

PULMONARY REHABILITATION TRAINING DEVICE FOR PATIENTS WITH CHRONIC RESPIRATORY DISEASE

Field of the Invention

5 The invention relates to the technical field of pulmonary rehabilitation training, and in particular to a pulmonary rehabilitation training device for patients with chronic respiratory disease.

Background to the Invention

10 Chronic respiratory disease is a kind of chronic bronchitis and/or emphysema with the characteristics of gas flow obstruction, which can further develop into a common chronic disease of pulmonary heart disease and respiratory failure. It is related to the abnormal inflammatory reaction of harmful gases and particles, and the disability rate and mortality rate are high. Chronic obstructive pulmonary disease needs diet conditioning, drug
15 treatment, psychological adjustment, long-term home oxygen therapy and appropriate exercise or pulmonary rehabilitation training.

In the rehabilitation period, patients with chronic respiratory diseases need to cooperate with respiratory training equipment to carry out continuous respiratory exercise to promote the recovery of pulmonary function and treat or alleviate pulmonary problems through
20 physical exercise.

In the prior art, a portable pulmonary function rehabilitation training device for patients with chronic obstructive pulmonary disease (COPD) of CN115155013B includes a housing, a channel unit, an inspiratory impedance unit, an expiratory impedance unit and an ultrasonic atomizer, where the channel unit, the inspiratory impedance unit, the expiratory
25 impedance unit and the ultrasonic atomizer are installed on the housing, the inspiratory impedance unit includes an inspiratory impedance mechanism, and an gas intake control assembly is installed at the lower end of an gas intake tank, and the gas intake control assembly is connected with the expiratory impedance unit. The expiratory impedance unit

includes an expiratory impedance mechanism, and the upper end of the gas outlet tank is provided with an gas outlet control assembly; the channel unit includes a connecting pipeline I, a valve assembly is installed on the connecting pipeline I, an exhaust assembly is installed on the connecting pipeline I, and the channel unit includes a rack and pinion assembly, so that the internal part of the device is completely cleaned, and rehabilitation personnel can carry out rehabilitation training in the state of inhaling and exhaling, so that alcohol can be quickly removed, and the efficiency is improved.

However, the existing pulmonary rehabilitation training devices have fixed expiratory resistance during use, which prevents adjustment of respiratory training intensity and thus fails to meet the training requirements of different patients. Additionally, they lack convenient nebulization assistance during training, presenting certain usage limitations.

Statement of Invention

The present invention aims to provide a pulmonary rehabilitation training device for patients with chronic respiratory disease, so as to solve the problems in the prior art that the existing pulmonary rehabilitation training devices on the market have fixed expiratory resistance during use, making it impossible to adjust the respiratory training intensity and thus failing to meet the training requirements of different patients, while also being inconvenient for nebulization assistance during the training process.

In order to achieve the above purpose, the invention provides the following technical scheme: a pulmonary rehabilitation training device for patients with chronic respiratory disease includes a housing for hand-holding, where a partition is fixedly installed at the inner side of the housing, and the partition evenly divides the interior of the housing into two spaces, and a filter screen is fixedly installed at the left end of the housing, while the right end of the housing is respectively connected with an intake pipe and an exhaust pipe, and the right ends of the intake pipe and the exhaust pipe are connected with a breathing mask, and an observation window with a transparent window is installed at the outer side of the housing;

the invention further includes: a fixed plate fixedly installed between the upper surface of

the partition and the housing, where the fixed plate is provided with a gas hole, a guide rod is fixedly installed on the left side of the fixed plate, and the outer side of the guide rod is elastically and slidably connected with a sealing assembly;

a regulating assembly installed between the housing and the guide rod;

5 a rotating shaft rotatably installed on the partition, where the rotating shaft is connected with the sealing assembly through a transmission assembly, and the sealing assembly drives the rotating shaft to rotate through the transmission assembly in the moving process;

10 a fixed seat fixedly installed at the upper end of the housing, where the upper surface of the fixed seat is provided with a prompt disc, the prompt disc is fixedly installed at the upper end of the rotating shaft, and a knocking assembly is arranged on the prompt disc; and

a nebulizing assembly arranged between the housing and the lower surface of the partition.

15 Optionally, the partition evenly divides the cavity inside the housing into an gas inlet cavity and an gas outlet cavity, and the gas inlet cavity and the gas outlet cavity are respectively connected with the intake pipe and the exhaust pipe, and the intake pipe and the exhaust pipe are provided with one-way valve structures, and rubber sleeves are sleeved outside the intake pipe and the exhaust pipe.

20 By adopting the technical scheme, the patient can inhale and exhale at the inner side of the breathing mask, and the gas is transported through the housing, the intake pipe and the exhaust pipe, so that the breathing mask does not need to be inhaled, and the convenience of training is improved.

25 Optionally, the sealing assembly includes a sliding plate elastically installed on the outer side of the guide rod in a sliding way, and a sealing plug is fixedly arranged on the sliding plate, and the sealing plug is configured in a truncated cone structure, and at the same time, the sealing plug seals the gas hole.

By adopting the technical scheme, when the patient breathes and exhausts, the exhaust

pipe can exhaust into the housing, so that the sliding plate can slide elastically under the action of gas pressure, and then the sealing plug is driven to separate from the fixed plate, so that the gas exhaled by the patient can be exhausted through the gas hole and the filter screen, and training is realized.

5 Optionally, the regulating assembly includes a screw rotatably mounted on the housing, and the left end of the screw is fixedly provided with a knob, and the right end of the screw is threadedly connected with an adjusting sleeve, and the adjusting sleeve is slidably sleeved with the guide rod, and a first spring is connected between the right end of the adjusting sleeve and the sliding plate.

10 By adopting the technical scheme, the knob is rotated to drive the screw to rotate, and the adjusting sleeve can be driven to extend and slide on the outer side of the guide rod through the screw connection, so that the adjusting sleeve can squeeze the first spring, and the initial compression of the first spring can be adjusted, thereby adjusting the training intensity.

15 Optionally, the transmission assembly includes a rack fixedly installed on the outer side of the sealing plug and a gear fixedly installed on the outer side of the rotating shaft, and the rack and the gear are meshed and connected.

 By adopting the technical scheme, during the breathing training process, the rack moves synchronously under the drive of the sealing plug, so as to drive the gears and the rotating
20 shaft to rotate through the meshing structure.

 Optionally, the knocking assembly includes a knocking piece vertically telescopically mounted on the prompt disc, and a second spring is connected between the knocking piece and the prompt disc, and a groove is formed on the upper surface of the fixed seat, and the lower end of the knocking piece is in an arc-shaped structure.

25 By adopting the technical scheme, when the rotating shaft rotates, the prompt disc can be driven to rotate synchronously, and when the knocking piece moves above the groove, the knocking piece elastically expands and contracts under the elastic force of the second spring, so as to impact the inner wall of the groove and generate sound prompt.

Optionally, the nebulizing assembly includes a rotating plate fixedly installed at the lower end of the rotating shaft, and a sponge is fixedly installed on the lower surface of the rotating plate, and the inside of the sponge absorbs nebulized medication.

5 By adopting the technical scheme, when the rotating shaft rotates, the rotating plate can drive the sponge to rotate at the same time, so that the sponge can promote the atomization of the medicine inside during the high-speed rotation process, and realize the auxiliary rehabilitation.

10 Optionally, the nebulizing assembly further includes a liquid box threaded below the housing, and the lower end of the sponge is fixedly connected with a liquid-sucking cotton tube, and the liquid-sucking cotton tube penetrates through the lower end of the housing, the lower end of the liquid-sucking cotton tube is located at the inner side of the liquid box, and the inner side of the liquid box is filled with the medication.

15 By adopting the technical scheme, the liquid box can be rotated, so that the medicine in the liquid box can be added and replaced conveniently, and at the same time, the liquid-sucking cotton tube can suck the medicine in the liquid box and supplement it to the sponge, so as to realize continuous atomization operation.

20 Optionally, the inner side of the lower end of the housing is integrally provided with a protrusion, and the upper surface of the protrusion is arranged in an arc structure, and the positions of the protrusion and the sponge are correspondingly arranged, and at the same time, the gas flow is accelerated through the surface of the protrusion.

By adopting the technical scheme, in the inhalation process of the patient, the gasflow is accelerated after passing through the protrusion and blown to the sponge, so that the liquid medicine is further atomized and volatilized, the action effect of the medicine is improved, and the training and rehabilitation are promoted.

25 Compared with the prior art, the beneficial effects of the present invention are as follows: the pulmonary rehabilitation training device for patients with chronic respiratory diseases can conveniently adjust the respiratory training intensity to accommodate the training requirements of different patients. Simultaneously, it can utilize the training respiratory gasflow to drive medication atomization, thereby further enhancing the training and

rehabilitation effectiveness. The specific details are shown as follows.

1. The intake pipe, the exhaust pipe, the fixed plate and the sealing plug are arranged, so that a patient can directly inhale and exhale by wearing the breathing mask, and the breathing mask does not need to be removed for ventilation; during the patient's exhalation process, the gas enters the upper chamber inside the housing, causing the sealing plug to elastically slide, thereby achieving exhaust and consequently realizing convenient and effective respiratory training;

2. the first spring, the screw and the adjusting sleeve are arranged. By rotating the screw, the screw drives the adjusting sleeve to slide and adjust on the outer side of the guide rod through threaded connection, so that the adjusting sleeve can squeeze the first spring, thereby changing the initial compression amount of the first spring and increasing the elastic resistance of the sealing plug, thus realizing the adjustment of breathing training to meet the training needs of different patients;

3. the rack, the gears and the prompt disc are arranged; during the movement of the sealing plug, it drives the rack and the gears to engage, thereby rotating the shaft; when the training requirement is met, the prompt disc rotates, causing its striking assembly to elastically extend and retract to strike the inner wall of the groove, thereby generating an audible signal to indicate successful completion of a single training session. This enables patients to effectively evaluate their training performance;

4. the rotating plate, the sponge and the liquid box are arranged; the liquid box can be installed at the lower end of the housing in a threaded connection way, and the sponge can automatically suck the medicine in the liquid box through the liquid-sucking cotton tube; with the rotation of the rotating shaft, the rotating plate at the lower end of the rotating shaft can drive the sponge to rotate synchronously, so as to realize the atomization of the medicine; at the same time, the arrangement of the protrusion can speed up the gas flow near the sponge, and further assist the atomization of the medicine, so as to achieve the purpose of auxiliary treatment and effectively improve the training and rehabilitation effect of the training device.

Brief Description of the Drawings

FIG. 1 is a schematic front view according to the present invention.

FIG. 2 is a schematic view of the bottom structure according to the present invention.

FIG. 3 is a schematic sectional view according to the present invention.

5 FIG. 4 is a schematic cross-sectional structural view of a rubber sleeve according to the present invention.

FIG. 5 is a schematic view of the installation structure of the sealing plug and sponge according to the present invention.

10 FIG. 6 is a schematic cross-sectional structural view of the prompt disc according to the present invention.

FIG. 7 is an enlarged schematic view of the structure at A in FIG. 6.

FIG. 8 is a schematic diagram of the connecting structure of the fixed plate and the sealing plug according to the present invention.

15 FIG. 9 is a schematic view of the cross-sectional structure of the adjusting sleeve according to the present invention.

In the figures: 1. housing; 101. observation window; 2. partition; 3. filter screen; 4. intake pipe; 5. exhaust pipe; 6. rubber sleeve; 7. breathing mask; 8. fixed plate; 9. gas hole; 10. guide rod; 11. sliding plate; 1101. sealing plug; 12. first spring; 13. screw; 14. knob; 15. adjusting sleeve; 16. rack; 17. rotating shaft ; 18. gear ; 19. fixed seat; 20. groove; 21. 20 prompt disc; 22. knocking piece; 23. second spring; 24. rotating plate; 25. sponge; 26. liquid-sucking cotton tube; 27. liquid box; and 28. protrusion.

Detailed Description

25 In the following, the technical scheme in the embodiment of the invention will be clearly and completely described with reference to the attached drawings. Obviously, the described embodiment is only a part of the embodiment of the invention, but not the whole embodiment. Based on the embodiments in the present invention, all other embodiments

obtained by ordinary technicians in the field without creative labor belong to the scope of protection of the present invention.

Embodiment 1: As shown in FIG. 1- FIG. 4 and FIG. 6- FIG. 9. The existing pulmonary rehabilitation training devices maintain fixed resistance during patient exhalation,
5 preventing adjustment of training intensity and consequently failing to accommodate varying therapeutic requirements across different patients. To address this technical limitation, the present embodiment discloses the following technical solutions:

A pulmonary rehabilitation training device for patients with chronic respiratory disease includes a housing 1 for hand-holding, where a partition 2 is fixedly installed at the inner
10 side of the housing 1, and the partition 2 evenly divides the interior of the housing 1 into two spaces, and a filter screen 3 is fixedly installed at the left end of the housing 1, while the right end of the housing 1 is respectively connected with an intake pipe 4 and an exhaust pipe 5, and the right ends of the intake pipe 4 and the exhaust pipe 5 are connected with a breathing mask 7, and an observation window 101 with a transparent
15 window is installed at the outer side of the housing 1;

the invention further includes: a fixed plate 8 fixedly installed between the upper surface of the partition 2 and the housing 1, where the fixed plate is provided with a gas hole 9, a guide rod 10 is fixedly installed on the left side of the fixed plate 8, and the outer side of the guide rod 10 is elastically and slidably connected with a sealing assembly;

20 a regulating assembly installed between the housing 1 and the guide rod 10; a rotating shaft 17 rotatably installed on the partition 2, where the rotating shaft 17 is connected with the sealing assembly through a transmission assembly, and the sealing assembly drives the rotating shaft 17 to rotate through the transmission assembly in the moving process; a fixed seat 19 fixedly installed at the upper end of the housing 1, where the upper surface of
25 the fixed seat 19 is provided with a prompt disc 21, the prompt disc 21 is fixedly installed at the upper end of the rotating shaft 17, and the prompt disc 21 is provided with a knocking assembly.

The partition 2 evenly divides the cavity inside the housing 1 into an gas inlet cavity and an gas outlet cavity, and the gas inlet cavity and the gas outlet cavity are respectively

connected with the intake pipe 4 and the gas outlet pipe 5, and both the intake pipe 4 and the gas outlet pipe 5 are provided with a one-way valve structure, while the outer sides of the intake pipe 4 and the gas outlet pipe 5 are sleeved with a rubber sleeve 6. The sealing assembly includes a sliding plate 11 elastically installed on the outer side of the guide rod 10 in a sliding way, and a sealing plug 1101 is fixedly arranged on the sliding plate 11, and the sealing plug 1101 is configured in a truncated cone structure, and at the same time, the sealing plug 1101 seals the gas hole 9.

The regulating assembly includes a screw 13 rotatably mounted on the housing 1, and a knob 14 is fixedly mounted on the left end of the screw 13, and an adjusting sleeve 15 is threadedly connected to the right end of the screw 13, and the adjusting sleeve 15 is slidably sleeved with the guide rod 10, and a first spring 12 is connected between the right end of the adjusting sleeve 15 and the sliding plate 11. The transmission assembly includes a rack 16 fixedly installed on the outer side of the sealing plug 1101 and a gear 18 fixedly installed on the outer side of the rotating shaft 17, and the rack 16 and the gear 18 are meshed and connected. The knocking assembly includes a knocking piece 22 vertically and telescopically mounted on the prompt disc 21, and a second spring 23 is connected between the knocking piece 22 and the prompt disc 21, and a groove 20 is formed on the upper surface of the fixed seat 19, and the lower end of the knocking piece 22 is in an arc-shaped structure.

By adopting the above technical solution, the patient holds the housing 1 while fitting the breathing mask 7 against the face. When the patient inhales, air is filtered through the breathing mask 7 and enters the housing 1, then passes through the lower cavity of the housing 1 into the intake pipe 4. When the gas approaches the fixed plate 8, the sealing plug 1101 is pushed by air pressure to drive the sliding plate 11 to move along the guide rod 10. At this time, the sliding plate 11 compresses the first spring 12, causing the sealing plug 1101 to disengage from the gas hole 9 of the fixed plate 8, thereby allowing the exhaled gas to be discharged and achieving respiratory training. As the sealing plug 1101 moves, the rack 16 on its outer side engages with the gear 18, driving the gear 18 to rotate the rotating shaft 17. The rotating shaft 17 then synchronously rotates the prompt disc 21 at its upper end. When the knocking piece 22 on the prompt disc 21 moves over the groove

20, the knocking piece 22 elastically extends and retracts under the force of the second spring 23, so that the knocking piece 22 can knock on the inner wall of the groove 20, thereby giving a knocking sound to alert the patient that a single respiratory training session has been successfully completed. When the training intensity needs to be adjusted, the knob 14 is rotated, so that the screw 13 rotates, thereby driving the adjusting sleeve 15 to slide outside the guide rod 10 through threaded connection, thereby adjusting the initial compression of the first spring 12 to regulate the assistance force applied to the sliding plate 11. This achieves training intensity adjustment to accommodate different patients' rehabilitation needs, while the adjustment range of the adjusting sleeve 15 can be monitored through the scale on the observation window 101.

Embodiment 2: The technical content disclosed in this embodiment is a further improvement on the basis of the above-mentioned Embodiment 1. The existing pulmonary rehabilitation training equipment can't carry out drug-assisted treatment for patients during training. In order to further solve this technical problem, this embodiment discloses the following technical content, as shown in FIG. 3 and FIG. 5:

a nebulizing assembly is arranged between the housing 1 and the lower surface of the partition 2. The nebulizing assembly includes a rotating plate 24 fixedly installed at the lower end of the rotating shaft 17, and a sponge 25 is fixedly installed on the lower surface of the rotating plate 24, and the inside of the sponge 25 sucks nebulized medication.

The nebulizing assembly further includes a liquid box 27 threaded below the housing 1, and the lower end of the sponge 25 is fixedly connected with a liquid-sucking cotton tube 26, and the liquid-sucking cotton tube 26 penetrates through the lower end of the housing 1, while the lower end of the liquid-sucking cotton tube 26 is located at the inner side of the liquid box 27, and the inner side of the liquid box 27 is filled with the medication.

The inner side of the lower end of the housing 1 is integrally provided with a protrusion 28, and the upper surface of the protrusion 28 is arranged in an arc structure, and the positions of the protrusion 28 and the sponge 25 are correspondingly arranged, and at the same time, the gas flow is accelerated through the surface of the protrusion 28.

By adopting the above technical scheme, before the device is used, the medication is

added to the liquid box 27, and then the liquid box 27 is in threaded connection with the lower end of the housing 1, so that the liquid-sucking cotton tube 26 is immersed in the agent in the liquid box 27, so that the liquid-sucking cotton tube 26 can suck and convey the liquid medicine into the sponge 25. During the patient's respiratory training, the rotation of rotating shaft 17 drives the rotating plate 24 at its lower end to spin, simultaneously causing the sponge 25 to rotate. This enables the sponge 25 to utilize centrifugal force to achieve medication dispersion and nebulization. During the inhalation process, the protrusion 28 accelerates airflow around the sponge 25, thereby enhancing medication nebulization. This facilitates the delivery of air mixed with nebulized medication into the patient's respiratory tract for adjuvant therapy, ultimately improving the rehabilitation training efficacy.

What is not described in detail in this specification belongs to the prior art known to those skilled in the art.

Although the present invention has been described in detail with reference to the foregoing embodiments, it is still possible for a person skilled in the art to modify the technical scheme described in the foregoing embodiments or to replace some technical features by equivalents. Any modification, equivalent replacement, improvement, etc. made within the spirit and principle of the present invention should be included in the protection scope of the present invention.