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### (54) MULTIFUNCTIONAL LEG TRAINING MACHINE

(57) A multifunctional leg training machine includes a framework (20), a weight-bearing mechanism (30) mounted at the framework (20) and movable in direction toward or away from the framework (20) and adapted to impart a downward pressure to the shoulders of the user

using the machine, allowing the user to conduct vertical exercises in a squat, lunge or calf-raise posture, transverse exercises, or mixed transverse and vertical training exercises.

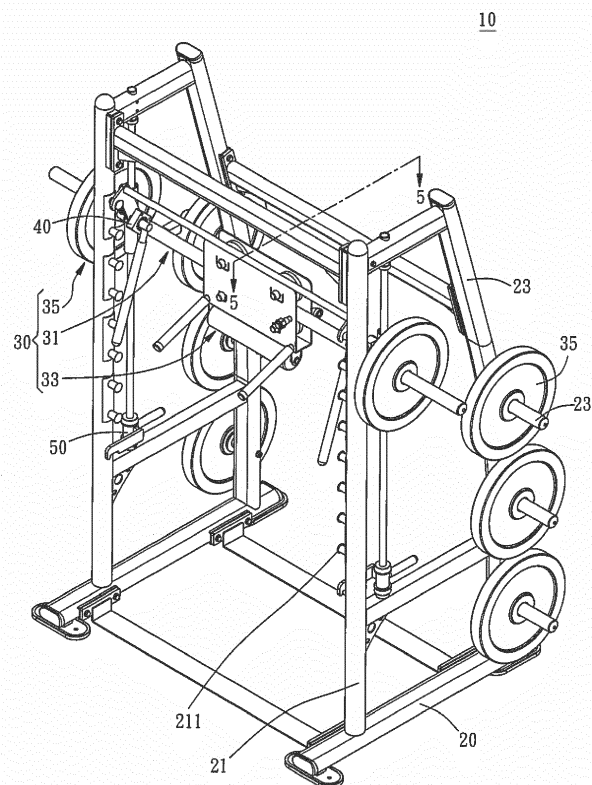


FIG. 1

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## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

[0001] The present invention relates to exerciser technology and more particularly, to a multifunctional leg training machine.

#### 2. Description of the Related Art

[0002] In order to maintain good health and body shape, enhanced leg weight training has great benefits on the support of the upper body. A typical leg exercise, such as squat, is normally trained using a weightlifting rack, however, it should be very careful when using a weightlifting rack to do a lunge or calf-raise exercise.

[0003] In early weight training, the barbell is directly carried on the shoulders. This method can simply do the conventional parallel squat exercise to train the muscles of the legs. However, because there is no any safety facilities used in the training, the user can be crushed by the barbell if the user is unable to withstand the load, or a poor training posture can lead to injuries of the waist, spine or knees.

[0004] Recently, Smith machines are widely used for a wide variety of exercises. A Smith machine generally comprises two vertical bars arranged at two opposite lateral sides of a framework in a parallel manner, two sliding sleeves respectively slidably coupled to the vertical bars, and a barbell fixedly connected between the sliding sleeves for vertical movement without vibration. However, this kind of weightlifting training machine can simply allow the user to lift weight vertically such as shoulder press or squat. When using a Smith machine to train the legs, the user can simply move the body up and down. This motion is not a natural arc movement and it will increase knee stress. Further, the user cannot fully train different muscle groups of the legs.

### SUMMARY OF THE INVENTION

[0005] The present invention has been accomplished under the circumstances in view. It is the main object of the present invention to provide a multifunctional leg training machine, which has a weight-bearing mechanism mounted at the framework thereof and movable in direction toward or away from the framework to impart a downward pressure to the shoulders of the user using the machine, allowing to the user to perform a squat exercise, a lunge exercise, a calf-raise exercise, a simple transverse body movement exercise, or a mixed training exercise of moving the body transversely and vertically to fully train different muscle groups of the legs.

[0006] To achieve this and other objects of the present invention, a multifunctional leg training machine of the invention comprises a framework placed on a bearing

surface, and a weight-bearing mechanism mounted in the framework and movable relative to the framework in direction toward or away from the framework. The weight-bearing mechanism comprises a longitudinal sliding device set vertically mounted in the framework and movable between the opposing top and bottom sides of the framework, a transverse sliding device set slidably coupled to the longitudinal sliding device set and movable between the opposing left and right sides of the framework, and a plurality of weight plates selectively mountable at the longitudinal sliding device set to impart a downward pressure to the longitudinal sliding device set so that when a user carries the weight-bearing mechanism with the shoulders, the weight plates give a downward pressure to the user.

[0007] Preferably, the longitudinal sliding device set comprises two vertical bars respectively vertically affixed to the opposing left and right sides of the framework, two sliding sleeves respectively sleeved onto the vertical bars and respectively axially movable along the vertical bars, and a sliding bar connected between the two sliding sleeves for allowing the transverse sliding device set to slide thereon.

[0008] Preferably, the longitudinal sliding device set comprises two pairs of vertical bars, two sliding sleeve sets, and a sliding bar connected between the sliding sleeve sets. The vertical bars are symmetrically fixedly mounted at the opposing left and right sides of the framework. The sliding sleeve sets are respectively coupled to and axially movable along the vertical bars. The sliding bar has two opposite ends thereof respectively fixedly connected to the sliding sleeve sets for allowing the transverse sliding device set to slide thereon.

[0009] Preferably, each sliding sleeve set comprises a link and two sliding sleeves. The sliding sleeves are respectively fixedly connected to two opposite ends of the link and respectively slidably sleeved onto the respective vertical bars. The sliding bar has two opposite ends thereof respectively fixedly connected to the links of the two sliding sleeve sets.

[0010] Preferably, the longitudinal sliding device set further comprises two stretcher bars respectively and fixedly connected between the links of the two sliding sleeve sets at two opposite sides relative to the sliding bar.

[0011] Preferably, the longitudinal sliding device set further comprises a hanging rod connected to each sliding sleeve and extending toward the sliding bar for hanging the weight plates.

[0012] Preferably, the transverse sliding device set comprises a pulley holder frame, a plurality of pulleys, a cushion set and two grips. The pulleys are rotatably mounted in the pulley holder frame at two opposite sides relative to the sliding bar. The cushion set is fixedly mounted at the pulley holder frame for stopping at the shoulders of the user operating the multifunctional leg training machine. The grips are affixed to the pulley holder frame corresponding to the user's shoulders for holding by the user.

**[0013]** Preferably, the sliding bar is a rhombic tube having four slanted sides. Each two adjacent slanted sides are connected together to create a sliding rail. Further, each pulley defines therein a sliding groove fitting the sliding rail.

**[0014]** Preferably, the cushion set comprises two pivot members and a cushion member. The pivot members are fixedly connected to a bottom side of the pulley holder frame. The cushion member is pivotally coupled between the two pivot members.

**[0015]** Preferably, the multifunctional leg training machine further comprises two positioning mechanisms respectively mounted at the sliding bar of the longitudinal sliding device set near the framework for positioning the weight-bearing mechanism in the framework at a predetermined elevation.

**[0016]** Preferably, the framework comprises two upright posts disposed at the opposing left and right sides of the framework and vertically upwardly extended from the bottom side of the framework, and a plurality of positioning rods located at each upright post at different elevations. Each positioning mechanism comprises a connection member, a handle and a hook member. The connection member is fixedly connected to the sliding bar. The handle is pivotally connected to the connection member. The hook member is biasable by the handle in two reversed directions to hook on the positioning rod or to release the positioning rod.

**[0017]** Preferably, the hook members of the two positioning mechanisms are connected together by a link for enabling the two positioning mechanisms to be moved synchronously.

**[0018]** Preferably, the multifunctional leg training machine further comprises two buffering mechanisms. Each buffering mechanism comprises a buffer sleeve, a grip and a clamping hook. The buffer sleeve is axially slidably and rotatably sleeved onto one respective vertical bar. The grip of each buffering mechanism is fixedly connected to the buffer sleeve. The clamping hook is biasable by the grip of the respective buffering mechanism in two reversed directions to hook on the positioning rod or to release the positioning rod. Thus, if the longitudinal sliding device set falls down with the attached weight plates accidentally when the user is squatting, the buffering mechanism can stop the longitudinal sliding device set at a certain elevation above the floor, preventing sports injuries.

**[0019]** Preferably, the framework further comprises two support posts disposed at the opposing left and right sides thereof and upwardly extended from the bottom side thereof, and a plurality of hanging rods located at each support post at different elevations for holding the weight plates that are not in use, facilitating the user to pick up and to store the weight plates.

**[0020]** Thus, the multifunctional leg training machine allows the user to conduct vertical exercises in a squat, lunge or calf-raise posture, or to conduct mixed transverse and vertical training exercises to fully train different

muscle groups of the legs.

**[0021]** Other advantages and features of the present invention will be fully understood by reference to the following specification in conjunction with the accompanying drawings, in which like reference signs denote like components of structure. Further, it is to be noted that the relative directional terms of "top", "bottom", "left", "right", "front" and "back" are the normal use of directional terms relative to the position of the user, for example, in FIG. 11A, the user stands on the left side of the multifunctional leg training machine to face forward.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0022]**

FIG 1 is an oblique top elevational view of a multifunctional leg training machine in accordance with a first embodiment of the present invention.

FIG 2 is an exploded view of the multifunctional leg training machine in accordance with the first embodiment of the present invention, illustrating the components of the transverse sliding device set and their relative positioning.

FIG 3 is a schematic front view of the multifunctional leg training machine in accordance with the first embodiment of the present invention, illustrating the transverse sliding device set moved transversely along the sliding bar.

FIG 4 corresponds to FIG 1 when viewed from another angle.

FIG 5 is a schematic sectional view of the multifunctional leg training machine in accordance with the first embodiment of the present invention, illustrating the relationship between the longitudinal sliding device set and the transverse sliding device set.

FIGS. 6A and 6B are schematic sectional views of the multifunctional leg training machine in accordance with the first embodiment of the present invention, illustrating the operation of the positioning mechanisms.

FIGS. 7A through 7C are schematic sectional views of the multifunctional leg training machine in accordance with the first embodiment of the present invention, illustrating the operation of the buffering mechanisms.

FIGS. 8A through 8D are schematic sectional views of the multifunctional leg training machine in accordance with the first embodiment of the present invention, illustrating the performance of a squat exercise, a lunge exercise or a calf-raise exercise.

FIG 9 is an oblique top elevational view of a multifunctional leg training machine in accordance with a second embodiment of the present invention.

FIG. 10 is an oblique top elevational view of a multifunctional leg training machine in accordance with a third embodiment of the present invention.

FIGS. 11A through 11C and FIGS. 11E through 11G

are schematic front views of the multifunctional leg training machine in accordance with the third embodiment of the present invention, illustrating the user in performance of mixed transverse and vertical training exercises.

FIG. 11D and 11H are schematic side views of the multifunctional leg training machine in accordance with the third embodiment of the present invention, illustrating the user in performance of mixed transverse and vertical training exercises.

## DETAILED DESCRIPTION OF THE INVENTION

[0023] Referring to FIGS. 1-5, a multifunctional leg training machine 10 in accordance with a first embodiment of the present invention is shown. The multifunctional leg training machine 10 comprises a framework 20, a weight-bearing mechanism 30, two positioning mechanisms 40, and two buffering mechanisms 50.

[0024] The framework 20 is placed on a bearing surface (floor), comprising two upright posts 21 and two support posts 23 located at two opposite lateral sides thereof and upwardly extended from the floor. Preferably, the upright posts 21 are bilaterally disposed at a front side, and the support posts 23 are bilaterally disposed at an opposing rear side. The framework 20 further comprises a row of positioning rods 211 located at each upright post 21 at an inner side and spaced along the length thereof at a predetermined interval, and a row of hanging rods 231 located at each support post 23 at an outer side and spaced along the length thereof at a predetermined interval for hanging weight plates (iron discs) 35. It is to be understood that the number and locations of the positioning rods 211 and the hanging rods 231 shown in the drawings are for the purpose of illustration only but not intended for use to limit the scope of the invention. Alternatively, the positioning rods 211 or the hanging rods 231 can be located at only one upright post 21 or one support post 23.

[0025] The weight-bearing mechanism 30 is mounted at the framework 20, and can be moved toward or away from the framework 20. The weight-bearing mechanism 30 can provide a weight so that when the user carries the weight-bearing mechanism 30 with the shoulders, the gravity of weight of the weight-bearing mechanism 30 is downwardly applied to the user. As illustrated in FIGS. 2 and 3, the weight-bearing mechanism 30 comprises a longitudinal sliding device set 31, a transverse sliding device set 33, and the aforesaid weight plates 35. The longitudinal sliding device set 31 is vertically mounted in the framework 20, and can be moved relative to the framework 20 between opposing top and bottom sides of the framework 20. The transverse sliding device set 33 is slidably coupled to the longitudinal sliding device set 31, and can be moved relative to the framework 20 between the two opposite lateral sides (the opposing left and right sides) of the framework 20. The user can selectively attach a predetermined number of the weight

plates 35 to two opposite sides of the longitudinal sliding device set 31 to give a downward pressure. The weight plates 35 that are not selected can be hung on the hanging rods 231 of the support posts 23. More specifically, the longitudinal sliding device set 31 comprises two vertical bars 311, two sliding sleeves 313, a sliding bar 315 connected between the sliding sleeves 313, and two hanging rods 317. The vertical bars 311 are respectively affixed to the opposing left and right sides of the framework 20. The sliding sleeves 313 are respectively sleeved onto the vertical bars 311 and movable axially up and down along the vertical bars 311. The sliding bar 315 has two opposite ends thereof respectively fixedly connected to the sliding sleeves 313. The transverse sliding device set 33 is slidably coupled to the sliding bar 315. The hanging rods 317 are respectively outwardly extended from the sliding sleeves 313 in direction away from the sliding bar 315 for supporting the weight plates 35. The transverse sliding device set 33 comprises a pulley holder frame 331, a plurality of pulleys 333, a cushion set 335, and two grips 337. The pulleys 333 are rotatably mounted in the pulley holder frame 331, and symmetrically disposed at opposing top and bottom sides the sliding bar 315. The cushion set 335 is fixedly mounted at a bottom side of the pulley holder frame 331 for supporting on the user's shoulders. The grips 337 are fixedly connected to the pulley holder frame 331, and respectively disposed corresponding to the user's two shoulders for gripping by the user's hands. Referring also to FIG. 5, in this embodiment, there are four pulleys 333; two pulleys 333 are arranged in parallel above the sliding bar 315; the other two pulleys 333 are arranged in parallel below the sliding bar 315 and respectively disposed in vertical alignment with the two top-sided pulleys 333. The sliding bar 315 is a rhombic tube having four slanted sides, and each two adjacent slanted sides of the sliding bar 315 are connected together to create a V-shaped sliding rail 316. Each pulley 333 defines therein a V-shaped sliding groove 334 mating with the V-shaped sliding rail 316. Thus, the pulleys 333 can be moved smoothly and stably along the sliding bar 315.

[0026] The weight-bearing mechanism 30 is mounted at the framework 20, and can be moved toward or away from the framework 20. The weight-bearing mechanism 30 can provide a weight. When the user carries the weight-bearing mechanism 30 with the shoulders, the gravity of weight of the weight-bearing mechanism 30 is applied to the user. As illustrated in FIGS. 2 and 3, the weight-bearing mechanism 30 comprises a longitudinal sliding device set 31, a transverse sliding device set 33, and the aforesaid weight plates 35. The longitudinal sliding device set 31 is vertically mounted in the framework 20, and can be moved relative to the framework 20 between opposing top and bottom sides thereof. The transverse sliding device set 33 is slidably coupled to the longitudinal sliding device set 31, and can be moved relative to the framework 20 between the two opposite lateral sides thereof. The user can selectively attach a prede-

terminated number of the weight plates **35** to two opposite sides of the longitudinal sliding device set **31** to give a downward pressure. The weight plates **35** that are not selected can be hung on the hanging rods **231** of the support posts **23**. More specifically, the longitudinal sliding device set **31** comprises two vertical bars **311**, two sliding sleeves **313**, a sliding bar **315** connected between the sliding sleeves **313**, and two hanging rods **317**. The vertical bars **311** are respectively affixed to the opposing left and right sides of the framework **20**. The sliding sleeves **313** are respectively sleeved onto the vertical bars **311** and movable axially up and down along the vertical bars **311**. The sliding bar **315** has two opposite ends thereof respectively fixedly connected to the sliding sleeves **313**. The transverse sliding device set **33** is slidably coupled to the sliding bar **315**. The hanging rods **317** are respectively outwardly extended from the sliding sleeves **313** in direction away from the sliding bar **315** for supporting the weight plates **35**. The transverse sliding device set **33** comprises a pulley holder frame **331**, a plurality of pulleys **333**, a cushion set **335**, and two grips **337**. The pulleys **333** are rotatably mounted in the pulley holder frame **331**, and bilaterally symmetrically disposed at different elevations. The cushion set **335** is fixedly mounted at a bottom side of the pulley holder frame **331** for supporting on the user's shoulders. The grips **337** are fixedly connected to the pulley holder frame **331**, and respectively disposed corresponding to the user's two shoulders for gripping by the user's hands. Referring also to FIG 5, in this embodiment, there are four pulleys **333**; two pulleys **333** are arranged in parallel above the sliding bar **315**; the other two pulleys **333** are arranged in parallel below the sliding bar **315** are respectively disposed in alignment with the two top-sided pulleys **333**. The sliding bar **315** is a rhombic tube having four slanted sides, and each two adjacent slanted sides of the sliding bar **315** are connected together to create a V-shaped sliding rail **316**. Each pulley **333** defines therein a V-shaped sliding groove **334** mating with the V-shaped sliding rail **316**. Thus, the pulleys **333** can be moved smoothly and stably along the sliding bar **315**. The cushion set **335** comprises two pivot members **336** and a cushion member **338**. The pivot members **336** are fixedly mounted at the bottom side of the pulley holder frame **331**. The cushion member **338** is pivotally coupled between the two pivot members **336**. In this embodiment, the cushion member **338** is a cylindrical cushion rotatably supported on the pivot members **336** and adapted to reduce the burden given by the gravity weight of the weight plates **35** to the user's shoulders during training, preventing sports injuries.

[0027] The positioning mechanisms **40** are mounted at the sliding bar **315** of the longitudinal sliding device set **31** adjacent to the two opposite lateral sides of the framework **20** for securing the weight-bearing mechanism **30** to the framework **20** in a predetermined elevational position. Referring also to FIGS. 2 and 4, more specifically, each positioning mechanism **40** comprises a connection member **41**, a handle **43**, and a hook member

**45**. The connection member **41** is fixedly connected to the sliding bar **315** of the longitudinal sliding device set **31**. The handle **43** is pivotally connected to the connection member **41**. The hook member **45** is biasable by the handle **43** to hook on the positioning rod **211** or to move away from the positioning rod **211**. Further, in this embodiment, two positioning mechanisms **40** are provided. For enabling the two hook members **45** to be moved synchronously, a link **47** is connected between the two hook members **45**. Thus, the two positioning mechanisms **40** can be moved together. With respect to the operation of the positioning mechanisms **40**, as shown in FIG 6A, before operating the multifunctional leg training machine **10**, attach the shoulders to the cushion member **338** and push the cushion member **338** upwards with the shoulders to lift the longitudinal sliding device set **31** and to disengage the hook members **45** from the positioning rods **211**, and then, as shown in FIG. 6B, hold the handles **43** with the two hands and push the handles **43** forwards, turning the handles **43** upwardly about the associating connection members **41**. At this time, the hook members **45** are moved by the associating handles **43** in direction away from the positioning rods **211** till that the hook members **45** do not collide with the corresponding positioning rods **211**.

[0028] The buffering mechanisms **50**, as shown in FIGS. 7A through 7C, each comprise a buffer sleeve **51**, a grip **53**, and a clamping hook **55**. The buffer sleeve **51** is slidably sleeved onto the vertical bar **311** and rotatable about the axis of the vertical bar **311**. The grip **53** is affixed to the buffer sleeve **51**. The clamping hook **55** is movable by the grip **53** to turn about the vertical bar **311** into engagement with or away from the selected positioning rod **211**. Thus, if the longitudinal sliding device set **31** drops down with the weight plates **35** accidentally in the exercise due to user fatigue or lack of muscle strength, the buffering mechanisms **50** can timely let the longitudinal sliding device set **31** be stopped above the floor at a certain height, preventing direct falling of the weight-bearing mechanism **30** to the floor to crush the user.

[0029] After set the buffering mechanisms **50**, the user can then operate the multifunctional leg training machine **10** to train different muscle groups of the legs, as shown in FIG. 8A. At the initial stage, the user stands up in the multifunctional leg training machine **10** with the shoulders stopped at the bottom side of the cushion member **338** and the both hands holding the grips **337**, thereafter, as shown in FIG. 8B, the user bends the knees to get into the squat position so as to train the quadriceps muscles, gluteal muscles and the back muscles of the legs, or, as shown in FIG 8C, the user can get into the lunge position where one leg is positioned forward with knee bent and foot flat on the ground while the other leg is positioned behind to train the muscles of the thighs and buttocks, or, as shown in FIG 8D, the user can get into the calf-raise position to exercise the deep calf muscles of the lower legs.

[0030] In other words, by means of moving the longi-

tudinal sliding device set **31** between the opposing top and bottom sides of the framework **20**, the user can perform exercises by moving the body vertically up and down. This vertical training method comprises the following steps as illustrated in FIGS. 8A-8D.

- a) The user stands up in the multifunctional leg training machine **10** with the shoulders stopped at the bottom side of the cushion member **338** and the two hands holding the grips **337**, and then adjusts the elevation of the transverse sliding device set **33** and locks it in the adjusted elevational position.
- b) The user performs exercises in one or a combination of: squat position to bend the knees, lunge position to position one leg forward with the knee bent and the foot flat on the ground and to position the other leg behind, and calf-raise position to stand on tiptoes.

**[0031]** Further, as shown in FIG 3, the user can adjust the longitudinal sliding device set **31** to the desired elevational position to fit with tiptoe, standing, stride, squat, or any other position, and then move the transverse sliding device set **33** transversely between the opposing left and right sides of the multifunctional leg training machine **10** to train the muscle groups of the lower limbs. Thus, the user can operate the longitudinal sliding device set **31** and transverse sliding device set **33** of the weight-bearing mechanism **30** of the multifunctional leg training machine **10** to perform simple training exercises by moving the body transversely, or to perform mixed training exercises by moving the body transversely and vertically. The invention makes the training mode more varied, and allows the user exercise different muscle groups of the legs.

**[0032]** In other words, by means of moving the transverse sliding device set **33** between the opposing left and right sides of the framework **20**, the user can perform exercises by moving the body transversely. This transverse training method comprises the following steps as illustrated in FIG 3.

- a) The user stands up in the multifunctional leg training machine **10** with the shoulders stopped at the bottom side of the cushion member **338** and the two hands holding the grips **337**, and then adjusts the elevation of the longitudinal sliding device set **31** and locks it in the adjusted elevational position.
- b) The user performs exercises in one or a combination of: standing position, squat position to bend the knees, tiptoe position with the heel of the foot lifted off the ground, and stride position with one leg in front.

**[0033]** Referring to FIG 9, a multifunctional leg training machine **10'** in accordance with a second embodiment of the present invention is shown. This second embodiment is substantially similar to the aforesaid first embod-

iment with the exception that the longitudinal sliding device set **31** of this second embodiment comprises two pairs of vertical bars **311**, two sliding sleeve sets **312**, and a sliding bar **315** connected between the two sliding sleeve sets **312**. The vertical bars **311** are respectively symmetrically affixed to the opposing left and right sides of the framework **20**. The sliding sleeve sets **312** are respectively coupled to the vertical bars **311** and axially movable along the vertical bars **311**.

**[0034]** The sliding bar **315** has two opposite ends thereof respectively fixedly connected to the sliding sleeve sets **312** for the sliding of the transverse sliding device set **33**. More specifically, each sliding sleeve set **312** comprises two sliding sleeves **313** and a link **314**. The two sliding sleeves **313** are respectively and fixedly connected to the two opposite ends of the link **314**, and respectively sleeved onto the respective vertical bars **311**. The sliding bar **315** has the two opposite ends thereof respectively fixedly connected to the links **314** of the sliding sleeve sets **312**. Thus, this second embodiment enhances the stability of the upward and downward movement of the longitudinal sliding device set **31** in the framework **20**. Further, in order to avoid deformation or damage of the sliding bar **315** due to overweight of the attached weight plates **35**, the longitudinal sliding device set **31** further provides a stretcher bar **318** that is fixedly connected between the two links **314** in a parallel manner relative to the sliding bar **315**. Of course, two or more than two stretcher bars **318** can be provided and connected between the two links **314** subject to actual requirements.

**[0035]** Referring to FIG 10, a multifunctional leg training machine **10''** in accordance with a third embodiment of the present invention is shown. This third embodiment is substantially similar to the aforesaid first embodiment with the exception that the framework **20** of the multifunctional leg training machine **10''** of this third embodiment is relatively wider than that of the aforesaid first embodiment so that the multifunctional leg training machine **10''** of this third embodiment is more practical for mixed transverse and longitudinal training exercises. Further, in this third embodiment, the pulley holder frame **331** of the transverse sliding device set **33** exhibits an inverted U-shape; the cushion member **338** consists of two elongated cushion blocks that are respectively and fixedly connected to the opposing left and right sides of the pulley holder frame **331**; the grips **337** are smoothly curved; and thus, the transverse sliding device set **33** is ergonomically designed, allowing the user to conduct training exercises more comfortable, and reducing the incidence of sports injuries.

**[0036]** When using the multifunctional leg training machine **10''** of the third embodiment of the present invention for conducting mixed training exercises, as illustrated in FIG. 11A, the user stands up on the left side in the multifunctional leg training machine **10''** with the shoulders stopped at the bottom side of the cushion member **338** and the two hands holding the grips **337**, and then,

as illustrated in FIG. 11B, the user steps rightward to move toward the right side of the multifunctional leg training machine **10''**. At this time, the transverse sliding device set **33** is moved to the midpoint of the framework **20**, and the longitudinal sliding device set **31** is synchronously lowered, and thus, the user is striding with one leg advanced. Thereafter, the user keeps moving rightwards and downwards to the right side of the framework **20**. At this time, the user has one leg thereof in a squat position and the other leg thereof in an obliquely extended position, as illustrated in FIG. 11C and FIG. 11D. After moved to the right side of the multifunctional leg training machine **10''**, the user moves the longitudinal sliding device set **31** upwards and resumes to the standing position, as illustrated in FIG. 11E, and then, as illustrated in FIGS. 11F-11H, the user moves leftwards and downwards to the left side of the multifunctional leg training machine **10''**. Thus, the user can move the longitudinal sliding device set **31** and transverse sliding device set **33** of the weight-bearing mechanism **30** vertically and transversely in a synchronous manner between the opposing top and bottom sides and left and right sides of the of the framework **20** of the multifunctional leg training machine **10''**, completing the squatting action of striding, going down on the knees and standing up.

**[0037]** In other words, by means of moving the longitudinal sliding device set **31** and transverse sliding device set **33** of the weight-bearing mechanism **30** vertically and transversely in a synchronous manner between the opposing left and right sides and top and bottom sides of the framework **20**, the user can conduct mixed transverse and vertical exercises. This mixed transverse and vertical training method comprises the following steps as illustrated in FIGS. 11A-11H.

- a) The user stands up on the left side in the multifunctional leg training machine **10''** with the shoulders stopped at the bottom side of the cushion member **338** and the two hands holding the grips **337**.
- b) The user moves synchronously rightwards and downwards with the two legs obliquely extended out in a striding posture, moving the transverse sliding device set **33** and the longitudinal sliding device set **31** synchronously rightwards and downwards to the midpoint of the framework **20**.
- c) The user continuously moves rightwards and downwards with the one leg in a squatting posture and the other leg obliquely extended out, moving the transverse sliding device set **33** and the longitudinal sliding device set **31** to the right side of the framework **20** of the multifunctional leg training machine **10''**.
- d) The user goes back to the standing position, and then moves synchronously leftwards and downwards to the left side of the framework **20** of the multifunctional leg training machine **10''**.

**[0038]** In conclusion, by means of the exercise of moving the weight-bearing mechanism **30** of the multifunc-

tional leg training machine **10,10',10''** toward or away from the framework **20**, the weightlifting training mode is more varied, allowing the user to perform a squat exercise, a lunge exercise, a calf-raise exercise, a simple transverse body movement exercise (see FIG. 3), or a mixed training exercise of moving the body transversely and vertically (see FIGS. 11A-11H) to fully train different muscle groups of the legs. In the muscle training process, the positioning mechanism **40** and the buffering mechanism **50** ensure a high level of safety and use convenience.

**[0039]** Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

## Claims

1. A multifunctional leg training machine (10, 10', 10''), comprising:
  - a framework (20) placed on a bearing surface; and
  - a weight-bearing mechanism (30) mounted in said framework (20) and movable in direction toward or away from said framework (20), said weight-bearing mechanism (30) comprising a longitudinal sliding device set (31) vertically mounted in said framework (20) and movable between opposing top and bottom sides of said framework (20), a transverse sliding device set (33) slidably coupled to said longitudinal sliding device set (31) and movable between opposing left and right sides of said framework (20), and a plurality of weight plates (35) selectively mountable at said longitudinal sliding device set (31) to impart a downward pressure to said longitudinal sliding device set (31) so that when a user carries said weight-bearing mechanism (30) with the shoulders, the attached said weight plates (35) give a downward pressure to the user.
2. The multifunctional leg training machine as claimed in claim 1, wherein said longitudinal sliding device set (31) comprises two vertical bars (311) respectively vertically affixed to the opposing said left and right sides of said framework (20), two sliding sleeves (313) respectively sleeved onto said vertical bars (311) and axially movable along said vertical bars (311), and a sliding bar (315) fixedly connected between said two sliding sleeves (313) for allowing said transverse sliding device set (33) to slide thereon.

3. The multifunctional leg training machine as claimed in claim 1, wherein said longitudinal sliding device set (31) comprises two pairs of vertical bars (311), two sliding sleeve sets (312), and a sliding bar (315) connected between said sliding sleeve sets (312), said vertical bars (311) being symmetrically fixedly mounted at the opposing said left and right sides of said framework (20), said sliding sleeve sets (312) being respectively coupled to and axially movable along said vertical bar (311), said sliding bar (315) having two opposite ends thereof respectively fixedly connected to said sliding sleeve sets (312) for allowing said transverse sliding device set (33) to slide thereon.
4. The multifunctional leg training machine as claimed in claim 3, wherein each said sliding sleeve set (312) comprises a link (314) and two sliding sleeves (313), said sliding sleeves (313) being respectively fixedly connected to two opposite ends of said link (314) and respectively slidably sleeved onto respective said vertical bars (311), said sliding bar (315) having two opposite ends thereof respectively fixedly connected to the links (314) of said two sliding sleeve sets (312).
5. The multifunctional leg training machine as claimed in claim 3, wherein said longitudinal sliding device set (31) further comprises a stretcher bar (318) fixedly connected between the links (314) of said two sliding sleeve sets (312).
6. The multifunctional leg training machine as claimed in claim 2 or 3, wherein said longitudinal sliding device set (31) further comprises a hanging rod (317) connected to each said sliding sleeve (313) and extending toward said sliding bar (315) for hanging said weight plates (35).
7. The multifunctional leg training machine as claimed in claim 6, wherein said transverse sliding device set (33) comprises a pulley holder frame (331), a plurality of pulleys (333), a cushion set (335) and two grips (337), said pulleys (333) being rotatably mounted in said pulley holder frame (331) at two opposite sides relative to said sliding bar (315), said cushion set (335) being fixedly mounted at said pulley holder frame (331) for stopping at the shoulders of the user operating the multifunctional leg training machine, said grips (337) being affixed to said pulley holder frame (331) corresponding to the user's shoulders for holding by the user.
8. The multifunctional leg training machine as claimed in claim 7, wherein said sliding bar (315) is a rhombic tube having four slanted sides, and each two adjacent said slanted sides being connected together to create a V-shaped sliding rail (316); each said pulley (333) defines therein a V-shaped sliding groove (334) fitting said V-shaped sliding rail (316).
9. The multifunctional leg training machine as claimed in claim 7, wherein said cushion set (335) comprises two pivot members (336) and a cushion member (338), said pivot members (336) being fixedly connected to a bottom side of said pulley holder frame (331), said cushion member (338) being pivotally coupled between said two pivot members (336).
10. The multifunctional leg training machine as claimed in claim 2 or 3, further comprising two positioning mechanisms (40) respectively mounted at said sliding bar (315) of said longitudinal sliding device set (31) near said framework (20) for positioning said weight-bearing mechanism (30) in said framework (20) at a predetermined elevation.
11. The multifunctional leg training machine as claimed in claim 10, wherein said framework (20) comprises two upright posts disposed at two opposite lateral sides thereof and vertically upwardly extended from a bottom side thereof, and a plurality of positioning rods located at each said upright post at different elevations; each said positioning mechanism (40) comprises a connection member (41), a handle (43) and a hook member (45), said connection member (41) being fixedly connected to said sliding bar (315), said handle (43) being pivotally connected to said connection member (41), said hook member (45) being alternatively biasable by said handle (43) in two reversed directions to hook on said positioning rod or to release said positioning rod.
12. The multifunctional leg training machine as claimed in claim 11, further comprising a link (314) connected between said hook members (45) of said two positioning mechanisms (40) for enabling said two positioning mechanisms (40) to be moved synchronously.
13. The multifunctional leg training machine as claimed in claim 10, further comprising two buffering mechanisms (50), each said buffering mechanism (50) comprising a buffer sleeve (51) axially slidably and rotatably sleeved onto one respective said vertical bar (311), a grip (337) fixedly connected to said buffer sleeve (51), and a clamping hook (55) alternatively biasable by the grip (337) of the respective said buffering mechanism (50) in two reversed directions to hook on said positioning rod or to release said positioning rod.
14. The multifunctional leg training machine as claimed in claim 1, said framework (20) further comprises two support posts (23) respectively disposed at the opposing said left and right sides of said framework

(20) and upwardly extended from the said bottom side of said framework (20), and a plurality of hanging rods (317) located at each said support post (23) at different elevations for selectively hanging said weight plates (35).

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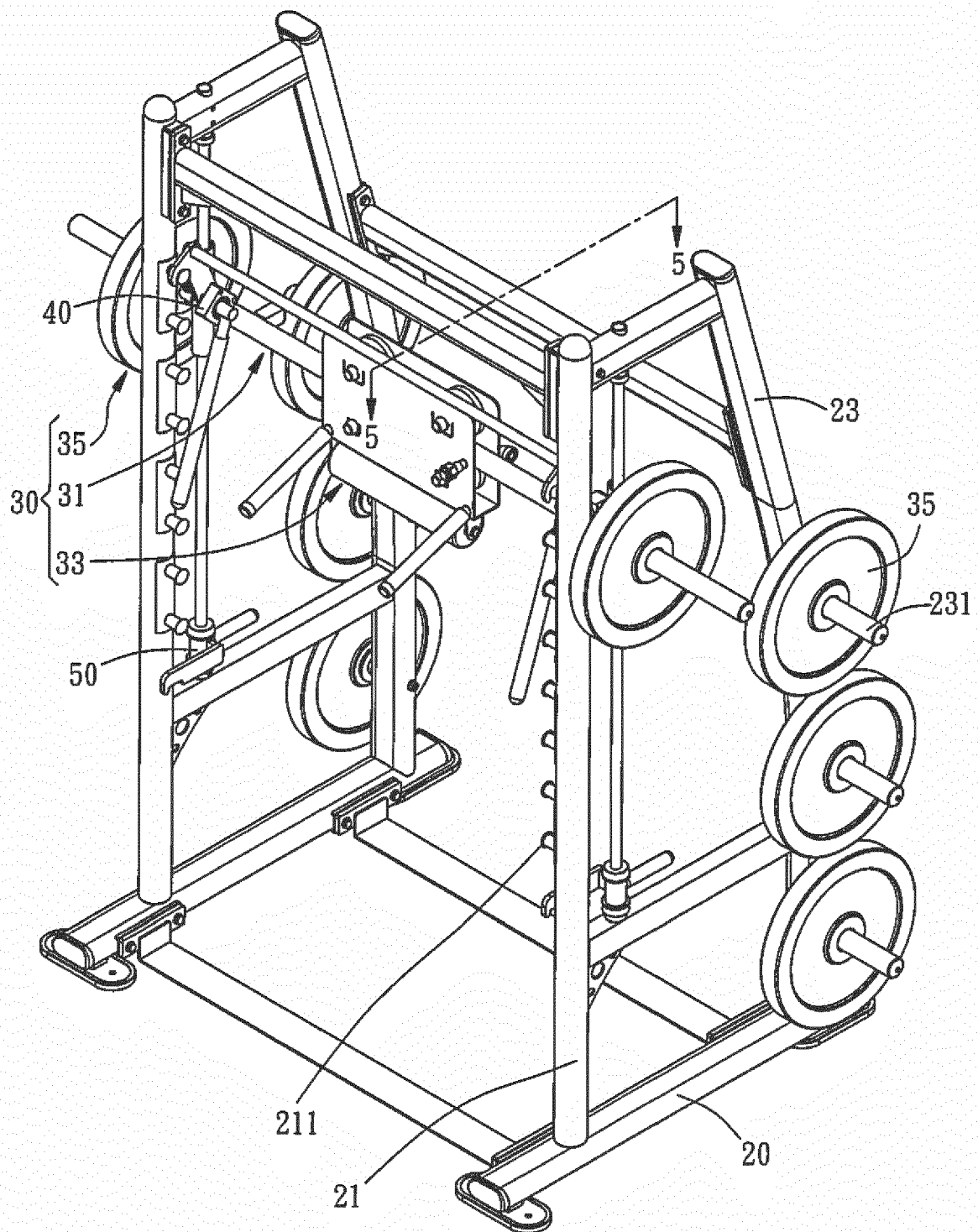


FIG. 1

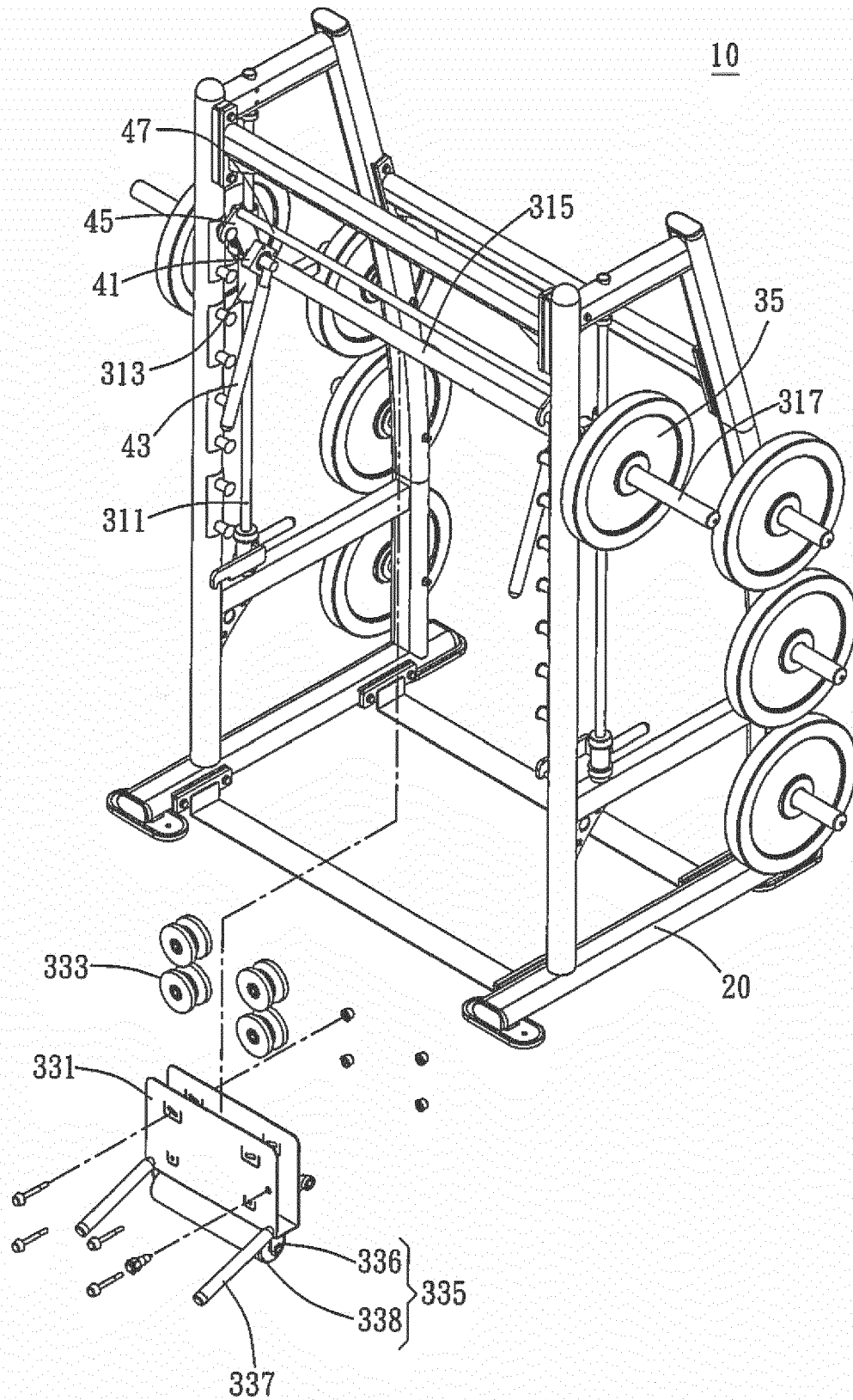


FIG. 2

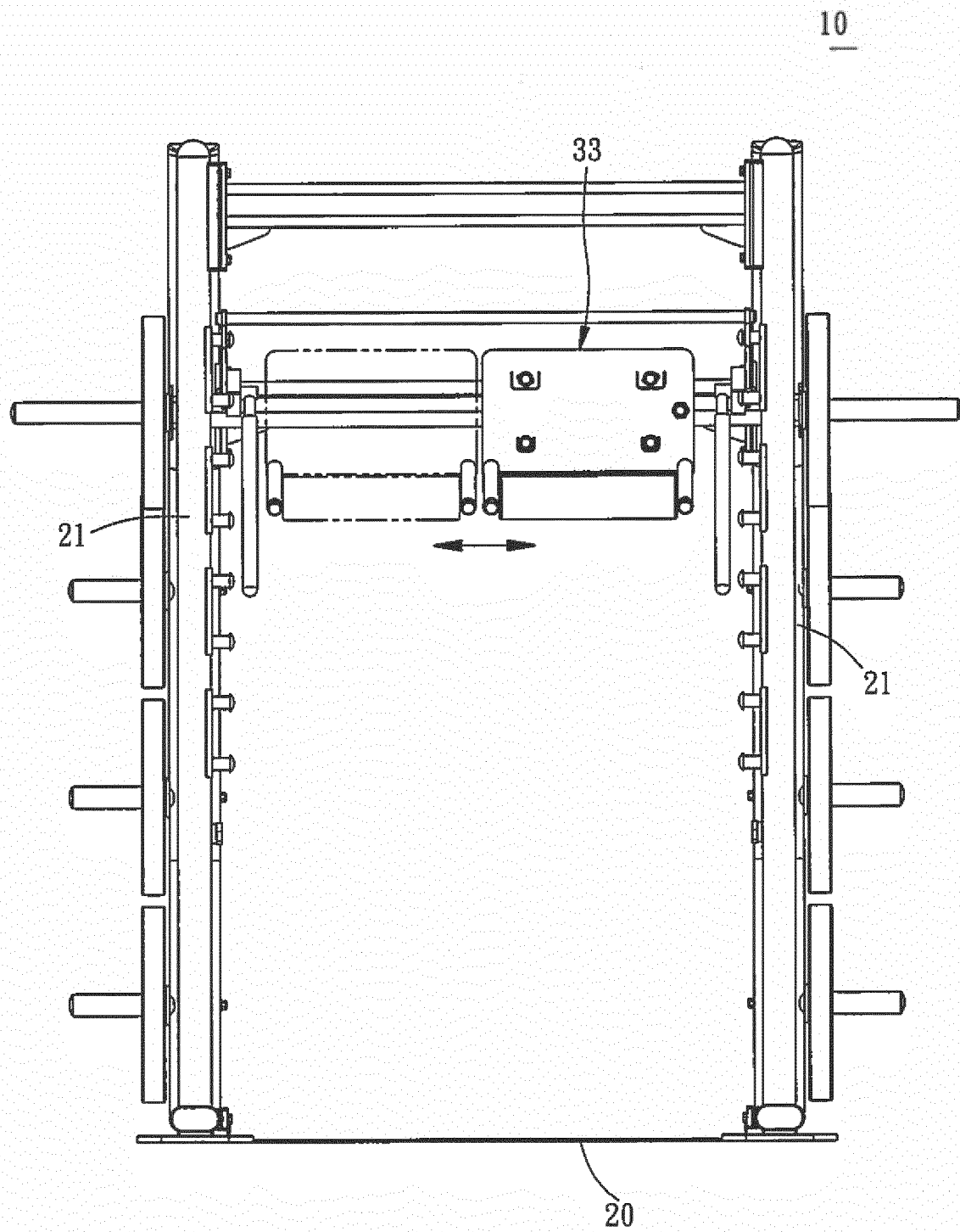


FIG. 3

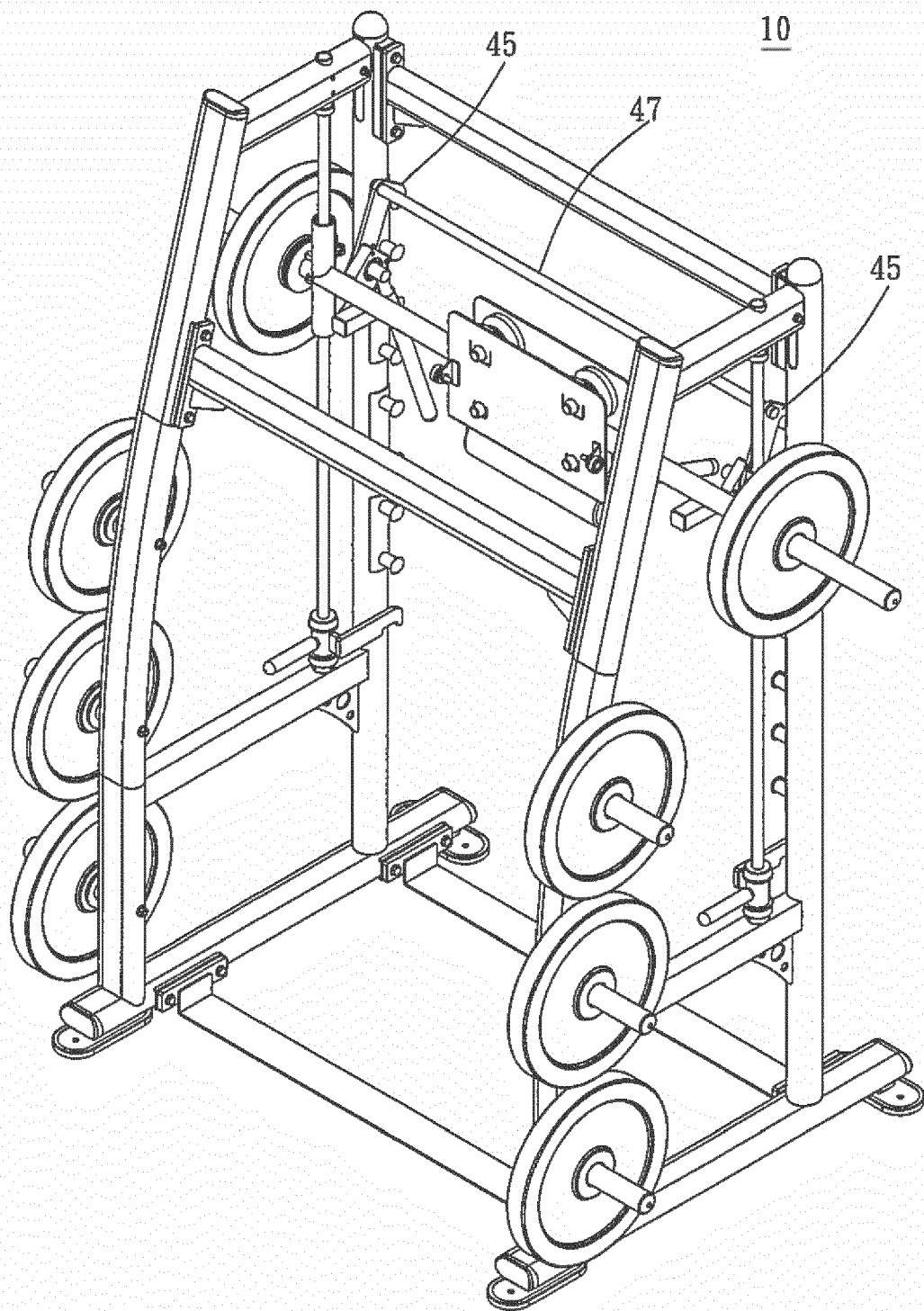


FIG. 4

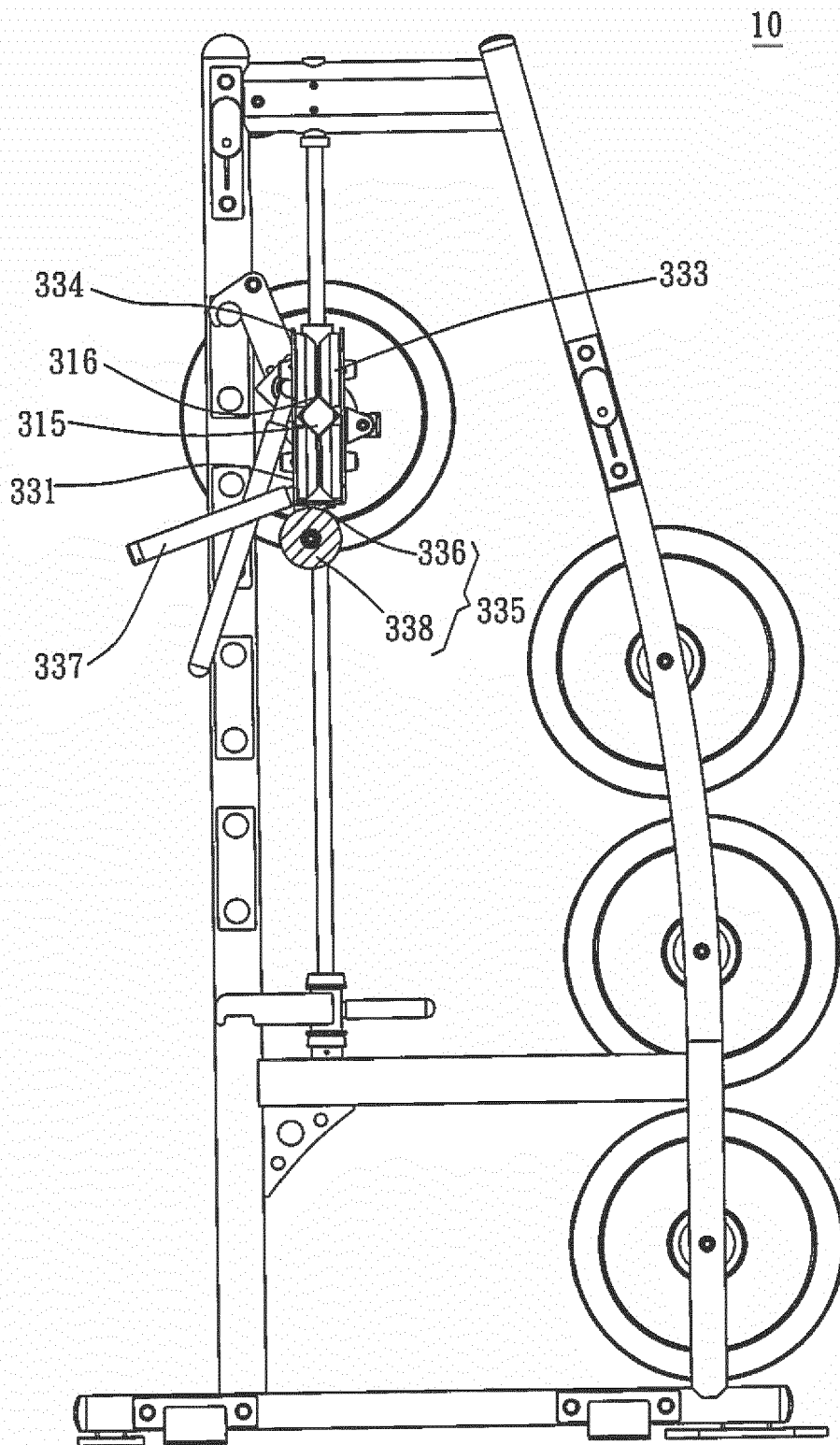


FIG. 5

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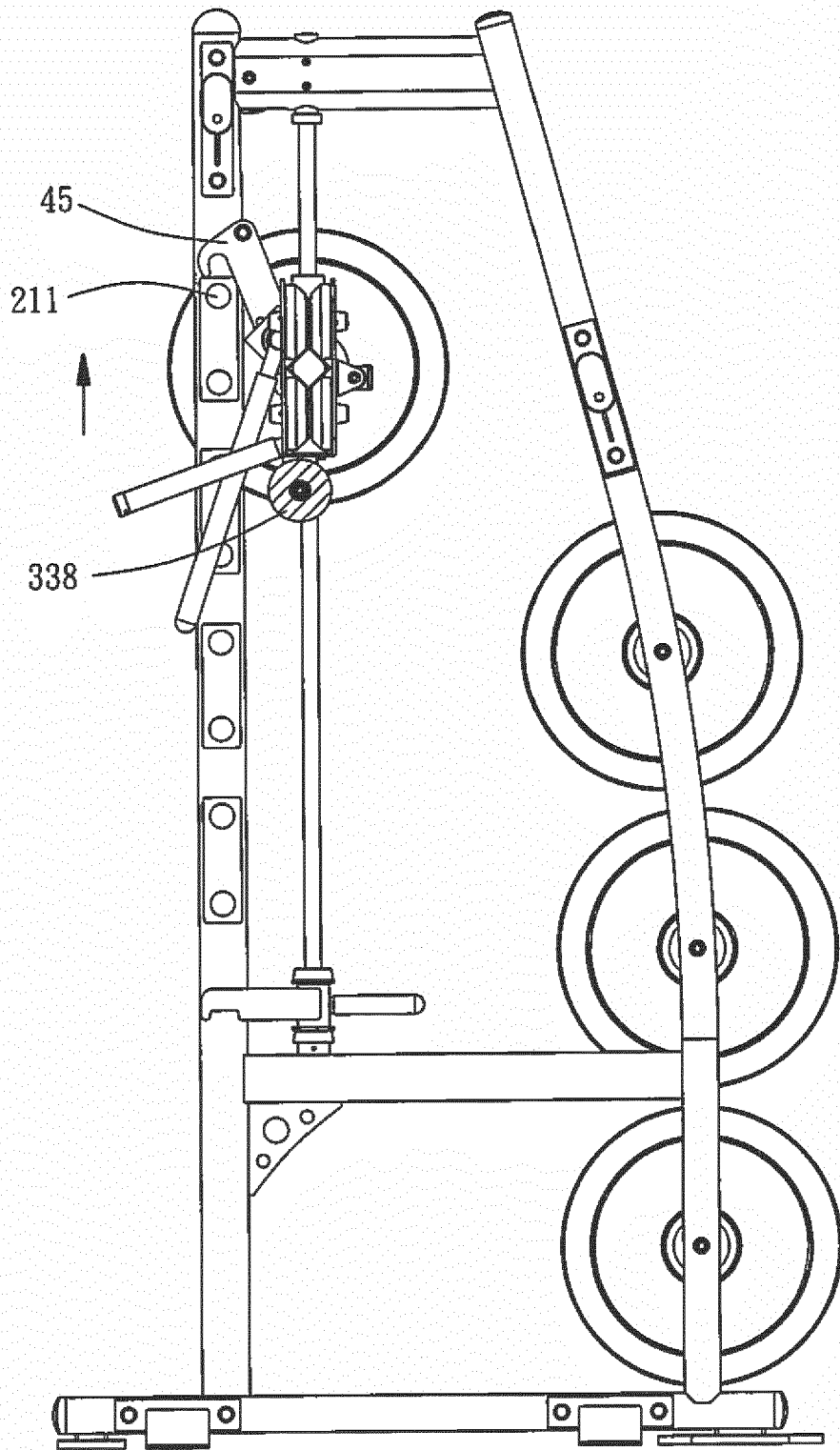


FIG. 6A

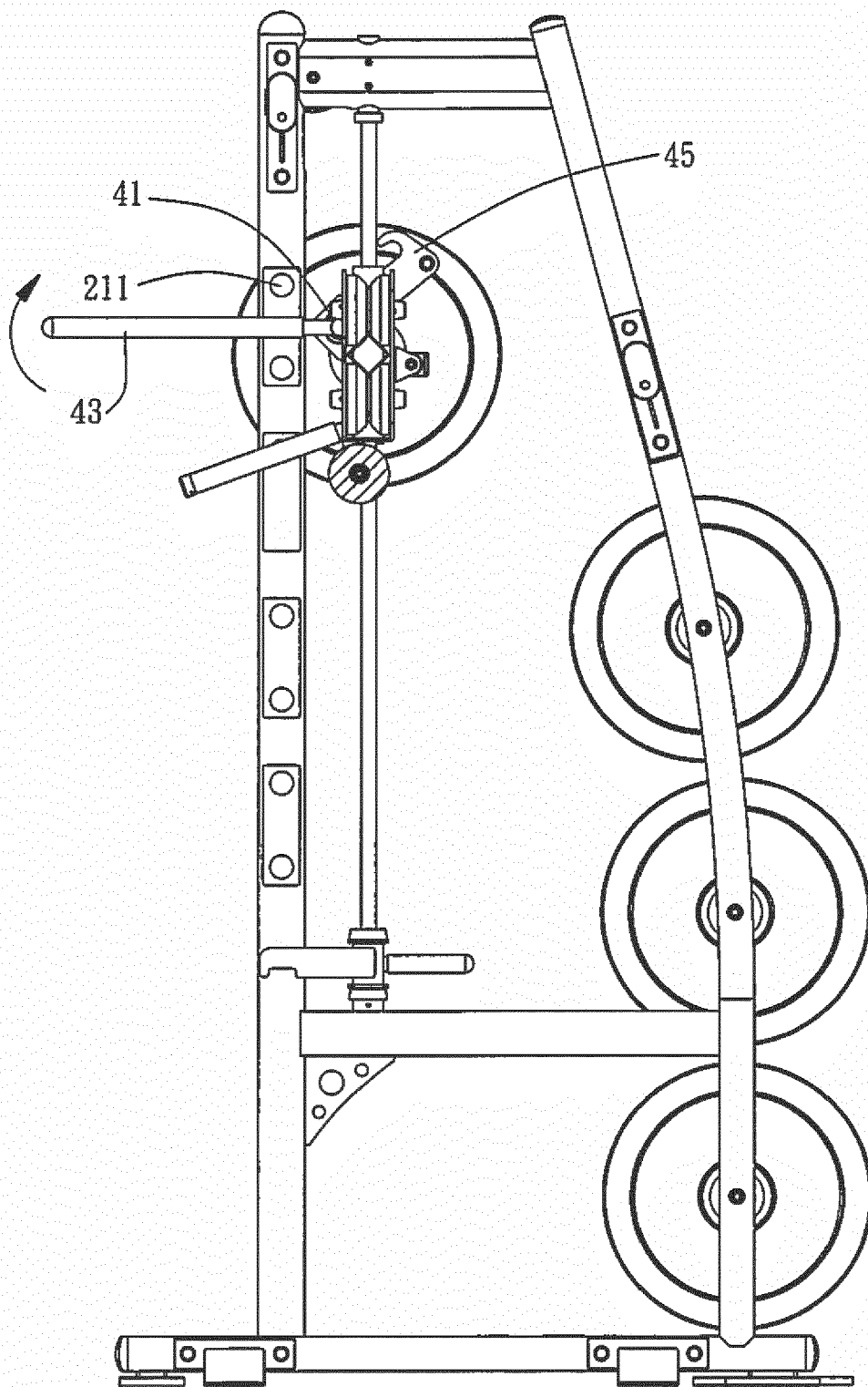


FIG. 6B

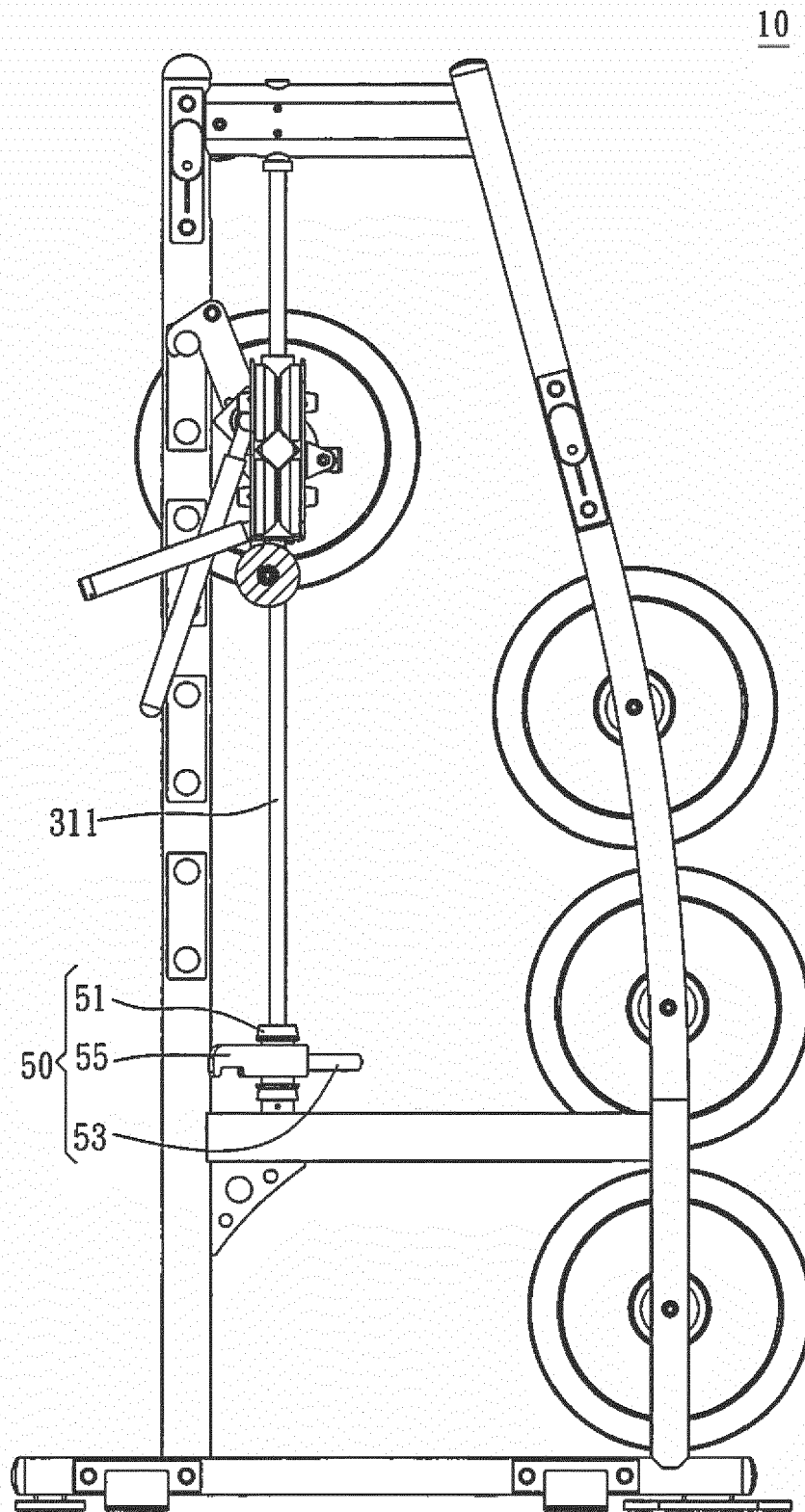


FIG. 7A

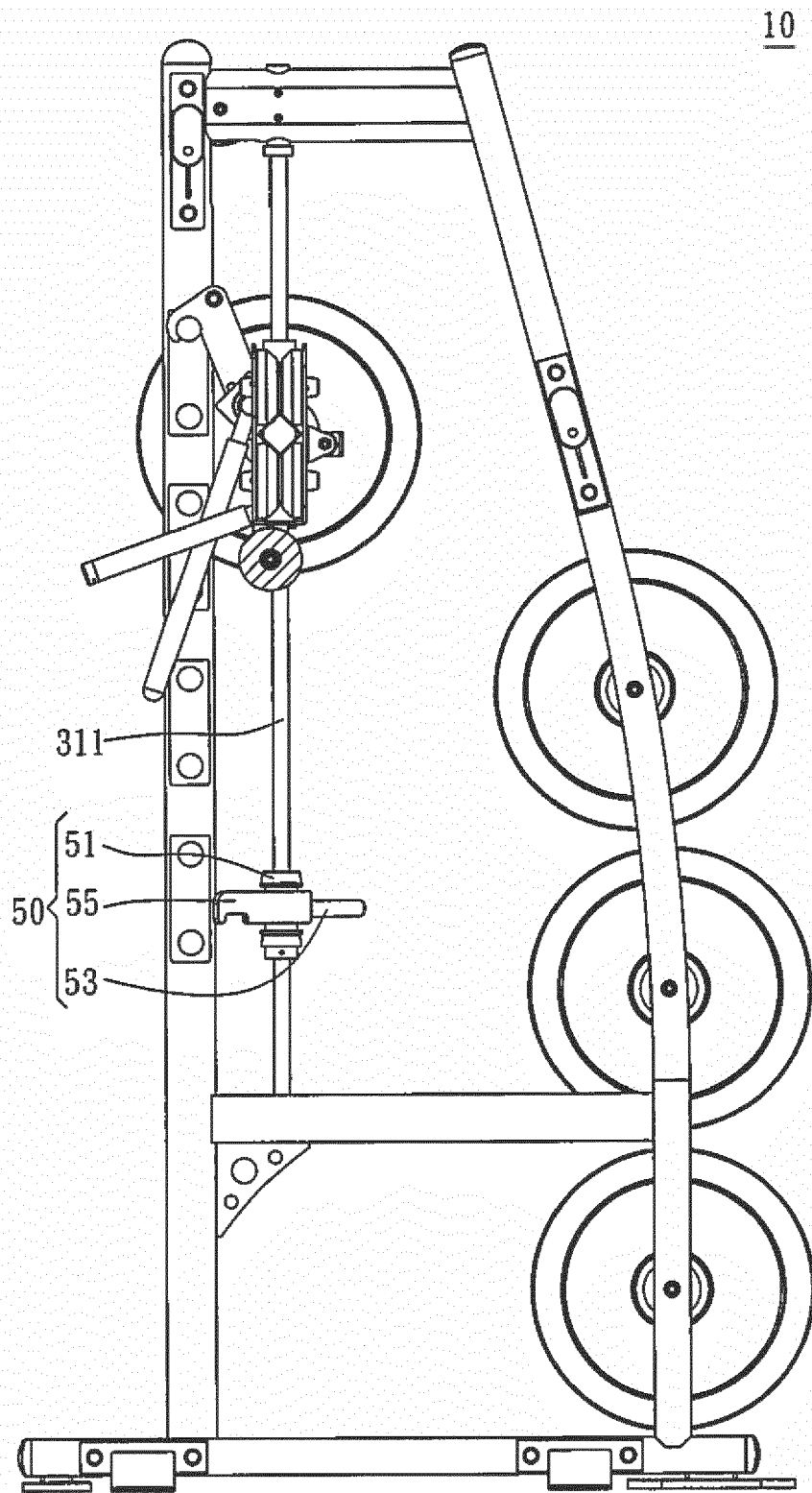


FIG. 7B

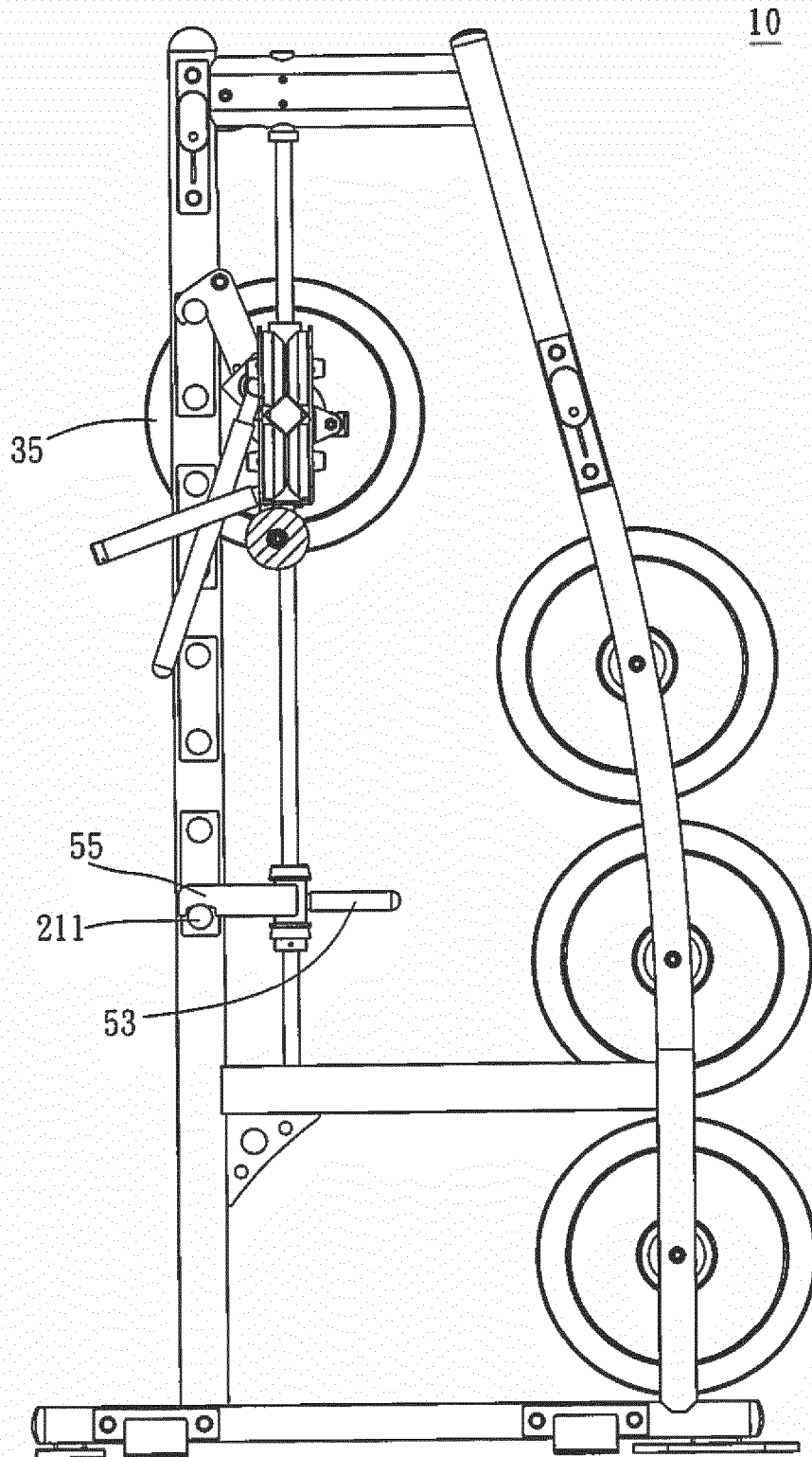
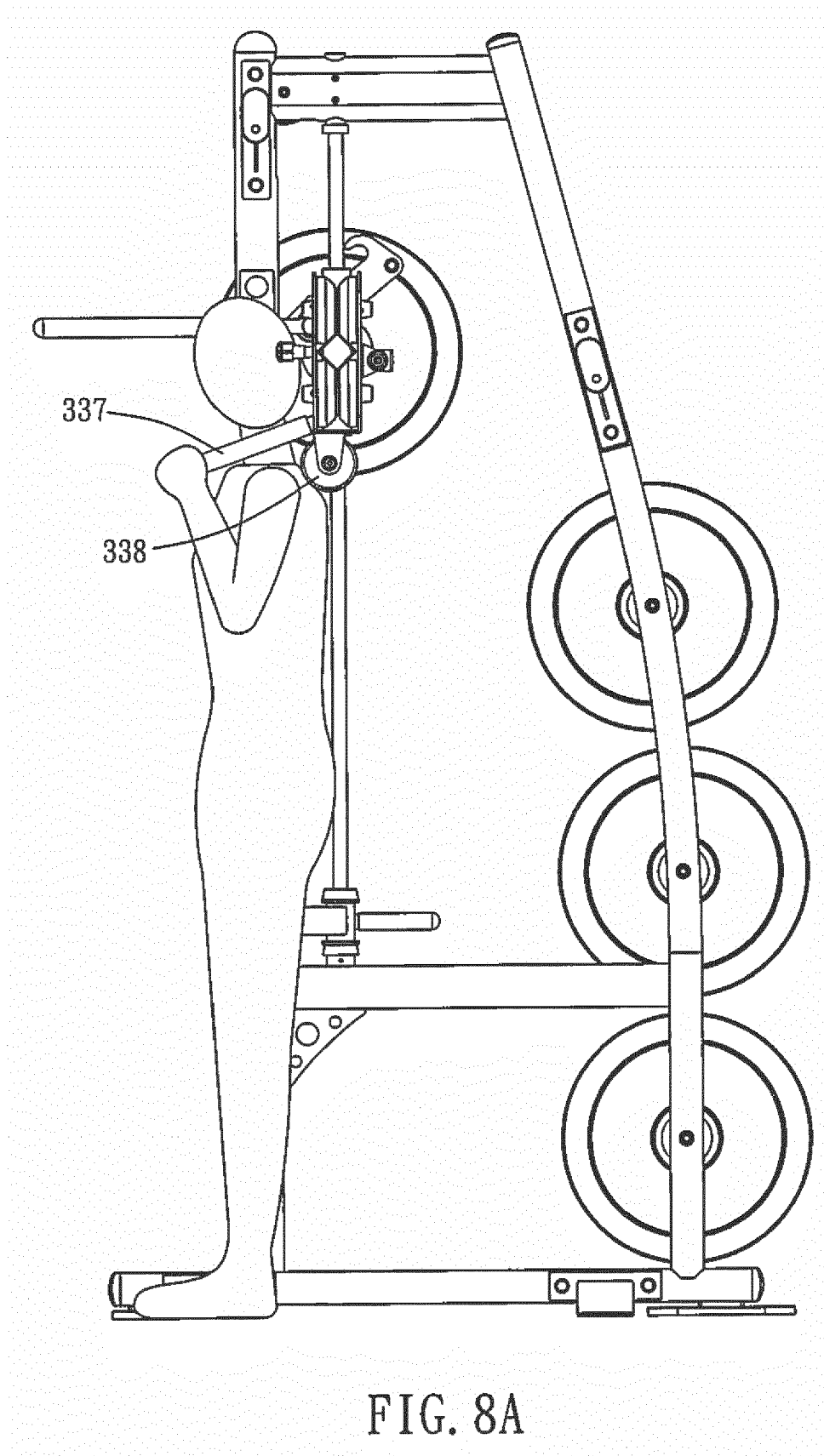


FIG. 7C



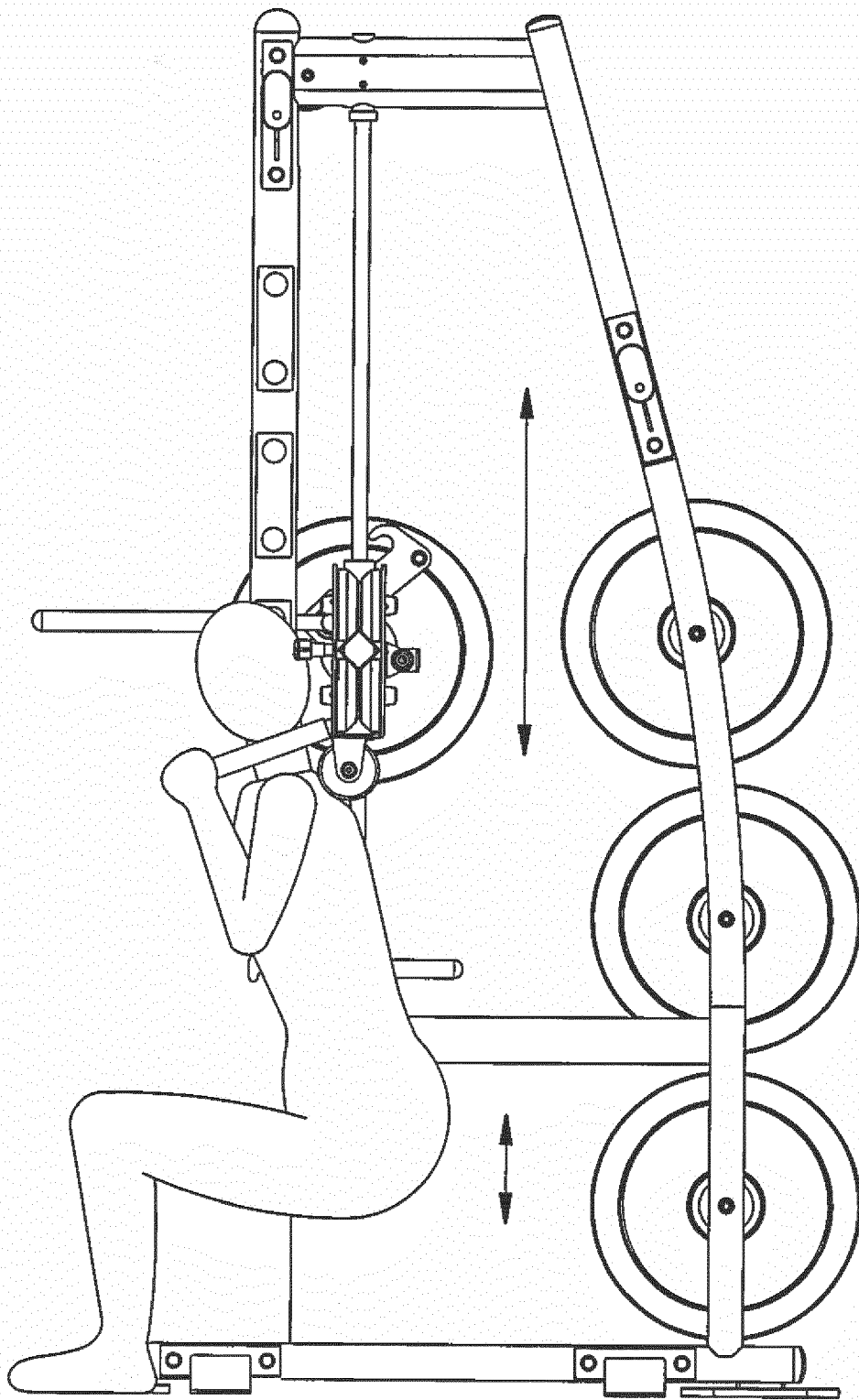


FIG. 8B

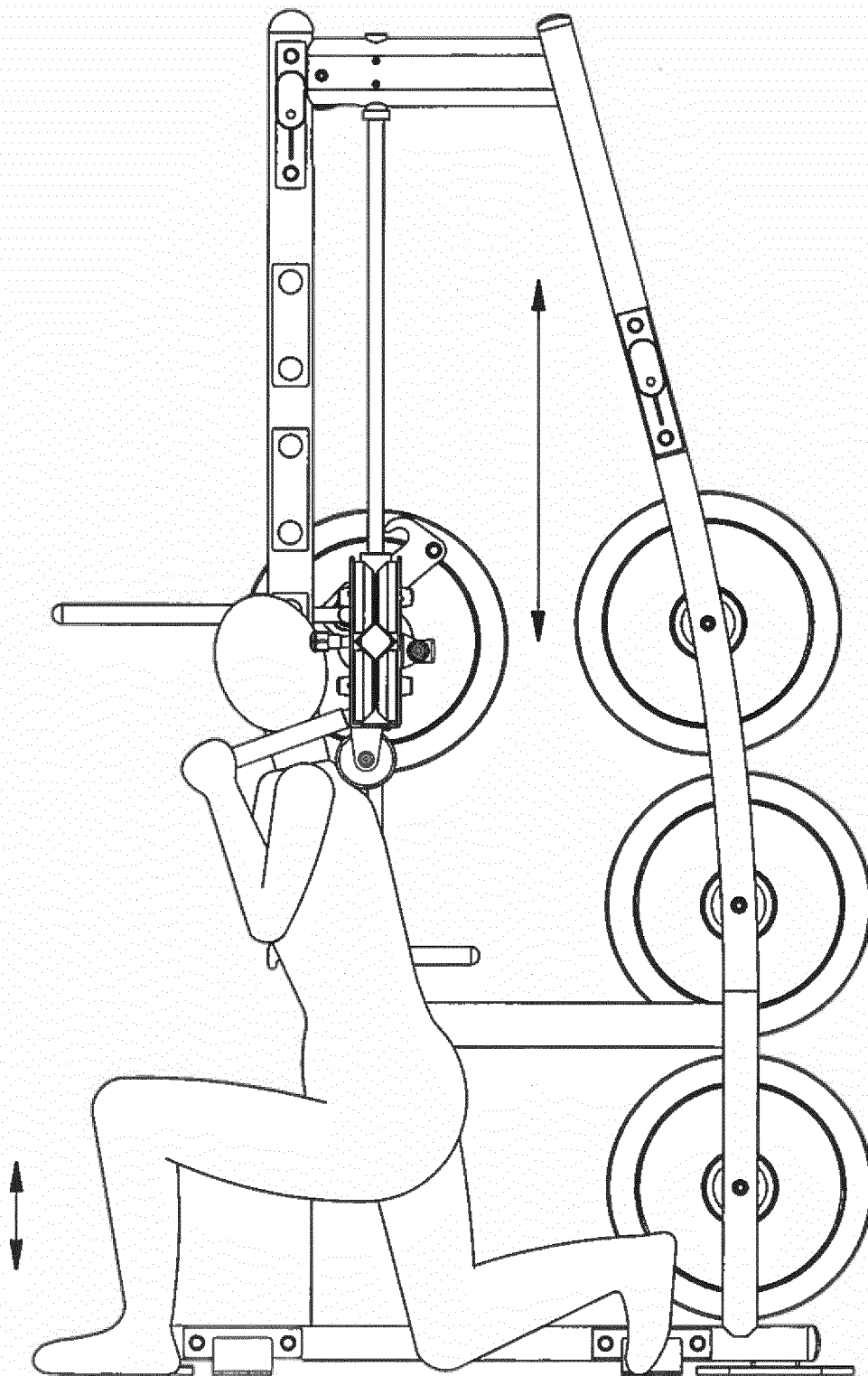


FIG. 8C

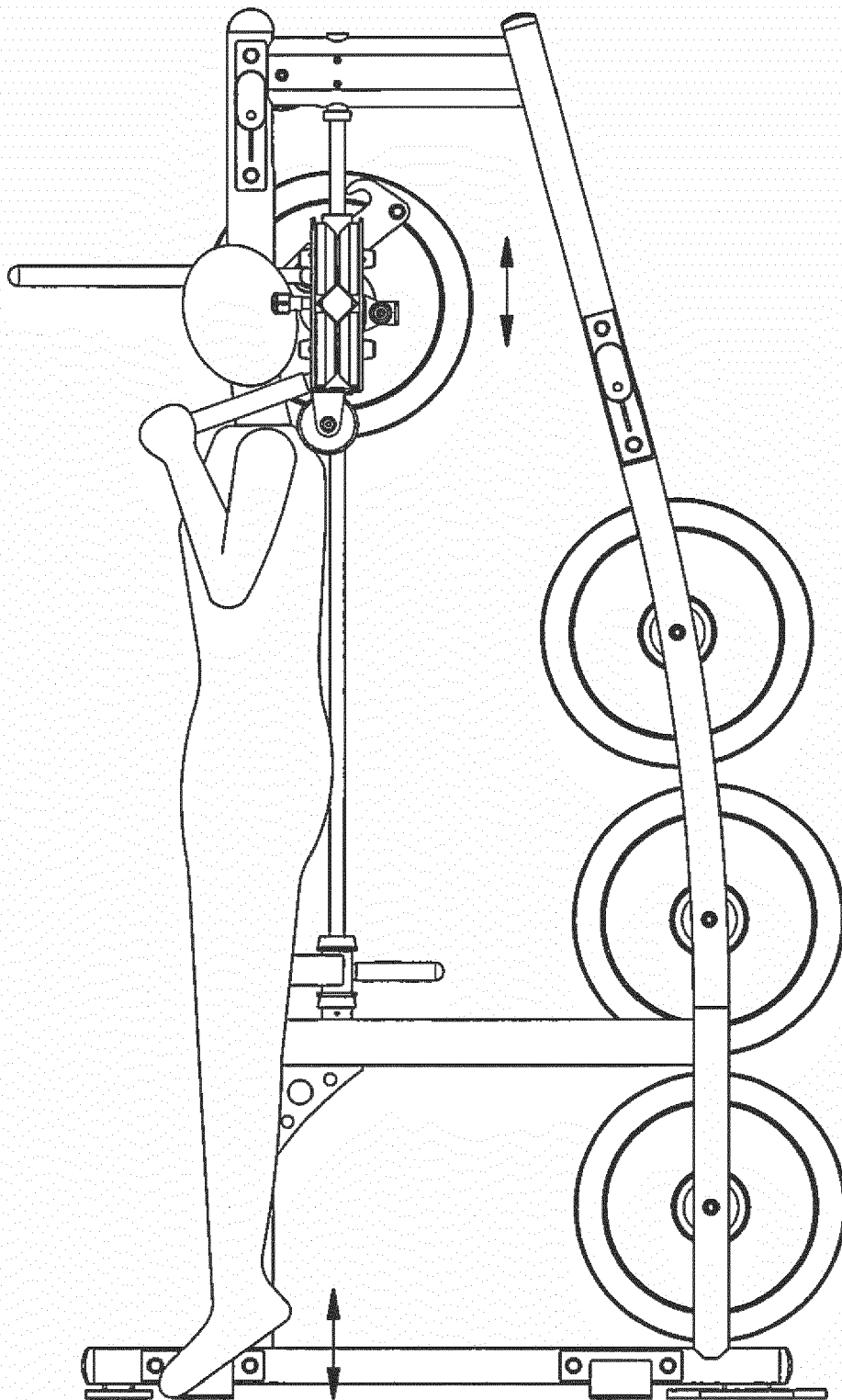


FIG. 8D

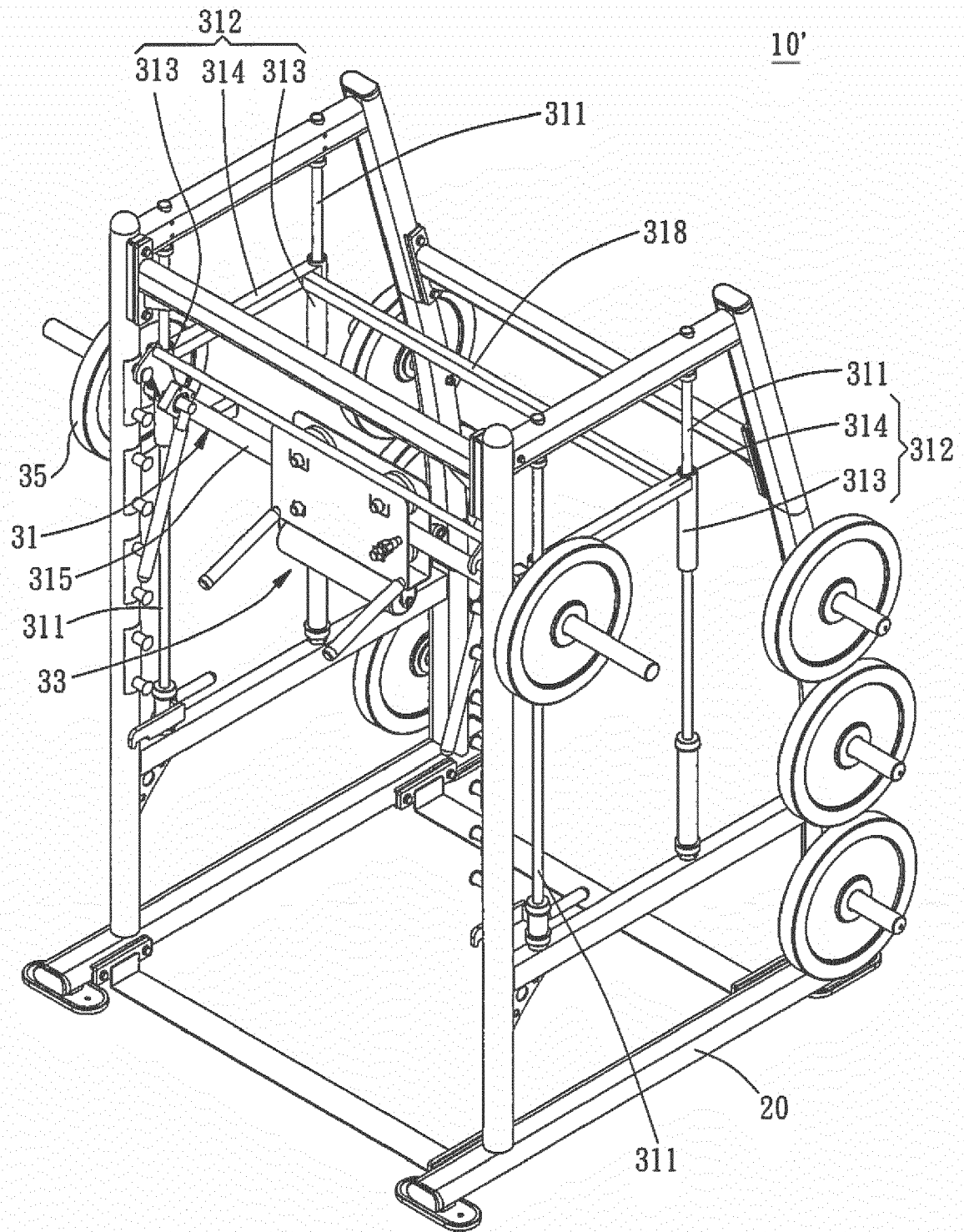


FIG. 9

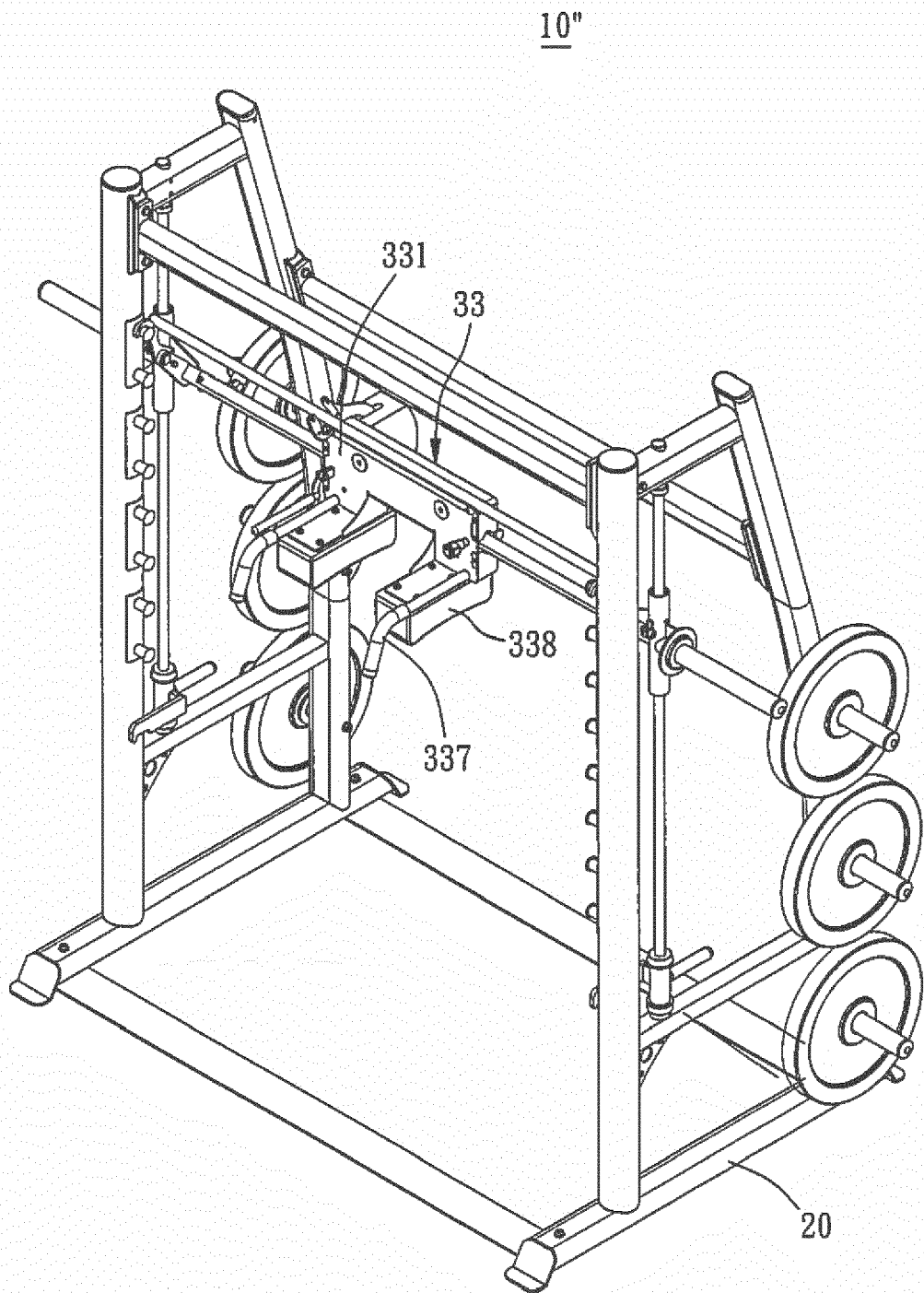


FIG. 10

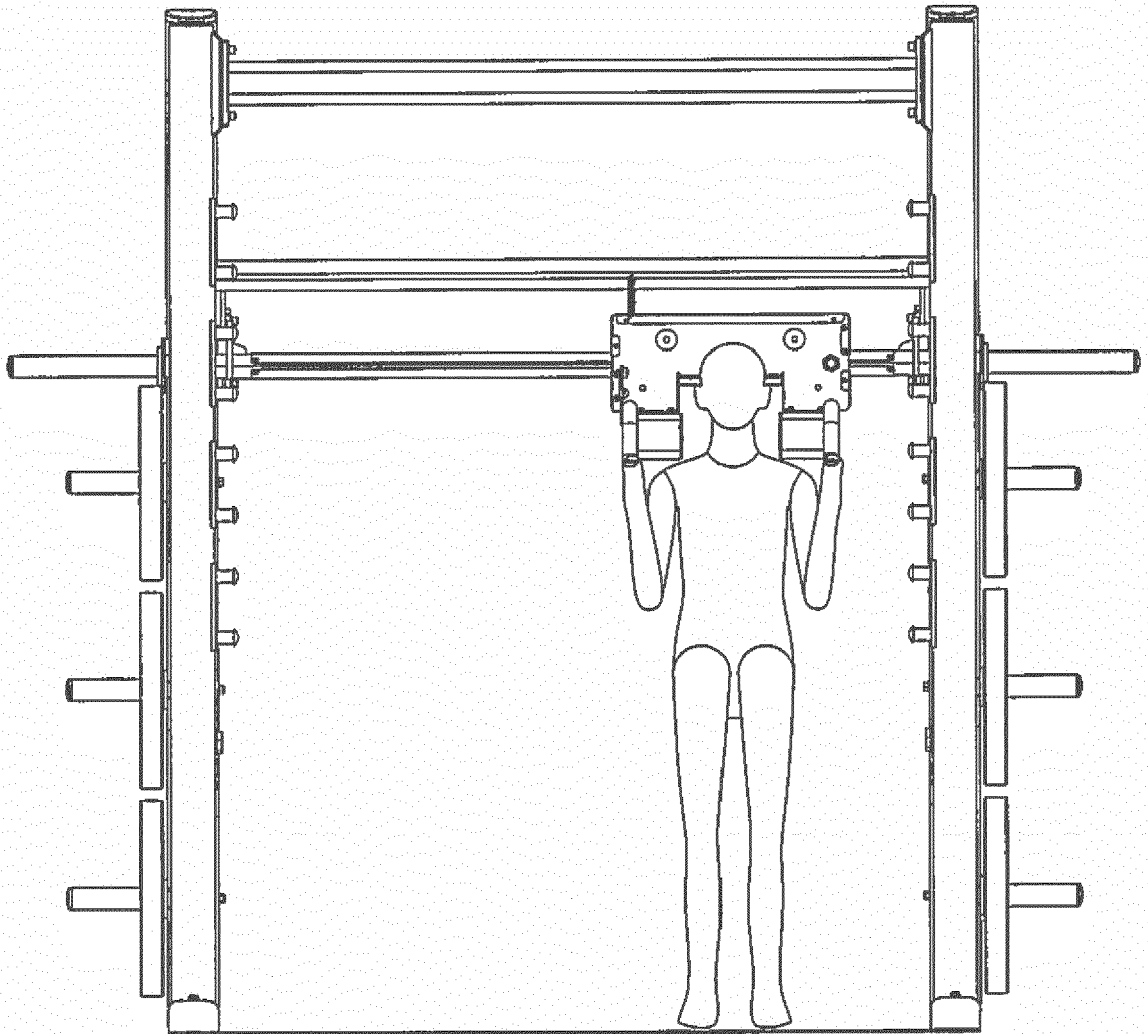
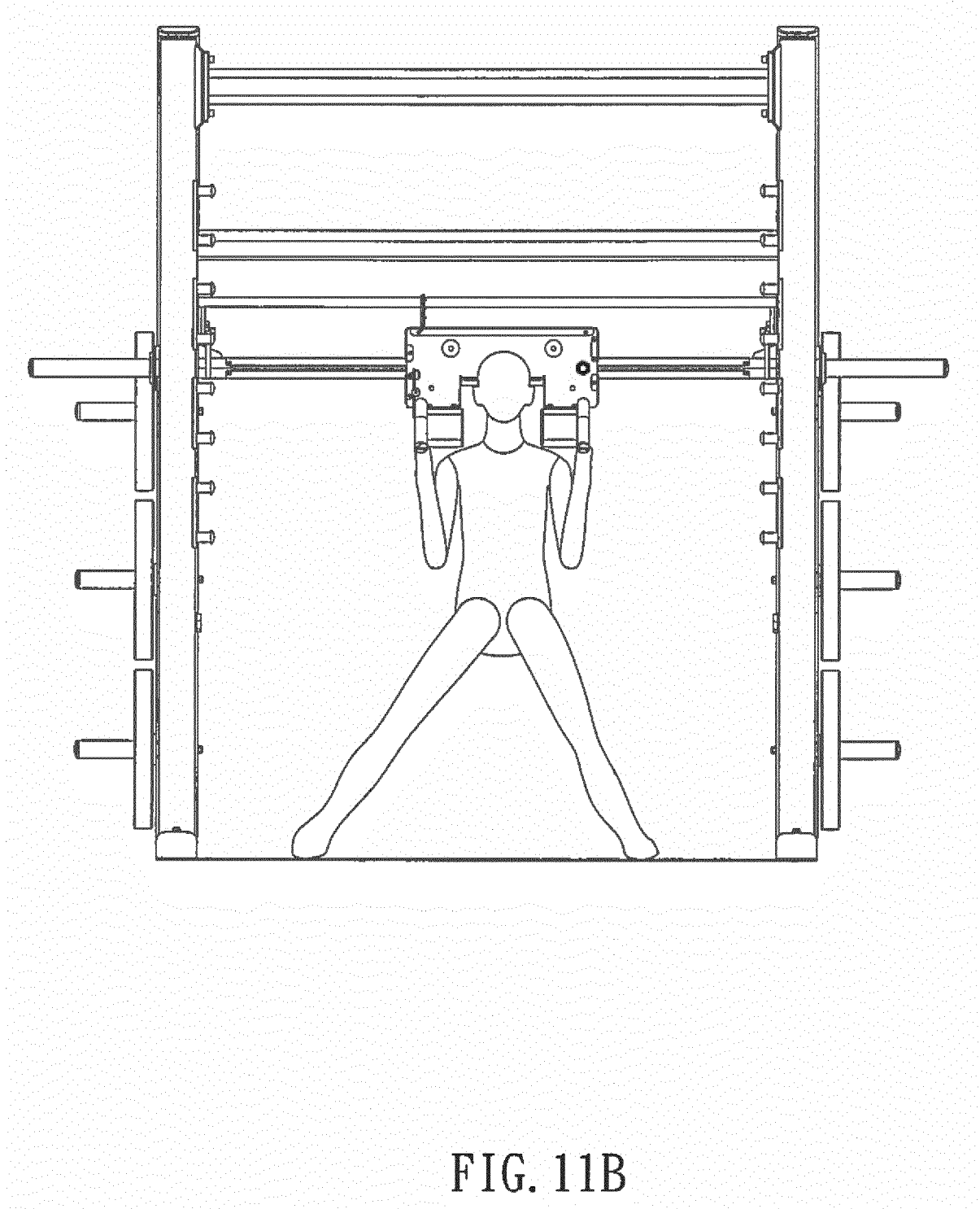


FIG. 11A



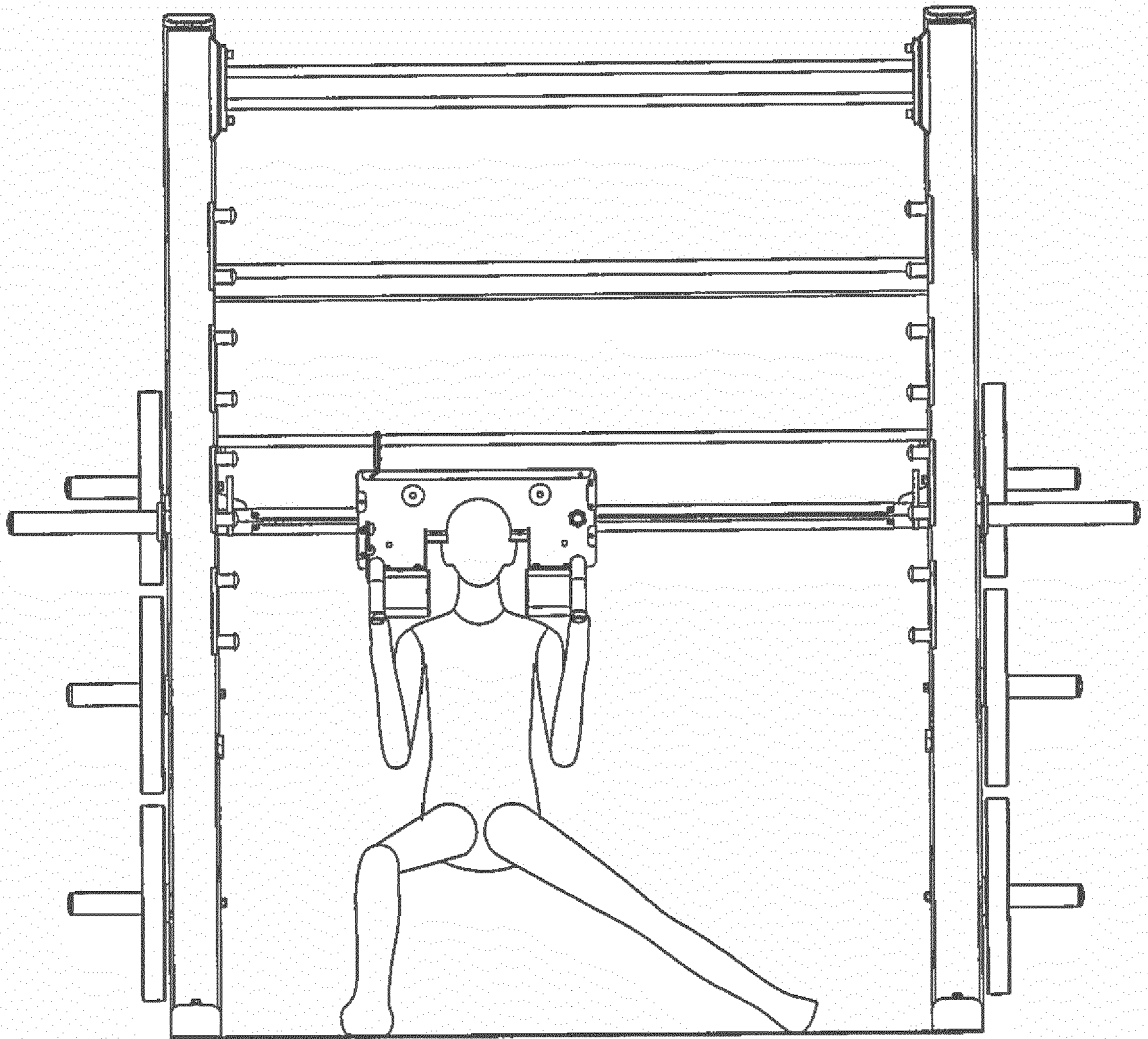
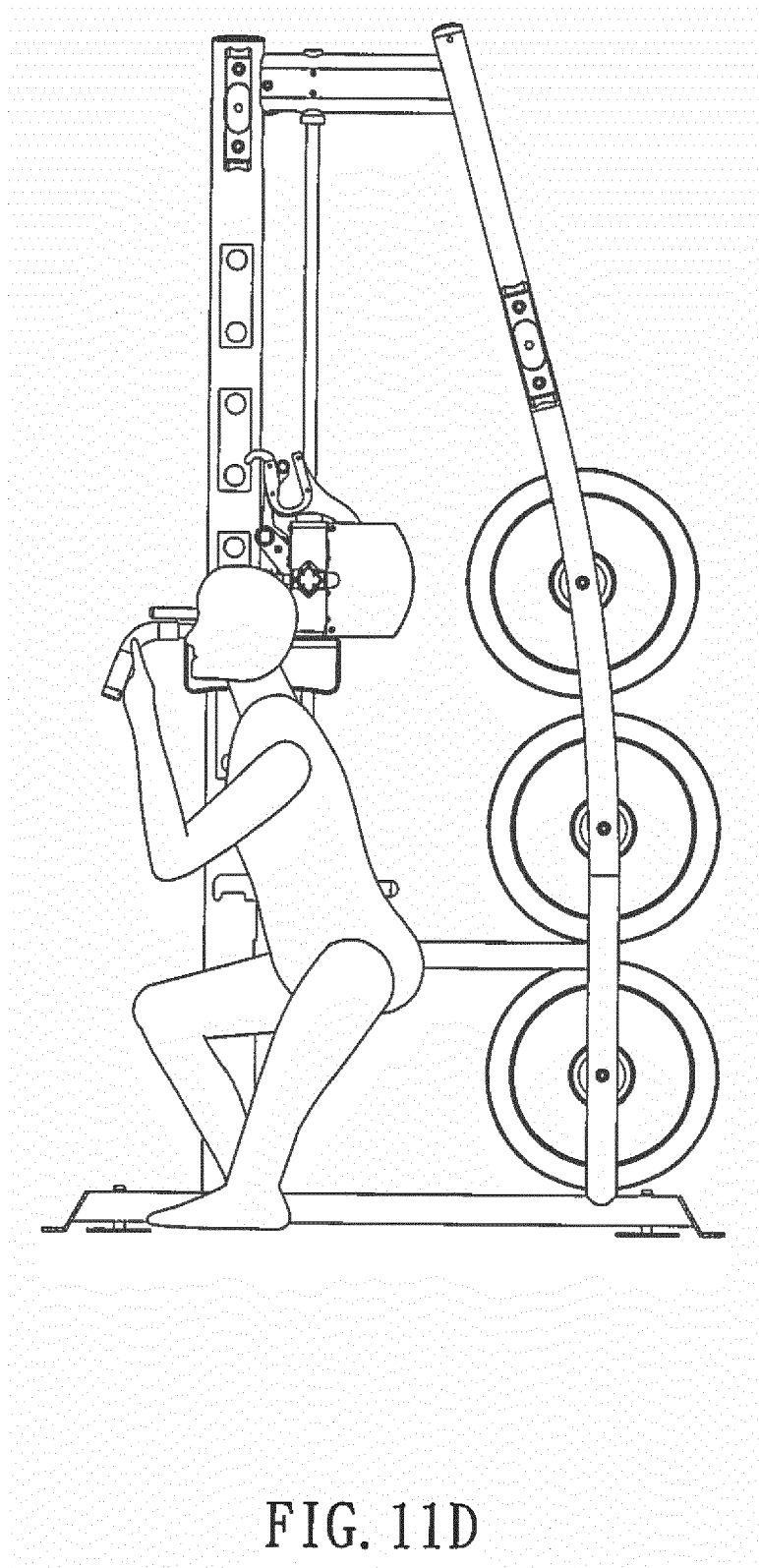


FIG. 11C



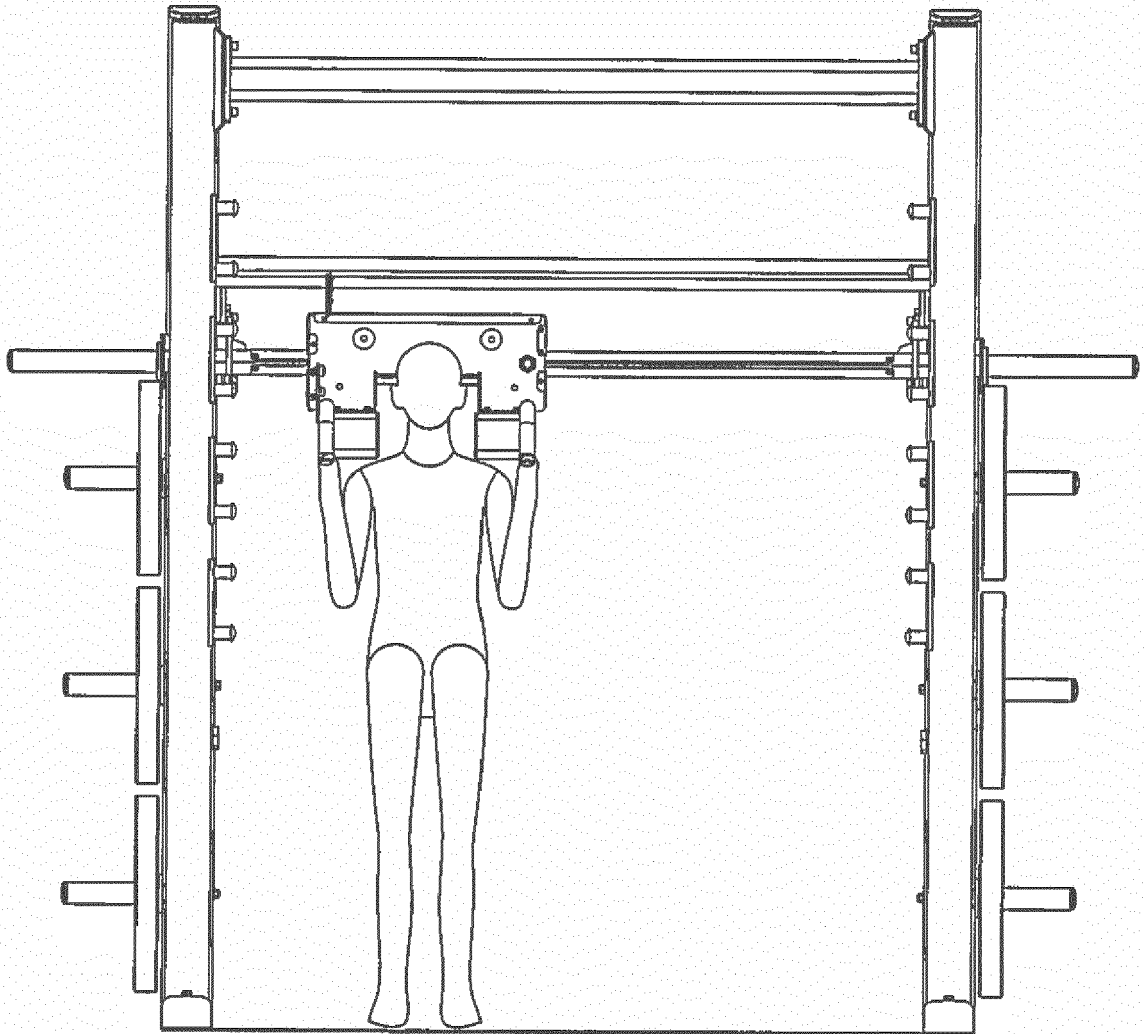


FIG. 11E

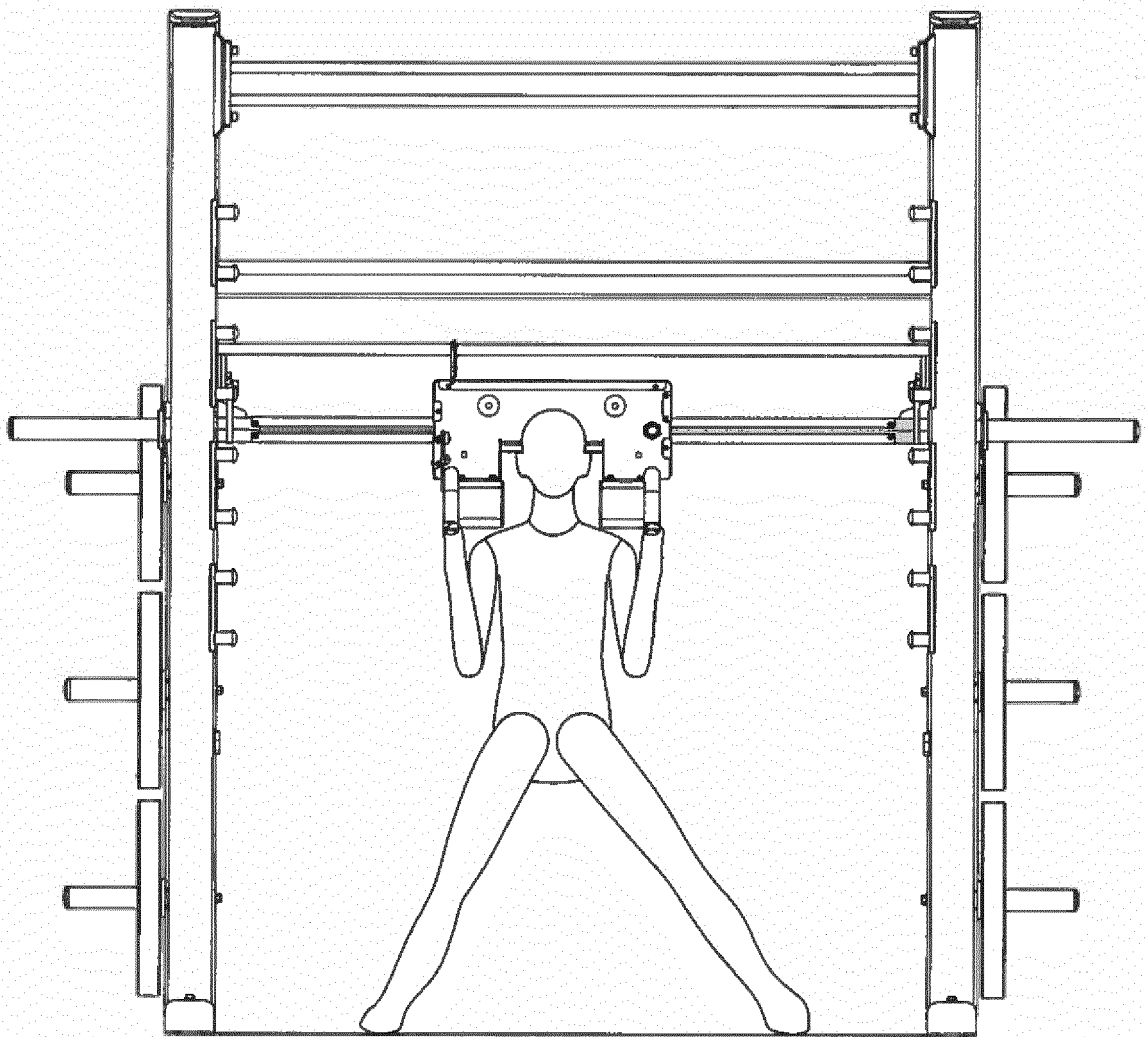


FIG. 11F

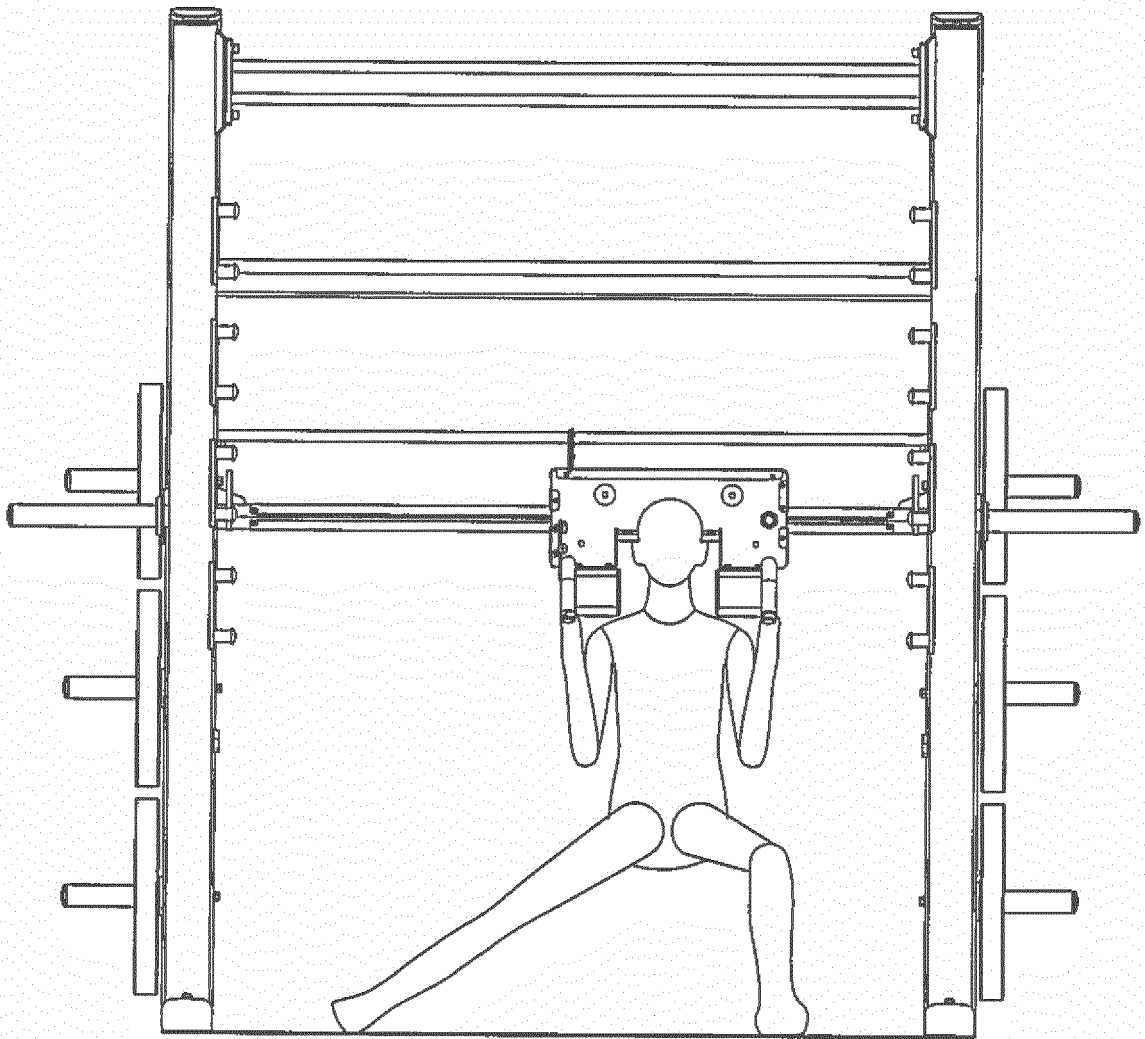
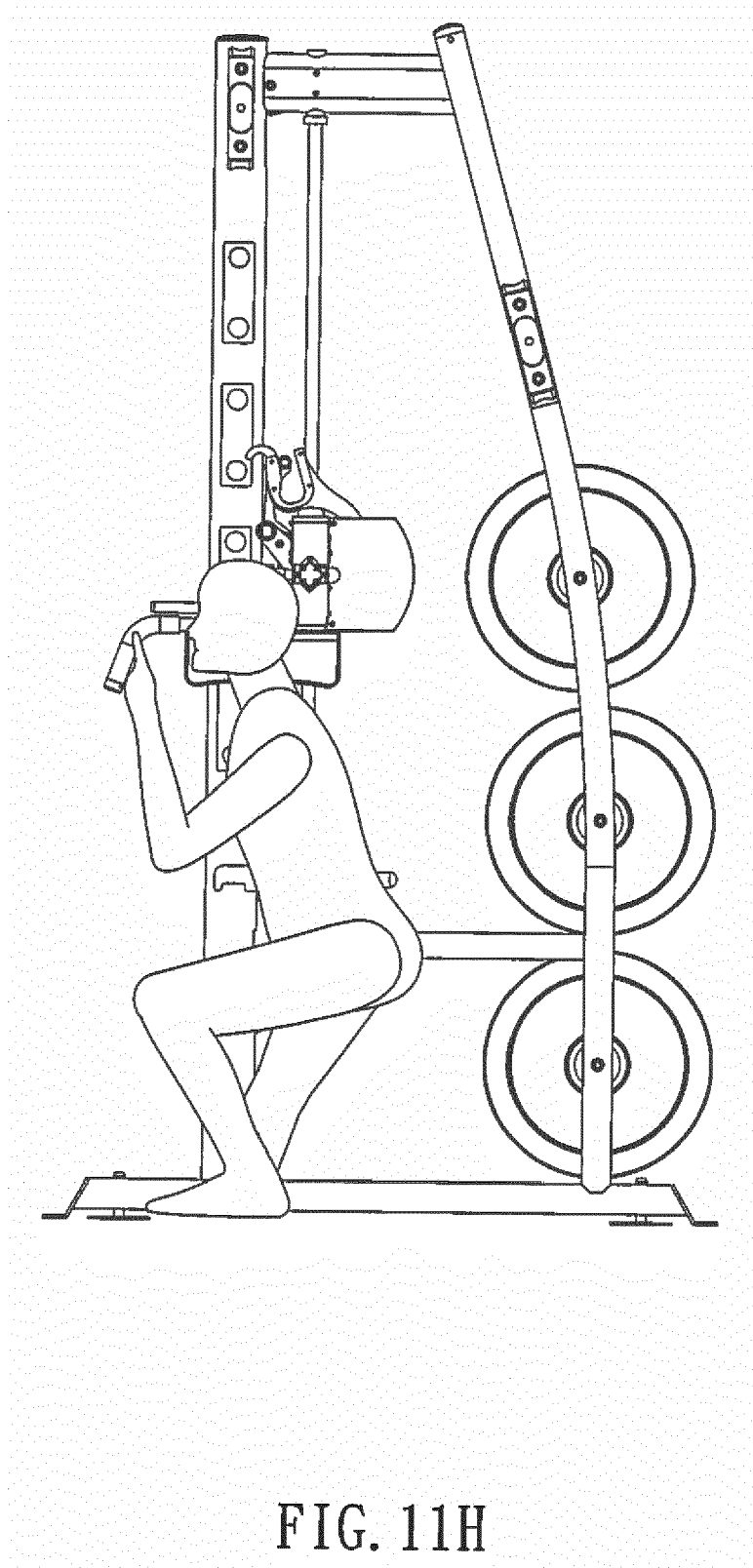


FIG. 11G





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Application Number  
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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                           |                                                     |                                              |
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| Place of search<br>Munich                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                           | Date of completion of the search<br>9 November 2016 | Examiner<br>Squeri, Michele                  |
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