

## Design of Physical Training Machine for College Students

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### Abstract

The design belongs to the technical field of physical training, in particular to a physical training machine for college students, which comprises a chassis; The top of the underframe is fixedly connected with a vertical frame, and the top of the vertical frame is provided with a group of guide pulleys; A steel rope is arranged on the guide pulley, one end of the steel rope is provided with a pull rod, and the other end is provided with an adjusting rod; A group of sliding holes are arranged at the bottom of the counterweight block, and sliding columns are slidably connected in the sliding holes; A spring is fixedly connected between the sliding column and the bottom of the sliding hole; The bottom of the sliding column extends to the outside of the counterweight block, and a rubber pad is fixedly connected with the bottom of the sliding column; The depth of that slide hole is greater than the sum of the length of the sliding column and the rubber pad; The bottom of the sliding hole is provided with an exhaust hole, and the diameter of the exhaust hole is less than one fifth of the diameter of the sliding hole; In this design, the speed of the counterweight is slowed down by the sliding column, Reduce the damage of the training device.

### Keywords

College students; Physical fitness; Training machine.

### 1. Preface

According to the performance and function of physical ability in different groups of people, physical ability can be divided into two levels: healthy physical ability and competitive physical ability. Healthy physical ability refers to the functional ability of organ system necessary for any group of people, which is the basis of competitive physical ability. The development of athletes' competitive physical ability is influenced by many factors. Congenital physical ability is obtained by genetic effect, while acquired physical ability is mainly improved by effective physical training. At the same time, it can be developed correspondingly in a suitable geographical environment and a good social environment. The direct task of physical training is to meet the needs of various events. Improve athletes' sports quality.

There are some technical schemes about physical training in the prior art. A Chinese patent discloses a physical training device used in physical education, which comprises an underframe, a support frame is fixedly installed on the top of the underframe, and a buffer seat is fixedly installed on the top of the underframe. According to the physical training device used in physical education, a user can sit on the seat plate, Place your feet on the pedal, grasp the pull ring with both hands, slowly pull the traction rope to lift the weight-increasing block, and then slowly put down the weight-increasing block. When performing abdominal training, you only need to lift your feet and place them on the rear frame, with your instep against the limit bar. You can train between the front frame and the rear frame, and you can also push the buckles on both sides to separate from the connectors. The restrictions on the bolt are lifted, the bolt is pulled away, and the seat plate is pulled away from the switching direction, symmetrically placed and fixed with the insert link bar, so that the seat plate forms an arc-shaped backing plate, and the user can train the waist and abdomen against the seat plate, thus achieving the

purpose of facilitating the operation of the user; However, in the prior art, when the pull rod is loosened or when the pull rod rises too fast, It is easy to cause the adjusting rod and the counterweight to fall down quickly, which makes the counterweight collide violently, producing huge noise, and in severe cases, the training device is damaged.

## 2. Design Content

In order to make up for the shortcomings of the prior art and solve the problem that the adjusting rod and the counterweight can easily fall down quickly when the pull rod is loose or when the pull rod rises too fast in the prior art, thus causing the counterweight to collide violently, generating huge noise and causing damage to the training device in severe cases, the physical fitness training machine for college students proposed in this design.

The technical scheme adopted by this design to solve its technical problems is as follows: the physical training machine for college students mentioned in this design includes a chassis; A cushion and a backrest are arranged at the top of the underframe, a vertical frame is fixedly connected to one side of the underframe far away from the backrest, and a group of guide pulleys are arranged at the top of the vertical frame; A steel rope is arranged on the guide pulley, one end of the steel rope is provided with a pull rod, and the other end is provided with an adjusting rod; One side of that chassis is provide with a support at a position corresponding to the adjust rod, the top of the support is fixedly connected with a pair of guide rods, a group of counterweight blocks penetrate through the guide rods, and the counterweight blocks are in sliding connection with the guide rods; A through hole is formed at the corresponding position of the counterweight and the adjusting rod; A jack is arranged on the side surface of the counterweight block, a bolt is inserted into the jack, and a group of adjusting holes matched with the jack are uniformly arranged on the adjusting rod; A group of sliding holes are arranged at the bottom of the counterweight block, sliding columns are slidably connected in the sliding holes, and springs are fixedly connected between the sliding columns and the bottom of the sliding holes; The bottom of the sliding column extends to the outside of the counterweight block, and a rubber pad is fixedly connected with the bottom of the sliding column; The depth of that slide hole is greater than the sum of the length of the sliding column and the rubber pad; The bottom of the sliding hole is provided with an exhaust hole, The diameter of the exhaust hole is less than one fifth of the diameter of the sliding hole; Slow down the speed of the counterweight through the sliding column and reduce the damage of the training device; When working, the pull rod is loosened, so that the adjusting rod falls and is inserted into the through hole under the action of dead weight, and then is inserted into different through holes through bolts, so that the adjusting rod pulls up different numbers of counterweight blocks. The pulling force of the pull rod can be quickly adjusted; When the pull rod comes loose or the speed of the pull rod rises too fast, it is easy to cause the adjusting rod and the counterweight to fall down quickly, which makes the counterweight collide violently and produce huge noise. In serious cases, the training device is damaged. At this time, through the sliding column slidably connected in the sliding hole, So that the rubber pad fixedly connected at the bottom of the sliding column first contacts the bottom counterweight, and then the rubber pad deforms to absorb a part of kinetic energy, thereby avoiding huge noise caused by direct collision of the counterweight between the upper and lower layers; meanwhile, the rubber pad and the sliding column shrink into the sliding hole under the pressure of the counterweight, and the air in the sliding hole blocks the sliding of the sliding column when compressed. Furthermore, the approaching speed of the counterweight blocks is reduced, the diameter of the exhaust hole is less than one fifth of the diameter of the sliding hole, and the exhaust speed of the sliding hole is limited through the exhaust hole, thereby further reducing the approaching speed between

the counterweight blocks, reducing the rigid collision between the counterweight blocks and further reducing the damage of the training device.

The exhaust hole is communicated with the through hole, and one side of the exhaust hole close to the through hole is Y-shaped; Air is blown into the through hole through the exhaust hole to reduce the blockage of the through hole by foreign matter and ensure the normal operation of the training device; When the sliding column slides toward the bottom of the sliding hole, the air at the bottom of the sliding hole is compressed, and the compressed air is introduced into the through hole through the exhaust pipe to clean the inner wall of the through hole. The penetration holes of foreign bodies are reduced, which affects the insertion of the adjusting rod into the penetration holes. At the same time, because one side of the exhaust holes near the penetration holes is Y-shaped, the air discharged from the exhaust holes is ejected obliquely to the upper and lower ends of the penetration holes, which further increases the cleaning effect of the exhaust holes on the penetration holes.

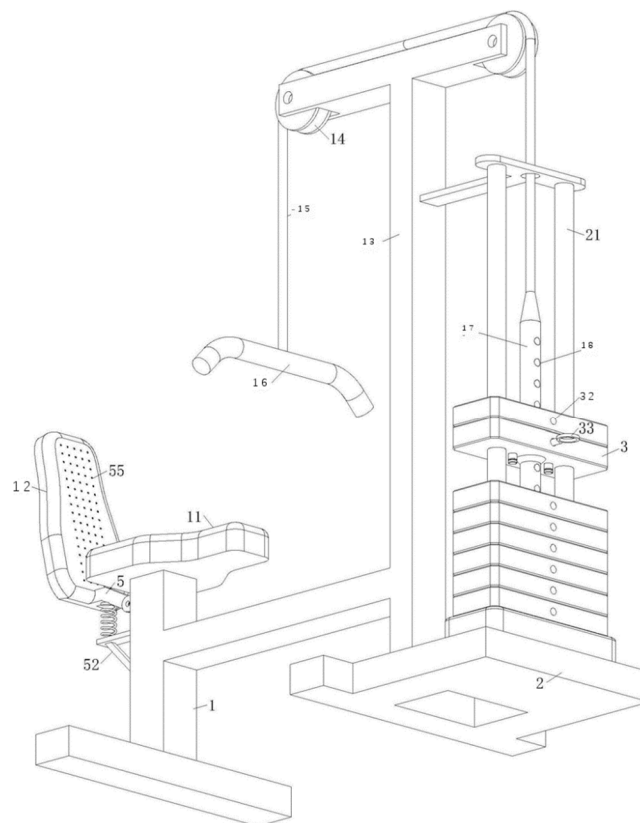
A tapered countersunk part is arranged at the top of the through hole, which is beneficial for the adjusting rod to be inserted into the through hole; The bottom of that through hole is a convex re matched with the countersunk head, and the convex re is embedded into the lower counterweight block, so that the air flow rate at the bottom of the counterweight block is increased, and the clean effect at the bottom of the counterweight block is increased; When the counterweight slides downward along the guide of the guide rod, Through the tapered countersunk head, it is convenient for the adjusting rod to be inserted into the through hole quickly. At the same time, when the convex ring approaches the countersunk head, the convex ring squeezes the air near the countersunk head, so as to increase the air flow and escape around the countersunk head, and further improve the cleaning effect on the bottom of the counterweight by cooperating with the air flow ejected from the through hole.

An elastic membrane is fixedly connected in the through hole at the lower part of the countersunk head, and a round hole with a diameter slightly smaller than that of the adjusting rod is arranged in the middle of the elastic membrane; The cleaning of the adjusting rod is increased through the elastic film to further prevent the adjusting rod from being stuck; When that adjust rod is inserted into the through hole, the adjust rod supports the round hole, so that the elastic film scrapes the periphery of the adjusting rod and further clean the adjusting rod. The impurities adhered by the adjusting rod are reduced to be stuck in the through hole, which hinders the smooth sliding of the adjusting rod. Meanwhile, when the adjusting rod supports the round hole, the elastic film is matched with the adjusting rod to seal the top of the through hole, so that all compressed air ejected from the exhaust hole is exhausted through the bottom of the through hole, increasing the air output at the bottom of the through hole and further improving the cleaning effect of the bottom of the counterweight. Ensure that the counterweight blocks return smoothly, reduce the dislocation between the jack and the adjusting hole caused by foreign matter inclusion between the counterweight blocks, and increase the efficiency of inserting the bolt into the jack and adjusting hole.

A support rod is arranged at the bottom of the backrest, a hinge bracket is fixedly connected to the underframe at the bottom of the cushion, and one end of the support rod close to the hinge bracket is hinged with the hinge bracket; The underframe at the bottom of the hinge bracket is fixedly connected with a tripod, and the top of the tripod and the support rod bracket are provided with a return spring; The rotation center of the backrest coincides with the rotation axis of the waist when the human body sits on the cushion; Reduce the friction between the back of the human body and the backrest through the rotating backrest, and reduce the exercise injury; As the rotation center of the backrest coincides with the rotation axis of the waist when the human body sits on the cushion, when the sportsman sits on the cushion and pulls the pull rod, the backrest rotates synchronously with the rotation of the waist of the sportsman, further reducing the sliding friction between the back of the sportsman and the backrest. Under the

action of ensuring sufficient supporting force of the backrest to the back of the personnel, the friction of the back of the personnel is reduced, and then the friction injury caused by sports to the human body is reduced.

A group of ventilation holes are uniformly arranged on the backrest; The top of that support is provide with a No.1 hole corresponding to the adjust rod, and the No.1 hole is in sliding and sealing connection with the adjusting rod; The bottom of that first hole is communicate with a second hole, and the second hole is communicated with a ventilation hole through an air pipe; The ventilation effect of the backrest is increased by blowing air through the No.1 hole, thereby increasing the exercise efficiency; When the pull rod is released to make the adjusting rod and the counterweight fall down, the bottom of the adjusting rod is inserted into the No.1 hole, which prevents the adjusting rod from moving down when the air in the No.1 hole is compressed, thus avoiding the deformation of the adjusting rod and the violent collision between the counterweights caused by the direct contact of the adjusting rod with the bottom. Further increase the ventilation performance of the backrest, reduce the influence of sweat on sports of athletes, and increase the exercise effect of the training device.



**Figure 1.** A perspective view of the design

In the drawing: underframe 1, seat cushion 11, backrest 12, upright frame 13, guide pulley 14, steel rope 15, pull rod 16, adjusting rod 17, support 2, guide rod 21, counterweight 3, through hole 31, insertion hole 32, pin 33, adjusting hole 18, sliding hole 34, sliding column 35, rubber pad 36 and exhaust hole 37

### 3. Specific Implementation Mode

In order to make the technical means, creative features, goals and effects of the design easy to understand, the design will be further elaborated with specific implementation methods.

As shown in fig. 1, the physical training machine for college students in this design includes a chassis; A cushion and a backrest are arranged at the top of the underframe, a vertical frame is fixedly connected to one side of the underframe far away from the backrest, and a group of guide pulleys are arranged at the top of the vertical frame; A steel rope is arranged on the guide pulley, one end of the steel rope is provided with a pull rod, and the other end is provided with an adjusting rod; A support is arranged on one side of the chassis at a position corresponding to the adjusting rod, A pair of guide rods are fixedly connected to the top of the support, a group of counterweight blocks penetrate through the guide rods, and the counterweight blocks are in sliding connection with the guide rods; A through hole is formed at the corresponding position of the counterweight and the adjusting rod; A jack is arranged on the side surface of the counterweight block, a bolt is inserted into the jack, and a group of adjusting holes matched with the jack are uniformly arranged on the adjusting rod; The bottom of that counterweight block is provide with a group of sliding hole, A sliding column is slidably connected in the sliding hole, and a spring is fixedly connected between the sliding column and the bottom of the sliding hole; The bottom of the sliding column extends to the outside of the counterweight block, and a rubber pad is fixedly connected with the bottom of the sliding column; The depth of that slide hole is greater than the sum of the length of the sliding column and the rubber pad; The bottom of the sliding hole is provided with an exhaust hole, and the diameter of the exhaust hole is less than one fifth of the diameter of the sliding hole; Slow down the speed of the counterweight through the sliding column, Reduce the damage of training device; When working, the pull rod is loosened, so that the adjusting rod falls and is inserted into the through hole under the action of self-weight, and then is inserted into different through holes through bolts, so that the adjusting rod can pull up different weights, and the pulling force of the pull rod can be quickly adjusted; When the pull rod comes loose or the pull rod rises too fast, It is easy to cause the adjusting rod and the counterweight to fall down quickly, which makes the counterweight collide violently and produce huge noise. In severe cases, the training device is damaged. At this time, the rubber pad fixed at the bottom of the slider contacts the counterweight at the bottom first through the slider slidably connected in the sliding hole, and then the rubber pad deforms and absorbs a part of kinetic energy. Avoid the huge noise caused by the direct collision of the counterweight between the upper and lower layers; at the same time, the rubber pad and the sliding column shrink into the sliding hole under the pressure of the counterweight; when the air in the sliding hole is compressed, it hinders the sliding of the sliding column, thereby reducing the speed at which the counterweight approaches each other; with the diameter of the exhaust hole being less than one fifth of the diameter of the sliding hole, the exhaust speed of the sliding hole is limited through the exhaust hole. Further reduce the approaching speed between the counterweight blocks, reduce the rigid collision between the counterweight blocks, and further reduce the damage of the training device.

The exhaust hole is communicated with the through hole, and one side of the exhaust hole close to the through hole is Y-shaped; Air is blown into the through hole through the exhaust hole to reduce the blockage of the through hole by foreign matter and ensure the normal operation of the training device; When the sliding column slides toward the bottom of the sliding hole, the air at the bottom of the sliding hole is compressed, and the compressed air is introduced into the through hole through the exhaust pipe to clean the inner wall of the through hole. The penetration holes of foreign bodies are reduced, which affects the insertion of the adjusting rod into the penetration holes. At the same time, because one side of the exhaust holes near the penetration holes is Y-shaped, the air discharged from the exhaust holes is ejected obliquely to the upper and lower ends of the penetration holes, which further increases the cleaning effect of the exhaust holes on the penetration holes.

A tapered countersunk part is arranged at the top of the through hole, which is beneficial for the adjusting rod to be inserted into the through hole; The bottom of that through hole is a

convex re matched with the countersunk head, and the convex re is embedded into the lower counterweight block, so that the air flow rate at the bottom of the counterweight block is increased, and the clean effect at the bottom of the counterweight block is increased; When the counterweight slides downward along the guide of the guide rod, Through the tapered countersunk head, it is convenient for the adjusting rod to be inserted into the through hole quickly. At the same time, when the convex ring approaches the countersunk head, the convex ring squeezes the air near the countersunk head, so as to increase the air flow and escape around the countersunk head, and further improve the cleaning effect on the bottom of the counterweight by cooperating with the air flow ejected from the through hole.

An elastic membrane is fixedly connected in the through hole at the lower part of the countersunk head, and a round hole with a diameter slightly smaller than that of the adjusting rod is arranged in the middle of the elastic membrane; The cleaning of the adjusting rod is increased through the elastic film to further prevent the adjusting rod from being stuck; When that adjust rod is inserted into the through hole, the adjust rod supports the round hole, so that the elastic film scrapes the periphery of the adjusting rod and further clean the adjusting rod. The impurities adhered by the adjusting rod are reduced to be stuck in the through hole, which hinders the smooth sliding of the adjusting rod. Meanwhile, when the adjusting rod supports the round hole, the elastic film is matched with the adjusting rod to seal the top of the through hole, so that all compressed air ejected from the exhaust hole is exhausted through the bottom of the through hole, increasing the air output at the bottom of the through hole and further improving the cleaning effect of the bottom of the counterweight. Ensure that the counterweight blocks return smoothly, reduce the dislocation between the jack and the adjusting hole caused by foreign matter inclusion between the counterweight blocks, and increase the efficiency of inserting the bolt into the jack and adjusting hole.

A support rod is arranged at the bottom of the backrest, a hinge bracket is fixedly connected to the underframe at the bottom of the cushion, and one end of the support rod close to the hinge bracket is hinged with the hinge bracket; The underframe at the bottom of the hinge bracket is fixedly connected with a tripod, and the top of the tripod and the support rod bracket are provided with a return spring; The rotation center of the backrest coincides with the rotation axis of the waist when the human body sits on the cushion; Reduce the friction between the back of the human body and the backrest through the rotating backrest, and reduce the exercise injury; As the rotation center of the backrest coincides with the rotation axis of the waist when the human body sits on the cushion, when the sportsman sits on the cushion and pulls the pull rod, the backrest rotates synchronously with the rotation of the waist of the sportsman, further reducing the sliding friction between the back of the sportsman and the backrest. Under the action of ensuring sufficient supporting force of the backrest to the back of the personnel, the friction of the back of the personnel is reduced, and then the friction injury caused by sports to the human body is reduced.

A group of ventilation holes are uniformly arranged on the backrest; The top of that support is provide with a No.1 hole corresponding to the adjust rod, and the No.1 hole is in sliding and sealing connection with the adjusting rod; The bottom of that first hole is communicate with a second hole, and the second hole is communicated with a ventilation hole through an air pipe; The ventilation effect of the backrest is increased by blowing air through the No.1 hole, thereby increasing the exercise efficiency; When the pull rod is released to make the adjusting rod and the counterweight fall down, the bottom of the adjusting rod is inserted into the No.1 hole, which prevents the adjusting rod from moving down when the air in the No.1 hole is compressed, thus avoiding the deformation of the adjusting rod and the violent collision between the counterweights caused by the direct contact of the adjusting rod with the bottom. Further increase the ventilation performance of the backrest, reduce the influence of sweat on sports of athletes, and increase the exercise effect of the training device.

When working, the pull rod is loosened, so that the adjusting rod falls and is inserted into the through hole under the action of self-weight, and then is inserted into different through holes through bolts, so that the adjusting rod can pull up different weights, and the pulling force of the pull rod can be quickly adjusted; When the pull rod comes loose or the pull rod rises too fast, it is easy to cause the adjusting rod and the counterweight to fall quickly. Further, the counterweight collides violently, resulting in huge noise, and in severe cases, the training device is damaged. At this time, the rubber pad fixedly connected at the bottom of the slide column first contacts the counterweight at the bottom layer, and then the rubber pad deforms to absorb a part of kinetic energy, thus avoiding the huge noise caused by the direct collision of the counterweight between the upper and lower layers. At the same time, the rubber pad and the sliding column shrink into the sliding hole under the pressure of the balance weight, and when the air in the sliding hole is compressed, it hinders the sliding of the sliding column, thereby reducing the speed of the balancing weights approaching each other. The diameter of the exhaust hole is less than one-fifth of the diameter of the sliding hole, and the exhaust speed of the sliding hole is limited by the exhaust hole, further reducing the approaching speed between the balancing weights. Less rigid collision between counterweight blocks, further reducing the damage of training device; When the sliding column slides toward the bottom of the sliding hole, the air at the bottom of the sliding hole is compressed, and the compressed air is introduced into the through hole through the exhaust pipe, so that the inner wall of the through hole is cleaned, foreign matters are reduced to block the column through hole, and the insertion of the adjusting rod into the through hole is affected. At the same time, because the side of the exhaust hole near the through hole is Y-shaped, the air discharged from the exhaust hole is obliquely ejected to the upper and lower ends of the through hole, which further increases the cleaning effect of the exhaust hole on the through hole; When the counterweight slides down along the guide of the guide rod, it is convenient for the adjusting rod to be quickly inserted into the through hole through the tapered countersunk portion, and at the same time, when the convex ring approaches the countersunk portion, the convex ring squeezes the air near the countersunk head, so as to increase the air flow and dissipation around the countersunk head, and further increase the cleaning effect on the bottom of the counterweight by cooperating with the airflow ejected from the through hole; When that adjust rod is inserted into the through hole, the adjust rod supports the round hole, so that the elastic film scrapes the periphery of the adjusting rod and further clean the adjusting rod. The impurities adhered by the adjusting rod are reduced to be stuck in the through hole, which hinders the smooth sliding of the adjusting rod. Meanwhile, when the adjusting rod supports the round hole, the elastic film is matched with the adjusting rod to seal the top of the through hole, so that all compressed air ejected from the exhaust hole is exhausted through the bottom of the through hole, increasing the air output at the bottom of the through hole and further improving the cleaning effect of the bottom of the counterweight. Ensure that the counterweight blocks return smoothly, reduce the dislocation between the jack and the adjusting hole caused by foreign matter inclusion between the counterweight blocks, and increase the efficiency of inserting the bolt into the jack and the adjusting hole; Because the rotation center of the backrest coincides with the rotation axis of the waist when the human body sits on the cushion, when the sportsman sits on the cushion and pulls the pull rod, the backrest rotates synchronously with the rotation of the waist of the sportsman. Further reduce the sliding friction between people's back and backrest, and reduce the friction of people's back under the action of ensuring sufficient support force of backrest to people's back, and then reduce the friction injury of sports to human body; When the pull rod is loosened to make the adjusting rod and the counterweight fall down, the bottom of the adjusting rod is inserted into the No.1 hole, so that the air in the No.1 hole is compressed to prevent the adjusting rod from moving down. Avoid the deformation of the adjusting rod and the violent collision between the counterweight blocks caused by the direct contact of the

adjusting rod with the bottom, and at the same time, the air in the No.1 hole is compressed and then discharged from the ventilation hole through the air pipe, which further increases the ventilation performance of the backrest, reduces the influence of sweat of athletes on sports, and increases the exercise effect of the training device.

#### 4. Conclusion

The physical training machine for college students described in this design, through the sliding column in the sliding hole, makes the rubber pad fixed at the bottom of the sliding column contact with the counterweight at the bottom of the first, then the rubber pad deforms to absorb part of the kinetic energy, so as to avoid the huge noise caused by the direct collision between the upper and lower weights. At the same time, the rubber pad and the sliding column contract into the sliding hole under the pressure of the counterweight, When the air in the sliding hole is compressed, it hinders the sliding of the sliding column, thus reducing the speed of the counterweight approaching each other. With the diameter of the exhaust hole less than one fifth of the diameter of the sliding hole, the exhaust speed of the sliding hole is limited through the exhaust hole, and the approaching speed between the counterweights is further reduced, and the rigid collision between the counterweights is less, and the damage of the training device is further reduced.

When the adjusting rod and the counterweight are falling, the bottom of the adjusting rod is inserted into the No.1 hole, so that the air in No, Then, it ejects from the ventilation hole through the trachea to further increase the ventilation performance of the back, reduce the influence of sweat on sports, and increase the exercise effect of the training device.

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