

Design of Lifting Equipment Beneficial to Students' Muscle Strength Training

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Abstract

To help students improve their muscle strength training, including limit mechanism of lower limbs and torso support institutions, lower limb limit mechanism including foot spacing rod, knee limit lever, for the first connecting rod and with boards of lower limbs and knee limit lever, for the first connecting rod and foot spacing rod assembly into h structure, the first link rod respectively installed on both sides of the radial has a lower limb adjustment with plate and the first link rod and lower limb with plate through the first rotating shaft and the lower limbs with adjustment Pin connection, two lower extremity adjustment plate coaxial assembly and two lower extremity adjustment plate axial and knee limit rod axial parallel; The lower limb adjustment plate is connected with the supporting member through the supporting connector, and the upper end of the supporting connector is connected with the torso supporting mechanism. This design by adjusting the Angle between the thigh and calf to reduce the thigh muscle group up tight load, to avoid the thigh muscle in the exercise of waist and abdomen strength appears slight strain, is conducive to people to carry out appropriate healthy and scientific progressive strength exercise.

Keywords

Health science strength training avoid strain injury.

1. Introduction

In daily life, it is easy for people to neglect the exercise of waist and abdomen strength because there are few occasions for using waist and abdomen strength and the time is short. However, when physical activity lasts for a long time, some people tend to feel tired easily, especially the lack of trunk strength (mainly waist and abdomen strength). This makes some people like to sit on the sofa or chair after a long period of physical activity. However, some existing waist and abdomen strength exercises are not effective, such as sit-ups, especially in the advanced training process of waist and abdomen strength, sit-ups can only meet the primary enhancement of waist and abdomen strength, but can't further improve waist and abdomen strength. When exercising waist and abdomen strength with instruments, the existing instruments have poor universality. For example, people with poor flexibility of leg muscles are not suitable to exercise with the existing supine board. The reason is that when using the existing supine board to exercise, the tension load of thigh muscles is large, which easily causes slight strain of thigh muscles when exercising waist and abdomen strength.

2. Research Purpose and Significance

The technical problem to be solved in this design is to provide an equipment which is beneficial to the training and promotion of students' muscle strength. By adjusting the included angle between thigh and calf, the tightening load of thigh muscle group can be reduced, and slight

strain of thigh muscle can be avoided when exercising waist and abdomen strength, which is beneficial to people's proper healthy and scientific step-by-step strength exercise.

3. Research on the Structure and Function Scheme of the Equipment

3.1. Structure

Comprise a lower limb limit mechanism and a trunk support mechanism, wherein that lower limb limiting mechanism comprises a foot limit rod, a knee limit rod, a first connecting rod and a lower limb adjusting plate; the knee limit rod, the first connecting rod and the foot limit rod are assembled into an I-shaped structure, Two lower limb adjustment plates are respectively installed on both sides of the first connecting rod in the radial direction, and the first connecting rod is connected with the lower limb adjustment plates through a first rotating shaft and a lower limb adjustment pin, and the two lower limb adjustment plates are coaxially assembled, and the axial direction of the two lower limb adjustment plates is parallel to the axial direction of the knee limiting rod; The lower limb adjusting plate is connected with the supporting member through the supporting connector, The upper end of that support connector is connected with the trunk support mechanism; The lower limb adjusting plate is axially provided with a plurality of limit holes around the lower limb adjusting plate; When adjusting the lower limb limiting mechanism by adjusting the included angle between the axial direction and the vertical direction of the first connecting rod and making the lower limb limiting mechanism suitable for different people, take out the lower limb adjusting pin first, then turn the first connecting rod, After the lower limb limiting mechanism is adjusted, insert the lower limb adjusting pin into the corresponding limiting hole to fix the posture of the first limiting rod.

The first connecting rod comprises an upper connecting rod and a lower connecting rod, the middle part of the knee limiting rod is fixedly connected with the upper end of the upper connecting rod, the lower end of the upper connecting rod is fixedly connected with the mounting plate, the mounting plate is fixedly connected with the upper end of the lower connecting rod, and the lower end of the lower connecting rod is fixedly connected with the foot limiting rod; The upper connecting rod and the lower connecting rod are coaxial; The mounting plate is connected with the lower limb adjustment plate through the first rotating shaft and the lower limb adjustment pin.

Two ends of the knee limiting rod are provided with elastic material sleeves for knee limiting, and the side walls of the elastic material sleeves for knee limiting are provided with grooves.

Two ends of the foot limiting rod are provided with elastic material sleeves for foot limiting, and the side walls of the elastic material sleeves for foot limiting are provided with limiting grooves.

The trunk supporting mechanism comprises a trunk supporting table, a sliding table, a hip limiting member, a back supporting member and a limiting screw, wherein the hip limiting member and the back supporting member are respectively installed on the sliding table, the sliding table is installed on the trunk supporting table and is in sliding connection with the trunk supporting table, and the first end of the trunk supporting table is hinged with the supporting member through a second rotating shaft and a U-shaped connecting piece; Limit screws fix the position of the sliding table on the trunk support table; The hip limiting member is located between the lower limb limiting mechanism and the back supporting member and adjacent to the back supporting member.

The hip limiting member and the back supporting member are both provided with pressure sensors in communication connection with the data collector.

The second end of that hip limit memb is connected with the first end of the back support memb; The first end of the inflatable auxiliary airbag is arranged on the second end of the hip limiting member, and the second end of the inflatable auxiliary airbag is arranged on the first end of the back support member.

The side wall of the trunk support table is provided with a limit strip groove, and elastic anti-skid material strips are fixedly installed in the limit strip groove; When the stop screw fixes the position of the sliding table on the trunk support table, the top end of the stop screw is in close contact with the elastic anti-skid material strip.

The second end of that trunk support platform is detachably connecte with the trunk posture adjusting plate through a trunk posture adjust pin arranged in the mounting hole of the trunk posture adjusting plate; When it is necessary to adjust the included angle between the trunk support table and the horizontal, insert the trunk adjustment pin into the corresponding mounting hole and connect the trunk support table with the trunk posture adjustment plate.

The torso posture adjusting plate is installed on the base; The sliding table is provided with an elastic band binding mechanism which is detachable from one end of the elastic band.

3.2. Functional Scheme

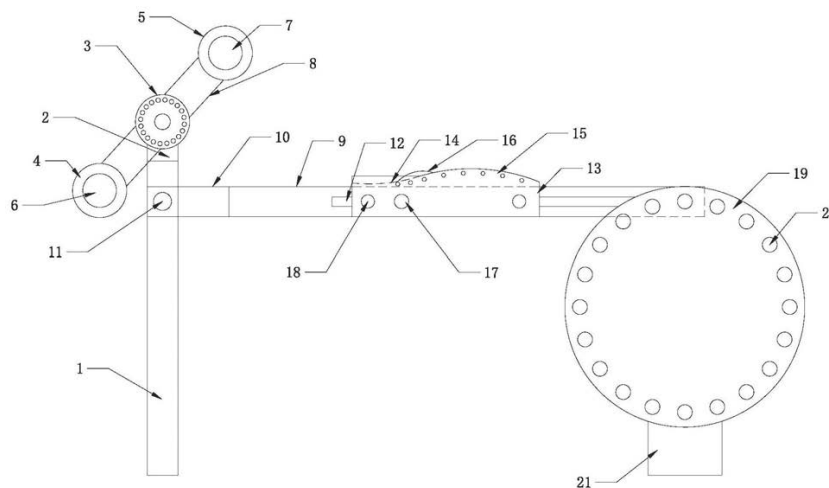


Figure 1. Schematic diagram of the structure of the equipment for strength training and promotion

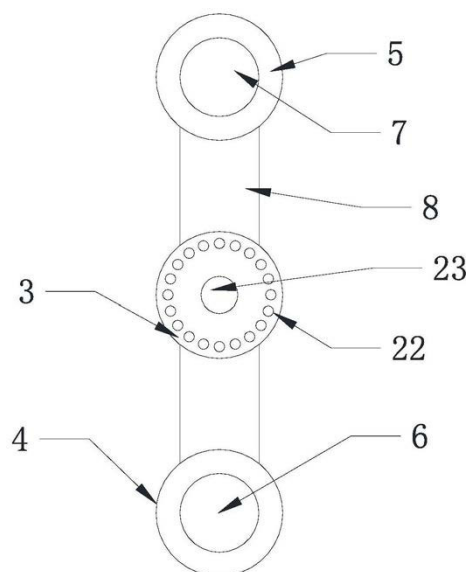


Figure 2. Schematic diagram of structure of lower limb limiting mechanism

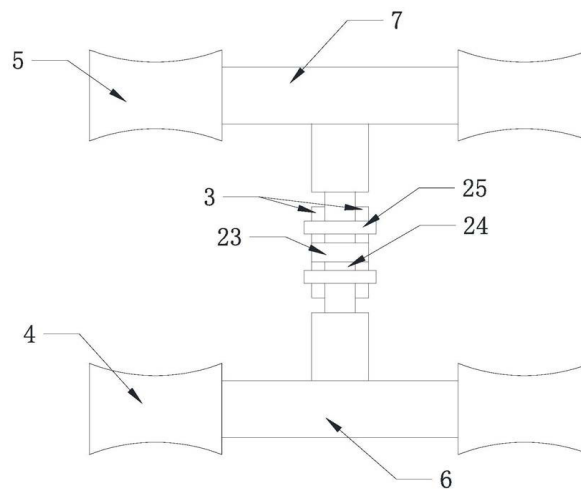


Figure 3. Another structural schematic diagram of figure 2 viewed downward

In the figure, 1- support member; 2- Supporting connectors; 3- Lower limb adjustment board; 4- Elastic material sleeve for foot spacing; 5- Elastic material sleeve for knee restraint; 6- Foot stop rod; 7- Knee stop lever; 8- The first connecting rod; 9- Trunk support table; 10-U-shaped connector; 11- the second rotating shaft; 12- elastic anti-skid material strip; 13- sliding table; 14- hip limiting member; 15- Back support member; 16- inflatable auxiliary airbag; 17- elastic band binding member; 18- limit screw; 19- torso posture adjustment board; 20- mounting hole; 21-base; 22- Limit hole; 23- the first rotating shaft; 24- mounting plate; 25- Pin for lower limb adjustment.

As shown in Figure 1~3, the designed equipment for improving students' muscle strength training includes lower limb limiting mechanism and trunk supporting mechanism. The lower limb limiting mechanism includes a foot limiting rod, a knee limiting rod, a first connecting rod and a lower limb adjusting plate. The knee limiting rod, the first connecting rod and the foot limiting rod are assembled into an I-shaped structure. Two lower limb adjustment plates are respectively installed on both sides of the first connecting rod in the radial direction, and the first connecting rod is connected with the lower limb adjustment plates through a first rotating shaft and a lower limb adjustment pin, and the two lower limb adjustment plates are coaxially assembled, and the axial direction of the two lower limb adjustment plates is parallel to the axial direction of the knee limiting rod; The lower limb adjusting plate is connected with the supporting member through the supporting connector, The upper end of that support connector is connected with the trunk support mechanism; The lower limb adjusting plate is axially provided with a plurality of limit holes around the lower limb adjusting plate; When adjusting the lower limb limiting mechanism by adjusting the included angle between the axial direction and the vertical direction of the first connecting rod and making the lower limb limiting mechanism suitable for different people, take out the lower limb adjusting pin first, then turn the first connecting rod, After the lower limb limiting mechanism is adjusted, insert the lower limb adjusting pin into the corresponding limiting hole to fix the posture of the first limiting rod. The supporting member is a hollow supporting column, and the supporting connector is a U-shaped supporting plate.

Wherein, the first connecting rod comprises an upper connecting rod and a lower connecting rod, the middle part of the knee limiting rod is fixedly connected with the upper end of the upper connecting rod, the lower end of the upper connecting rod is fixedly connected with the mounting plate, the mounting plate is fixedly connected with the upper end of the lower connecting rod, and the lower end of the lower connecting rod is fixedly connected with the

foot limiting rod; The upper connecting rod and the lower connecting rod are coaxial; The mounting plate is connected with the lower limb adjustment plate through the first rotating shaft and the lower limb adjustment pin. In this embodiment, both ends of the knee limit rod are provided with knee limit elastic material sleeves, and the side walls of the knee limit elastic material sleeves are provided with grooves; Two ends of the foot stop rod are provided with foot stop elastic material sleeves, and the side walls of the foot stop elastic material sleeves are provided with stop grooves. And the groove and the limiting groove are arranged to avoid the muscle or skin at the instep support point and the knee support point from being squeezed and damaged.

The difference of individual physique leads to the different stretchability of rectus femoris, sartorius muscle, medial femoris muscle and lateral femoris muscle in thigh muscle group. By adjusting the angle between the first connecting rod and the vertical direction, the posture of the lower limb limiting mechanism can be adjusted, and then the angle between calf and thigh can be adjusted during waist and abdomen strength training. Therefore, the rectus femoris, sartorius muscle, medial femoral muscle and lateral femoral muscle in the thigh muscle group are prevented from being stretched excessively, and the rectus femoris, sartorius muscle, medial femoral muscle and lateral femoral muscle in the thigh muscle group are also prevented from being pulled.

The trunk supporting mechanism comprises a trunk supporting table, a sliding table, a hip limiting member, a back supporting member and a limiting screw, wherein the hip limiting member and the back supporting member are respectively installed on the sliding table, the sliding table is installed on the trunk supporting table and is in sliding connection with the trunk supporting table, and the first end of the trunk supporting table is hinged with the supporting member through a second rotating shaft and a U-shaped connecting piece; Limit screws fix the position of the sliding table on the trunk support table; The hip limiting member is located between the lower limb limiting mechanism and the back supporting member and adjacent to the back supporting member. Wherein, the hip limiting member and the back supporting member are both provided with pressure sensors in communication connection with the data collector, The pressure sensor is shown by the small circle on the back support member in the figure; The second end of that hip limit memb is connected with the first end of the back support memb; The first end of the inflatable auxiliary airbag is arranged on the second end of the hip limiting member, and the second end of the inflatable auxiliary airbag is arranged on the first end of the back support member; The side wall of that trunk support table is provide with a limit strip groove, Elastic antiskid material strips are fixedly installed in the strip-shaped groove; When the limit screw fixes the position of the sliding table on the trunk support table, the top end of the limit screw is in close contact with the elastic anti-skid material strip; The second end of that trunk support platform is detachably connecte with the trunk posture adjusting plate through a trunk posture adjust pin arranged in the mounting hole of the trunk posture adjusting plate; When it is necessary to adjust the included angle between the trunk supporting table and the horizontal, insert the trunk adjusting pin into the corresponding mounting hole and connect the trunk supporting table with the trunk posture adjusting plate; The torso posture adjusting plate is installed on the base; An elastic band binding member is arranged on the sliding table, and the elastic band binding member and one end of the elastic band are detachable. The hip limiting member and the back supporting member are arranged on the sliding table, and the sliding table can freely slide on the trunk supporting table, so that people with different heights can use the same device to exercise waist and abdomen strength. In this embodiment, the hip limiting member and the back supporting member are integrally processed, That is to say, a U-shaped side opening half groove for preventing the hip from laterally shifting to both sides is excavated on a workpiece, and an arc-shaped protrusion is arranged on the workpiece to facilitate the opening of the back spine to open the chest cavity,

while the inflatable auxiliary airbag is arranged at the junction of the U-shaped side opening half groove and the arc-shaped protrusion, as shown in the figure.

According to the design, the posture of the trunk support table is adjusted by adjusting the position of the second end of the trunk support table in the vertical direction, so that the posture of the trunk of exercisers can meet the personal exercise needs in the exercise process, and at the same time, the elastic band is added, so that the spine of exercisers who are exercising waist and abdomen strength can be restrained to a certain extent, Avoid spondylolisthesis caused by your own weight or excessive force during sitting-up, improve exercise safety and avoid sports injuries.

However, in the actual waist and abdomen strength exercise, the opening degree between the lumbar vertebra and the sacrum affects the stretching degree of rectus abdominis, external oblique abdominis, internal oblique abdominis, external oblique abdominis aponeurosis and sulcus abdominis ligament in the abdominal muscle group. The stretching degree of rectus abdominis, external oblique abdominis, internal oblique abdominis, external oblique abdominis aponeurosis and sulcus abdominis ligament in abdominal muscle group is directly related to the strength exercise of abdominal muscle group, but personal physical factors have an influence on the stretching degree of abdominal muscle group that they can bear. Therefore, waist and abdomen strength exercise with the same abdominal muscle group stretching degree requiring different people will cause some people's abdominal muscle strain. In this design, the inflatable auxiliary airbag is used to adjust the stretching degree of the abdominal muscle group, which can effectively avoid the abdominal muscle strain under the condition of hard stretching, and the inflatable auxiliary airbag can be used.

The data collector can collect the pressure of the waist and the back on the back support member through the pressure sensor, and analyze the back muscle state and strength through the change of pressure acting time and size, so that targeted exercise can be carried out and the integrity of waist and abdomen strength can be improved.

4. Innovation

1. This design alleviates the stretching state of thigh muscles by adjusting the angle between calf and thigh, so that the thigh muscles are in a critical state between tension and the same pain, which can not only prevent the thigh muscles from being pulled or torn, but also enable the thigh muscles to be exercised when people exercise waist and abdomen strength.
2. This design uses inflatable auxiliary airbag to adjust the opening degree of lumbar spine, and it is also beneficial to adjust the stretching degree of rectus abdominis, external oblique abdominis, internal oblique abdominis, external oblique abdominis aponeurosis and sulcus abdominis ligament, which is beneficial to adjust the exercise intensity of abdominal muscles, so that exercisers can exercise step by step.
3. In this design, the elastic band is used to fix the spine in an auxiliary way, so as to prevent the exerciser from slipping off the spine when the second end of the trunk support platform is lower than the first end of the trunk support platform, and further avoid sports injuries.

5. Conclusion

With the improvement of economic development, people's living and health standards are constantly improving. Starting from the actual needs of fitness users, this paper designs a new type of fitness training equipment, introduces the design scheme and functions of the new type of fitness training equipment, and realizes the popularization, multifunction and economy of fitness equipment. This new training fitness equipment meets the health needs of young people

at present, and also caters to the current market trend. It has high cost performance and promotion value.

Acknowledgments

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