

[54] **EXERCISE DEVICE**

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[58] Field of Search..... 272/81, 79 R, 83 R, 58

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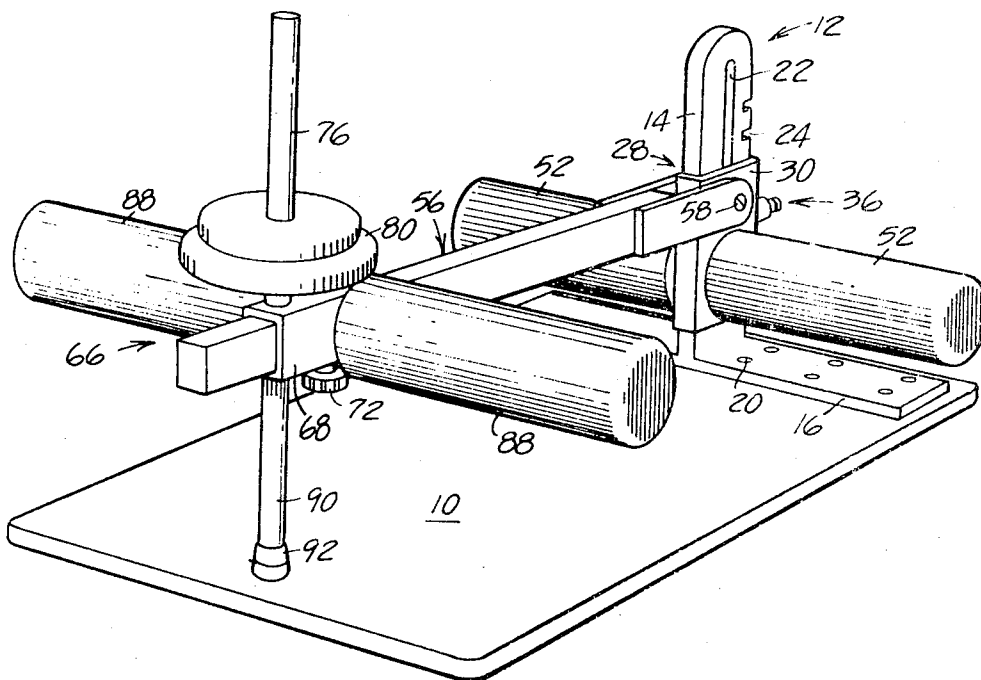
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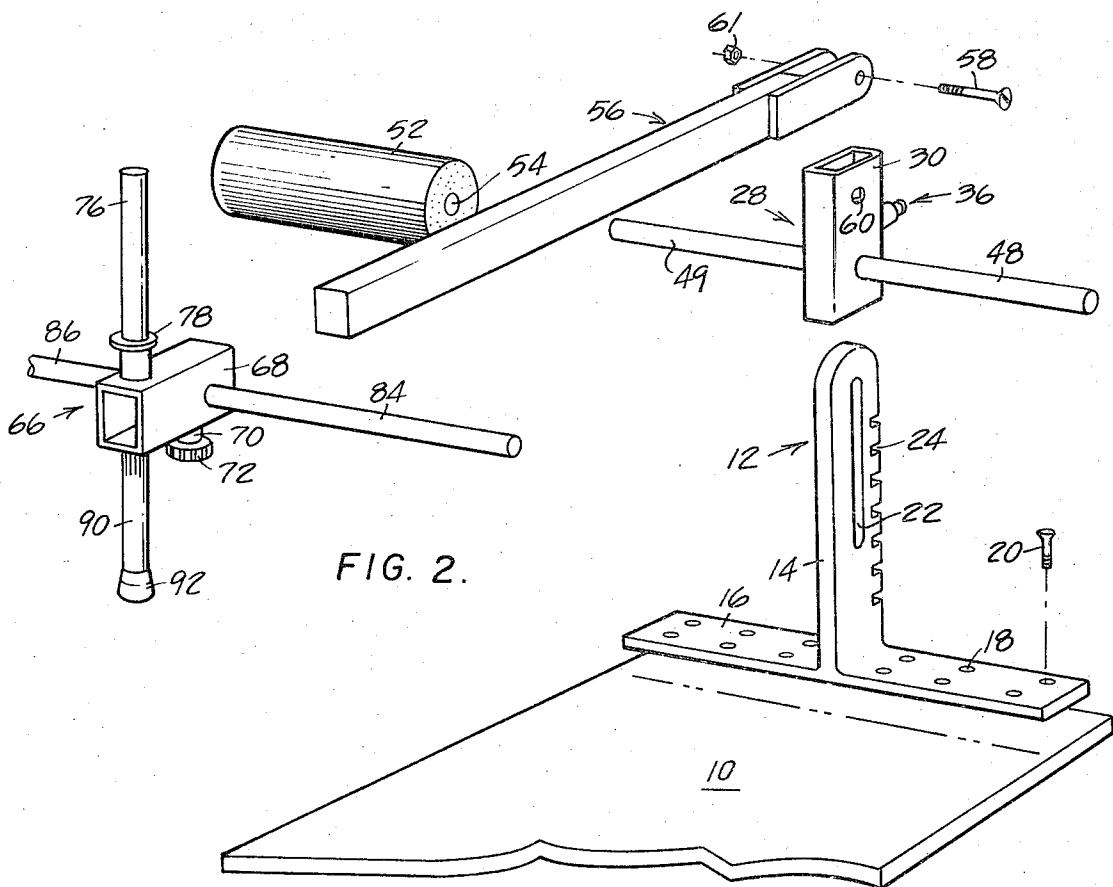
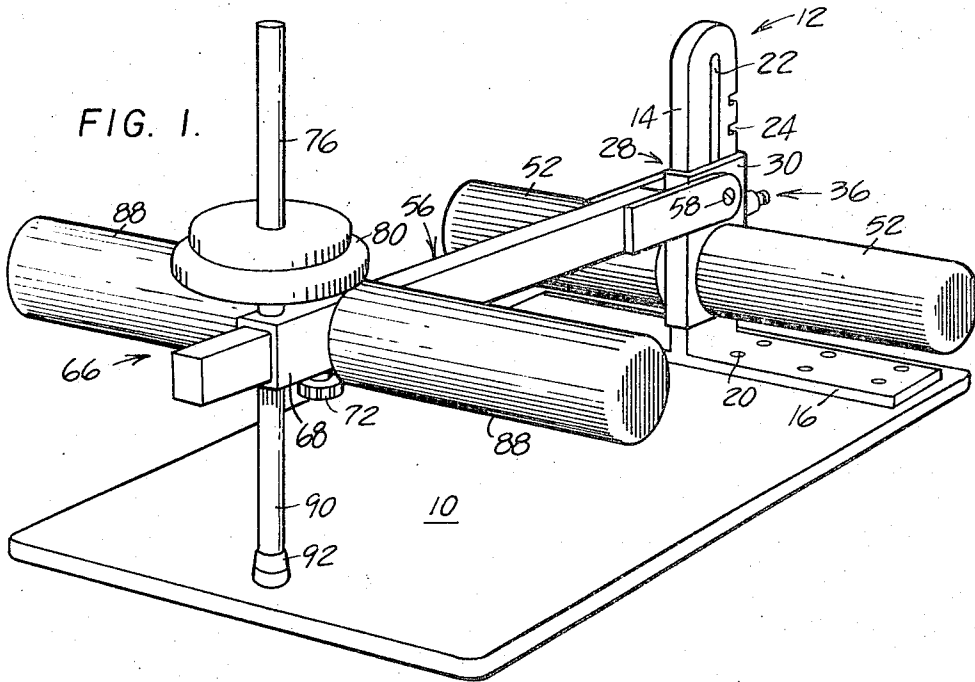
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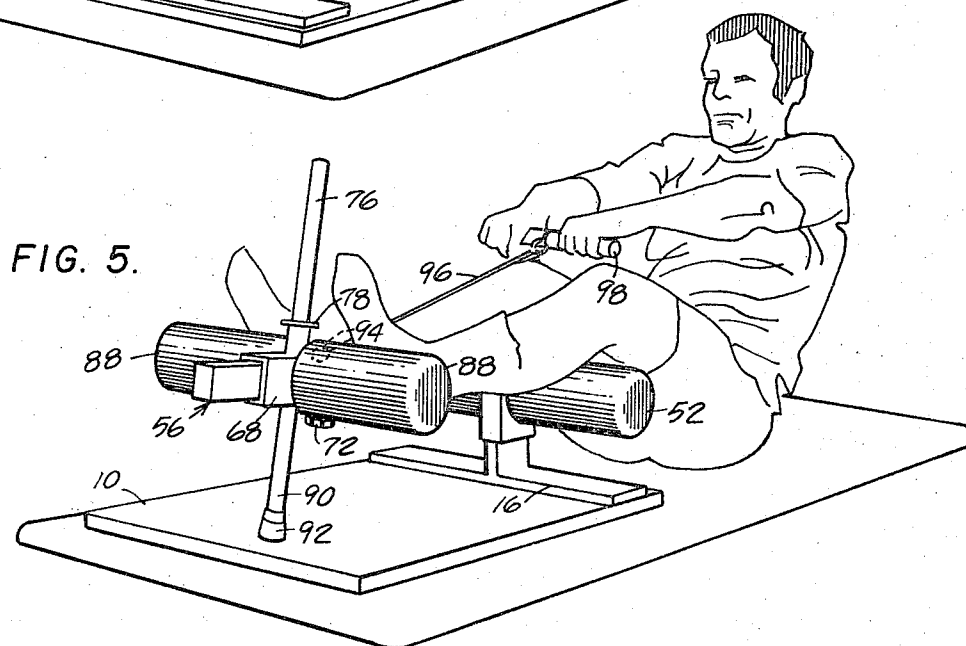
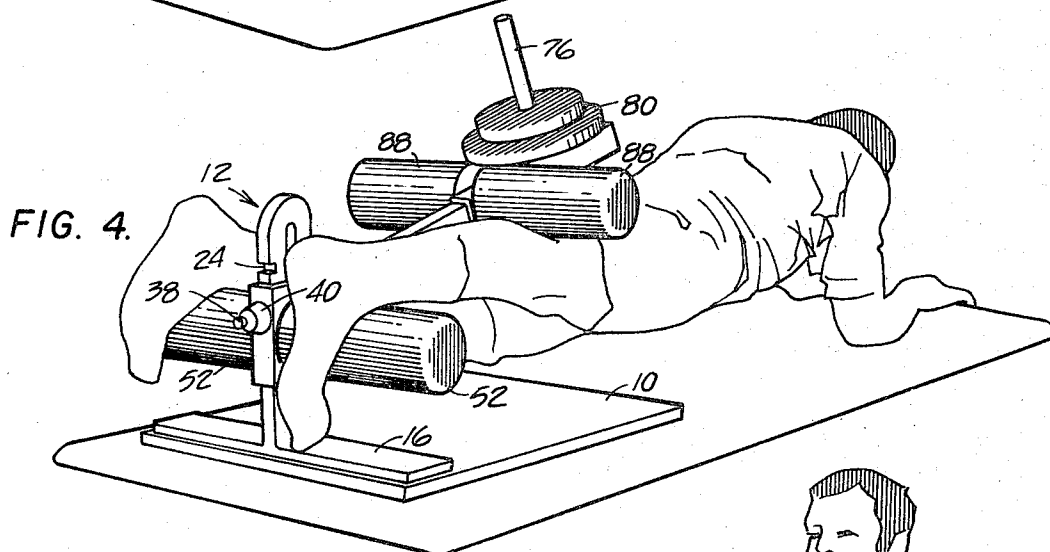
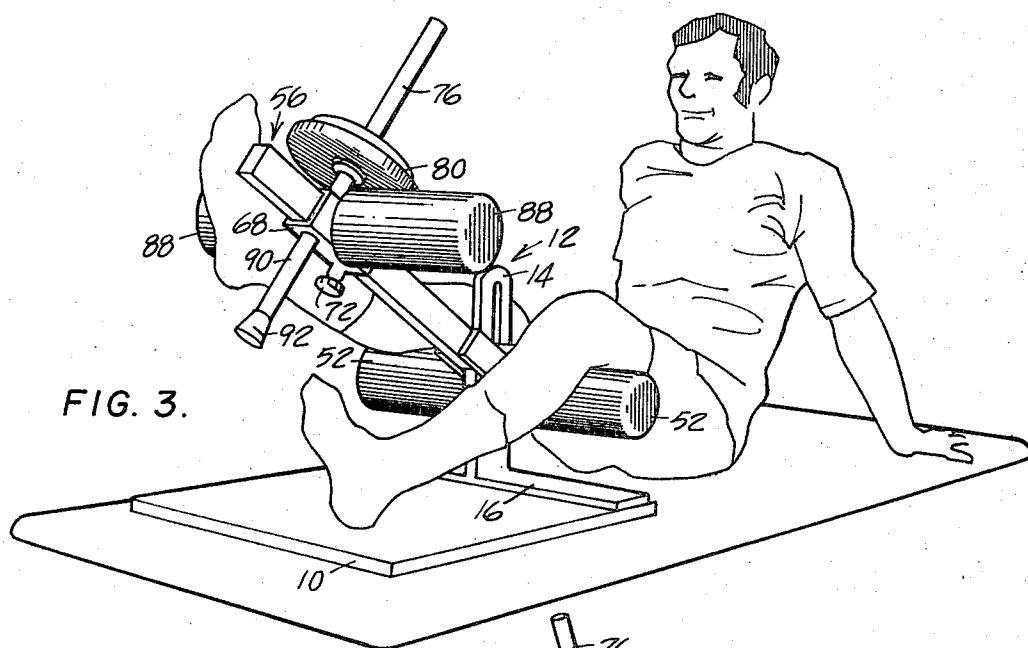
**ABSTRACT**

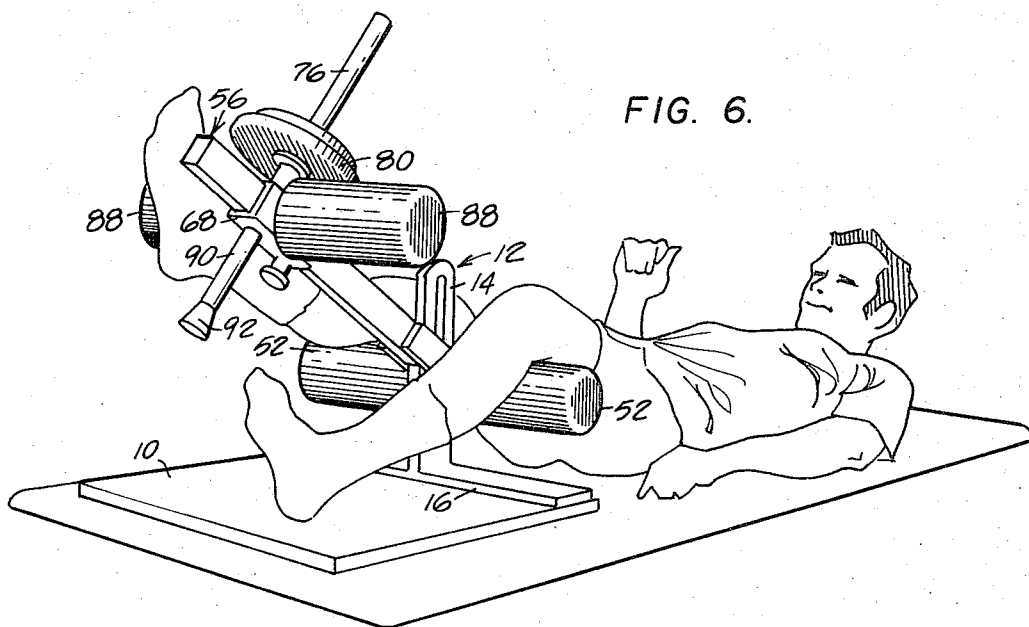
An exercise device is provided which elicits hamstring reinforcement of the quadriceps during terminal extension of the knee. The device has a main base member to which is secured a height adjustment post. Counter resistance means are slidably supported by the height adjustment post. A pivot arm is pivotally attached to the counter resistance means and resistance transfer means are slidably secured to the pivot arm.

**13 Claims, 6 Drawing Figures**









## EXERCISE DEVICE

## SUMMARY OF THE INVENTION

This invention relates to a device which may be used for performing exercises to develop and strengthen the muscles of the legs, hips, trunk and arms. The present invention provides an exercise device which is readily adjustable to perform several different exercises. In particular proper use of this invention develops and strengthens the muscles about the knee in a manner which previous exercise devices were unable to do.

Knee injuries have become a commonplace occurrence to many individuals today, especially athletes who participate in such contact sports such as football, soccer, rugby and basketball. Numerous promising athletic careers have been abruptly cut short by reason of knee injuries.

One of the primary problems in the rehabilitation of the injured or weakened knee is the strengthening of the musculature in order to stabilize the terminal phase of extension, that is, when the leg is straight. For example, during normal gait there is a simultaneous contraction of the hamstring and quadricep muscles during terminal extension at heel strike, just like there is prior to take off in a standing jump. The hamstring muscles act to pull the knee posteriorly into extension at heel strike thereby reinforcing the action of the quadriceps during terminal extension. Thus, one proven way to develop and strengthen the muscles about an injured knee is to provide hamstring reinforcement of the quadricep during terminal extension.

The following two paragraphs will define hamstring reinforcement as used in the present invention.

It is well-known that the quadriceps and the hamstrings work directly opposite to each other in function. The prime function of the quadriceps is knee extension. The prime function of the hamstrings is knee flexion. Thus, when the knee is bent the hamstrings are contracted and shortened and the quadriceps are relaxed and lengthened. As the knee goes from the bent position and starts to approach the straight or extended position, the hamstrings are relaxed and lengthened and the quadriceps are contracted and shortened.

However, it is now known that during the last few degrees of terminal extension or as the knee is becoming straight or is fully extended, the quadriceps and hamstrings no longer work directly opposite to each other in function. The quadriceps continue to be contracted and shortened while the hamstrings also contract and shorten at the last few degrees of terminal extension, pulling the tibia posteriorly, thus reinforcing the function of the quadriceps in straightening the knee.

Unfortunately, no current quadricep strengthening device presently on the market elicits hamstring reinforcement of the quadriceps during terminal extension of the knee. In fact, some devices even allow additional injury to occur to the knee because there is no limitation provided which restrains the actual movement of the knee during exercise.

I have overcome the above problems by providing an exercise device in which resistance can be given in a progressive manner for terminal extension of the knee in the long sitting, supine and prone positions thus strengthening the knee extensors and eliciting hamstring reinforcement of the quadriceps during terminal

extension but still limiting the range of knee motion during exercise.

It is the primary object of the present invention to provide a new and improved exercise device.

Another object is to provide structure which is lightweight, portable and economical to produce.

Another object is to provide structure in which the muscles about the knee cannot be exercised through their full range of motion, thus minimizing the danger of further trauma to the weakened, damaged or post surgical knee.

A further object of the invention is to provide an exercise device which allots progressive resistance exercise to the knee flexors, knee extensors, hip flexors, hip extensors, trunk flexors and trunk extensors, depending of course upon which position is assumed during exercise.

A still further object is to provide structure having a hand grip member which allows compression isometrics of the hamstrings and quadriceps while in minimal flexion of the knee joint.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the exercise device of the present invention.

FIG. 2 is an exploded perspective view of the exercise device of the present invention.

FIG. 3 illustrates the exercise device being used with the exercisor in the long sitting position.

FIG. 4 illustrates the exercise device being used with the exercisor in the prone position.

FIG. 5 illustrates the exercise device being used with the exercisor in the compression isometrics sitting position.

FIG. 6 illustrates the exercise device being used with the exercisor in the supine position.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1 in conjunction with FIG. 2, the exercise device comprises a main base 10, preferably in the form of a flat board-like member, onto which is mounted a height adjustment post, shown generally at 12. The height adjustment post 12 comprises an upright rail or post 14 which projects perpendicularly from a base plate 16 which is provided with a series of holes 18 through which fasteners 20 may be inserted to attach plate 16 to the top of main base 10 as shown. The post 14 is provided with a relatively long vertical slot 22 and is further provided with a series of horizontal slots 24 located on the rearward side of the post.

A counter resistance means, shown generally at 28, is adapted to be received on the post 14 in various vertically adjustable positions. The counter resistance means comprises a rectangular shaped tube 30 which slidably engages the post 14 as shown. The tube 30 is provided with a hole 32 on the posterior side thereof which hole may be selectively aligned with a desired one of the horizontal slots 24 formed on the rearward side of post 14.

As is also well-known, for every force there is an equal and opposite force for that object to remain at equilibrium and in an exercise device such as lifting weights over one's head the counter resistance to the weight is the ground or floor that one stands on.

The use of the counter resistance means 28 is an integral part of the exercise unit as it engages the exer-

cisor's leg and is adjustable up and down on the height adjustment post 12 which is secured to a main base member 10. Adjusting the vertical height of the counter resistance means on the height adjustment post changes the angle of the exercisor's hip and knee. The exercisor presses on the counter resistance means in contact with that portion of the leg as the portion of the leg in contact with the resistance transfer means lifts the weight against gravity.

As best shown in FIG. 2, a spring loaded locking mechanism, shown generally at 36, is provided around the hole 32 of the tube 30. A pin 38 is retained in position by a cover 40 secured to the tube 30. The pin has a flange 42 thereon and a spring 44 urges the pin 38 inwardly toward the hole 32 at all times. The outer end of the pin can be manually engaged to pull the pin out of its locking position for vertical adjustment of the position of the counter resistance means 28 relative to the height adjustment post 12.

The tube 30 is also provided with lateral tubular extensions 48 and 49 on each side thereof. Each tubular extension has a roller pad 52 mounted thereon. The roller pads are preferably made of flexible polyethylene and have a hole 54 extending therethrough for mounting same on the tubular extensions 48 and 49.

A pivot arm, generally shown at 56, is pivotally mounted to the counter resistance means 28 by means of a pivot pin 58 which passes through a hole 60 formed through the tube 30. The pin 58 is held in place by lock nut 61 and is free to slide in slot 22 of the height adjustment post 12 when the counter resistance means 28 is adjusted vertically relative to the height adjustment post 12.

A resistance transfer means, shown generally at 66, is adapted to be slidably received on the pivot arm 56 in various adjustable positions. The resistance transfer mechanism comprises a rectangular or square shaped tube 68 which is adapted to slidably engage the outside of pivot arm 56. Of course, the shape of tube 68 depends on the shape of pivot arm 56. The tubular member 68 is provided with a hole (not shown) on the underside thereof which has been threaded to accept a threaded bolt 70 onto which a turning knob 72 has been attached, thus locking the resistance transfer mechanism onto the pivot arm 56 when the bolt 70 is forced against pivot arm 56, so that the resistance transfer means 66 may be selectively positioned along the length of the pivot arm 56.

The resistance transfer means 66 further comprises a first vertical post 76 extending upwardly from the rectangular tube 68. The post 76 has a fixed retaining ring 78 formed near its lower end so that one or more weights 80 and 82 may be placed over the post. Of course, the heavier the weights 80 and 82, the greater the amount of resistance. Thus it can be seen that the resistance transfer means 66 applies a downward force to the leg of an exercisor during the elevation of the leg.

Mounted on the sides of rectangular tube 68 are a pair of laterally extending tubular members 84 and 86. Each tubular extension has a roller pad 88 mounted thereon in identical fashion to the arrangement previously described with respect to the counter resistance means 28.

Mounted on the lower side of rectangular tube 68 is a second post element 90 which is provided with a rubber pad 92 which pad normally rests on the main base

10 thereby maintaining the resistance transfer means at a desired height above the main base.

The long sitting and supine positions illustrated in FIGS. 3 and 6 strengthen the knee extensors as well as providing hamstring reinforcement of the quadriceps. This occurs because the hamstrings contract in an effort to extend the hip as the counter resistance is applied to the posterior portion of the knee, thus reinforcing the quadriceps as the resistance is applied to the knee extensors through the resistance transfer means 66. There is less strain on the abdominals in the long sitting position compared to the supine but the results are the same as it relates to the hamstring reinforcement of the quadriceps.

The range of knee motion during exercise is limited by the position of the counter resistance means 28. Even when the counter resistance means 28 is positioned as high as possible on uppermost horizontal slot 24, the maximum amount of possible knee flexion is approximately 70°. As the position of the counter resistance means 28 is lowered, the maximum amount of possible knee flexion is naturally decreased.

Also referring to FIG. 3, when the knee is fully extended and lifted above the counter resistance means 28, then the hip and trunk flexors are strengthened and the hamstring reinforcement of the quadriceps ceases.

The prone position of FIG. 4 is somewhat like the long sitting and supine positions of FIGS. 3 and 6 but with stronger hamstring reinforcement because the whole body is extended once the knee is off the ground. In other words, there is simultaneous extension of the knee and hip.

The prone position of FIG. 4 places greater emphasis on the hip extensor mechanism by placing the resistance over the posterior portion of the knee and the foot over the counter resistance means 28, thus providing maximum hamstring reinforcement of the quadriceps during terminal extension of the knee.

The compression isometrics sitting position of FIG. 5 with the handgrips or handle members 98 attached to the resistance transfer means 66 elicits simultaneous extension of the knee and the hip without movement and exerting a compressive force through the articular surfaces of the knee joint, thus strengthening the muscles and restoring normal fluid dynamics of the knee. In addition, the trunk and shoulder extensor mechanisms are strengthened through isometrics.

In any of the above positions, either knee can be exercised by itself, or both knees can be exercised simultaneously.

Thus, it will be seen that the present invention provides structure which can be used by an exercisor to strengthen the knee extensors and elicit hamstring reinforcement of the quadriceps during terminal extension but still limits the range of knee motion during exercise.

What is claimed is:

1. An exercise device comprising:

- a. a main base member,
- b. a height adjustment post secured to said main base member,
- c. counter resistance means slidably supported by said height adjustment post,
- d. a pivot arm pivotally attached to said counter resistance means,

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e. and resistance transfer means for applying a downward force to the leg of an exercisor during elevation thereof and slidably secured to said pivot arm whereby hamstring reinforcement of the quadriceps is elicited during terminal extension of the knee.

2. The exercise device of claim 1 wherein first locking means are provided in conjunction with the slidable connection between the height adjustment post and the counter resistance means whereby the height of said counter resistance means above the main base member is selectively adjustable.

3. The exercise device of claim 2 wherein second locking means are provided in conjunction with the slidable connection between the pivot arm and the resistance transfer means whereby the position of said resistance transfer means along the length of said pivot arm is selectively adjustable.

4. The exercise device of claim 1 wherein second locking means are provided in conjunction with the slidable connection between the pivot arm and the resistance transfer means whereby the position of said resistance transfer means along the length of said pivot arm is selectively adjustable.

5. The exercise device of claim 1 wherein weight receiving means are provided on the resistance transfer means whereby one or more weights may be selectively utilized in conjunction with the resistance transfer means.

6. The exercise device of claim 1 wherein the counter resistance means is provided with a lateral extension on each side thereof, each extension having associated

therewith a roller pad.

7. The exercise device of claim 6 wherein the resistance transfer means is provided with a lateral extension on each side thereof, each extension having associated therewith a roller pad.

8. The exercise device of claim 1 wherein the resistance transfer means is provided with a lateral extension on each side thereof, each extension having associated therewith a roller pad.

9. The exercise device of claim 1 wherein the height adjustment post comprises an upright rail element and the counter resistance means is provided with an open ended tubing slidably received about the rail element.

10. The exercise device of claim 9 wherein first locking means are provided for adjustably securing the open ended tubing to the rail element whereby the height of said counter resistance means above the main base member is selectively adjustable.

11. The exercise device of claim 9 wherein the upright rail is provided with a longitudinal slot.

12. The exercise device of claim 1 wherein the pivot arm comprises a rail element and the resistance transfer means has an open ended tubing slidably received about the rail element.

13. The exercise device of claim 12 wherein second locking means are provided for adjustably securing the open ended tubing to the rail element whereby the position of the resistance transfer means along the length of the pivot arm is selectively adjustable.

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