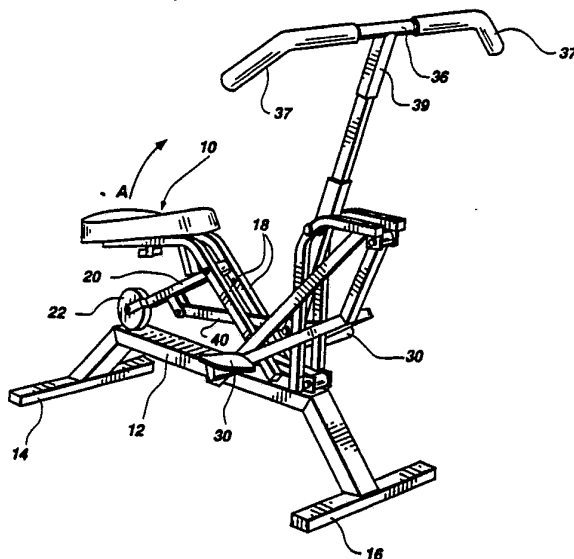




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : A63B 22/06, 21/068	A1	(11) International Publication Number: WO 92/18204 (43) International Publication Date: 29 October 1992 (29.10.92)
(21) International Application Number: PCT/US92/03131 (22) International Filing Date: 16 April 1992 (16.04.92) (30) Priority data: 686,532 17 April 1991 (17.04.91) US (71) Applicant: EXERHEALTH, INC. [US/US]; 7050 Union Park Center, Midvale, UT 84047 (US). (72) Inventor: LAMBERT, Lloyd ; 1120 North Main, Perryland, TX 77581 (US). (74) Agents: CLAYTON, Grant, R. et al.; Thorpe, North & Western, 9035 South 700 East, Suite 200, Sandy, UT 84070 (US).		(81) Designated States: AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GA (OAPI patent), GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU (European patent), MC (European patent), MG, ML (OAPI patent), MR (OAPI patent), MW, NL (European patent), NO, PL, RO, RU, SD, SE (European patent), SN (OAPI patent), TD (OAPI patent), TG (OAPI patent). Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: EXERCISE DEVICE



(57) Abstract

An exercise machine including a base (12, 14, 16) for supporting the apparatus above the underlying surface and a seat (10) for supporting the user's body is disclosed. Structures which permit the seat to be smoothly raised and lowered in relation to the base are also provided. A pair of grips (37), mounted on a handlebar (36), are positioned forward of the seat (10) and are configured to be grasped by the user. A pair of pedals (30), each of the pedals positioned forward of the seat (10) and each configured to rest the foot of the user upon, are also included. Structures are provided which permit the grips (37) and pedals (30) to move in a back-and-forth reciprocating fashion are also included. A mechanical linkage (20, 41) for transferring the reciprocating movement of the pair of grips and the pair of pedals to the seat is provided such that as the user moves the pair of grips and the pair of pedals in a reciprocating fashion, the seat (10) is raised and lowered in proportion to the movement. Thus, as the user pulls with his arms and pushes with his legs, he raises his body which, as carried out repeatedly, results in a muscle and cardiovascular conditioning exercise.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	RU	Russian Federation
CG	Congo	KP	Democratic People's Republic of Korea	SD	Sudan
CH	Switzerland	KR	Republic of Korea	SE	Sweden
CI	Côte d'Ivoire	LI	Liechtenstein	SN	Senegal
CM	Cameroon	LK	Sri Lanka	SU	Soviet Union
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
DE	Germany	MC	Monaco	TG	Togo
DK	Denmark			US	United States of America

EXERCISE DEVICE**1. The Field of the Invention.**

This invention relates to exercise apparatus used
10 to improve cardiovascular conditioning and muscle
conditioning of the human body.

2. The Prior Art.

Year by year, mounting evidence supports the claim
that regular exercise improves the health and appearance
15 of the human body as well as the overall well being of
the person. Exercise can take many forms. Exercise
often will emphasize cardiovascular, or aerobic,
conditioning. Alternatively, exercise will emphasize
muscle or strength conditioning.

20 Repetitive motion activities such as running,
cycling, swimming, rowing, and cross country skiing all
have the potential of providing cardiovascular
conditioning. Each of these activities, however, has
one or more drawbacks. For example, running often leads
25 to impact injuries of joints such as knees and hips;
swimming requires access to a pool; and, cross country
skiing requires snow. These drawbacks make such
activities less than ideal.

Activities such as weight lifting or resistance
30 training provide muscle conditioning. These muscle
conditioning activities, however, require the purchase
of, or access to, specialized equipment and, for the
beginner, should be carried out under the supervision of
an experienced trainer to avoid injury.

35 Numerous machines have been devised which provide
aerobic conditioning, muscle conditioning, or to some
extent, a combination of both. These devices include
treadmills, and machines which simulate climbing stairs,
cross country skiing, rowing, or cycling. All of the
40 previously proposed devices incorporate cables, ropes,
chains, belts, sliding rails, pivoting steps, friction
wheels, fans, sophisticated electrical circuits, or
other complicated electrical and/or mechanical

components which are subject to wear or breakdowns. Similarly, resistance training machines also include such components and are comparably expensive and subject to wear and breakdowns.

5 In view of the foregoing, it would be an advance in the art to provide an exercise machine which is capable of providing cardiovascular conditioning, stretching and toning of various regions of the body, and muscle conditioning without the drawbacks of previously
10 available exercise devices.

BRIEF SUMMARY OF THE INVENTION

The present invention provides an exercise machine which is of straight forward construction and easy for
15 even a beginner to use. Exercise on an embodiment of the present invention involves virtually all of the major muscles of the body in an exercise that optimally distributes the exercise effort throughout the body's musculoskeletal system.

20 The described embodiment of the present invention includes a base having a forward end and a rearward end. A seat is also provided upon which the user's body rests. A means for permitting the seat to be smoothly raised and lowered in relation to the base is also
25 provided.

A pair of grips, desirably mounted on a handlebar, are positioned forward of the seat and are configured to be grasped by the user. A means for permitting the pair of grips to move in a back-and-forth reciprocating
30 fashion is provided. A pair of pedals, each positioned forward of the seat and each configured to rest a foot of the user upon, are also included. A means for permitting the pair of pedals to move in a back-and-forth reciprocating fashion is also included.

35 A means for transferring the reciprocating movement of the pair of grips and the pair of pedals to the seat such that as the user moves the pair of grips and the

pair of pedals in a reciprocating fashion, the seat is raised and lowered in proportion to the movement. Thus, as the user pulls with his arms and pushes with his legs, he raises his body. In this way, the user's upper
5 and lower extremities, as well as major muscles in other regions of the body, are worked an amount which is regulated by the weight of the user and in accordance with the number of repetitions per minute carried out by the user.

10 When exercise is carried out in accordance with the present invention, the user lifts his own body weight which ensures that musculoskeletal strength matches the user's body weight. Furthermore, the mechanical leverage provided by the apparatus balances the relative
15 strength of the user's upper and lower extremities and the user's trunk in order to equally share the exercise effort among the large muscles of the body in proportion to their strength. Moreover, exercise carried out in accordance with the present invention produces greater
20 energy expenditure at a standard heart rate than conventional forms of exercise such as walking, jogging, cycling, swimming, or weight lifting machines because of the widespread metabolic activity of the body muscles.

25 BRIEF DESCRIPTION OF THE DRAWINGS

In order to better appreciate how the above-recited and other advantages and objects of the invention are obtained, a more particular description of the invention briefly described above will be rendered by reference to
30 a specific embodiment thereof which is illustrated in the appended drawings. Understanding that these drawings depict only a typical embodiment of the invention and are not therefore to be considered limiting of its scope, the invention will be described
35 and explained with additional specificity and detail through the use of the accompanying drawings in which:

Figure 1 is a perspective view of the presently preferred embodiment of the present invention.

Figure 2 is a side view of the apparatus represented in Figure 1 showing the movement of the apparatus as a user operates the apparatus.

Figure 3 is a side view of the apparatus in a resting position.

Figure 4 is a side view of the apparatus in a fully extended position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made to the drawings wherein like structures will be provided with like reference designations.

Provided in Figure 1 is a perspective view of the presently preferred embodiment of the present invention. The illustrated embodiment of the present invention provides resistive muscle conditioning of virtually all of the major muscles of the body while also providing aerobic conditioning.

Also, in contrast to previously available exercise machines, the present invention provides a balance between upper extremity and lower extremity exercise without requiring any conscious adjustment on the part of the user. Even further, the present invention matches the effort required of the user to the user's body weight to avoid over exertion, and accompanying injuries, or under exertion, and an ineffective workout.

Still further, the embodiments of the present invention do not require complicated electrical circuits or mechanical devices which add cost and maintenance concerns to other exercise machines which have heretofore been available. For example, the sturdy mechanical linkages represented in the illustrated embodiment are durable, long lasting, require a minimum of maintenance, and are easily serviced by the user if such attention is ever required.

As shown in Figure 1, a seat 10 is provided whereupon the body (not illustrated) of the user is supported. The seat 10 is merely one example of a means for supporting a body. For example, many different structures adapted to support the weight of the user via contact with various body parts can also be used. Such structures may also include straps, saddles, or other structures now known or to be developed in the future which perform a function similar or equivalent to the illustrated seat or other described structures.

To operate the embodiment, a user rests his body weight on the seat 10 and takes hold of grips 37 on handlebar 36. An additional grip 39 can also be provided. Both grips 37 and 39 are preferably covered with a padding material. The user also places his feet on pedals 30. Then, as the user pulls the handlebar 36 toward his body, and pushes the pedals 30 away from his body, the seat 10 is raised in proportion to the movement of the handlebar 36 and the pedals 30. Thus, the user's own strength, using muscles not just in the lower and upper extremities but also using muscles located in the back and abdominal regions, raises the user's body in the direction of Arrow A.

Reference will next be made to the side view of Figure 2 wherein the apparatus illustrated in Figure 1 is represented in a resting or starting position in phantom image and in a fully extended or raised position in solid image. Figure 2 will be used to describe the structures used to carry out the above described general functions of the illustrated embodiment.

A base 12 with feet 14 and 16 is provided to support the moving structures of the apparatus up off the floor or other underlying surface. Many structures performing similar or equivalent functions can be substituted for the base 12 and the feet 14 and 16. The seat 10 is attached to a seat support member 18.

It will be appreciated that the structures described herein can be fabricated from many different materials known to those skilled in the art. It is preferred, however, that the apparatus be fabricated from steel or some other similarly durable material.

Pivotally connected to the seat support member 18 is a wheel strut 20. At the end of wheel strut 20 is a wheel 22. As shown best in Figure 1, the wheel is preferably connected to wheel strut by way of a clevis arrangement.

Referring again to Figure 2, the wheel strut 20 is attached by axle 21 to a first interconnecting member 40. The first interconnecting member 40 and the second interconnecting member 41 function to transfer the movement of handlebar 36, pedals 30, and their associated structures, to the wheel strut 20 and serve as one example of a means for transferring the reciprocating movement of the handlebar and the pedals to the seat such that as the user moves the pair of grips 37 and the pair of pedals 30 in a reciprocating fashion, the seat is raised and lowered in proportion to the movement.

As the wheel strut 20 is pulled forward, the wheel 22 rolls along the upper side of the base 12 and pushes the seat support member 18 and the seat 10 in an upward direction. A wheel stop structure, such as a vertical protrusion (not illustrated) attached to base 12, can desirably be included to ensure that the wheel 22 stops at the position represented by the phantom image.

The handlebar 36 is attached to an arm 34. It will be appreciated that it is within the scope of the present invention to provide a means for varying the length of the arm 34 in order to accommodate users of different heights and to change the mechanical advantage provided to the user. It is preferred, however, to accommodate users of different heights by adjusting the

position of the seat 10. The arm 34 is pivotally connected to a support 24 at pivot point 38.

The pedals 30 are each pivotally connected to a leg 28 which in turn is swingably connected to the support 24 at pivot point 32. It is to be understood that the swinging, rotating, or pivoting structures included in the embodiments of the present invention can include bearings or other friction reducing devices and materials in accordance with general practice in the art.

With the arm 34 and the leg 28 mounted as illustrated, the arm 34 and the leg 28 move in a back and forth reciprocating fashion, as represented by Arrows B and C, respectively, with the movement of the user's hands and feet. One end of the arm 34 is pivotally connected to the first interconnecting member 40 at 46. The leg 28 is pivotally connected to the second interconnecting member 41 at 48. Another end of the second interconnecting member 41 is pivotally attached to the arm 34 at 46.

The seat support member 18 is also swingably connected to the support 24 by a stud 44 which is connected to a rotating structure at pivot point 42. The rotating structure at pivot point 42 can be a suitable bearing structure keeping in mind that the bearing structure will carry the weight of the user.

Still referring to Figure 2, with the apparatus in the resting position illustrated by the phantom image, a user mounts the apparatus and pulls with his arms and pushes with his feet. This causes the wheel strut 20 to be pulled forward resulting in the seat 10 being raised. It will be appreciated that it is within the scope of the present invention to vary the lengths, or the pivot points, of the articulating structures in order to vary the exertion which must be put forth by the user. Generally, however, any adjustments for different sized

users is made by longitudinally moving the position of the seat 10.

Significant to the proper operation of the illustrated embodiment are the four pivot points represented at 23, 32, 28, and 42. These four pivot points should be arranged so that when the arm 34 has reached a vertical orientation the wheel 22 has traveled forward from about four inches to about eight inches, and most preferably approximately six inches, in the direction of Arrow F. As the arm 34 arrives at the orientation represented by the solid image (the fully extended position), the wheel 22 should have traveled an amount in the range from about eight inches to about sixteen inches, and most preferably twelve inches. Using these parameters allows the user to obtain an optimum workout and eliminates any need to adjust the length of the arm 34 or legs 28 but the only adjustment needed is the longitudinal adjustment of the seat 10 position.

Referring next to Figure 3, the apparatus of the present invention is illustrated in a starting or resting position. As will be understood by examining Figure 3, the user's upper body is stretched out to reach the handlebar 37 when in the illustrated position. The height of the seat 10 in relation to the position of the grips 37 when in the starting position represented in Figure 3 should be calculated to fully stretch the user's body.

In order to provide additional work and stretching to the upper extremities and body, a means for allowing the grips 37 to rotate in the direction of Arrow D can preferably be included. By rotating the grips 37, with each up and down cycle on the apparatus, the user can further work his back and arms and more fully stretch these portions of his body.

Desirably, the present invention simultaneously works, conditions, and stretches the major muscles and

5 joints of the body. Using the illustrated embodiment, the body regions which are involved in the exercise include, among others, the: calves; thighs; buttocks; abdomen; lower back; upper back; shoulders; chest; front
10 of upper arms; back of upper arms; and forearms. The involvement of all of these body regions during the use of the present invention is in contrast to other exercise activities which concentrate on only specific regions of the body. The stretching of the arms, shoulders, upper back, and lower back during each up and down cycle of the illustrated embodiment is a benefit to the user.

15 The grips 37 are one example of a means for receiving an upper extremity of the body. Other structures which receive the user's grasp or receive the arm of the user are also intended to fall within the scope of the means for receiving an upper extremity of the body. For example, straps, cuffs, or other connecting devices can also be included if desired.

20 The seat 10 desirably includes means for varying the longitudinal position of the seat to accommodate different size users. Moreover, the shape of the seat 10 should allow the user to freely move his legs during the up and down cycles of the illustrated embodiment.
25 It is also desirable that the shape of the seat provide adequate support for large users and allow shorter users to slide forward on the seat 10 to assume a better position. Those skilled in the art can devise an appropriate structure for the seat 10 using the
30 teachings set forth herein.

Referring next to Figure 4, when the apparatus is in the illustrated raised or fully extended position, the handlebar is drawn up against the body of the user (not illustrated) and his legs are extended against the
35 pedals 30. Desirably, a means for allowing the pedals 30 to rotate in the direction of Arrow E is provided. This allows the user to stretch his leg at the end of

each cycle in a fashion similar to the stretching of the arms by rotating when rotating the grips 37.

It is also within the scope of the present invention to substitute other structures for the
5 illustrated pedals 30, including straps, clips, and similarly functioning arrangements. The pedals 30 are the presently preferred example of a means for receiving the lower extremity of the user. Other structures performing the same or similar functions of serving as
10 a foot rest or receiving the foot or leg of the user are also intended to fall within the scope of a means for receiving the lower extremity of the user.

The rotation of the pedals 30 as represented by Arrow E allows full extension of the leg and knee joint
15 of the user. Full extension, or "locking," of the knee joint is important to preserving the long-term health of the joint and is not accomplished in other conventional exercises such as running.

The illustrated mechanical interconnection of the
20 articulating structures is a presently preferred example of a means for raising and lowering the means for supporting the body in proportion to the movement of the grips and the pedals as well as a means for transferring the motion of the grips and the pedals to the seat.
25 Other structures performing similar or equivalent functions can also be used.

The simplicity of the embodiments of the present invention is an advance over previously available devices and exercises. In contrast to weight lifting
30 machines, where arbitrary weights and resistances are used, the present invention utilizes the weight of the user's body to properly match the effort required of the user. The articulating structures are designed to the balance the relative strength of the upper and lower
35 body in order to equally share the exercise load among the large muscles of the body in proportion to their strength. The moderate resistance of raising and

lowering the body weight, combined with the repetitive movements, results in an ideal exercise that contributes to overall physical fitness.

Because the arms, legs, and trunk muscles are all
5 involved simultaneously when using the present invention, a greater amount of oxygen is used by the body, at a standard heart rate, than during conventional exercises such as walking, running, or cycling. Thus, more calories are consumed using the present invention
10 per unit of time than with other exercises. A user can easily find the best level of exertion by merely adjusting the number of up and down cycles performed per minute on the apparatus. In order to help the user to maintain a desired number of cycles per minute, a
15 metronome device can desirably be included with embodiments of the present invention.

The present invention can desirably be carried out without the inclusion of weight plates, cables, ropes, chains, electrical circuits, or other complicated
20 electromechanical components which are subject to wear and breakage. The invention can be carried out, however, using such mechanical, pneumatic, hydraulic, or electrical components if desired but the illustrated embodiment and similarly straight forward arrangements
25 are presently preferred. The simplicity with which the present invention can be carried out results in an exercise machine which can be used by beginners and experienced athletes alike; no particular athletic ability or experience is necessary to use the
30 embodiments of the present invention. Moreover, since the present invention avoids placing undue strain on any particular joint or muscle, the chance of injury during use of the present invention is greatly reduced.

In summary, the present invention provides an
35 apparatus wherein the human body is exercised in a unique and novel way which simultaneously conditions the major muscles of the arms, legs, and trunk and

12

contributes equally to all of the essential elements of physical fitness. All of these benefits are obtained with an apparatus which is of straight forward and durable construction which can be used by persons of all
5 levels of physical fitness.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as
10 illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within
15 their scope.

20

CLAIMS

1. An exercise device comprising:

means for supporting a user's body, the body comprising at least one upper extremity and at least one lower extremity;

means for permitting the means for supporting to raise and lower;

means for receiving the lower extremity of the body;

means for permitting the means for receiving the lower extremity to move in a reciprocating fashion in response to the movement of the lower extremity;

means for receiving the upper extremity of the body;

means for permitting the means for receiving the upper extremity to move in a reciprocating fashion in response to the movement of the upper extremity; and

means for raising and lowering the means for supporting the body in proportion to the movement of the means for receiving the upper extremity and in proportion to the movement of the means for receiving the lower extremity such that the work performed by the user of moving the upper extremity and moving the lower extremity raises and lowers the weight of the body.

2. An exercise device as defined in claim 1 wherein the means for supporting a user's body comprises a seat.

3. An exercise device as defined in claim 2 further comprising means for adjusting the position of the seat.

4. An exercise device as defined in claim 1 wherein the means for receiving the lower extremity of the body comprises a pedal.

5. An exercise device as defined in claim 1 wherein the apparatus further comprises a base and wherein the means for permitting the means for receiving the lower extremity to move in a reciprocating fashion comprises a leg member pivotally connected to the base.

6. An exercise device as defined in claim 1 wherein the means for receiving the upper extremity of the body comprises a hand grip.

7. An exercise device as defined in claim 1 wherein the means for raising and lowering the means for supporting comprises an articulating mechanical linkage consisting of rigid members which are connected to the means for supporting, the means for receiving the upper extremity and the means for receiving the lower extremity.

8. An exercise device as defined in claim 1 wherein the means for receiving the lower extremity of the body comprises means for receiving a first foot of the user and means for receiving a second foot of the user and wherein the means for receiving the upper extremity of the body comprises means for receiving a first hand of the user and means for receiving a second hand of the user.

9. An exercise machine comprising:
a base having a forward end and a rearward end;
a seat;
means for permitting the seat to be raised and lowered in relation to the base;
a pair of grips, each of the grips positioned forward of the seat and configured to be grasped by a user;
means for permitting the pair of grips to move in a reciprocating fashion;

a pair of pedals, each of the pedals positioned forward of the seat and each configured to rest the foot of the user upon;

5 means for permitting the pair of pedals to move in a reciprocating fashion; and

means for transferring the reciprocating movement of the pair of grips and the pair of pedals to the seat such that as the user moves the pair of grips and the pair of pedals in a reciprocating fashion, the seat is raised and lowered in proportion to the movement.

10 10. An exercise machine as defined in claim 9 wherein the seat comprises a padded seat.

11. An exercise machine as defined in claim 9 further comprising means for adjusting the longitudinal position of the seat.

12. An exercise machine as defined in claim 9 further comprising means for axially rotating each of the grips.

20 13. An exercise machine as defined in claim 9 further comprising means for axially rotating each of the pedals.

14. An exercise machine as defined in claim 9 wherein the means for permitting the seat to be raised and lowered comprises a seat support member pivotally attached to the base and to which the seat is connected and wherein the means for permitting the pair of grips to move comprises an arm pivotally connect to the base and to which the grips are connected and wherein the means for permitting the pair of pedals to move comprises a leg pivotally connected to the base and to which the pedals are connected and wherein the means for transferring comprises an rigid members pivotally attached to the leg, to the arm, and to the seat support member.

15. An exercise machine as defined in claim 14 wherein the means for permitting the seat to be raised

and lowered further comprises a strut pivotally attached to the seat support member at a first end and a wheel rotatably attached at a second end thereof.

16. A method of exercising the human body
5 comprising the steps of:

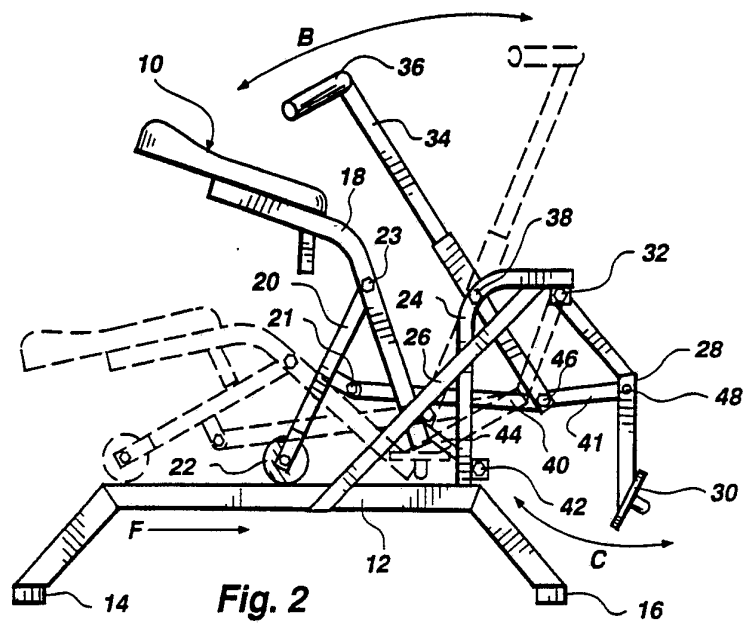
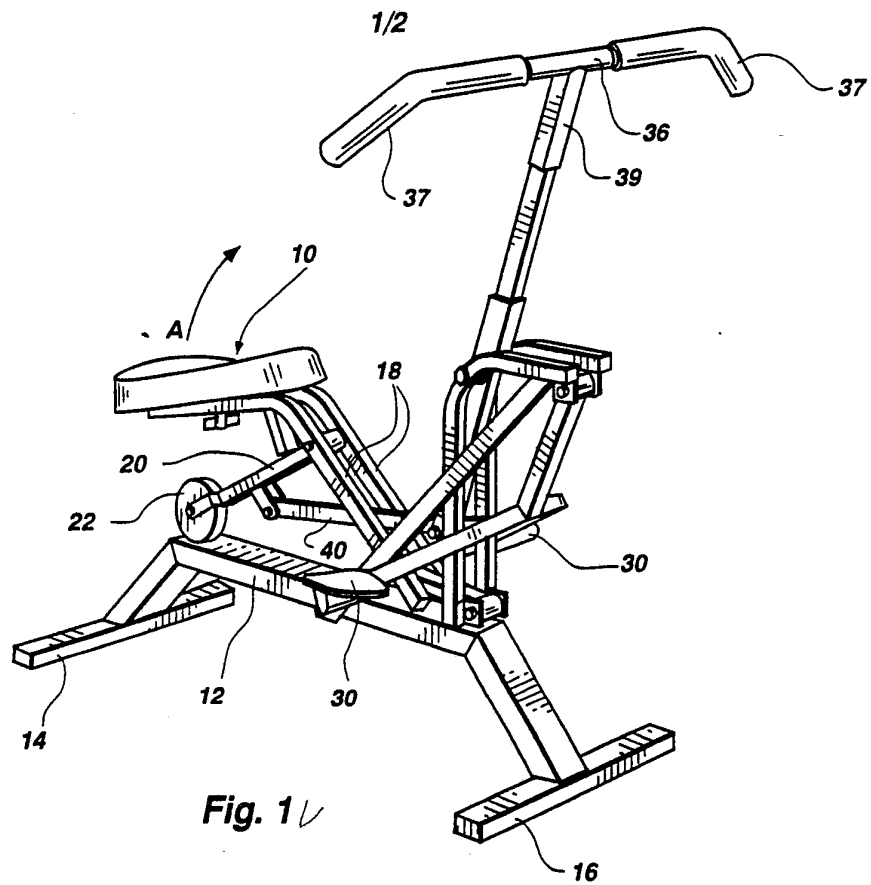
supporting the body on a seat;
grasping at least one grip with a hand;
resting at least one foot on a pedal;
pulling on the grip and pushing on the pedal
10 and causing the seat and the body to be lifted
proportionally to the movement of the grip and the
pedal.

17. A method of exercising the human body as
defined in claim 16 wherein the step of grasping at
15 least one grip comprises the steps of the grasping a
first grip with a left hand and grasping a second grip
with a right hand.

18. A method of exercising the human body as
defined in claim 17 wherein the step of resting at least
20 one foot on a pedal comprises the steps of resting a
left foot on a first pedal and resting the right foot on
a second pedal.

19. A method of exercising the human body as
defined in claim 18 further comprising the step of
25 rotating the first grip and the second grip.

20. A method of exercising the human body as
defined in claim 18 further comprising the step of
rotating the first pedal and the second pedal.



SUBSTITUTE SHEET

2/2

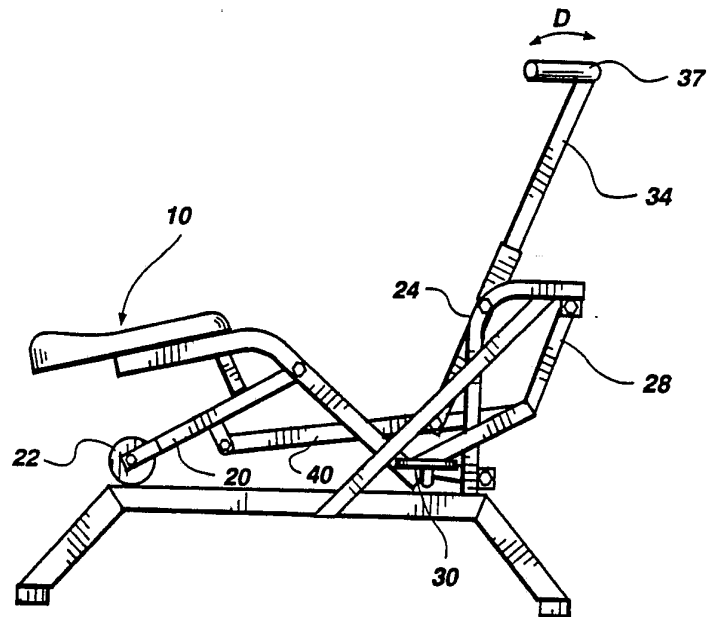


Fig. 3

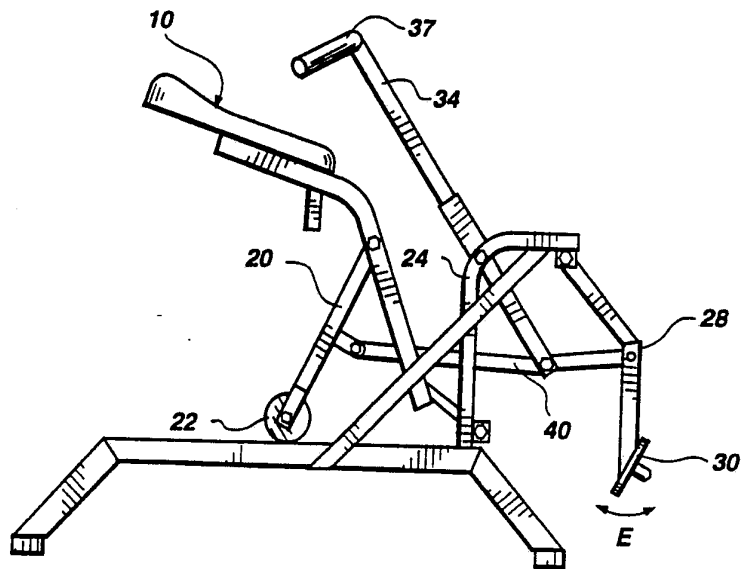


Fig. 4

SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US92/03131

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) : A63B 22/06; A63B 21/068

US CL : 482/57; 482/95

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 482/96,148,142,97,57,95

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A 4,300,760 (BOBROFF) 17 NOVEMBER 1981 SEE THE ENTIRE DOCUMENT	1-20
X	US,A 2,470,544 (BELL) 17 MAY 1949 SEE THE ENTIRE DOCUMENT	1-20
X	US,A 2,642,288 (BELL) 16 JUNE 1953 SEE THE ENTIRE DOCUMENT	1-20
X	US,A 2,924,456 (MILLER) 09 FEBRUARY 1960 SEE COL. 3 LINES 1-10	3,10,11

☐ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be part of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 21 JULY 1992	Date of mailing of the international search report 12 JUL 1992
Name and mailing address of the ISA/ Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer STEVE CROW <i>Jerome Scales</i>
Facsimile No. NOT APPLICABLE	Telephone No. (703) 308-3398