

A method for developing or strengthening a particular muscular system. The method immobilizes and isolates certain muscle groups while exercising the desired group. The device groups into a single framework, a resilient force generator enclosure attached handle (13) and a user station. The user station includes an assortment of contoured seats (4), body restraints (10) and a pushplate (11) which allows the user to immobilize those parts of his body which are not to be exercised and to position himself so that only a specific part of his musculature is used in the exercise.

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SPECIFICATION

ABDOMINAL MUSCULATURE DEVELOPMENT METHOD AND DEVICE

TECHNICAL FIELD

5 This invention relates to the increasingly popular field of body development and exercise activity to increase tone, size and definition of musculature. More specifically it relates to isometric exercise methods and devices.

BACKGROUND ART

10 With increasing emphasis on fitness in modern life, development of new forms of exercise and exercise machines have accelerated rapidly. Examples of full range-of-motion pulley-weight exercise machines and methods using these devices are found in United States Patent Numbers:
15 4,290,597; 3,558,130; and 4,616,825. Each of the devices suffers, however, from lack of ability to isolate and exercise some specific muscle groups, although, some declare muscle isolation as a desirable objective. The full range-of-motion
20 embodied in these devices necessarily induces vertebral flexion, exercising multiple muscle groups. The desired muscle will not receive the

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full benefit of the exercise workout unless it can isolated. In addition, the required flexion and exercise of other sensitive or inadequate muscles in certain individuals may preclude the use of these devices and methods.

Full motion method exercises, as well as many other common weight-lifting and machine-oriented exercise methods, may also contribute to imbalance of muscular development. Because muscle groups are exercised together, the relative development of one muscle within the group, or of one group within several groups in proximity, cannot be specifically enabled. A particularly difficult problem is development of the abdominal musculature. Because these muscles, especially the transverse abdominus group, are not attached to a skeletal joint which can be flexed in order to exercise attached muscles, motion-oriented exercise is not effective to work the abdominal group because the motion centers on the moving joints involved in the exercise such as hip flexors.

Therefore the full effort of prior art abdominal workouts is dispersed to other muscles around the joints. The workout is not focused on

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the desired musculature which is not attached to the moving skeletal structure. Further, the flexors may overdevelop to the point that the abdominal carry less and less of the workout load, further decreasing the desired effect.

The traditional exercise to develop the specific abdominal group of muscles is a common sit-up, an example of a range-of-motion exercise. But the sit-up methods are only partially effective for exercising the abdominal group of muscles desired purpose. It is well-known that many hours and years of repetitions are necessary to produce any effect at all on abdominal musculature definition. Some machines, which take as their objective the development of the abdominal musculature, are merely weight-loaded sit-ups, and are similarly only partially effective. Another difficulty in effectively exercising abdominal musculature is that the frontal abdominal muscle groups are tied, directly or indirectly, to the spinal erector muscles groups. These groups are ideally balanced against those counter-poised muscle groups in the back.

This points to another difficulty with sit-up-

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style exercises, and especially weight-loaded exercises. They ignore the related muscle groups in the back and exacerbate back problems by excessive spinal movement, imbalance of fore-and-aft spinal forces, and possibly vertebral dislocation.

Thus, flexion type of exercise, especially weight loaded exercise methods, can exacerbate back problems by excessive spinal movement, imbalance of fore-and-aft spinal forces, and possibly vertebral dislocation. Ideally, the abdominal group is balanced against those counterpoised muscle groups in the back. Exercises which ignore the stresses on the spine and related muscle groups in the back can create as many problems as they try to cure.

Another type of abdominal strengthening method involves the use of compression devices. Elastic girdles, belts, and wrapped sashes are used during flexion exercises or normal daily activity. These types of devices tend to be used in the treatment of low back pain. This compression factor during abdominal strengthening exercises has been credited with the limited success of this

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treatment of low back pain. However, the devices also tend to limit flexion of the spine during normal activity.

5 It is an objective of the within device and method not only to effectively exercise and develop the abdominal musculature, but to do so in a way that does not require significant spinal movement or unduly load the spine or the spinal erector group with imbalanced forces that will cause
10 orthopedic problems.

Another object of the invention is to provide an apparatus which will enable practice of the exercise methodology.

15 Another object of the invention is to provide a specific apparatus to maximize efficiency of exercise of the abdominal musculature.

20 Another object of the invention is to provide an exercise machine that is adaptable to various exercises of both the isolated muscle exercise variety defined herein, and ordinary weight-loading exercise and training exercises.

DISCLOSURE OF INVENTION

The within invention as an exercise

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methodology defines a specific exercise position that will balance the user's entire body and focus the exercise effort upon an isolated desired muscle group. Specifically the methodology and the machine developed to enable practice of the methodology are here focused on the abdominal musculature. They can also be adapted for exercises focusing on other isolated muscle groups as well. Tensioning devices of traditional weight-and-pulley style or spring-force style are provided, but positioned to require only a short range of motion before the desired tensioned isometric position is reached. The position is then held immobile for a period of time by the user. In the balanced, tensioned position, the user will realize maximum effect on the isolated muscle group, in the principal illustrated case, the transverse abdominus muscle group.

A uniquely constructed exercise machine is defined to enable the practice of the exercise methodology, and to hold the user's body in a specifically suspended and tensioned position whereby all exerted forces are directed toward and balanced at the abdominal musculature.

Thus the principal object of the invention is

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to provide an exercise method that will exercise a specific muscle group.

Another object of the invention is to define a specific end position for an exercise which will suspend, tension and balance the user's body to maximum effect on a specific isolated muscle group, without significant flexion of the skeletal structure.

Another object of the invention is to provide a method which maximizes the efficiency of the exercise, concentrating the exercise effects on the specific isolated muscle group.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a perspective view of the abdominal exercise machine on which the unique exercise methodology may be practiced;

Figure 2 is a side view of the exercise machine with a human subject shown in the basic suspended position during exercise;

Figure 3 is a side view of the abdominal exercise machine with the human subject in a secondary arm-curl exercise position;

Figure 4 is a side view of the abdominal

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exercise machine with the subject in a tertiary exercise position;

Figure 5 is a mechanical diagram of a subject exercising in an equilibrium position; and

5 Figure 6 is a mechanical diagram of a subject exercising in an alternate equilibrium position.

Figure 7 is a perspective view of an alternative abdominal device;

10 Figure 8 is a side view of the alternative abdominal device;

Figure 9 is a schematic side view of a second alternative abdominal device in a first position; and

15 Figure 10 is a schematic side view of a second position of the second alternative device.

BEST MODE OF CARRYING OUT THE INVENTION

20 Referring now to the drawings, there are shown various views of the invention and its parts which will illustrate attainment of the objectives specified above. The perspective view of Figure 1 illustrates the exercise machine which enables the primary exercise and various other exercises for development of specific muscle groups. The frame 1

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is mounted on footings 2 in a wide infrastructure which further supports horizontal members 3. Exercise seat 4 supports the user in a specific exercise position which will be later defined, and is in turn supported by seat post 5 which rests on seat bearing 6, slidably supported and arranged on seat bearing 6, girder 7 and buttress bearing 8, which rests upon the horizontal supports. Other aids for restraining the user in the specifically defined exercise position are the ankle restraining blocks 10, in proximity to the foot push plates 11 which are in turn integrally connected to tensioning pistons 12 of spring, pneumatic, or hydraulic operation.

The operative weight loading mechanism is embodied in curl handles 13 consisting of a bar with two hand grips of standard configuration, attached at its center to weight cable 14, which is engaged around pulley frame 15 and various pulleys 16, and is tensioned by a weight stack 17. Thus, in operation as shown in Figure 2, the exercising subject is supported in the basic exercise position. The seat is adjusted both in height and in horizontal separation from the footplate to

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accommodate the user's individual physical size. The seat supports the user at a point approximately under the thighs, with the user's center of gravity positioned rearward of the seat support. The legs
5 are extended and the user pushes against the tensioning footplate to provide a balancing force first against the contracting force applied to the curl handle which will be described shortly, and second against the lever arm force of the user's
10 center of gravity acting downward aft of the fulcrum created by the seat against the thighs. The user now pulls against the curl handle which is attached by pulley arrangement to the weight stack and the weight stack is loaded according to the
15 user's ability. As can be seen, only a short range of motion is required to pull the user's hands toward him into a position approximately with the elbows at his side. In this position all four forces acting on the subject's body are in balance
20 and tension is required to maintain this position by pushing on the footplate and pulling on the curl handle. It has been calculated that all of these forces will center on the transverse abdominus group in this position. As can also be seen, all
25

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of the muscle groups around the skeletal joints, such as the hip flexors and the knee, elbow and shoulder joints, have been either immobilized in the tensioning exercise or move only through a very short range of motion. Therefore a great part of the effort required to maintain the tensioning position must be exerted through the now-isolated abdominal muscles, greatly enhancing efficiency of exercise of those muscles. Further this balanced position will require corresponding tensioning of the spinal erector muscles, in order to maintain a balanced erect position. Accordingly, and the opposing or erecting forces of the abdominals against the spinal erectors will develop in proportionally balanced fashion to the orthopedic benefit of the user.

Shown on Figure 1 in the last itemized detail is a secondary exercise seat 18, which is shown in use on Figure 3. Figure 3 shows in side view a portion of the exercise machine and the user placed on the secondary seat 18, positioned for an arm curl exercise which will be seen to increase efficiency of bicep workout by immobilizing other muscle groups in proximity. The curl handle 13 and

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weight cable 14 have been repositioned on other available pulleys 16, to accommodate the arm curl exercise, and the exercise seat 4 has been adjusted forwardly to fit now under the user's armpits, and the user's lower body is immobilized by placement of thigh blocks 22 consisting of a padded roller device over the top of the thighs.

In standard arm curl exercise fashion, the user works the bicep muscle by weight loaded exercise of pulling up the arm curl bar and rotating the forearms upward, and reversing the exercise to lower and extend the muscle slowly.

Other muscle groups are isolated from the exercise because the entire upper body and lower body is immobilized by placement of the subject in seated position with the exercise seat 4 under the armpits, and only very small movement of the shoulder muscles is possible. The majority of the exercise force is now concentrated on the biceps and forearms, the intended development object of this exercise. This is in contrast to free weight arm curls or traditional exercise machine arm curls in which there are many opportunities for upper body movement which detracts from exercise

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efficiency.

Similarly Figure 4 shows in rearranged position, particularly with aftward rotation of exercise seat 4 to provide now a shoulder and head rest, and rearward adjustment of secondary exercise seat 18. The user is engaged in an exercise corresponding to a traditional lat pull which, having similarly immobilized other muscle groups surrounding skeletal joints, will concentrate the force of the exercise in the desired muscle group in the back and shoulders, and illustrating the diversity of arrangement of the exercise machine as designed.

Figure 5 is a diagrammatical rendition of an exercising subject in an equilibrium position. After shifting the body away from the foot restraint point contact 23 (representing roller 10 shown on Figure 1) on fulcrum 24 (representing seat 18 shown in Figure 1), the body's center of gravity must be counteracted by the legs acting against foot restraint point contact 23 and by pulling the arms against force \bar{F} in order to maintain equilibrium by means of handle 25. The subject's forearms 26 are coaxial with the force \bar{F} , so that

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no flexing of biceps is required. This combination of equilibrium forces on the subject's body requires flexing of the abdominal muscle group, but eliminates flexure after initial moving into position and limits non-abdominal muscle flexing.

Figure 6 shows an alternate equilibrium position. The diagram representation of subject 13 has moved a short distance away from foot restraint 23 on the fulcrum 24 (representing seat 18 shown in Figure 1), but is now further leaning backwards against a cervical support point 27. Forearm 26 is again coaxial with the force vector \vec{F} , while subject grasps handle 25. The cervical restraint further limits skeletal movement of the subject's body, again focusing the exercise on the abdominal muscles.

Figure 7 is a perspective view of an alternative embodiment of an abdominal exercise device. The subject's thighs (see Figure 8) are placed on the fulcrum or ridged seat 28. The ridged seat 28 is supported by a rail 29, which in turn is supported by an enclosure 30 and a rail end 31. The seat 28 is slidably mounted on the rail 29, and can be manually or automatically adjusted

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or set up at different heights and distances from the enclosure 30. Automatic adjustment of the seat 28 is accomplished by actuating a seat motor 32 (shown dotted within enclosure for clarity), which
5 moves an actuating rod 33 (shown dotted within rail for clarity).

Attached to the seat 28 is a chest restraint bar 34. The pivoted attachment at a pivot pin 35 also allows individual automatic adjustment of the
10 chest bar 34 by means of a second actuating rod 33 (not shown for clarity). A foot restraint 36 and an ankle restraint 37 immobilize the subject's feet against a heel restraint 38 and a toe restraint 39 attached to enclosure 30.

15 Extending out from the enclosure 30 is a gripping handle 40 attached to a cable 41. The cable 41 is attached to a cable drum 42 (shown dotted within the enclosure 30 for clarity). The cable drum 42 is tensioned and actuated by a cable
20 motor 43. The cable motor 43 can again provide automatic adjustment of the length of the cable and the cable tension to individually suit each subject sitting on the seat 28. The cable motor 43 and the seat motor 32 are controlled by a monitor and a

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touch screen 44 connected to a microprocessor in a monitor enclosure 45. The monitor enclosure 45 is supported by a structural member 46, attached to the enclosure 30.

5 Figure 8 is a side view of the alternative embodiment shown in Figure 7. A subject 45 is seated on the fulcrum seat 28 in an isometric exercise position where the subject's center of gravity 46 and leg sockets 47 are placed on one
10 side of the fulcrum support point 48 of the seat 28 opposite the enclosure 30. The distance "a" from the leg sockets 47 to the fulcrum support point 48 is at least 2.5 cm (one inch), typically between 2.5 cm to 5 cm (one - two inches). The subject 45
15 has a view of the monitor 45 and can control position, tension and other parameters by accessing the touch screen 44 within reach (first alternative hand and arm position 49 shown dotted for clarity). The normal isometric exercise hand and arm position
20 50 is pulling on the handle 40 attached to the cable 41. A second alternative isometric arm and hand position 51 and a corresponding alternate cable position 52 are shown dotted for clarity. The enclosure 30 houses the cable drum 42 and

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attached cable 41 (shown dotted inside enclosure for clarity). The normal isometric exercise position has a cable 41 angle "b" with respect to the horizontal of 15 degrees and an alternative position angle "c" of five degrees.

The leg restraint 36 and ankle restraint 37 restrict vertical motion of the leg in the normal isometric exercise position. The major vertical axis 53 of the subject 45 in this position has a slight tilt angle "d" of five degree with respect to the vertical, as does the front face 54 of the enclosure 30. Mounted on the enclosure front face 54 are a heel restraint 38 and toe restraint 39. The heel restraint 38 is cushioned, but fixed to the front face 54, the heel cushions allowing a depression "e" of no more than 0.6 cm (1/4 inch) when depressed by subject 45. The subject can also alternately depress the toe restraint 39. The toe restraint 39 is bias or spring 55 mounted to the enclosure face 54. The spring 55 allows the subject 45 a toe depression "f" of a maximum of 3.8 cm (1.5 inches).

The chest restraint 34, along with the other restraints, prevent the subject 45 from moving from

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either of the isometric exercise positions shown. The two isometric exercise positions shown vary primarily by the addition of exercising arm muscles. This requires repositioning the handle 40 a distance "g", which is nominally 18 cm (7 inches), but can be individually adjusted. This position, with the subject's center of gravity forces off the fulcrum is directly counteracted by arm pull and heel or toe depression forces. One method of use of the device is to alternate a series of toe and heel depressions, followed by a period of rest, while pulling with the arms. This method maximizes the exercise of the abdominal muscles, without motion of the subject's spinal column.

Figure 9 shows a schematic representation of a second alternative abdominal exercise device. The subject 45 maintains a similar isometric exercise position to that shown in Figure 8. The foot restraint 36 and ankle restraint 37 are also similar to that shown in Figure 8. The alternate chest restraint 56 is the exercise position is moved up and out of the way into an entry subject chest restraint position 57. The arm tension is

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provided by a combination of a pivoted bar linkage 58 (also shown dotted in alternative exercise position for clarity), wire and stackable weights 60. The heel and toe restraints of Figure 8 have been combined into a sole plate 61, shown with the subject 45 depressing on the heel portion, proximate to the sole plate pivot 62. The sole plate 62 is biased proximate to the subject's toe.

The depression seat 63 is similar to the fulcrum seat having a fulcrum support point 48 as shown in Figure 8, except the depression seat has a back support 64 and concave cavity or depression 65 under the subject's torso. The depression 65 and back support 64 allows the subject an alternate rest and entry position 66 (shown dotted for clarity). The rest position 66 does not require arm pulling or foot exertions to maintain equilibrium. The subject 45 can first enter the device in this entry or rest position 66, individually adjust the positions of the seat, cable, handle, monitor and restraints. The subject can then pull and roll up the seat to the thigh on fulcrum portion shown. After inserting feet into restraints, isometric exercise can begin.

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Figure 10 is similar to Figure 9 except the subject 45 is depressing the toe portion of the pushplate or sole plate 61 while the feet are still restrained by the foot restraint 36 and ankle restraint 37. A maximum benefit to the abdominal musculature can be achieved by alternate heel and toe exertions as shown in Figures 9 and 10 while in one of the isometric exercise positions.

While the preferred embodiment of the invention has been described and modifications thereto have been suggested, other applications and modifications could be made without departing from the spirit of the invention and the scope of the appended claims.

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CLAIMS

1 1. A method for developing or strengthening a
2 particular muscular system in a subject's body,
3 which comprises:

4 placing said subject on an exercise rack
5 configured to immobilize the subject's body,
6 except for a part of said body which is
7 activated by said muscular system;

8 causing the subject to move said part of
9 his body against an opposite-force-developing
10 apparatus until a state of equilibrium is
11 reached between the maximum force that the
12 subject can exert and said apparatus;

13 maintaining said equilibrium for a time
14 period achievable by the subject.

1 2. The method of Claim 1, wherein the step of
2 placing the subject on an exercise rack comprises:

3 sitting the subject on a narrow support
4 forming a fulcrum under the upper part of the
5 subject's legs, and immobilizing the lower
6 limbs of the subject; and

7 the step of causing the subject to move
8 comprises:

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9 having the subject pull said
10 apparatus horizontally toward him while
11 keeping his arm in a generally orthogonal
12 position in relation to his forearms.

1 3. The method of Claim 2, wherein the step of
2 immobilizing the lower limbs comprises having the
3 subject place his foot against a generally vertical
4 pushplate and the upper part of his ankle against a
5 horizontal bar horizontally distal from said plate.

1 4. A method for the treatment of a subject's back
2 pain syndrome which comprises:
3 exercising the subject's abdominal
4 muscles while supporting the subject's body to
5 prevent vertebral flexion.

1 5. The method of Claim 4, wherein the step of
2 exercising comprises:
3 having the subject steadily hold a
4 handle proximate to the subject's torso; and
5 subjecting said handle to a force
6 directed away from the subject's torso.

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1 6. The method of Claim 5, wherein the step of
2 exercising also comprises:

3 having the subject place a foot against a
4 foot support; and

5 subjecting said foot support to a force
6 by said foot directed away from said subject's
7 torso.

1 7. The method of claim 6 wherein said foot support
2 force is alternately applied by the sole and toe
3 portions of said foot.

1 8. The method of Claim 5, wherein the step of
2 subjecting comprises applying a force to said
3 handle in a direction generally orthogonal to said
4 torso.

1 9. The method of Claim 5, wherein the act of
2 supporting further comprises:

3 sitting the subject on a narrow support
4 forming a fulcrum under the subject's thighs;
5 and

6 limiting the movement of the subject's
7 feet.

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1 10. The method of Claim 9, wherein the act of
2 supporting also comprises:

3 alternately resting the subject on a
4 depression under the subject's torso and a
5 back rest; and

6 limiting the movement of the subject's
7 upper torso.

1 11. The method of Claim 9, wherein the step of
2 limiting movement of subject's feet comprises
3 placing a stationary barrier against the upper part
4 of the subject's ankles.

1 12. The method of Claim 10, wherein said limiting
2 the upper torso movement tends to maintain the
3 subject's upper torso in a generally vertical
4 position.

1 13. The method of Claim 12, wherein said generally
2 vertical position varies from a vertical axis by no
3 more than five degrees.

1 14. The method of Claim 13, wherein the step of
2 subjecting further comprises attaching said handle

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3 to a traction resilient apparatus.

1 15. The method of Claim 14, wherein the step of
2 subjecting further comprises attaching said handle
3 to a weighted string and orienting the direction of
4 said string in relation to said handle by means of
5 at least one pulley.

1 16. The method of Claim 14, wherein the step of
2 subjecting further comprises attaching said handle
3 to a drum mounted string and tensioning said handle
4 by torque applied to said drum.

1 17. A method for exercising a portion of the
2 muscles of a subject's body in combination with a
3 plurality of body supports, said method comprising:
4 initially supporting the subject's body
5 at a first position;
6 moving the subject to a second
7 equilibrium position designed to maintain said
8 equilibrium position of said subject's body
9 only when said subject exercises said muscle
10 portion;

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11 positioning a second body support
12 proximate to said subject to prevent vertebral
13 flexion; and
14 maintaining said equilibrium position of
15 the subject.

1 18. The method of Claim 16, wherein one of said
2 body supports is resilient.

1 19. A multi-use apparatus for exercising various
2 muscular systems in a subject's body which
3 comprises:

4 a force generating device comprising a
5 force-generator, a handle, a cable joining
6 said handle to said force-generator, a
7 plurality of pulleys guiding said cable
8 through a plurality of directions; and

9 a framework mounting said pulleys;

10 a first support of said subject
11 adjustably fixed in a position distal from
12 said framework, said support comprising a
13 first cushion member and a vertical leg
14 mounting said first cushion member above
15 ground to an overall height between 90

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16 centimeters and 120 centimeters;
17 a horizontal anklebar on said framework,
18 said anklebar being capable of resisting
19 forces exerted by said subject's foot in a
20 direction generally perpendicular to the
21 bottom of said subject's foot, and said
22 anklebar positioned above ground to a lower
23 height than said first cushion support,
24 wherein said force generating device, said
25 anklebar, said first cushion member and said
26 leg are shaped and dimensioned to immobilize
27 said subject while said subject is tensing the
28 abdominal portion of said muscular systems;
29 and
30 wherein the first of said pulleys
31 which is proximate to said handle and said
32 first pulley is generally located in the same
33 horizontal plane as said anklebar and
34 immediately above it.

1 20. The apparatus of Claim 19 which further
2 comprise a resilient pushplate mounted vertically
3 within said framework and behind said anklebar in
4 relation to said first support.

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1 21. The apparatus claimed in Claim 19, wherein
2 said force-generator comprise at least a weight
3 hanging from the end of said cable opposite the end
4 associated with said handle.

1 22. The apparatus of Claim 20, wherein said
2 pushplate comprises a resilient force-generator
3 applied horizontally against said plate and biased
4 toward said first support.

1 23. An exercise device for exercising specific
2 muscles within a subject's body which comprises:

3 a force resisting device for resisting
4 a first exercise force applied by said subject
5 said force resisting device comprising a first
6 means for resisting said first exercise force,
7 a framework, a handle, and means for
8 adjustably connecting said handle to said
9 first means for resisting, wherein said first
10 means for resisting is generally undeformed by
11 said exercise force;

12 a cushioning device shaped and
13 dimensioned to support a portion of said
14 subject's weight when said subject is placed

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15 in a first position, said cushioning device
16 attached to said framework;

17 a first restraint adjustably attached to
18 said force resisting device, said first
19 restraint comprising a member shaped and
20 dimensioned to block movement of a first
21 portion of said subject's body when placed
22 proximate to said first portion; and

23 wherein said first position requires said
24 subject to apply said first exercise force in
25 order to maintain a balanced position on said
26 exercise device achieve an equilibrium of
27 forces acting on said subject's body.

1 24. The device of Claim 23, wherein said first
2 cushioning device comprises a first seat portion
3 having a convex subject support surface and
4 adjustably attached to said framework in a position
5 spaced apart a first distance from said first means
6 for resisting, wherein said convex surface
7 primarily supports the thigh portion of said
8 subject when said subject is in said first
9 position.

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1 25. The device of Claim 24, wherein said first
2 position comprises placement of said thigh portion
3 on said convex surface, wherein a majority of said
4 subject's torso is spaced apart from said force
5 resistor a distance greater than said first
6 distance, and placement of said subject's legs is
7 in a generally horizontal position with the feet
8 proximate to said first means for resisting.

1 26. The device of Claim 25, wherein said first
2 restraint comprises a generally horizontal anklebar
3 member placed above the subject's ankles when in
4 said first position.

1 27. The device of Claim 26, wherein said force
2 resisting device also comprises:

3 a foot support attached to said force
4 resisting device; and

5 second means for resisting a second
6 exercise force applied to said foot support
7 attached to said force resisting device.

1 28. The device of Claim 27, wherein said foot
2 support comprises a generally fixed position heel

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3 support and a deformable toe support.

1 29. The device of Claim 28, wherein said second
2 means for resisting comprises a rigid attachment of
3 said heel support to said force resisting device,
4 and a bias displacement attachment of said toe
5 support to said force resisting device.

1 30. The device of Claim 27, wherein said foot
2 support comprises a pivoted pushplate biased to an
3 undeformed position.

1 31. The device of Claim 30 which also comprises a
2 second restraint adjustable attached to said force
3 resisting device, said second restraint comprising
4 a member shaped and dimensioned to block movement
5 of a second portion of said subject's body when
6 placed proximate to said second portion.

1 32. The device of Claim 31, wherein said second
2 restraint comprises a chest cushioning member
3 adjustably attached to said force resisting device.

1 33. The device of Claim 23, wherein said means for

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2 adjustably connecting said handle comprises a
3 string attached to a variable position drum.

1 34. The device of Claim 33, wherein said means for
2 adjustably connecting said handle also comprises a
3 motor actuating said drum to provide specific force
4 resisting tension and said first position of said
5 handle.

1 35. The device of Claim 34, wherein said means for
2 adjustably connecting said handle also comprises:

3 a programmable data processor controlling
4 said motor; and

5 instruction and control means for
6 positioning and tensioning said handle in
7 response to inputs from said subject.

1 36. The device of Claim 35, wherein said
2 instruction and control means comprise a monitor
3 and a touch screen control system.

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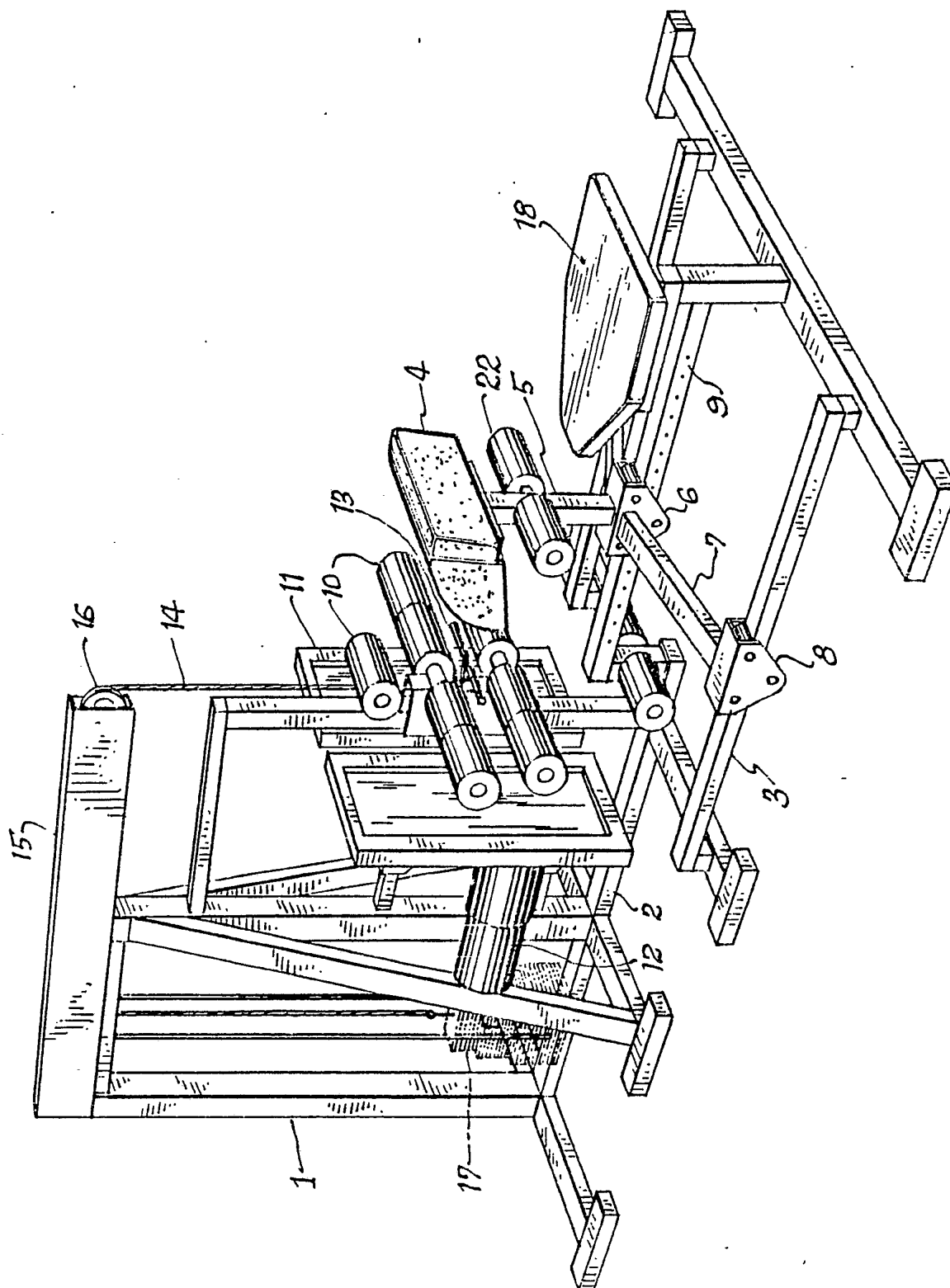


FIG. 1

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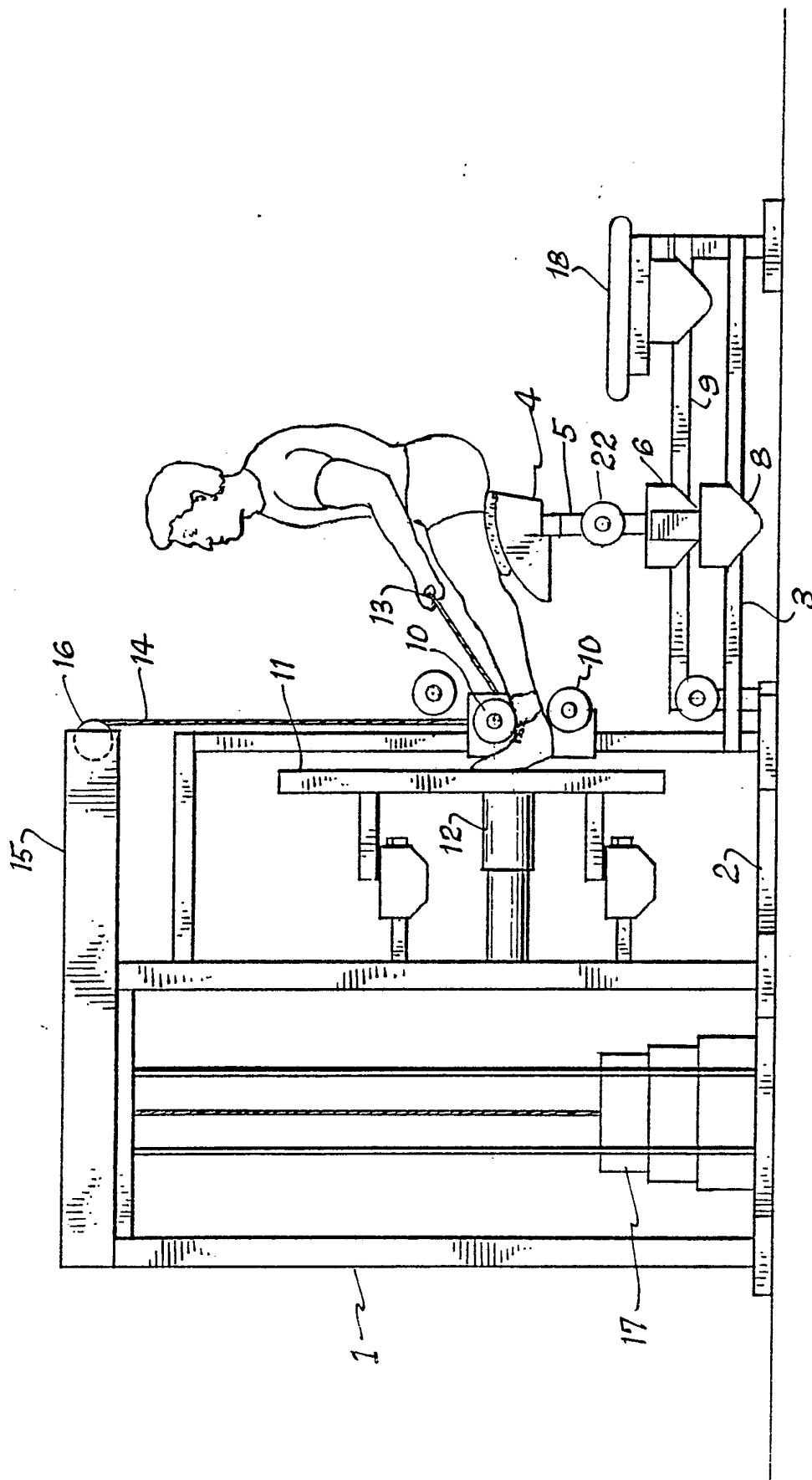


Fig. 2

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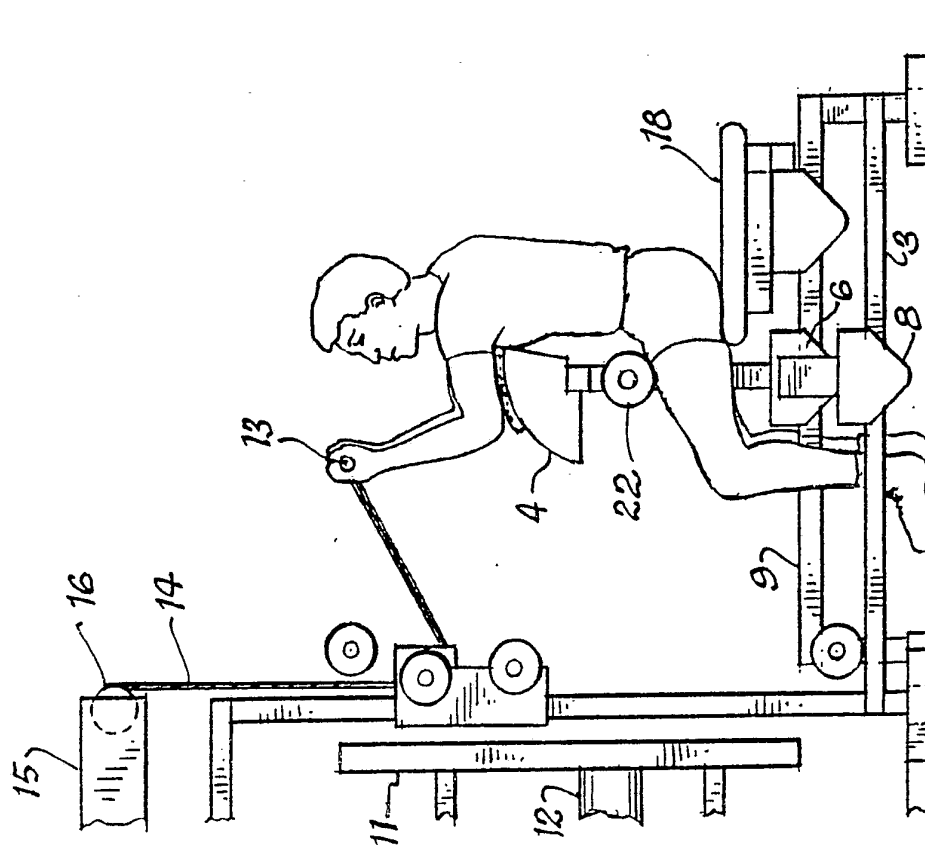


FIG. 3

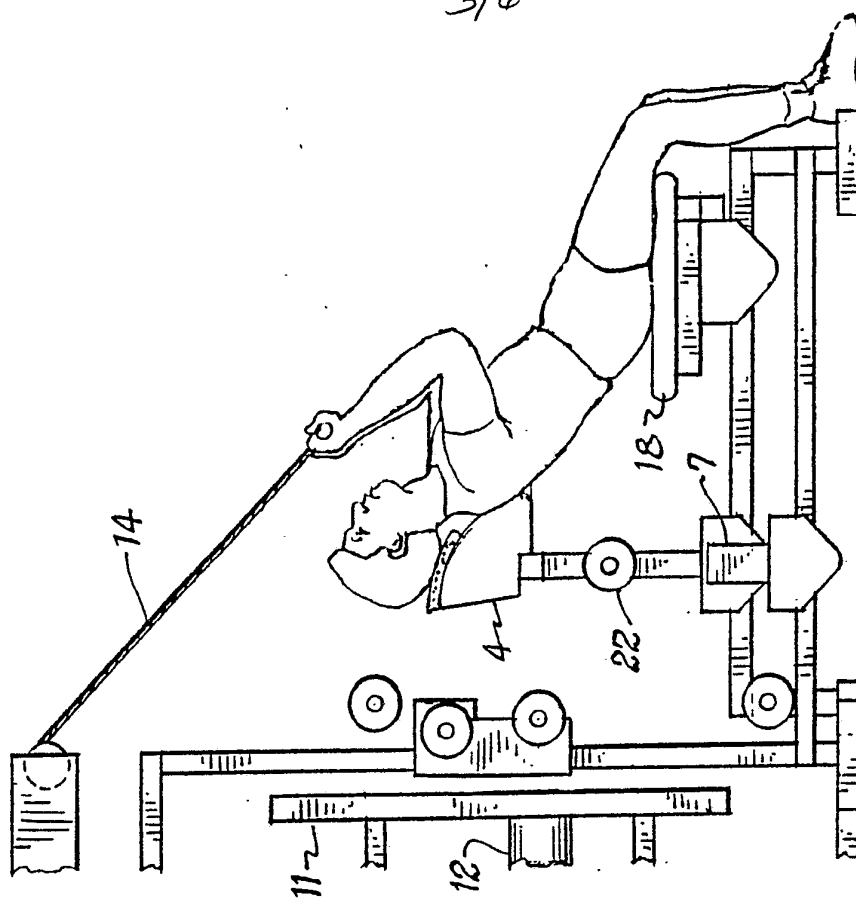


FIG. 4

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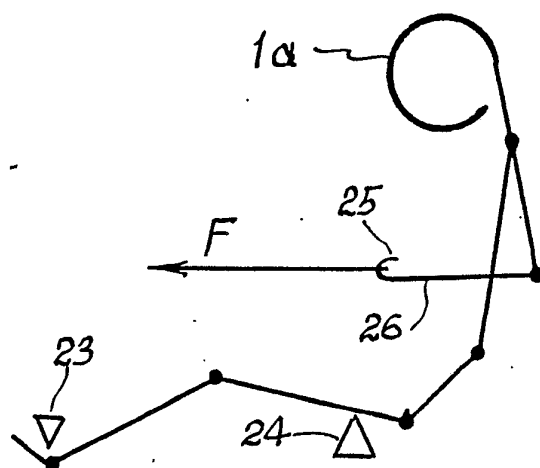


FIG. 5

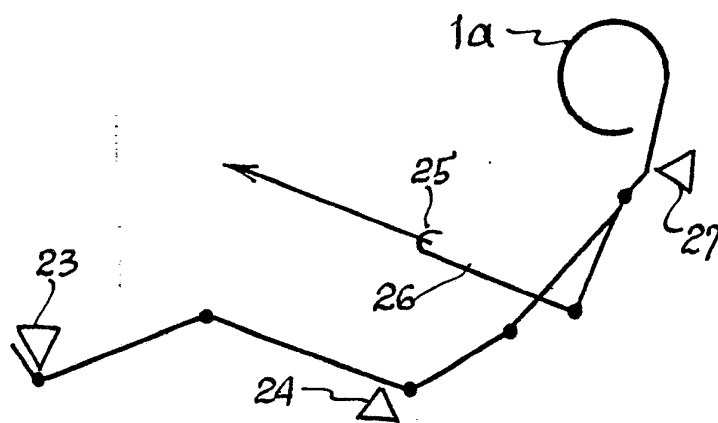


FIG. 6

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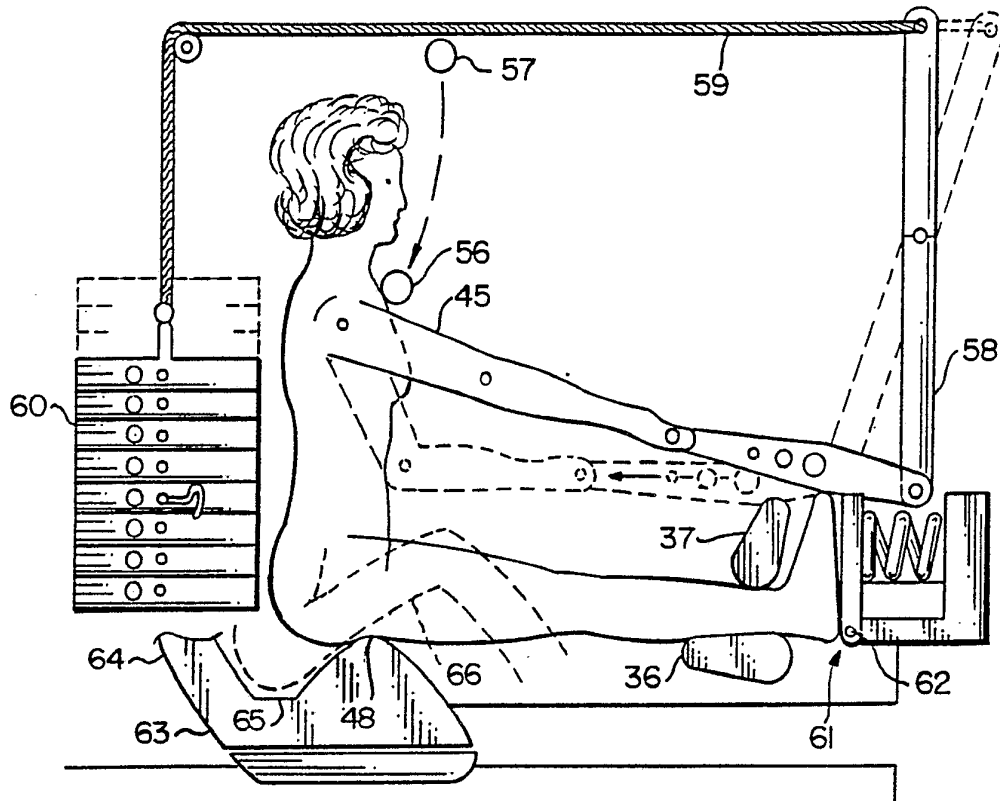


FIG. 9

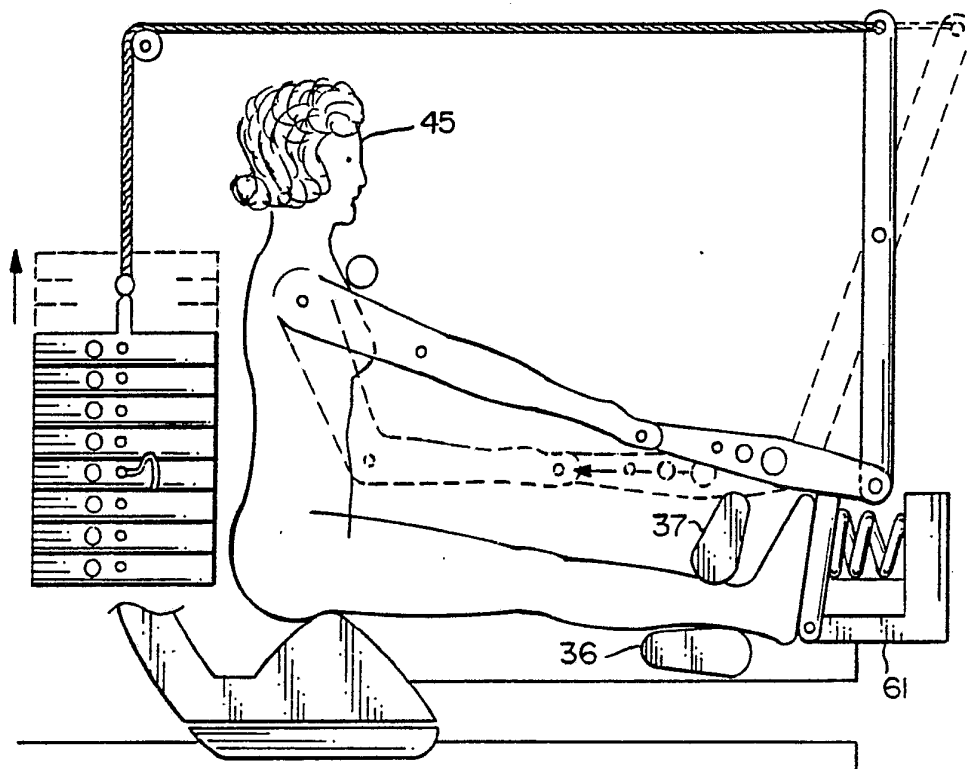


FIG. 10

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US89/00620

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
U.S. CL. 272/134		
IPC (4): A63B 21/00		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
U.S.	272/72 272/134	272/117-118 272/136
	272/125 272/142-143	272/129-130 272/145
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y / A /	US,A, 4,702,108 (AMUNDSEN ET AL) 27 October 1987. See column 6, line 42 through column 19, line 26.	23,33-35 1-22,24- 32,36
Y /	US,A, 4,261,562 (FLAVELL) 14 April 1981. See column 2, line 39 through column 3, line 16.	33-35
Y /	US,A, 4,235,437 (RUIS ET AL) 25 November 1980. See column 7, lines 14-41.	35
A /	US,A, 4,290,597 (SCHLEFFENDORF) 22 September 1981. Figure 7.	1-36
A /	US,A, 4,398,713 (ELLIS) 16 August 1988. Figures 7A,7B, 8 and 9.	1-36
<p>* Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
17 March 1989	1 MAY 1989	
International Searching Authority	Signature of Authorized Officer	
ISA/US	Robert Bahr	