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(54) **INTEGRATOR FOR GLOBAL ELASTIC MOTION MODE OF HUMAN BODY**

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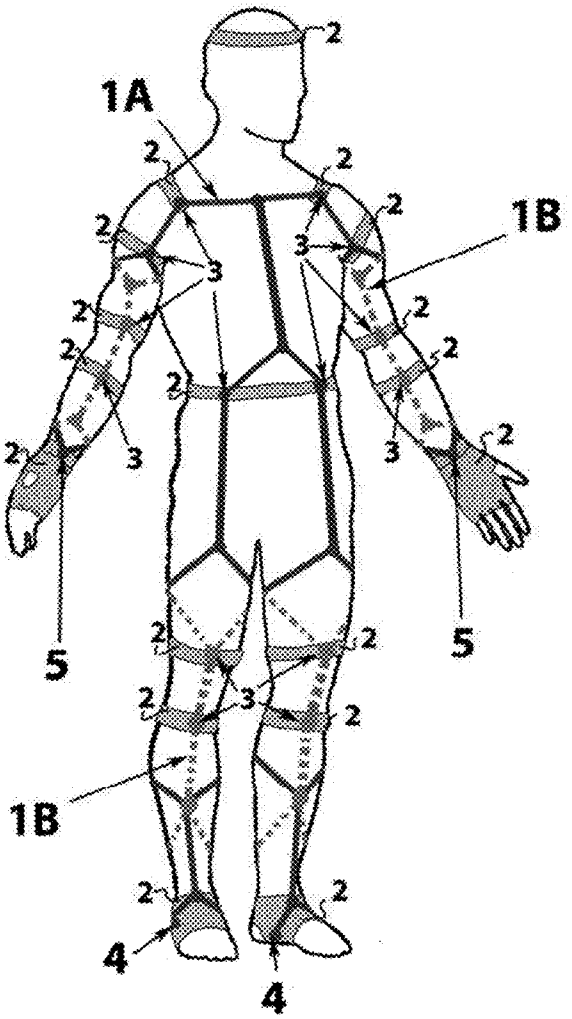
(57) **ABSTRACT**

An integrator for global elastic motion mode of human body comprises an elastomer (**1**A,**1**B) and at least five joint fixing elements (**2**) worn on the joint parts of the human body. Initial points (**4**) of the elastomer (**1**A,**1**B) are fixed on two joint fixing elements (**2**), and end points (**5**) are fixed on three joint fixing elements (**2**). Location buckles (**3**) allowing the elastomer (**1**A,**1**B) to pass through are provided on the intermediate joint fixing elements (**2**) except the joint fixing elements (**2**) on the initial points (**4**) and the end points (**5**). The integrator for global elastic motion mode of the human body overcomes the shortcoming that exercise apparatus and exercise protective equipment in the prior art lack the ability of integration and protection. The efficiency and security of training are improved.



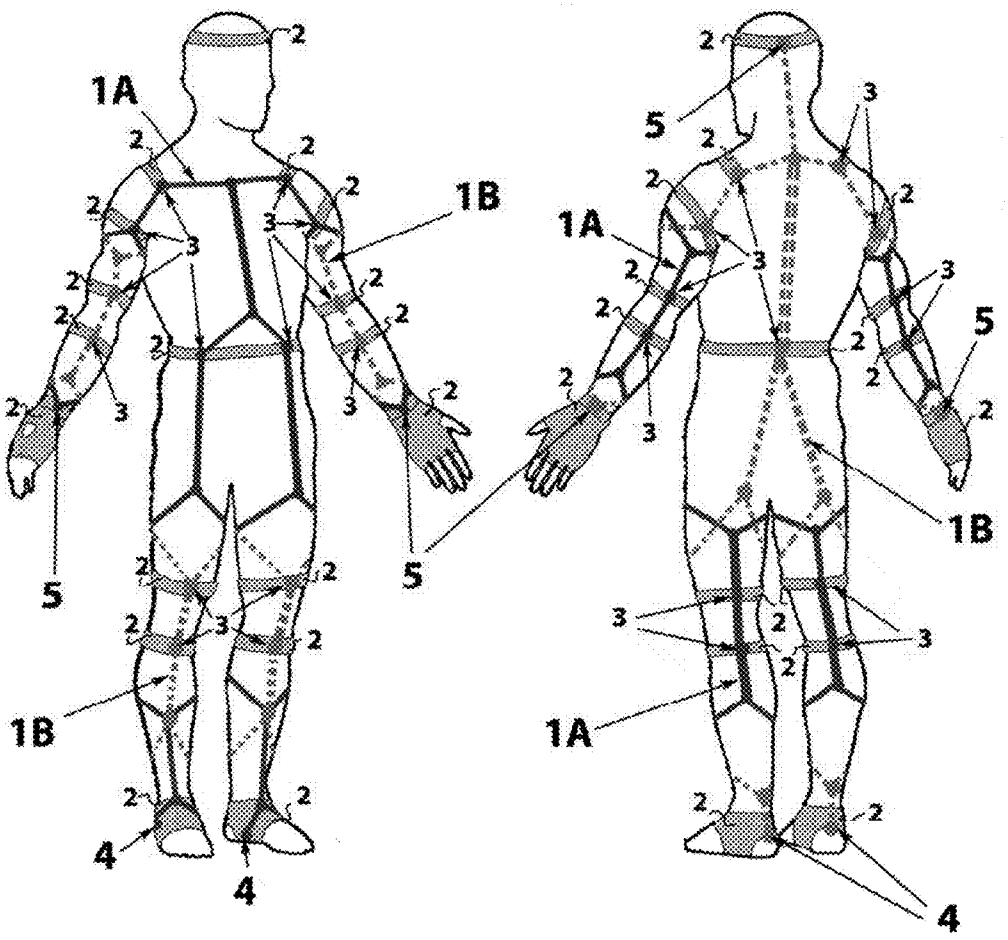


Fig 1 (a)

Fig 1 (b)

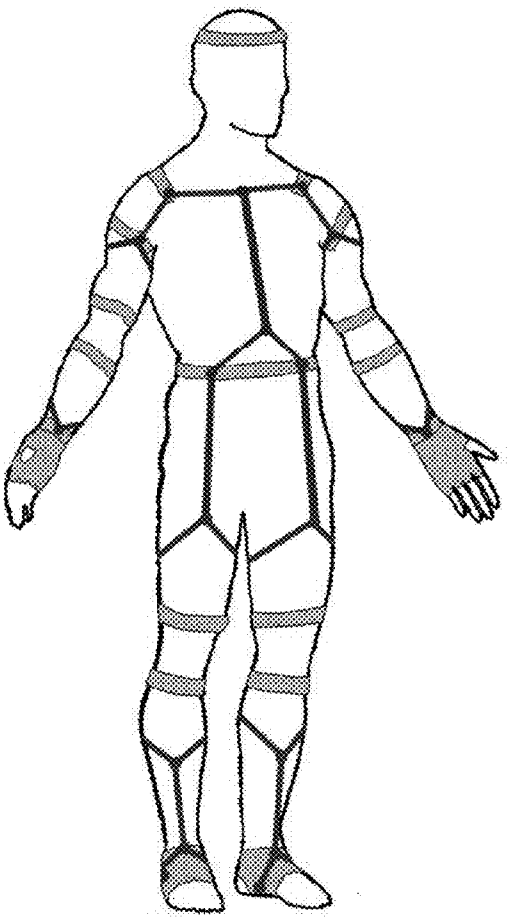


Fig 2 (a)

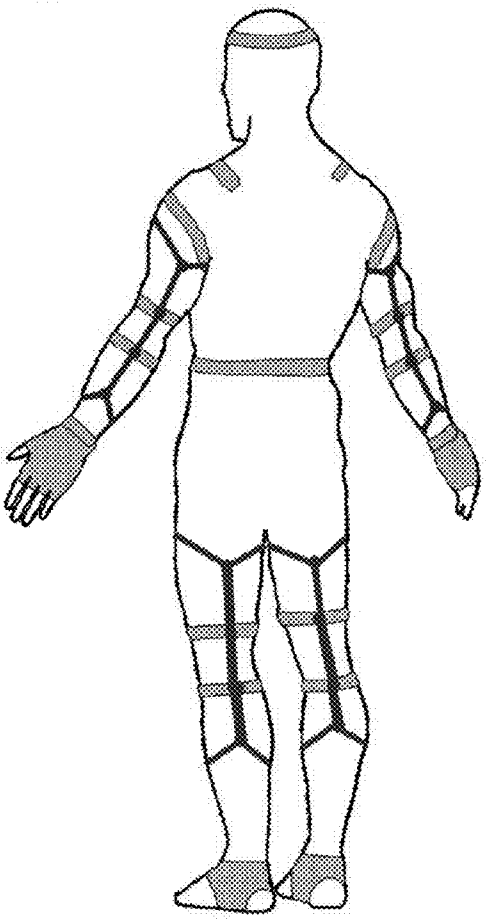


Fig 2 (b)

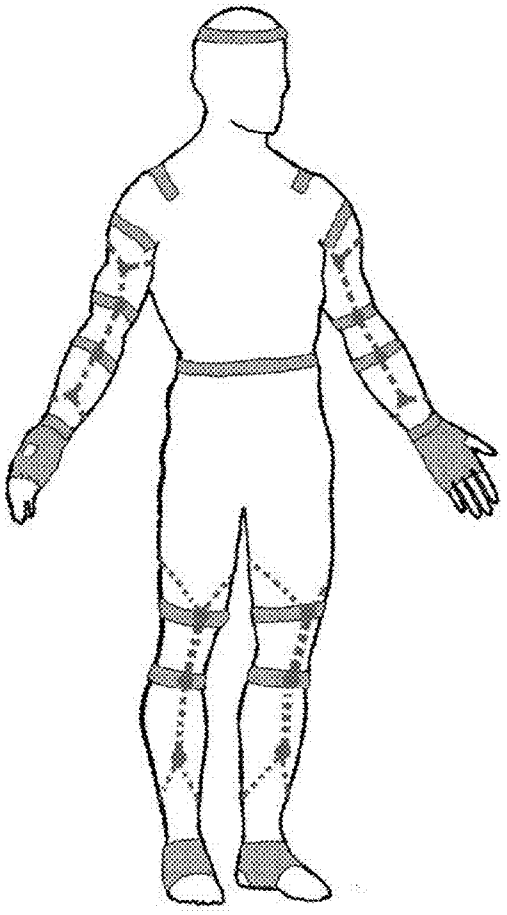


Fig 3 (a)

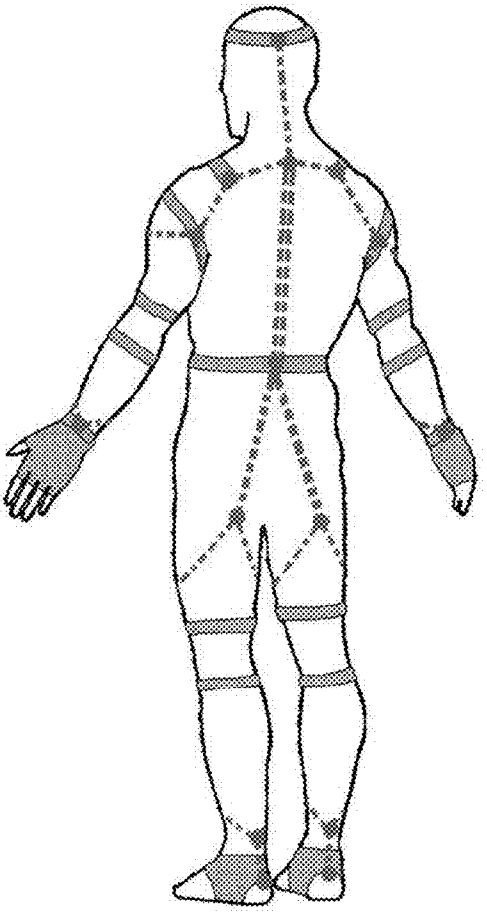


Fig 3 (b)

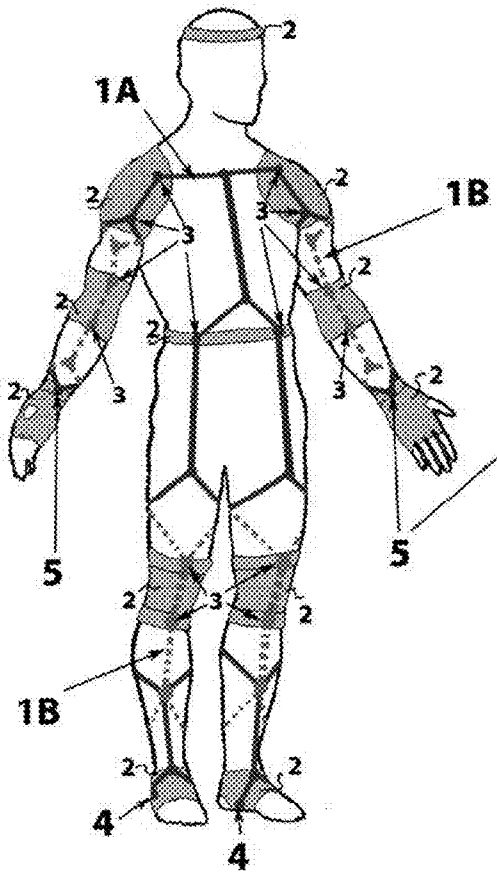


Fig 4 (a)

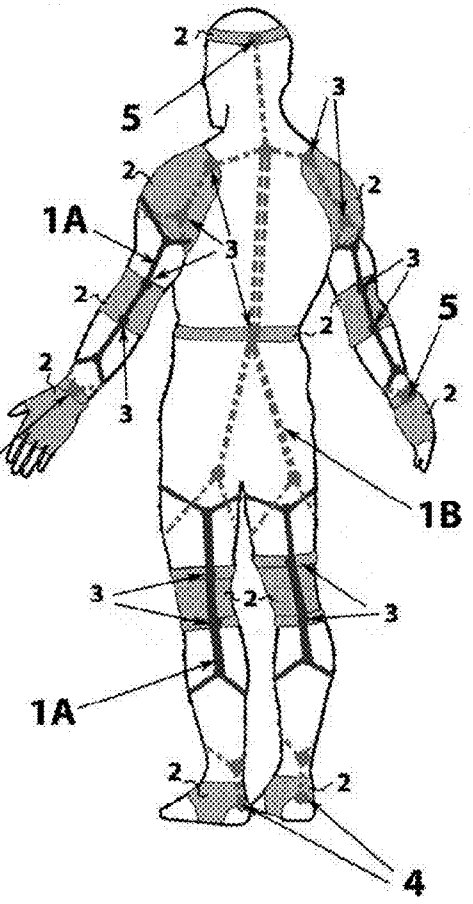


Fig 4 (b)

INTEGRATOR FOR GLOBAL ELASTIC MOTION MODE OF HUMAN BODY

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to physical training/exercise equipment and sports protection and rehabilitation equipment. In particular, the present invention relates to a human body overall elastic exercise mode integrated device.

[0003] 2. Background of the Art

[0004] The training/exercise equipment on the present market include a rubber chest expander, which utilizes the rubber elastomers with various shapes and elastic coefficients for providing antagonistic resistance to the user during stretching exercises. The muscle strength could be enhanced by means of the training.

[0005] However, the rubber chest expander is only a simplified type of training or exercise equipment, and its principle is to aim at partial tissue structures and to provide a partial and simplified antagonistic training means. It cannot be utilized to take exercise on most of the joints and muscles of a human body as well as the whole body, and cannot make effective integration of the overall exercise capacity of the human body.

[0006] Sports protection equipment: the protection equipment can be allocated for the easily injured joints during exercise, such as back belt, knee pad, elbow guard, cuff, etc. On the one hand, the elastic material of the protection equipment absorb part of the mechanical energy which the joints endure during the exercise. On the other hand, the protection equipment can restrict the motion extent of the protected joints, so as to achieve a certain degree of protection.

[0007] However, the sports protection equipment in the art is only a protection device for a single joint, and its absorption and decomposition ability of the mechanical energy applied to the protected joint is limited, therefore the actual protection effect can be restricted.

SUMMARY OF THE INVENTION

[0008] Considering the disadvantages in the prior art mentioned above, it is an object of the present invention to provide a human body overall elastic exercise mode integrated device, which overcomes the shortcomings of the exercise equipment and the sports protection equipment in the prior art, such as the poor association and integration, the over-emphasis on the exercise and protection of a local structure, as well as the overlook of overall functionality training and protection, which results in the deficiency of the integration and protection ability. The present invention can help trainers to master and use a new sports mode and protection equipment with high association and integration, therefore it provides a new way for the trainers to improve their overall exercise and protection capacity.

[0009] These objects of the present invention have been achieved by the following technical means: a human body overall elastic exercise mode integrated device according to the present invention, which comprises the elastic bodies and at least five joint fixtures, wherein the joint fixtures are attached to the joints of a human body, with the starting point of each elastic body being fixed on two joint fixtures and the end point being fixed on the other three joint fixtures.

[0010] Based on actual requirements, more than five joint fixtures could be comprised. Except the joint fixtures used for fixing the starting point and end point of the elastic bodies, the medial joint fixtures consist of positioning buckles, which the elastic bodies are capable of passing through, and the elastic bodies pass through the medial joint fixtures and are movably fixed through the positioning buckles. The positioning buckles serve to restrict detachment of the elastic body from the joint fixtures.

[0011] The elastic bodies can be classified as the external elastic bodies which essentially extend along the moving portion of the flexor surfaces of the human body and the external elastic bodies which essentially extend along the moving portion of the extensor surfaces of the human body.

[0012] The elastic bodies extend respectively along the middle segment of each moving portion of the arms and legs, then fork and twist around the external and internal sides toward the opposite for cross connection thereof, and serve as the external elastic bodies across the corresponding adductor and abductor muscle groups as well as rotatory muscle groups.

[0013] Depending on the individual exercise intensity of each person, the elastic bodies could be single-bar-type or multi-strand twist type, wherein each elastic body is provided with several forks, and these two types of external elastic bodies could have different colors. For flexible elastic intensity options, the tension strength of the external elastic body can be determined according to the exercise purpose and requirement of individual trainers. On the one hand, multi-level options of the elastic coefficient of elastic material could be provided. On the other hand, several options of the number of the external elastic body could be provided. Both material and number of the elastic body are factors for prestress elastic intensity adjustment. For example, during the profession sports training with hard intensity, apart from choosing an elastic material with high elastic coefficient, the number of the elastic bodies could also be increased depending on the requirement of the event and action.

[0014] The initial length of each elastic body is shorter than the length of the corresponding portion of the human body to which the elastic body attaches.

[0015] Depending on the practical requirement, the joint fixtures could be worn on several joints among ankle joints, knee joints, waist, shoulder joints, head, elbow joints, wrist joints, and metacarpophalangeal joints. For flexible structure combination options, the joint fixtures could be worn on all the joints mentioned above. According to the individual requirement of the trainer, a structure combination for partial multi joints connection could also be chosen, such as the structure combination from the ankle as a starting point to the belt as an end point special for lower limbs exercise, the structure combination from the belt as a starting point to the neck fixture as an end point special for vertebral column longitudinal stretch exercise or protection, the structure combination between left and right wrists as starting and end points for upper limb transverse exercise, etc.

[0016] The joint fixtures could be made into types of ankle guard, knee pad, waist support, shoulder protector, elbow guard, wrist guard, and finger guard.

[0017] Depending on the practical requirement, the positioning buckles could be a hook-and-loop fastener, such as Velcro®, and the positioning buckles are adhered on the joint fixtures.

[0018] For exercise convenience, the human body overall elastic exercise mode integrated device could be embedded in sports wears and race suits. The present invention has flexible

appearance design and material options. For hard intensity sports training, the elastic material with high quality and strength could be chosen and the present invention could be designed with exposed appearance form. For low intensity exercise and casual events, an elastic material which is flexible, close-fitting, and breathes freely could be chosen for underclothes design. Another professional manner is to embed the particular elastic material into sports wear and race suits as required.

[0019] The present invention has advantages as follows compared with the prior art:

[0020] The human body overall elastic exercise mode embodied by the present invention is a special and highly integrated exercise mode. First of all, the main parts of the human body, such as trunk and limbs, are stretched centrifugally along their respective central axes, and the centrifugal stretch movement between parts is accomplished by means of centrifugal activity of corresponding muscle groups. The elastic tension generated by the centrifugal activity of corresponding muscle groups stretches and adjusts the parts of the human body into an integrated elastic body of reticulation shape, then overall exercise can be carried out on the basis of the integrated elastic body and overall elastic pre-stress tension. The present invention is designed for effectual accomplishment of the novelty exercise mode. According to the direction of main muscle groups of the parts of the human body and the requirement for adjustment of the novelty exercise mode, the present invention connects elastic material into an external reticulation elastic structure along the corresponding parts of the human body. And the external elastic structure is orderly attached to the corresponding parts of the human body and generates a certain pre-stress tension. Any part of the human body which is adjusted and takes activity will act on the external elastic structure of the present overall elastic exercise mode device, which is reflected by the corresponding variation of the elastic tension. Conversely, the corresponding variation of the elastic tension could serve to induce and accomplish the human body overall elastic exercise as a factor, and provide a special and effective training manner for the conformation of exercise mode dynamic stereotype.

[0021] (1) Advantage of Structure Mode Adjustment:

[0022] The adjustment of portions of the human body into an integrated elastic body structure mode of reticulation type is an alternation and leap of structure and status. According to its character, apart from energy conduction which is same as a rigid body, it is more important that the elastic body can also serve to store the elastic energy. Moreover, an integrated elastic body can maximize the capacity of energy generation, conduction, and storage.

[0023] (2) Advantage of Muscle Power Motivation and Transfer:

[0024] According to the theory and requirement of the human body overall integrated elastic exercise mode, the present invention forces the trainer to make more centrifugal activity using muscles during exercise. It has been proved by numerous research results that the force is doubled while muscles are stretched. Accordingly, the strain energy stored in the Series Elastic Component (SEC) after motivation of the largest muscle stretch could be doubled. On the one hand, the stretched muscles could enhance the force and power generated by the equal length and centripetal activity hereafter. On the other hand, the enhancement does not require extra metabolism energy consumption, therefore the economy and efficiency of the equal length and centripetal activity hereafter will be improved, and the moment value of the largest centrifugal activity is significantly larger than the moment value of the centripetal activity.

[0025] The experimental data acquired by the inventors show that: (1) during the human body overall elastic exercise mode adjustment, more deep muscles in the trunk are made to participate; (2) during exercise, the muscle groups with inverse function are made to participate in the exercise at the same time, therefore more muscles are motivated and transferred to participate the exercise in form of agonistic muscle, which is beneficial for the improvement of exercise ability and effect.

[0026] (3) Benefit of the Body Parts Centrifugal Extending Activity:

[0027] The present invention can help trainers make the centrifugal activity adjustment between body portions, and the adjustment is beneficial for the conformation and exercise of the reticulation typed elastic body. The present invention can also serve to effectively prevent sports injuries and actively treat and recover injured joints and soft tissues because of the normal elastic tension generated and retained by the human body internal adjustment and the external elastic body.

[0028] (4) The Protection Effect Produced by the Advantage of Mechanical Energy Conduction and Storage:

[0029] The elastic body of the present invention makes overall or multi joints elastic connection with the general single joint protection devices, such as knee pads and elbow guards, meanwhile forms an internal and external integrated elastic body which works together with the effective motivation of corresponding body portions and the centrifugal activity of muscle groups. It is beneficial to conduct and transfer the mechanical energy received by the protected joints and convert the mechanical energy into elastic energy, therefore the protection provided to the joints can be more effective.

[0030] In conclusion, the present invention can help the trainers master the human body overall elastic exercise mode, therefore improve the efficiency and security of sports training, enhance the effect of exercise, and raise the protection and recover capacity of injured joints.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] FIG. **1**(*a*) is an overall structure diagram of the human body overall elastic exercise mode integrated device of a first embodiment of the invention (Front view);

[0032] FIG. **1**(*b*) is an overall structure diagram of the human body overall elastic exercise mode integrated device of a first embodiment of the invention (Back view);

[0033] FIG. **2**(*a*) is a distribution and direction exploded view of line **1**A in FIG. **1** (Front view);

[0034] FIG. **2**(*b*) is a distribution and direction exploded view of line **1**A in FIG. **1** (Back view);

[0035] FIG. **3**(*a*) is a distribution and direction exploded view of line **1**B in FIG. **1** (Front view);

[0036] FIG. **3**(*b*) is a distribution and direction exploded view of line **1**B in FIG. **1** (Back view);

[0037] FIG. **4**(*a*) is a structure diagram of the enhanced exercise protection design of a second embodiment of the invention (Front view);

[0038] FIG. **4**(*b*) is a structure diagram of the enhanced exercise protection design of a second embodiment of the invention (Back view).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0039] Now, embodiments of the present invention will be described in detail by reference to the accompanying drawings.

[0040] A first embodiment of the present invention:

[0041] The human body overall elastic exercise mode integrated device shown as FIG. **1**(*a*), FIG. **1**(*b*), FIG. **2**(*a*), FIG. **2**(*b*), FIG. **3**(*a*), and FIG. **3**(*b*), comprises eighteen joint fixtures **2** and elastic bodies, wherein the elastic bodies are classified as the external elastic bodies **1**A essentially extending along the moving portion of the flexor surfaces of the human body (shown as solid lines in the figures) and the external elastic bodies **1**B essentially extending along the moving portion of the extensor surfaces of the human body (shown as dotted lines in the figures). The elastic body extends respectively along the middle segment of each moving portion of the arms and legs, then forks and twists around the external and internal side toward the opposite for cross connection thereof, and serves as an external elastic body across the corresponding adductor and abductor muscle groups as well as rotatory muscle groups. The joint fixtures **2** can be worn on the joints of human body, such as ankle joints, knee joints, waist, shoulder joints, head, elbow joints, wrist joints, and metacarpophalangeal joints. The joint fixtures **2** of the ankle joints fix the starting points **4** of the elastic bodies **1**A,**1**B, and the joint fixtures **2** of the wrist joints and head fix the end points **5** of the elastic bodies **1**A,**1**B, and the medial joint fixtures **2** consist of positioning buckles **3**, which the elastic body **1**A or **1**B is capable of passing through, and the elastic bodies **1**A,**1**B pass through the medial joint fixtures **2** and are movably fixed through the positioning buckles **3**. The positioning buckles **3** serve to restrict detachment of the elastic bodies **1**A,**1**B from the joint fixtures **2**, and the joint fixtures **2** mainly serve to ensure that the elastic bodies **1**A, **1**B pass along the specific body portions as well as being attached and fixed. The starting points **4** and the end points **5** can serve to adjust the length and tightness of the elastic bodies and then be stuck and fixed.

[0042] The elastic body can be clipped into a suitable length depending on the length parameter and strength requirement of the body parts of the population with individual body heights and types, and the length of the elastic body is shorter than the length of the corresponding body part of the human body attached by the elastic body. The elastic bodies are made of rubber materials with different elasticity coefficients and shapes. The structures of the elastic bodies **1**A, **1**B are integrally formed, and the elastic bodies **1**A,**1**B are provided with several forks. The color of the external elastic body **1**A can be red, and the color of the external elastic body **1**B can be blue. The positioning buckles **3** are made from a hook-and-loop fastener, such as Velcro®, and the positioning buckles **3** are adhered on the joint fixtures **2**.

[0043] Installation steps: After all the parts are prepared, first, fix the joint fixtures on the joints, then connect the two types of elastic bodies using the joint fixtures of the ankle joints as the starting point, then position the elastic bodies along the two lines from bottom to top through the corresponding joint fixtures using e.g., Velcro®, which ends at the positions of the wrist joints and head. After the external reticulation structure is formed by connection, adjust the length and tightness depending on the trainer and requirement. By training, the trainer can achieve a high level coordination of the human body adjustment activity with the effect of the external elastic bodies, therefore realize a status of internal and external integration, which embodies the advantage of the overall elastic exercise mode.

[0044] For exercise convenience and dressing comfort, the human body overall elastic exercise mode integrated device can be embedded in sports wears and race suits.

[0045] The two groups of elastic bodies form an external reticulation elastic structure on the surface of a human body. The two groups of elastic bodies are clipped into a length shorter than the total length of the body part of the human body which the elastic bodies pass along. Coupled with the length and tightness adjustment of the connection between the starting point and end point, the external elastic reticulation is made to generate a centripetal pre-stress elastic tension applied to the human body in order to induce and strengthen the centrifugal antagonistic activity along the central axis of each part of the human body. Therefore the centrifugal tension generated by the centrifugal activity of the body parts or body sections and corresponding muscle groups of the human body acts antagonistically with the external elastic reticulation. By this way a pre-stress elastic tension of internal and external integration is composed which integrates the the body parts or sections of a human body into an integrated elastic body, and the human body overall elastic exercise is prepared for implementation.

[0046] Depending on the requirement of the human body overall elastic exercise mode, when the corresponding portions or sections of a human body make the action of stretch, the muscle groups on the flexor surfaces do not release and yield, but make a strengthened centrifugal activity actively, and the activity would be shown by driving the elastic body **1**A (shown as FIG. **2**(*a*) and FIG. **2**(*b*)); on the contrary, when the corresponding portions or sections of human body make the action of bending, the centrifugal activity of the muscle groups on the extensor surfaces would be shown by driving the elastic body **1**B (shown as FIG. **3**(*a*) and FIG. **3**(*b*)). According to the theory and principle of the human body overall elastic exercise mode, the tasks of the corresponding muscle groups distributed on the front and back sides of the human body are integrated following the relationship of unity of opposites. On the pre-stress status that the body portions or sections generate centrifugal tension extending along the central plane or the central axis, when the corresponding muscle groups on the front side make the centripetal activity, the corresponding muscle groups on the back side could strengthen the corresponding centrifugal activity in order to ensure the effect of the centrifugal tension and maintain the corresponding actions on the overall elastic status. When the muscle groups make then centripetal activity, the muscle groups on the front side would make corresponding adjustment as well.

[0047] The present invention can help trainers master the human body overall elastic exercise mode. The elastic material (such as rubber) is distributed on the surface of human body and connected into an elastic reticulation structure. The effect of the external elastic bodies and elastic structure is as follows. First, the working status of the body parts and muscle groups will be shown directly by the alternation of the elastic tension, which provide visual feedback information for correctly mastering the human body overall elastic exercise mode. Second, the elastic tension of the external elastic bodies acts as the antagonistic resistance to the corresponding activity of the muscle groups, which provide favorable conditions for correct stereotypes of the overall muscle intensive

training and muscle activity mode. Third, the elastic energy is stored at the same time of energy conduction, which reflects the significant character of the elastic bodies. The design of the present invention combines the external elastic bodies with the activity of muscles and joints of human body, and strengthens the overall elastic force.

[0048] A second embodiment of the present invention:

[0049] The second embodiment of the present invention is identical with the first embodiment except the following characteristics: as shown in FIGS. **4**(*a*),**4**(*b*), the joint fixture is made into an ankle guard, knee pad, waist support, shoulder protector, elbow guard, wrist guard, and finger guard, therefore the joint fixtures can serve as sports protection better and the joint protectors can be installed according to the requirements for corresponding joints of trainers.

[0050] Although the preferred embodiments of the present invention have been described herein, it is to be understood that the invention is not limited to those preferred embodiments, and various other changes and modifications may be effected by one skilled in the art without departing from the scope or spirit of the invention.

1.-**10**. (canceled)

11. A human body overall elastic exercise mode integrated device comprising: elastic bodies and at least five joint fixtures, wherein the joint fixtures are attached to the joints of a human body, with the starting point of each elastic body being fixed on two joint fixtures and the end point being fixed on the other three joint fixtures.

12. A human body overall elastic exercise mode integrated device as set forth in claim **11**, wherein the device comprises more than five joint fixtures, and except the joint fixtures used for fixing the starting point and end point of the elastic bodies, the medial joint fixtures consist of positioning buckles which the elastic bodies are capable of passing through, and the elastic bodies pass through the medial joint fixtures and are movably fixed through the positioning buckles.

13. A human body overall elastic exercise mode integrated device as set forth in claim **11**, wherein the elastic bodies are external elastic bodies which essentially extend along the moving portion of the flexor surfaces of the human body and along the moving portion of the extensor surfaces of the human body.

14. A human body overall elastic exercise mode integrated device as set forth in claim **13**, wherein the elastic bodies extend respectively along the middle segment of each moving portion of the arms and legs, then fork and twist around the external and internal sides toward the opposite for cross connection thereof, and serve as the external elastic bodies across the corresponding adductor and abductor muscle groups as well as rotatory muscle groups.

15. A human body overall elastic exercise mode integrated device as set forth in claim **13**, wherein the elastic bodies are of a single-bar-type or multi-strand twist type, and each elastic body is provided with several forks.

16. A human body overall elastic exercise mode integrated device as set forth in claim **11**, wherein the initial length of each elastic body is shorter than the length of the corresponding human body part to which the elastic body attaches.

17. A human body overall elastic exercise mode integrated device as set forth in claim **11**, wherein the joint fixtures are worn on several joints selected from among: ankle joints, knee joints, waist, shoulder joints, head, elbow joints, wrist joints, and metacarpophalangeal joints.

18. A human body overall elastic exercise mode integrated device as set forth in claim **11**, wherein the joint fixtures are provided as an ankle guard, knee pad, waist support, shoulder protector, elbow guard, wrist guard, or finger guard.

19. A human body overall elastic exercise mode integrated device as set forth in claim **12**, wherein the positioning buckles comprise Velcro, and the positioning buckles are adhered on the joint fixtures.

20. A human body overall elastic exercise mode integrated device as set forth in claim **11**, wherein the human body overall elastic exercise mode integrated device is embedded in sports wears and race suits.

21. A human body overall elastic exercise mode integrated device as set forth in claim **15**, wherein the two types of external elastic bodies have different colors.

* * * * *