric exercises in special therapeutic postures with the permanent weights or the elastic cables in symmetrical and asymmetrical directions (Fig. 15 and 16).

Conducting functional muscle tests to detect abnormal posture;

Performing exercises sitting on a fitball with knees

resting against the lower movable crossbar 107 in combination with the elastic 125 or the static cables 118;

Performing exercises lying on a fitball (back/abdomen) using lower movable crossbar 107 as a foot support adjustable for height;

Performing exercises with back and pelvis support on the vertical guide rail 101, which allows controlling center of gravity shift in frontal and sagittal planes, returning the body to the correct vertical position. This creates a feedback system between body position in space and vestibular apparatus, forming the correct moving pattern.

Performing detorsional gymnastics at scolioses for the correction of spine axis in all its parts. For example, vertebrae rotation in the direction opposite to the torsion in spine axis curvature zone (Fig. 13);

Performing scoliosis correction with the leveling of inclined pelvis and the restoration of lumbar-pelvic balance;

Performing stretching of shortened and strengthening of stretched muscles in lumbar and thoracic spine zones;

Carrying out exercises with hand/foot support on the lower pivoting crossbar 107 located at different heights. The crossbar is somewhat away from the wall (or other obstacle), which does not interfere with the movements of the head and limbs.

[0065] The vertical guide rail 101 and special suspensions 132 (in this case, special suspensions are specially made belts with rings at the ends for connection with the latch hooks, by which it is possible to reduce the load on the spine and other body parts) allow bringing physiological spine bends to almost normal positions and performing light spine tractions under body gravity (Fig. 17). The stretching in this initial position evenly reduces the pressure in the discs and helps in the disc height restoration, nerve root decompression and swelling removal. All manipulations for the posture correction with respect to the vertical plane do not present anything new and unaccustomed; they allow the spinal column to return to its normal functional position in a natural way, without disturbing the natural body protection mechanisms. The exercises allow gradually eliminating the problems that were generated during this impairment process development with application of an attenuated integrative approach.

[0066] Special recuperative exercises and unloading-corrective postures/movement with isometric and dynamic tension are provided to correct the posture in the vertical position, that is, most of the corrective exercises occur in combination with the vertical guide rail.

[0067] The performance of the exercises with support on the vertical guide rail 101 permits to set the correct body position and carry out the exercise in correct ranges in this position, smoothly overcoming pathological movement patterns.

[0068] The combination of the vertical guide rail 101

and the elastic tension bar 125 allows performing the exercises in special therapeutic postures with the simultaneous stretching or overcoming of elastic resistance in symmetrical and asymmetrical directions. The main task is to achieve a balanced tone between the muscles of different body parts, changing the position of segments relative to each other and relative to gravity. It is possible to create pushing or pulling forces in planes perpendicular to the elastic tension axis at the elastic tension bars 125, and strain along the body by means of the cantilever 100 and the lower adjustable crossbar 107. This allows using deep functional tension lines for the left and right body halves, moving the muscles experiencing insufficient tension.

[0069] The combination of the vertical guide rail 101 and the cable 118, sliding through the roller block 105 and the blocks 130, allows performing spiral-diagonal movements, and activating the inactive muscles when performing exercises with daily exerciser loading. It is possible to increase the movement range with the use of healthy limbs in case of limited movement amplitude in the joint.

[0070] The presence of the unstable supports, the block rollers 130, the elastic tension bars 125, the special suspensions 132, the-shaped pull-up bar 100, the lower crossbar 106 to facilitate pulling up and to provide supports for the legs and arms, allows performing many exercises popular in fitness and sports.

[0071] It is preferable to use fitness devices, such as smart watches, fitness bracelets, and fitness assistants for training with the claimed exerciser. In another embodiment, a user mobile device, preferably a smartphone or tablet, such as Apple iPhone or Samsung Galaxy, can be used as the fitness assistant. In this case, the exerciser software shall be installed on the user smartphone. Then, the user downloads the training program developed specially for him/her by the physician, or selects a ready-made general program from the available ones. An example of program interface implementation is shown in Fig. 19-23. The user would be able to train with the use of a general or an individual program thanks to the software. The program describes the correct exercise method. The application provides for a module to analyze the training process dynamics derived on a special plot.

Industrial applicability

[0072] Industrial applicability is confirmed by a large number of examples for potential use of the exerciser, as well as a detailed description of all exerciser parts and assemblies.

Claims

1. A multifunctional exerciser containing:

i. a vertical guide rail, the front side of which is

a support for a human back with sliding possibility of said human back along said support;
 ii. a movable horizontal crossbar connected with a swivel roller block and cable fasteners capable to move along the reverse side of the vertical guide rail having the possibility of fixation in different positions, wherein said horizontal crossbar is provided with sports accessories mounting zone;
 iii. a cantilever pull-up bar connected to the upper end of the vertical guide rail, wherein the cantilever pull-up bar is provided with a fixing point for fixation of the sports accessories, as well as with guide rollers for cables;
 iv. a swivel bar connected to the lower part of the vertical guide through a rotation axis so that the swivel bar could either rotate or be fixed in different positions relative to the vertical guide rail, wherein on the farthest from the rotation axis end of the bar, the horizontal crossbar is mounted, wherein on said horizontal crossbar is provided with the fixing point for fixation of the sports accessories, as well as with the guide rollers for the cables.

2. The exerciser according to claim 1, **characterized in that** the sports accessories are one or more of the following:

i. handles,
 ii. loop bands,
 iii. straps for comfortable grip or fixation,
 iv. cables for force transfer,
 v. blocks and rollers to change the direction of force and to create rotational movements,
 vi. elastic elements to create additional and increasing loads and used as weight-relief elements for weight compensation,
 vii. latch hooks,
 viii. locks,
 ix. rings,
 x. loop bands,

3. The exerciser according to claim 1, **characterized in that** it is a wall exerciser, and the fixing points to the wall are located at least one in the cantilever pull-up bar area and at least one in the area of the swivel bar rotation axis.

4. A posture correction method using the exerciser according to claim 1.

5. The method according to claim 4, **characterized in that** a training program, an order of exercises, a pace and a load, as well as a description of the exercises are provided to a user through his/her mobile device.

6. The method according to claim 5, **characterized in**

that the training program is chosen by the user from ready-made programs and loads to his/her mobile device.

7. The method according to claim 5, **characterized in** 5
that the user training program is selected by a doctor individually, the user loads said program using his/her preliminary obtained unique identifier code, and the doctor may control the training regime through the user's mobile device feedback. 10

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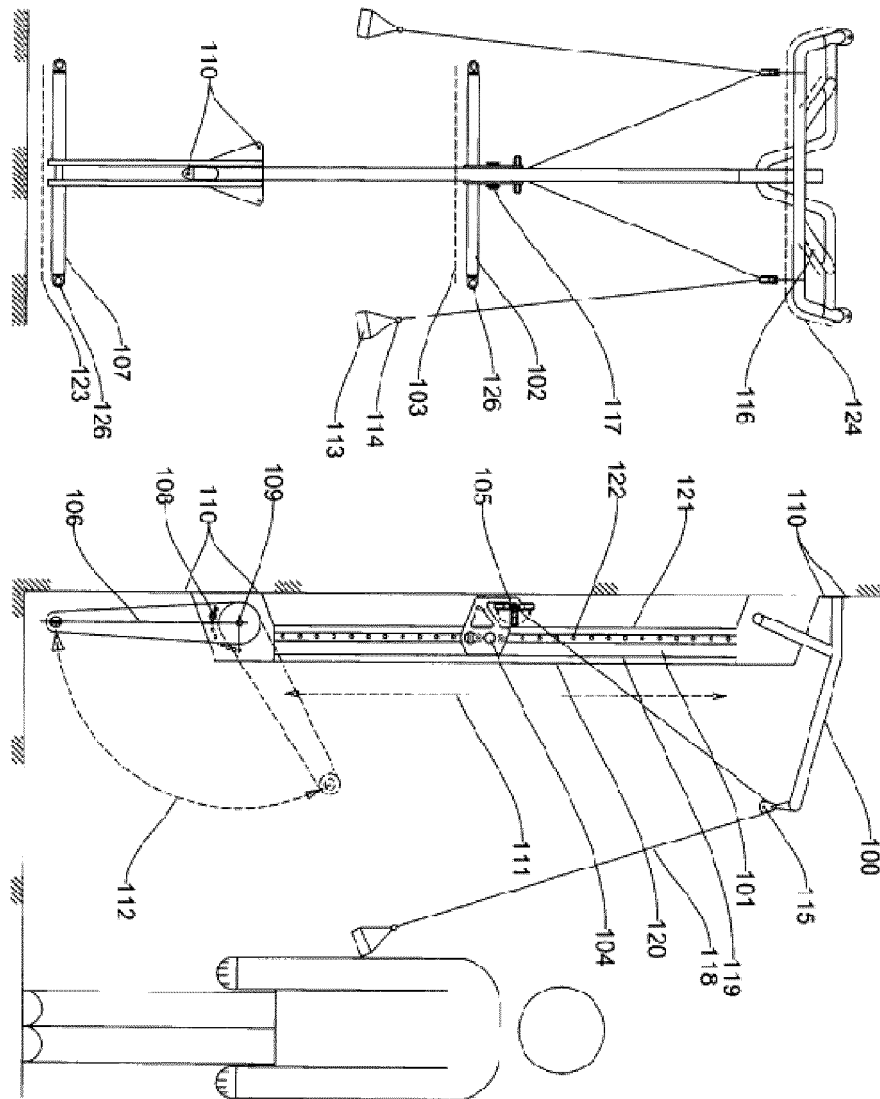


FIG.1

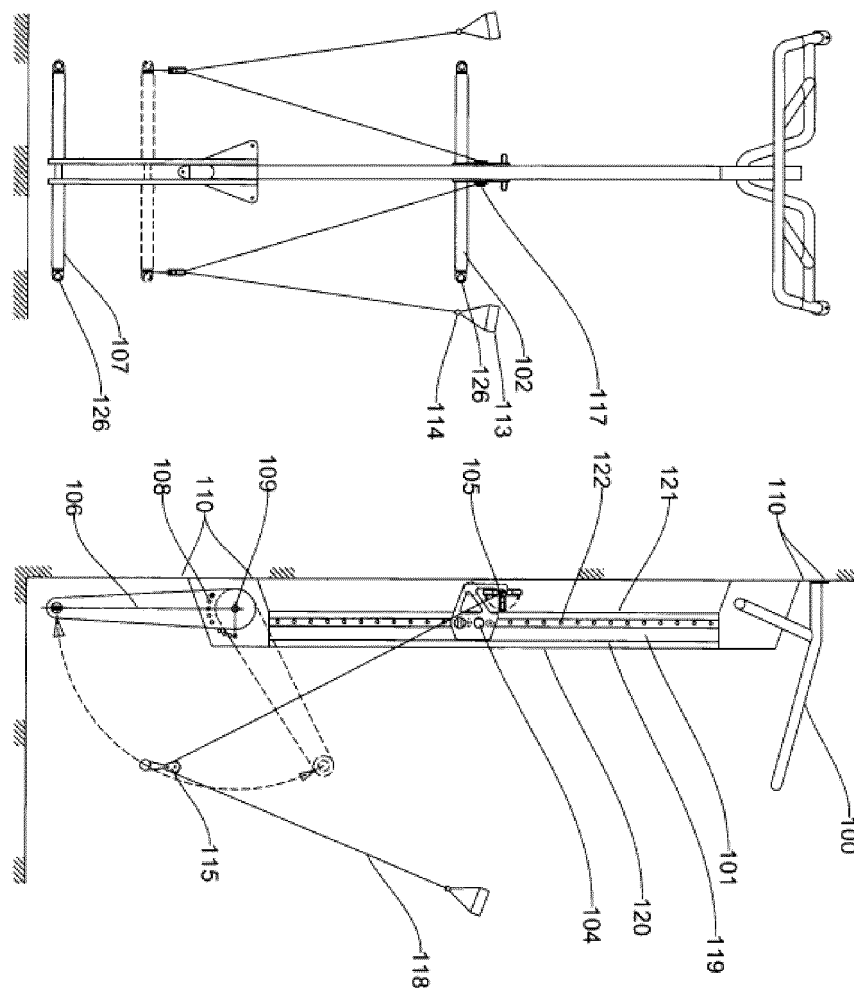


FIG.2

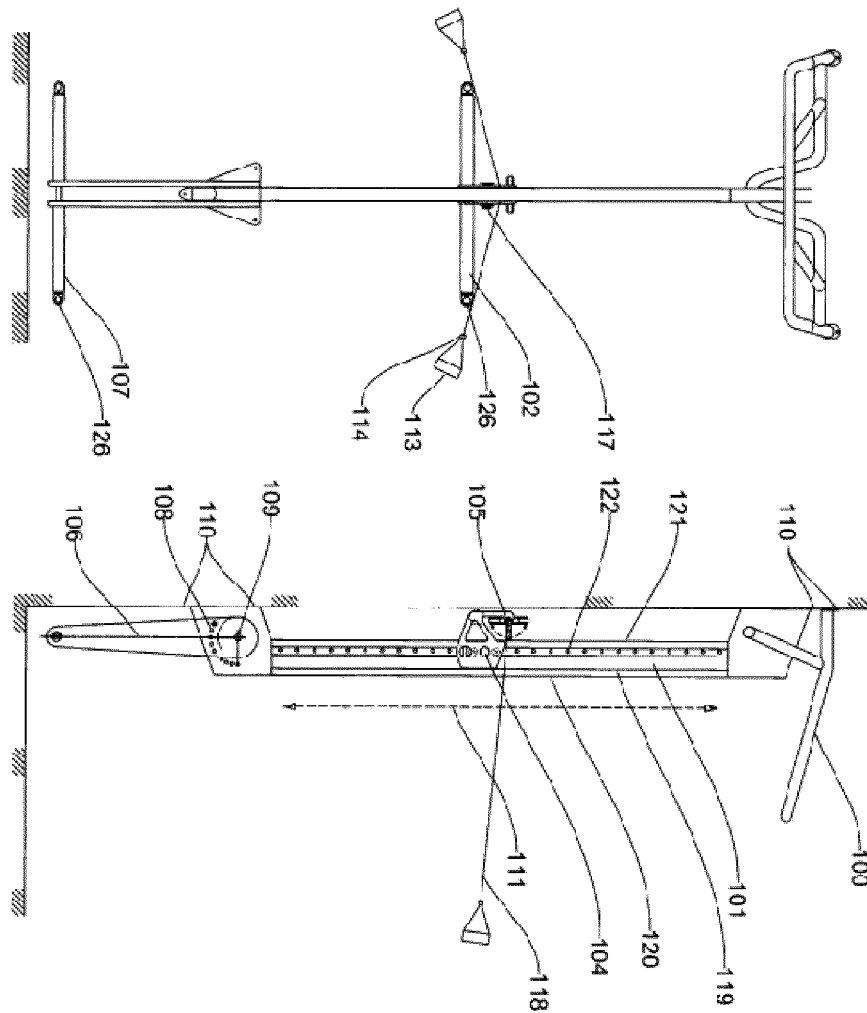


FIG.3

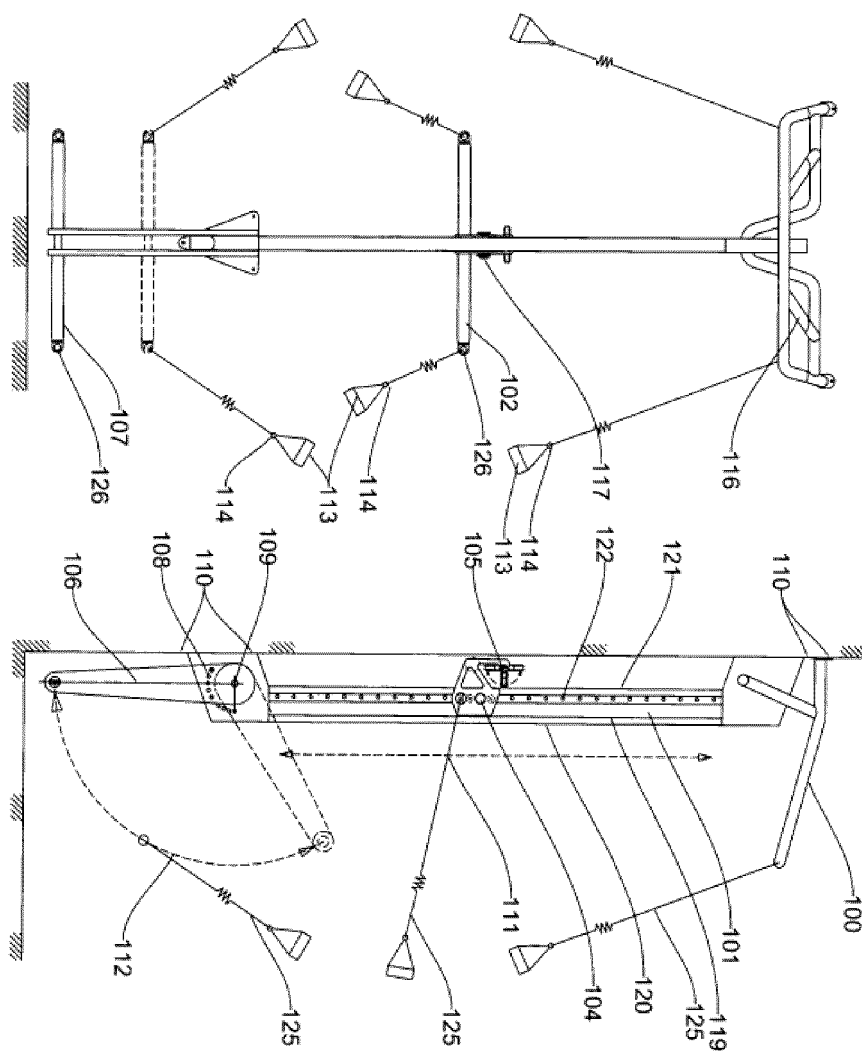


FIG.4

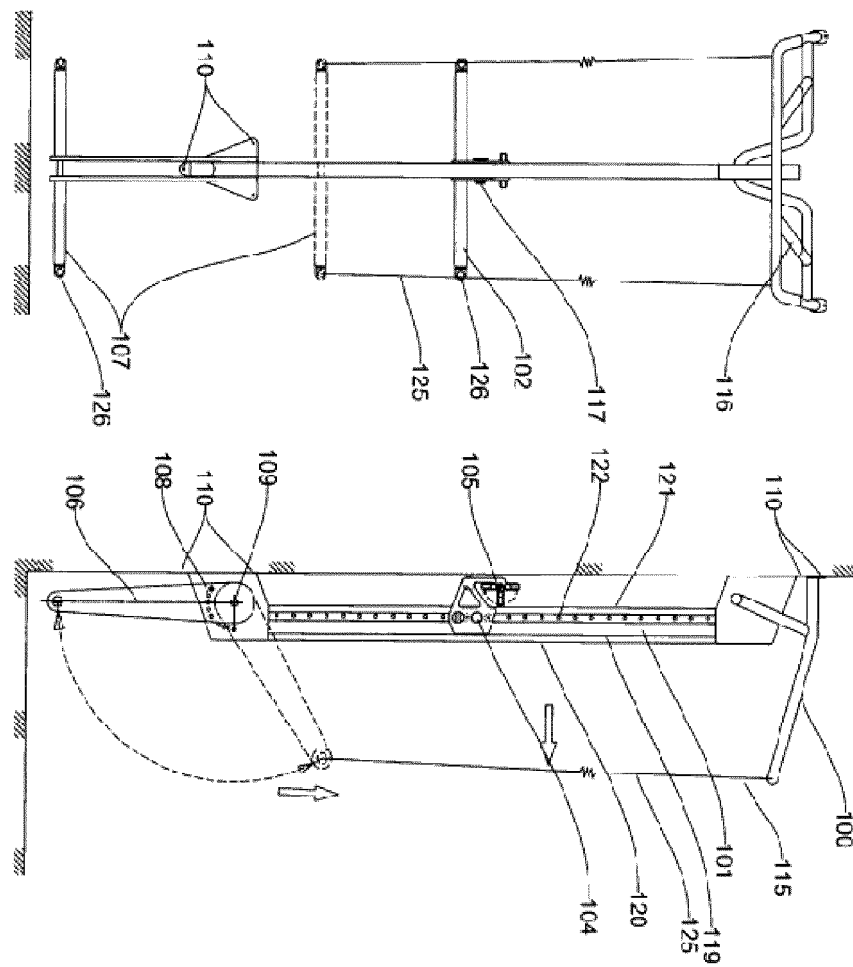


FIG.5

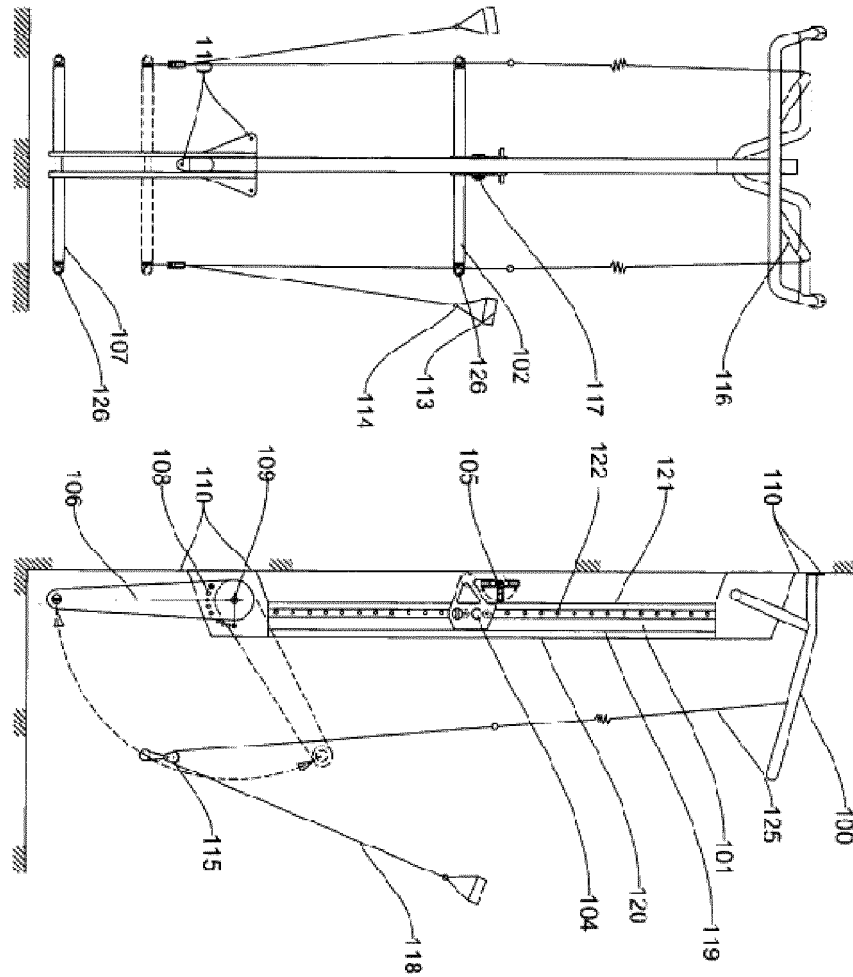


FIG.6

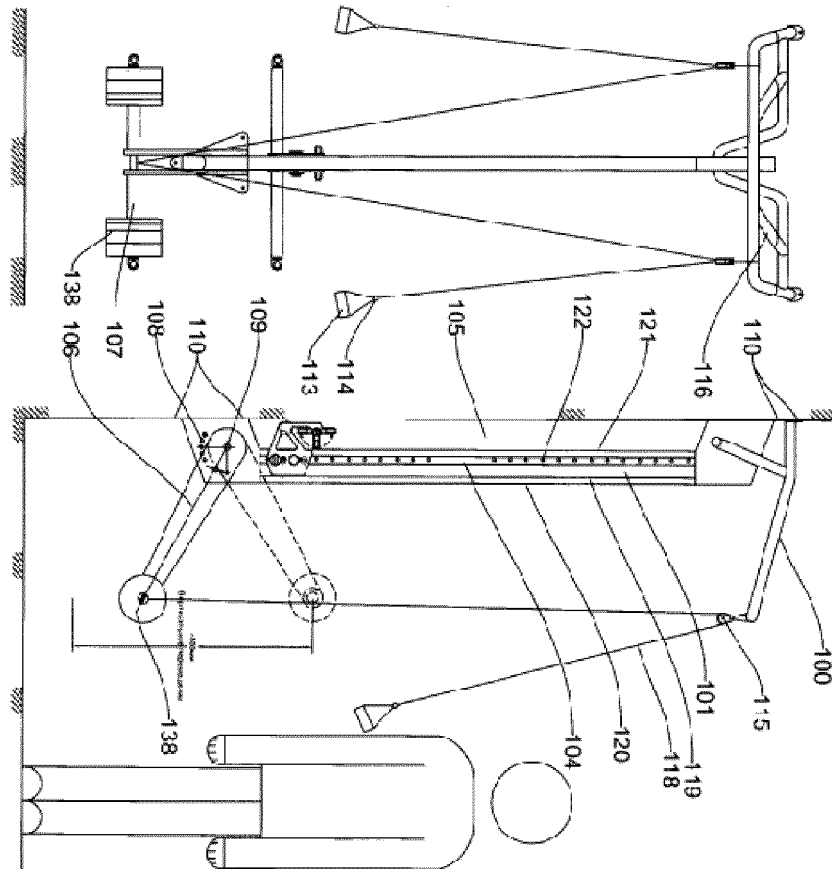


FIG. 7

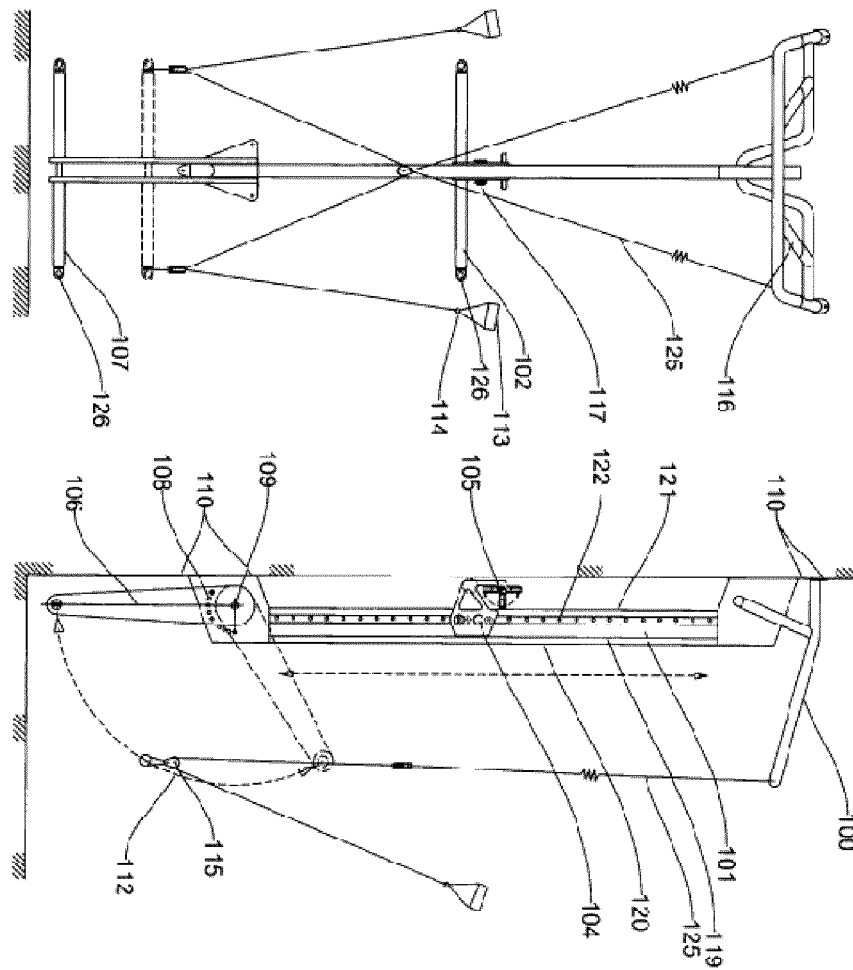


FIG.8

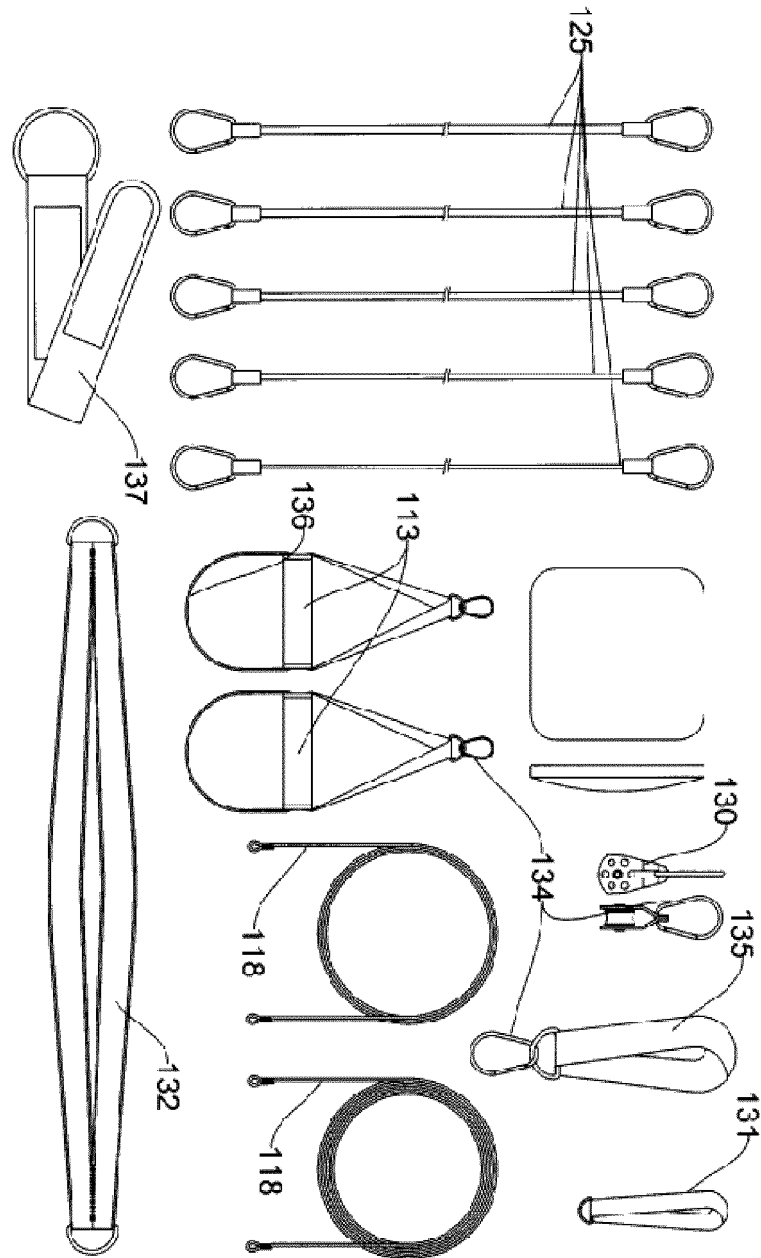


FIG.9

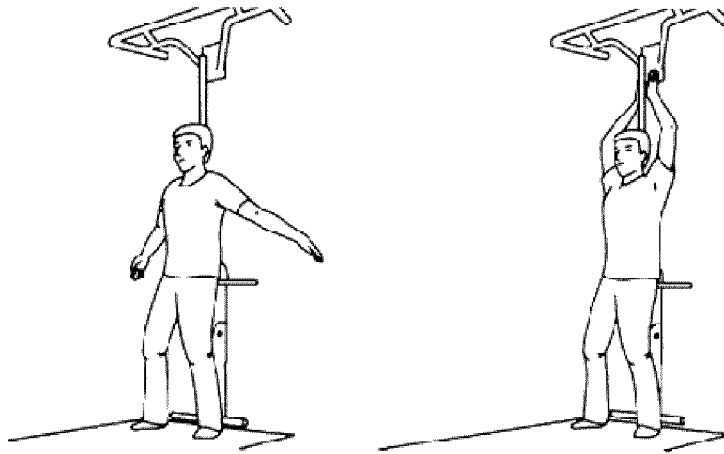


FIG.10

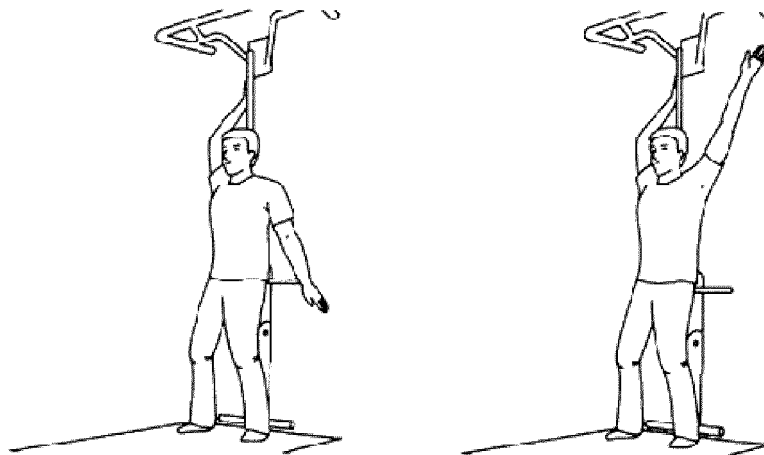


FIG.11

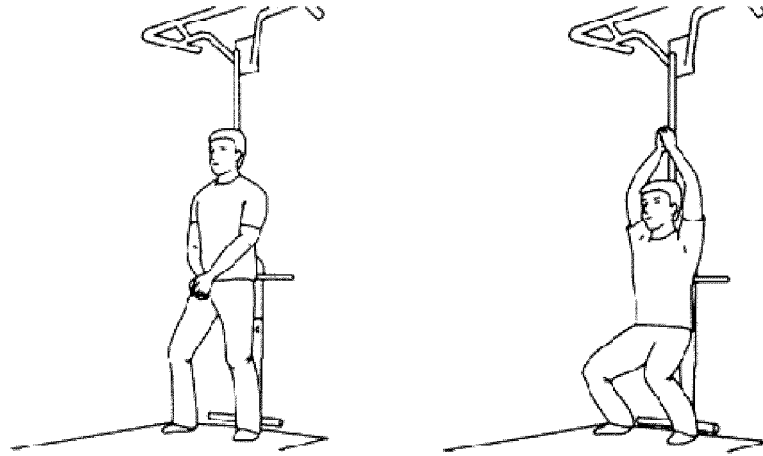


FIG.12

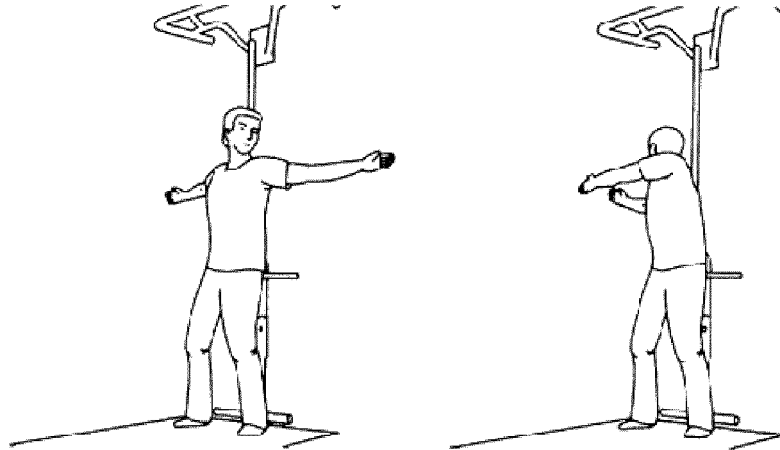


FIG.13

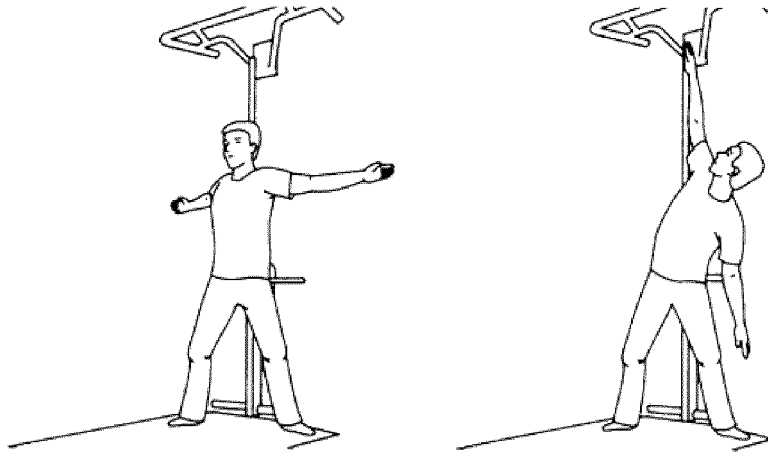


FIG.14

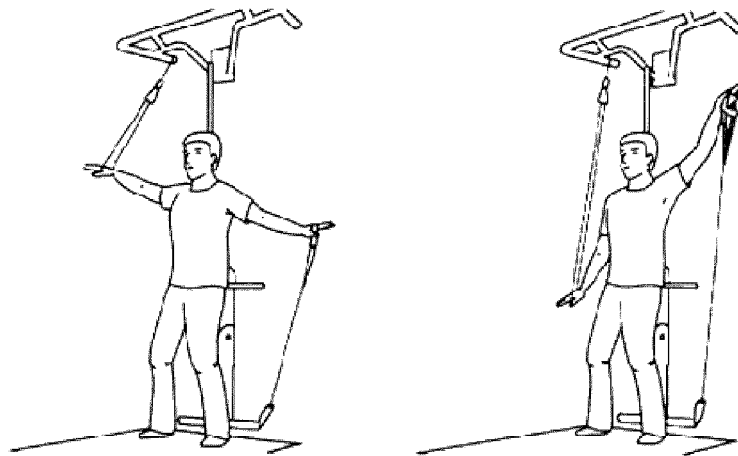


FIG.15

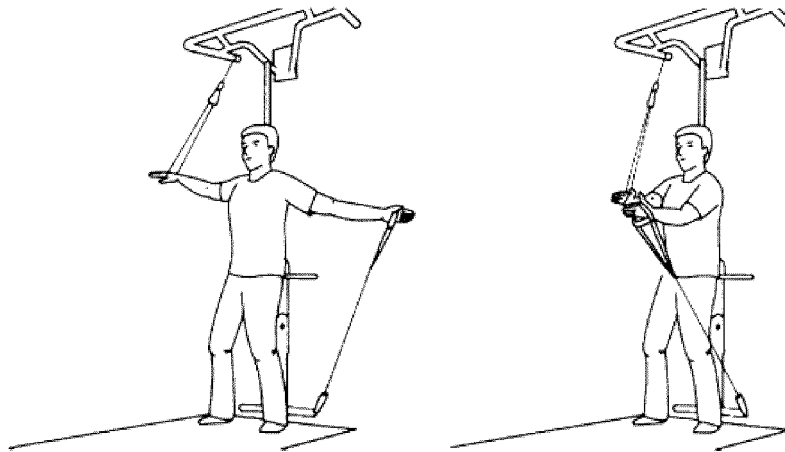


FIG.16

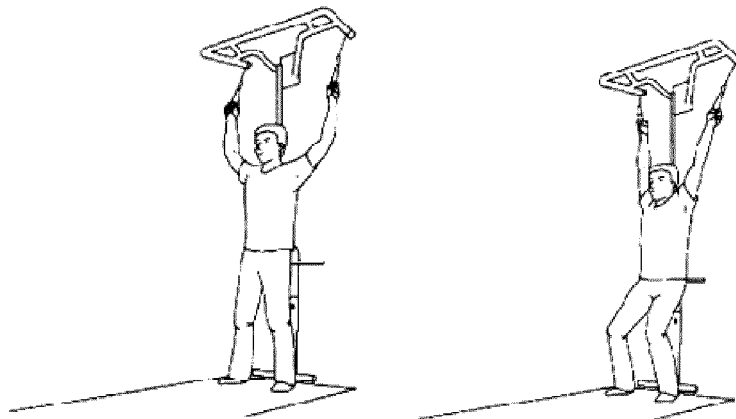


FIG.17

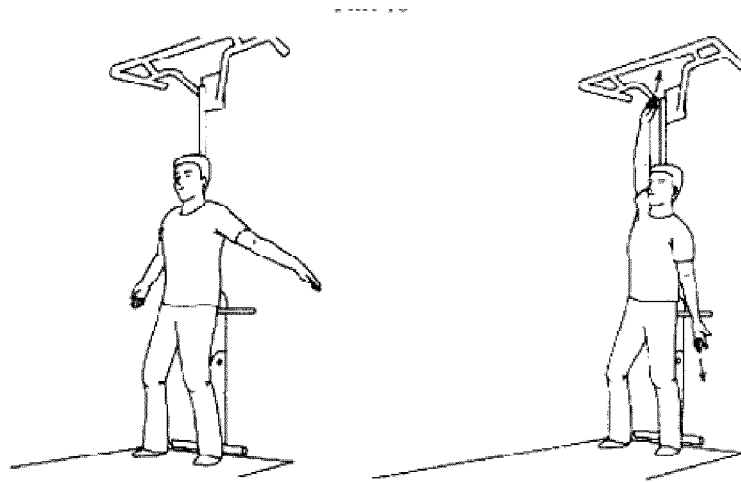


FIG.18

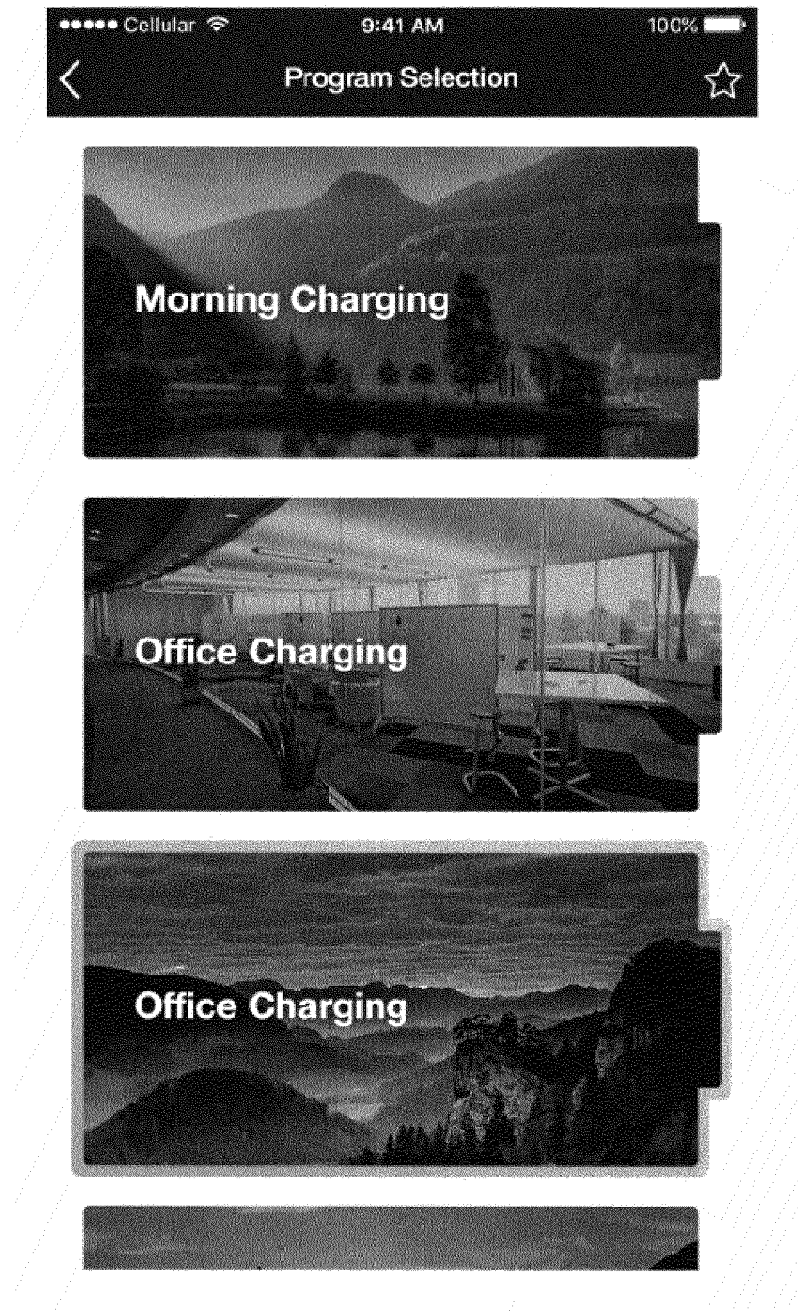


FIG.19

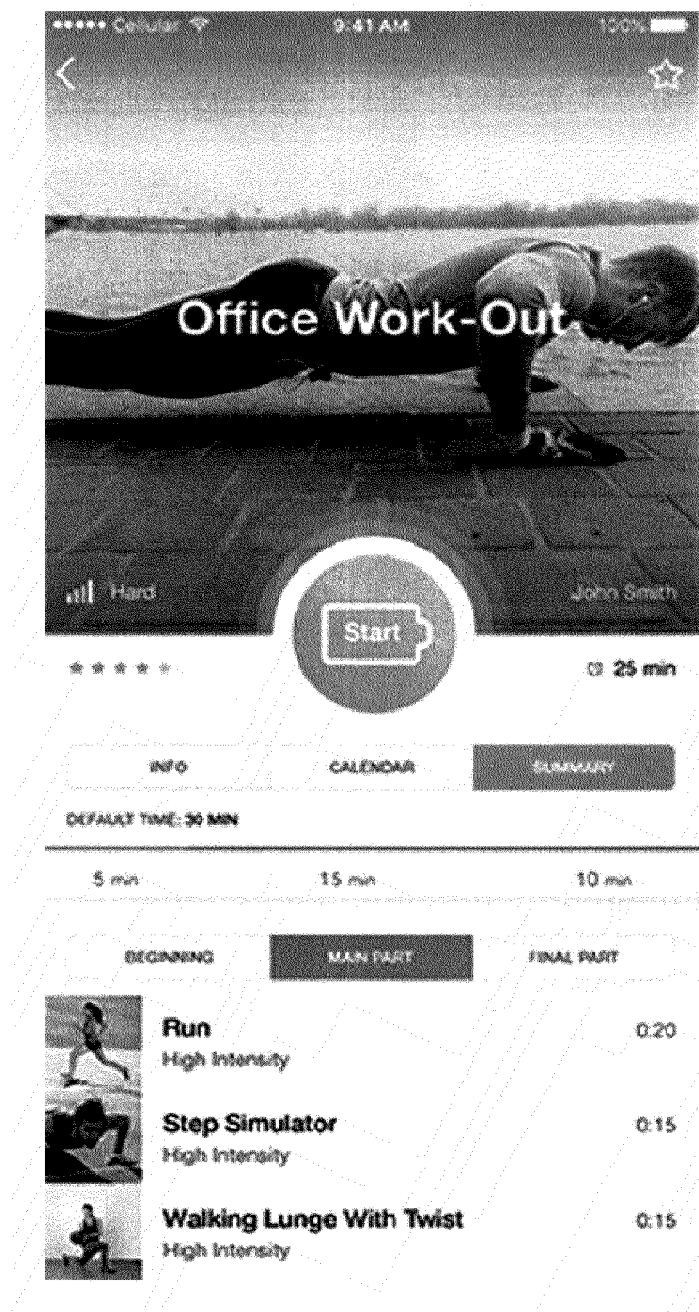


FIG.20

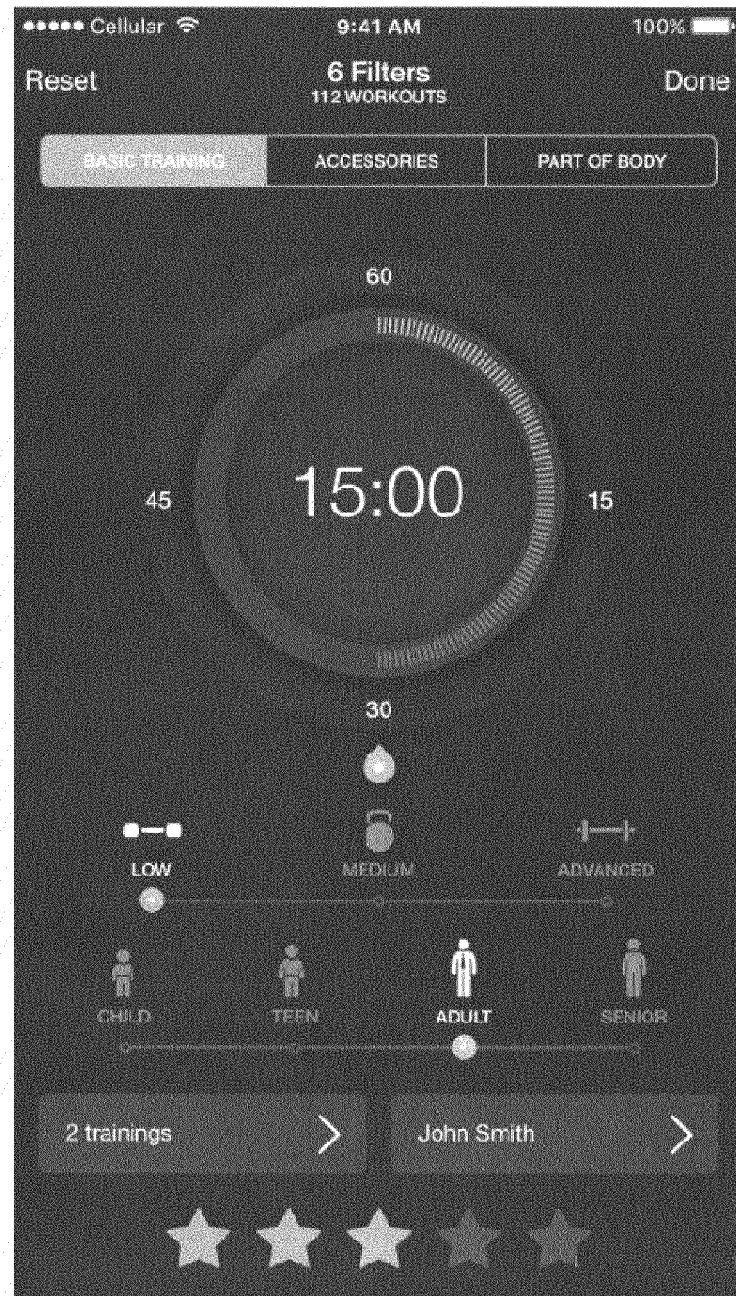


FIG.21

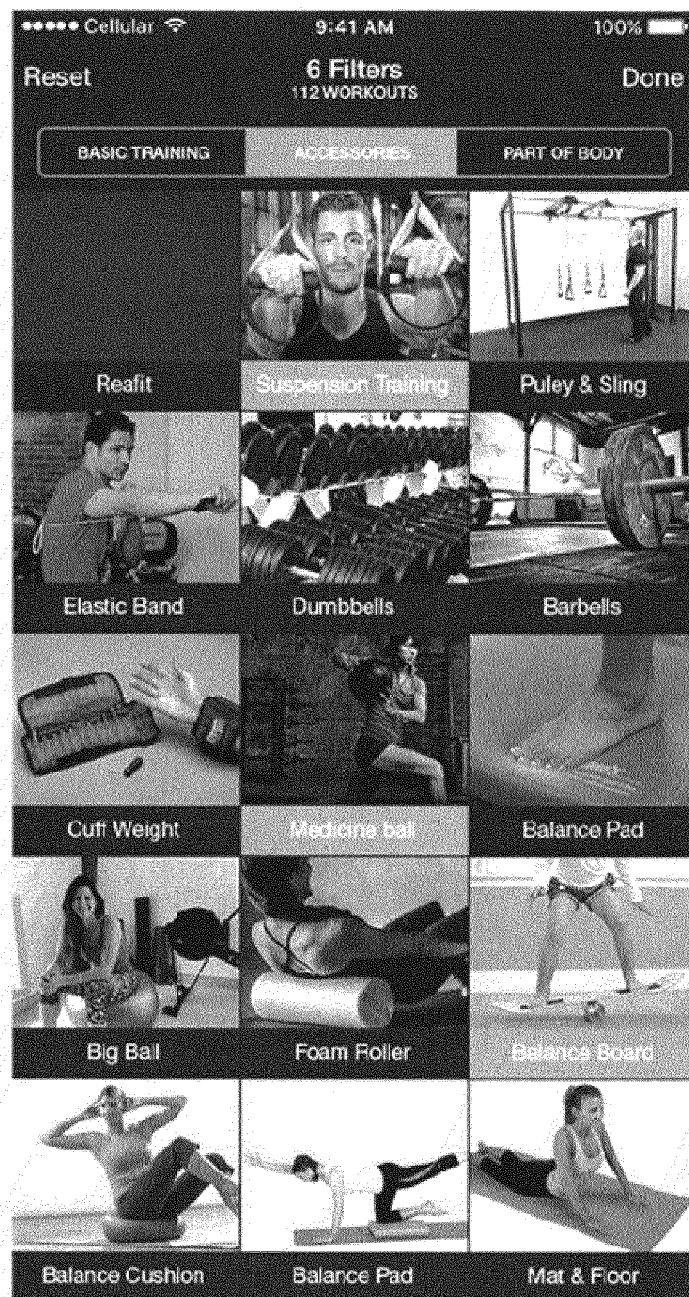


FIG.22

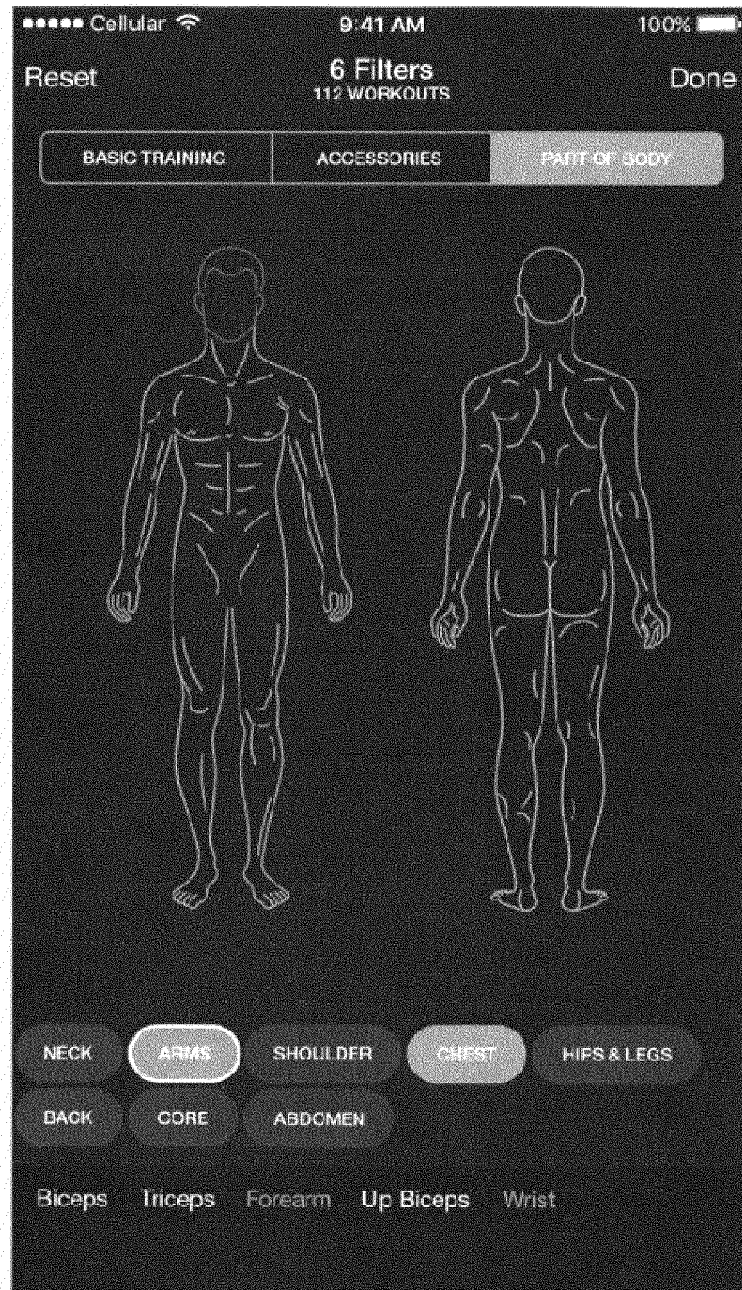


FIG.23

INTERNATIONAL SEARCH REPORT

International application No.

PCT/RU 2017/000533

A. CLASSIFICATION OF SUBJECT MATTER

A63B 21/02 (2006.01); A63B 21/04 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A63B 21/02, 21.04,21/062

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatSearch (RUPTO internal), USPTO, PAJ, K-PION, Esp@cenet, Information Retrieval System of FIPS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2002/0065176 A1 (JULIE LAFOND et al.) 30.05.2002, fig. 1, 2A-B	1-7
Y	DE 19801672 A1 (BOSSERT, MATTHIAS) 26.11.1998, fig. 1-6	1-7
Y	US 2003/0176261 A1 (FREE MOTION FITNESS, INC.) 18.09.2003, fig. 1	1-7

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:

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"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

14 March 2018 (14.03.2018)

Date of mailing of the international search report

22 March 2018 (22.03.2018)

Name and mailing address of the ISA/
RU

Authorized officer

Facsimile No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/RU 2017/000533

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2010/0048368 A1 (DARREN DONOFRIO) 25.02.2010, fig. 1, pos. 7, fig. 20, pos. 36, par. [0005]	1-7
Y	RU 119247 U1 (ISAEVA OLGA VITALIEVNA) 20.08.2012, fig. 1, pos. 1, 4, 7, 9-11, 7th par. of the description	2
Y	SU 1804872 A1 (VYTOVTOV VLADIMIR ALEKSEEVICH) 30.03.1993, fig. 1, pos. 7	2
Y	RU 2454259 C2 (SONI ERIKSSON MOBAIL KOMMIUNIKEISHNZ AB) 27.06.2012, p. 5, 6, fig. 1-3	5-7

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REFERENCES CITED IN THE DESCRIPTION

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