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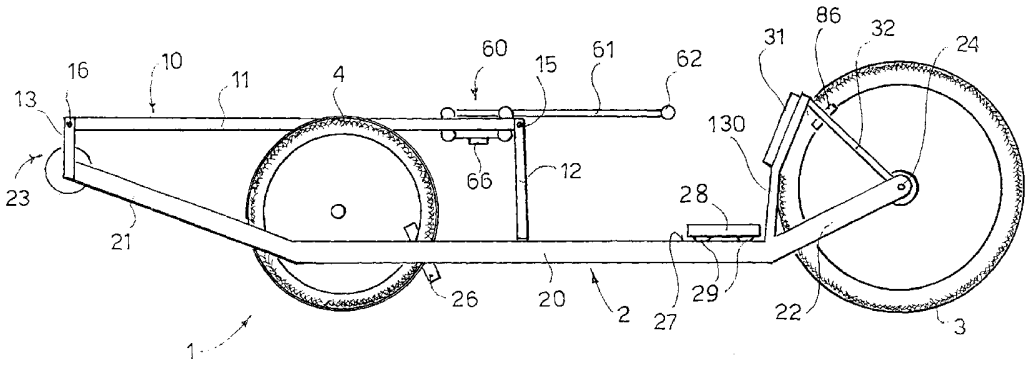
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(54) Title: WHEELED ROWING MACHINE



(57) Abstract: A rowing machine (1) comprising a supporting frame (2) mounted on wheels (3, 4), a seat (28) mounted slidably on the supporting frame, two footboards (26) for the user's feet mounted fixedly on the supporting frame, and a handlebar (62) comprising two handgrips for the user mounted slidably on a secondary frame (10) horizontally pivoted on the supporting frame (2) along a longitudinal midline axis, the handlebar (62) being operatively connected to a drive able to set in rotation at least one (3) of said wheels and the secondary frame being operatively connected to steering means, able to bring about steeing of at least one (4) of said wheels.

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WHEELED ROWING MACHINE

DESCRIPTION

The present invention refers to a wheeled rowing machine, that is to say a rowing machine mounted on wheels set in rotation by means of the user's muscle power. Said wheeled rowing machine, is suitable to be used as a vehicle travelling on road or track for pleasure and for training of the user or else it can be used in the home, as exercise equipment.

The stress of modern life with its frantic repetitive rhythms and above all with the almost total lack of physical activity, has given rise to a great need in people to exercise. Recent years have seen a considerable boom in keeping fit, with the appearance on the market of various items of exercise equipment, some of which have launched a real fashion.

Often the drawback related to this equipment is that of activating only one part of the human musculature, ultimately proving disharmonic, if not downright harmful. Cycling, for example, is in fact absolutely incomplete, in that it sets in motion mainly the muscles of the lower limbs, leaving many other parts of the body inactive.

A really complete sport is rowing because it puts into action practically all the body's muscles and particularly those connected to the back, abdomen, legs and arms.

Various types of rowing machines are known to the art. The best known are vehicles which move in water. A rowing machine of this type comprises a hull, at least one pair of oars and at least one seat for the user. The oars are hinged to the side edges of the hull and the seat is mounted slidably in the hull. Such rowing machines are used by skilled, motivated athletes and impose the need to go to a suitable, equipped stretch of water. Furthermore, on account of the provision of the hull, they are bulky and costly and are therefore used by a narrow circle of enthusiasts.

Other types of rowing machines known to the art are items of exercise equipment in the form of static machines. Such a rowing machine comprises a frame destined to be secured to the ground. Two levers operable by the user are hinged to said frame and a seat is mounted slidably. Said rowing machines can be mounted in indoor environments,

such as a gymnasium or a home. However, use thereof proves boring and repetitive and for this reason they have not met with great commercial success.

The object of the present invention is to eliminate the drawbacks of the prior art, providing a wheeled rowing machine that is able to travel on road or track thanks to the action of the user's muscle power.

Another object of the present invention is to provide such a wheeled rowing machine that allows the user both the possibility of performing a training exercise and the possibility of travelling on road.

Another object of the present invention is to provide such a wheeled rowing machine that is economical and occupies little space.

These objects are achieved in accordance with the invention with the characteristics listed in appended independent claim 1.

Advantageous embodiments of the invention are apparent from the dependent claims.

The rowing machine according to the invention comprises a supporting frame mounted on wheels, a seat mounted slidably on the supporting frame, resting means for the user's feet mounted fixedly on the supporting frame, and a handlebar comprising two handgrips for the user, mounted slidably on the supporting frame. The handlebar is operatively connected to a drive able to set in rotation at least one of said wheels and to steering means, able to generate a swerve on at least one of said wheels.

In particular the handlebar comprises a slide mounted slidably on a secondary frame horizontally pivoted along a longitudinal midline axis on the supporting frame. The steering means are connected to the secondary frame, so that a turn of the handlebar causes a rocking movement of the secondary frame and thus a swerve of the wheels.

The drive can be a belt or chain drive which is set in motion by the translatory motion of the handlebar to set the driving wheel in rotation.

The advantages of the wheeled rowing machine according to the invention are obvious. In fact, said rowing machine can travel on the road allowing the user both to train in the open air with a complete sport, and to enjoy himself travelling for distances.

Further characteristics of the invention will be made clearer by the detailed description that follows, referring to a purely exemplary and therefore non-limiting example thereof, illustrated in the appended drawings, wherein:

Figure 1 is a side elevation schematically illustrating the wheeled rowing machine according to the invention, wherein, for greater clarity, some drive elements have been omitted;
Figure 2 is a plan view from above of the wheeled rowing machine of Figure 1;
Figure 3 is a side elevation illustrating the drive of the wheeled rowing machine according to the invention;
Figure 3A is a side elevation like Figure 3, illustrating a first variant of the drive system of the wheeled rowing machine according to the invention;
Figure 3B is a side elevation like Figure 3, illustrating a second variant of the drive system of the wheeled rowing machine according to the invention;
Figure 4 is a front view, partially in cross section, illustrating the steering carriage of the wheeled rowing machine according to the invention;
Figure 5 is a front view, partially in cross section, illustrating the steering mechanism of the wheeled rowing machine according to the invention.
The wheeled rowing machine according to the invention, denoted as a whole with reference numeral 1, is described with the aid of the figures.

With reference for now to Figures 1 and 2, the wheeled rowing machine 1 comprises a supporting frame 2 supported by three wheels, that is to say a rear driving wheel 3 and two front steered wheels 4. The supporting frame 2 consists of two parallel steel tubes. Each tube has a straight horizontal middle portion 20, a slightly upwardly inclined front portion 21 and a slightly upwardly inclined rear portion 22.

The frame 2 ends at the front in a fork 23 serving the purpose of supporting the shaft of a drive pinion which will be described further on. At the rear end of the frame 2a second fork 24 is provided, serving the purpose of supporting the hub 30 of the rear driving wheel 3.

A transverse axle 25, serving the purpose of supporting the two front wheels 4, is welded in the front middle portion of the 20 of the tubes.

Rearward of the transverse axis 25 of the front wheels there are two footrests 26 responsible for providing a rest for the user's feet and provided with ties to retain the feet.

At the rear end of the middle portion 20 of the frame a vertical portion 130 which rises upward to support a backrest 31 to support the user's back is provided. The upper end of the vertical part 130 of the frame 2 is connected by means of two supporting rods 32 to the respective rear ends of the frame 2.

In the middle-rear part of the middle portion 20 of the frame 2, two parallel guide rails 27 are provided to support a seat 28 mounted on wheels 29 sliding on guides 27. The seat 28 consists of a small wooden or fibreglass board, bearing the imprint of the buttocks and has a stroke that goes from the parts 30 of the frame supporting the backrest 31 to some vertical supports 12 disposed in front of the footrests 26.

Above the front half of the main frame 2 there is disposed a secondary frame 10 consisting of a rectangular frame formed by two long parallel metal tubes 11, joined at the two ends by two shorter tubes 14, so as to form a monolithic rectangle. The secondary frame 10 is supported at it rear and front ends respectively by two vertical supporting brackets 12 and 13, disposed respectively at the midpoint of the middle portion 20 and at the front end of the front portion 21 of the main frame 2. The short tubes 14 of the secondary frame 10 are hinged, by means of pins 15 and 16 to the supporting brackets 12 and 13 so that the secondary frame 10 can rock around a longitudinal midline axis passing through the two pins 15 and 16.

The secondary frame 10 also acts as a support and guide for a slide or carriage 60 which slides along its entire length. At the rear end of the slide 60 is fixed a longitudinal rod 61 ending with a transverse rod 62 with two lateral handgrips, acting as a handlebar, suitable to be gripped by the user. In this manner the user, by gripping the handlebar 62, can push the slide 60 forward and pull it backward; furthermore the user can turn the handlebar to the right or to the left, causing a rocking movement of the secondary frame 10.

As shown in Figure 4, this slide 60 has the peculiarity of being able to slide along the secondary frame 10 with low friction, thanks to the presence of twelve ball bearings, four upper 63 and four lower 64 disposed with a horizontal axis of rotation and a further four ball bearings 65 inside the horizontally pivoted frame 10 and disposed with a vertical axis of rotation.

The object of the eight outer ball bearings 63, 64 with a horizontal axis is to allow linear sliding of the carriage 60 on the secondary frame 10 without allowing right-angled sideslipping thereof with respect to the horizontal plane. Whilst the four inner ball bearings 65 with a vertical axis prevent right-angled sideskids of the carriage 60 with respect to the vertical plane. In practice, the slide or carriage 60 proves to have only one degree of freedom along the longitudinal axis of the secondary frame 10.

Obviously simplified versions of the slide can be provided, with a smaller number of ballbearings, for example with only four ballbearings.

An antiroll hinge 66 protrudes downward from the carriage 60. As shown in Figure 3, the antiroll hinge 66 has one end fixed to the carriage 60, whereas the other end is integral with a primary drive chain 70. In practice the primary chain 70 originates and ends on one of the two edges of the antiroll hinge 66, whereas the other edge is integral with the carriage 60 of the handlebar.

This arrangement makes it possible to avoid transmitting to the chain the torsional stresses (roll) caused by rotation of the handlebar which bring about the rotation of the secondary horizontally pivoted frame 10, whereas it allows only the tractional force which must reach the rear driving wheel 3 to be applied thereto.

The primary chain 70 is of the cycling type and winds along the machine forming a substantially upturned B-shaped closed course to be able to reverse the direction of rotation in the second loop of the B with respect to the first loop.

In order to obtain such a course, the primary chain 70 starts from the antiroll hinge 66, then winds on a first idler pinion 71 disposed at the front end of the main frame 2, passes on a second tensioning pinion 72, disposed at the midpoint of the front portion 23 of the frame 2, then engages in a third 73 and in a fourth 74 tensioning pinion 74 disposed in the middle portion 22 of the frame 2, then winds on a fifth idler pinion 75, disposed at the

rear end of the middle portion 22 of the frame, then is driven by a sixth 76 and a seventh 77 tensioning pinion disposed in proximity to the vertical bracket 12 of the frame and returns to the antiroll hinge 66.

On the same axis as the idler pinion 75, disposed at the rear end, a pinion 80 is provided wherein is driven a secondary drive chain 81, which from this point returns toward the rear wheel 3 to close again on itself winding round the pinions 82 forming part of the gear change and the pinion 83 integral with the axle of the rear wheel 3. The pinion 80 of the secondary chain 81 is integral with its axis of rotation, whereas the pinion 75 of the primary chain 70 has a free snap, that is to say it is integral in rotation with its own axis in one direction, whereas it is free in rotation with respect to its own axis in the opposite direction.

When traction is exerted on the handlebar 62, the primary chain 70 is tensioned and also draws the secondary chain 81 into motion because the free snap of the pinion 75 is engaged, but during the return stroke, that is to say when a push is exerted on the handlebar 62, the free snap is released, allowing the secondary chain 81 to remain stationary while the primary chain 70 makes its return movement.

The necessary tension on the secondary chain 81 is ensured by the spring incorporated into the gear selector 82. The movement of the gear change 82 takes place by means of a lever 84 (Figure 2) disposed on one side of the handlebar 62. Said lever 84 is connected to a tie rod which operates the gear change 82.

On the other side of the handlebar 62 there is a lever 85 which operates the brake control. The rowing machine 1 has a main brake 86 applied to the rim of the rear wheel 3 and operated by the lever 85 placed on the handlebar 62 and an auxiliary and parking brake (not shown) which acts directly on the rear tyre 3 by means of a lever (not shown) situated beneath the seat 28.

Furthermore the rowing machine may have a secondary brake which acts on both front wheels.

Variations can be made to the chain drive described above, such as replacing the primary chain 70 with a sprocket chain.

Figure 3A shows a first variant, wherein in place of the primary chain 70, a thin open circuit belt 170 is provided, directly connected to a pulley 183 mounted with a free snap on the axle of the rear wheel 3.

One end of the belt 170 is connected to the antiroll hinge 66 of the carriage 60 of the handlebar. The pinion 71 has been replaced with a pulley 171 and the belt 170 is wound on the pulley 171 for a part of its periphery, then the belt 170 departs towards the rear part of the machine, passing in the centre of the main frame 2 and beneath the seat 28, being supported and guided by other idler pulleys 172, 173 mounted rotatably on the frame 2.

When it reaches the end of the straight portion of the carriage of the seat 28, the pulley 172 directs the belt 170 towards the centre of the rear wheel 3, where a terminal pulley 183 with two races receives it to wind it.

The terminal end of the drive belt 170 is fixed with screws on the bottom of the innermost race of the pulley 183 (the other end is fixed to the anti-rolling hinge 66). Then the drive belt 170 is wound in a clockwise direction so that by pulling the handlebar towards one, said belt 170 draws the rear wheel 3 into rotation.

A second belt 180, smaller than the first belt 170, is wound anticlockwise on the outermost race of the pulley 183, so that as one winds, the other stretches.

The small belt 180 in turn runs on some pulleys and is connected with an elastic cord 182 (shown with a dotted line), the other end whereof is fixed to the front part of the frame 2 of the rowing machine.

Operation of this variant is as follows.

When the athlete pulls the handlebar 62 towards himself, the larger belt 170 is tensioned and transmits motion directly to the wheel 3. Whilst the large belt 170 is stretched, the small belt 180 is wound on the relative race of the pulley 183. During winding of the small belt 180, the elastic cord 182 is tensioned.

At the end of the working stroke, the athlete brings the handlebar forward again, thus the elastic cords 82 recalls the small belt 180, which causes rotation of the pulley 183 and thus rewinding of the large belt 170.

The free snap incorporated into the axle of the rear wheel 3 allows same to continue its rotation irrespective of the movements of the belts 180 and 170.

This drive system, thanks to the provision of belts, has the advantage of being quieter, lighter and cheaper than a chain drive system. Furthermore, this belt drive system allows less initial effort by the athlete, because the diameter of the pulley 183 is greatest when the whole belt 170 is wound, therefore it is as if an automatic step-down ratio were inserted.

Figure 3B describes a second embodiment of the drive system of the rowing machine according to the invention. In this embodiment the primary circuit is formed by a belt 20 driven on a pulley in a closed loop circuit and connected to the antiroll hinge 66 of the carriage 60. In the rear part the belt 270 is driven by a pulley 273 which meshes peripherally with an idle gear 274 for reversal of the direction of rotation. In fact the idle gear 274 turns in the opposite direction with respect to the direction of rotation of the pulley 273. A chain 81 forming part of the secondary drive circuit which is substantially similar to that described previously is driven in the idle gear 274.

The steering mechanism of the rowing machine 1 is described below.

As shown in Figure 5, the secondary frame 10 is connected in its middle zone to two laterally protruding flanges 40. Each flange 40 is hinged at one end, by means of a pin 41, to a substantially vertical rod 42. The two free ends of the rods 42 are hinged, by means of respective pins 43, to the two end of a horizontal arm of a bracket 44 shaped like an upside down T.

In a central position the T-shaped bracket 44 is hinged by means of a pin 50 to the main frame 2. A first sprocket wheel 45 is fixed integrally to the main frame 2. At the upper end of the vertical arm of the T-shaped bracket 44 a second sprocket wheel 46 which meshes with the first sprocket wheel 45 is pivoted by means of a centrally disposed pin 49.

Two horizontal rods 48 are hinged to the second sprocket wheel 46, by means of a pin 47, disposed in an eccentric position. The other ends of the rods 46 go to respective hinges of the steering gear 150 disposed between the transverse axis 25 of the main frame and the hubs of the front wheels 4. In this manner the horizontal rods 48 control the hinges of the steering gear 50 adjusting the steering angle of the front wheels 4.

An important peculiarity is represented by the steering adjustment device which will be described hereunder. The steering adjustment device serves to amplify the steering (that is, to reduce the turning radius), without compromising the stability of direction.

Automotive vehicles are known to have a steering reduction gear, that is a system which reduces the angle measured on the pivot of the wheels with respect to that measured on the steered wheel. This is necessary to increase "driveability", that is to make it possible not to skid because of excessive pressure on the wheel, a typical problem of Formula 1 cars. Consequently, in an ordinary vehicle, to make a curve with a narrow radius it is necessary to turn the wheel several times, whereas to take bend with a wide radius, a light pressure on the steering wheel is sufficient.

The same principle applies to the rowing machine described, with the difference that it is neither conceptually nor structurally possible to turn the handlebar a number of times to take a tight bend.

In order to solve this problem, a device is needed that transmits the command applied to the handlebar to the wheels in a non-linear fashion, that is a device which transmits a reduced command to the wheels if the steering angle is small, whereas it transmits an increased command to the wheels if the steering angle exceeds a certain value.

Summarising, for small angles imparted to the handlebar, the rowing machine swerves little (allowing excellent steering accuracy), whereas for large angles imparted to the handlebar (near to the maximum range allowed), the rowing machine turns very much, making it possible to take very tight bends or sudden changes of direction.

This function is provided for by the pair of gears 45 and 46 whereof the second 46 is integral with the vertical arm of the T-shaped bracket 44, nevertheless being able to turn on its pivot 49, whereas the first gear 45 with a greater radius, is fixed, being fixed integrally to the main frame 2.

When the handlebar 62 is given a small angular movement, the slide 60 causes the secondary frame 10 to rock, making the T-shaped bracket 44 turn, by means of the rods 42, around its own pivot 50, in the desired direction. When the T-shaped bracket 44 turns around its own pivot 50 it draws with it the gear 46, which is obliged to move turning around its own pivot 49 and at the same time performing a movement of revolution around the gear 45 in the direction of movement of the vertical axis of the T-shaped bracket 44.

Said movement is due to the fact that the gear 46, being engaged on the peripheral teeth of the gear 45 which is fixed to the main frame 2, can move only by rotating around its own axis 49 and at the same time travelling along the periphery of the gear 45.

This movement of rotation and revolution of the gear 46 initially causes the desired lag of the position of the eccentric pivot 47 with respect to the position of the T-shaped bracket 44. This applies only for small angles imparted to the handlebar; this situation solves the problem of steering accuracy.

But when the angle imparted to the handlebar 62 increases, the eccentric pin 47 of the gear 46 is brought into increasingly outward positions, causing an increasingly long stroke of the two horizontal steering gear arms 18, thus causing the steering radius to decrease; this situation solves the problem of steering intensity.

The vehicle has a light fairing serving the purpose of concealing the mechanical members from view and giving the vehicle a certain aerodynamic penetration.

Operation of the rowing machine 1 according to the invention is described hereunder.

The athlete sits on the seat 28, places his feet on the footrest 26 and fixes them with the straps; he then grips the handlebar 62 and crouches forward using his feet for leverage.

Starting from this position, the athlete straightens his legs through rearward translation of the seat 28, then arches his back and pulls the handlebar 62 toward his chest, at the same time ensuring steering of the vehicle by small corrections with the handlebar 62 which causes a rocking movement of the secondary frame 10 and therefore adjustment of the steering.

By operating in this manner the force resulting from the movement of back, legs and arms for pulling on the handlebar 62 is transmitted to the driving wheel 3 through the chain 70 or the other variants described.

The stroke of the carriage 60 mounted on the handlebar is such as to cause the rear driving wheel 3 to make a few turns at a time, corresponding to a few metres travelled for each rowing stroke, depending upon the ratio of the gear 82 engaged (if present).
Steering of the vehicle is ensured by the possibility of turning the handlebar 62 to the right or left at any point of its linear translation.

It should further be noted that the rowing machine 1 can be positioned with the driving wheel 3 over a pair of rotatable rollers, so that rotation of the driving wheel does not cause the rowing machine 1 to travel. In this manner the rowing machine 1 can by used in the home or gym, as static training equipment.

In the present embodiment of the invention, a single seater rowing machine 1 with two front steered wheels and one rear driving wheel has been described. However, other solutions can be provided, such as for example a two-seater rowing machine, or a rowing machine with two front driving wheels and one rear steered wheel-

Furthermore, an auxiliary motor such as an internal combustion engine, connected to the drive can be installed on the rowing machine according to the invention. In this manner the user can start the engine when he has to cover uphill stretches, for example, to aid coverage of slopes.

Numerous changes and modifications of detail within the reach of a person skilled in the art can be made to the present embodiment of the invention without departing from the scope of the invention as set forth in the appended claims.

CLAIMS

1. A rowing machine (1) comprising:
- a supporting frame (2),
- a seat (28) mounted slidably on said supporting frame,
- resting means (26) for the user's feet mounted fixedly on the supporting frame, and
- a handlebar (62) comprising two handgrips for the user mounted slidably on the supporting frame (2),
characterised in that
said supporting frame (2) is mounted on wheels (3, 4), and
said handlebar (62) is operatively connected to a transmission able to set in rotation at least one (3) of said wheels and to steering means able to bring about steering of at least one (4) of said wheels.

2. A rowing machine according to claim 1, characterised in that said handlebar (62) is connected to a slide (60) mounted slidably, in a longitudinal direction, on a secondary frame (10) and said secondary frame is horizontally pivoted, around a longitudinal axis, on said supporting frame (2).

3. A rowing machine according to claim 2, characterised in that said slide (60) s mounted slidably on the secondary frame (10) by means of ball bearings (63, 64, 65).

4. A rowing machine according to claim 3, characterised in that said slide (60) comprises twelve ball bearings, whereof four (63) with a horizontal axis of rotation disposed above the secondary frame (10), four (64) with a horizontal axis of rotation disposed beneath the secondary frame (10) and four (63) with a vertical axis of rotation disposed inside the secondary frame (10).

5. A rowing machine according to claim 3, characterised in that said slide (60) comprises four ball bearings.

6. A rowing machine according to any one of claims 2 to 5, characterised in that said slide (60) is connected by means of an antiroll hinge (66), to a chain or belt drive (70; 170; 270) driving the driving wheel (3) of said rowing machine in rotation.

7. A rowing machine according to claim 6, characterised in that said chain or belt drive comprises a main circuit consisting of a main chain or belt (70; 270) connected to said antiroll hinge (66) and driven by pinions in a closed circuit and a secondary circuit consisting of a secondary chain (81) driven in a closed loop between a first pinion (80; 274) operatively connected to the main chain or belt (70; 270) and a second pinion (83) integral with the hub of the driving wheel (3).

8. A rowing machine according to claim 7, characterised in that said main chain (70) of the main circuit performs a substantially upturned B-shaped course and said first pinion (80) of the secondary chain (81) is mounted on the same shaft as a pinion (75) having a free snap, whereon the main chain (70) winds.

9. A rowing machine according to claim 7, characterised in that said main chain (270) of said main circuit performs a substantially closed loop circuit and said first pinion (274) of the secondary chain (81) is an idle gear which engages peripherally with a pulley (175) whereon the main belt (270) winds.

10. A rowing machine according to any one of claims 7 to 9, characterised in that between said secondary chain (81) and said second pinion (83) integral with the wheel a gear change device (82) comprising several pinions is provided, said gear change device (82) being operated by a cable connected to a lever (84) disposed on the handlebar (62).

11. A rowing machine according to claim 6, characterised in that said belt drive comprises a main belt (170) connected to said anti-rolling hinge (66), driven by means of pulleys in an open circuit and winding in a first race of a pulley (183) mounted on the hub of the driving wheel (3) and a secondary belt (180) winding in a second race of said pulley (183) and connected at one end to an elastic cord (182) fixed to the main frame (2).

12. A rowing machine according to any one of claims 2 to 11, characterised in that said steering means comprise two substantially vertical connecting rods (42), hinged at their ends in two opposite side edges of said secondary frame (10) and at two ends of a bracket (44) hinged to said supporting frame (2) and supporting a gear (46) whereto are hinged two substantially horizontal control rods (48), connected to the respective hinges of the steering (150) disposed on the axle (25) of the steered wheels (4).

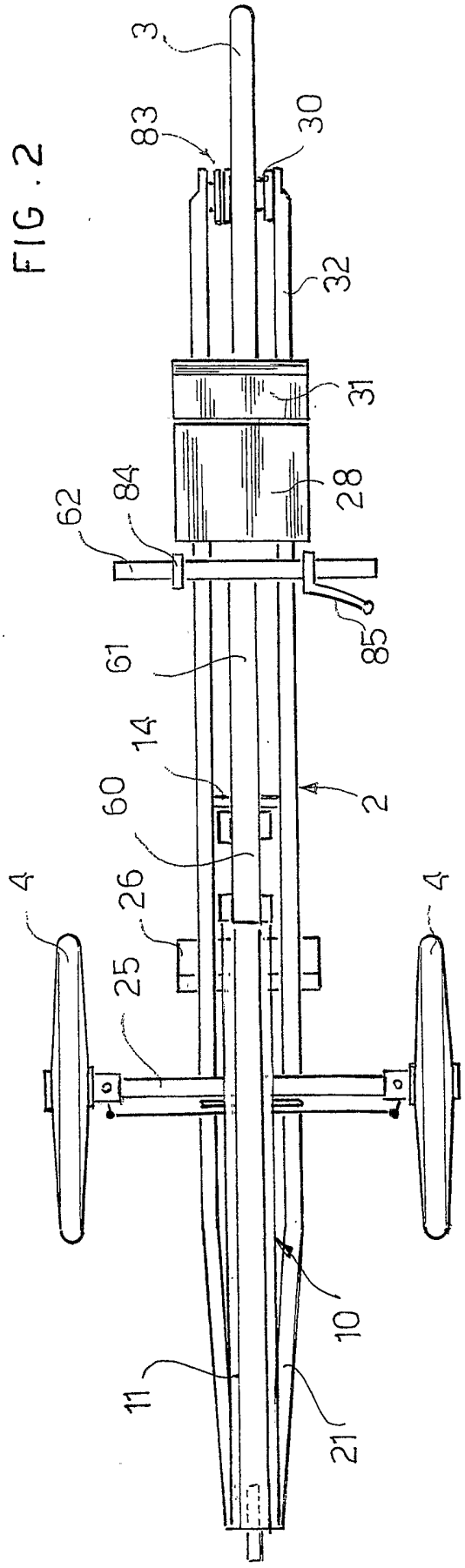
13. A rowing machine according to claim 9, characterised in that said bracket (44) of the steering means is substantially shaped like an upside down T, wherein the two ends of the horizontal armed of the T-shaped bracket are hinged to the respective ends of the vertical connecting rods (42) and the end of the vertical arm of the T-shaped bracket (44) is hinged to said sprocket wheel (46) which meshes on another sprocket wheel (45) fixed integrally to the main frame (2) and said horizontal control rods (48) are hinged to a pin (47) disposed in an eccentric position on said gear (46) connected to the T-shaped bracket.

14. A rowing machine according to any one of the preceding claims, characterised in that it comprises a brake acting on the rear wheel rim and and/or on the two front wheels and operated by a cable connected to a lever (85) disposed on said handlebar (62).

15. A rowing machine according to any one of the preceding claims, characterised in that it comprises an auxiliary motor connected to the rowing machine drive.

16. A rowing machine according to claim 1, characterised in that it comprises a steered rear wheel and two driving front wheels.

FIG. 2


3
83
30
32
31
28
84
62
61
85
14
60
2
4
26
25
10
11
21

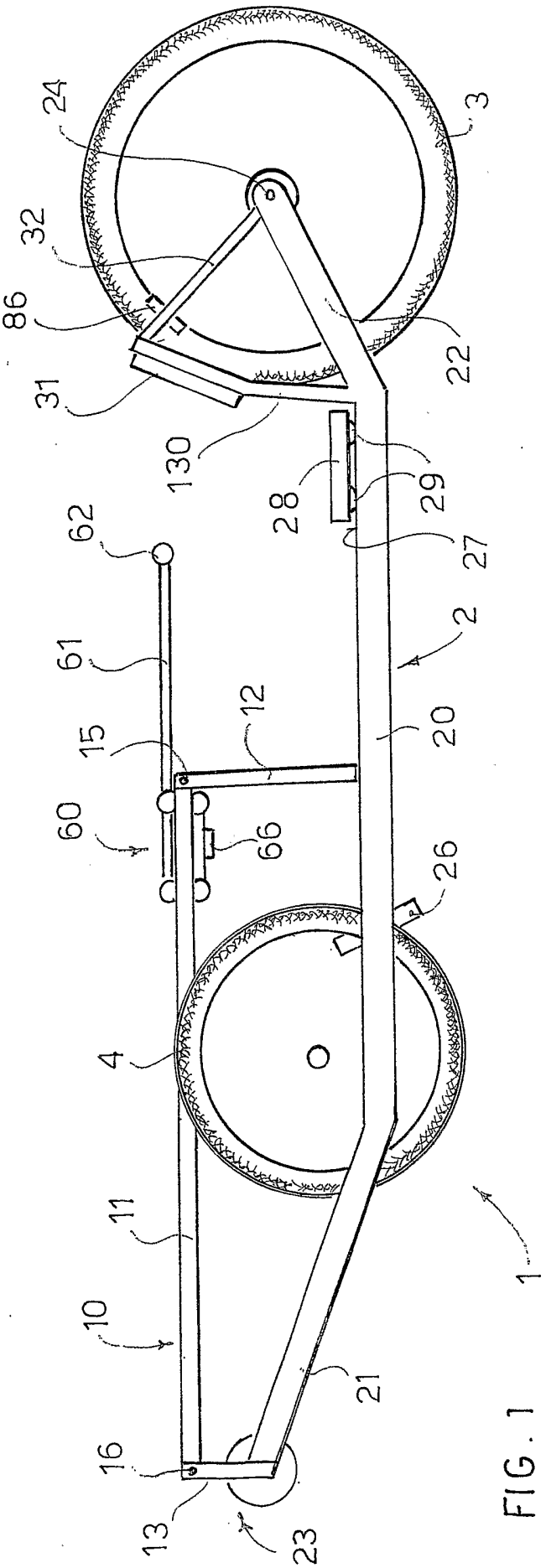

24
3
32
86
22
31
130
28
29
27
62
61
2
12
15
20
60
66
26
4
11
10
21
16
13
23
1

FIG. 1

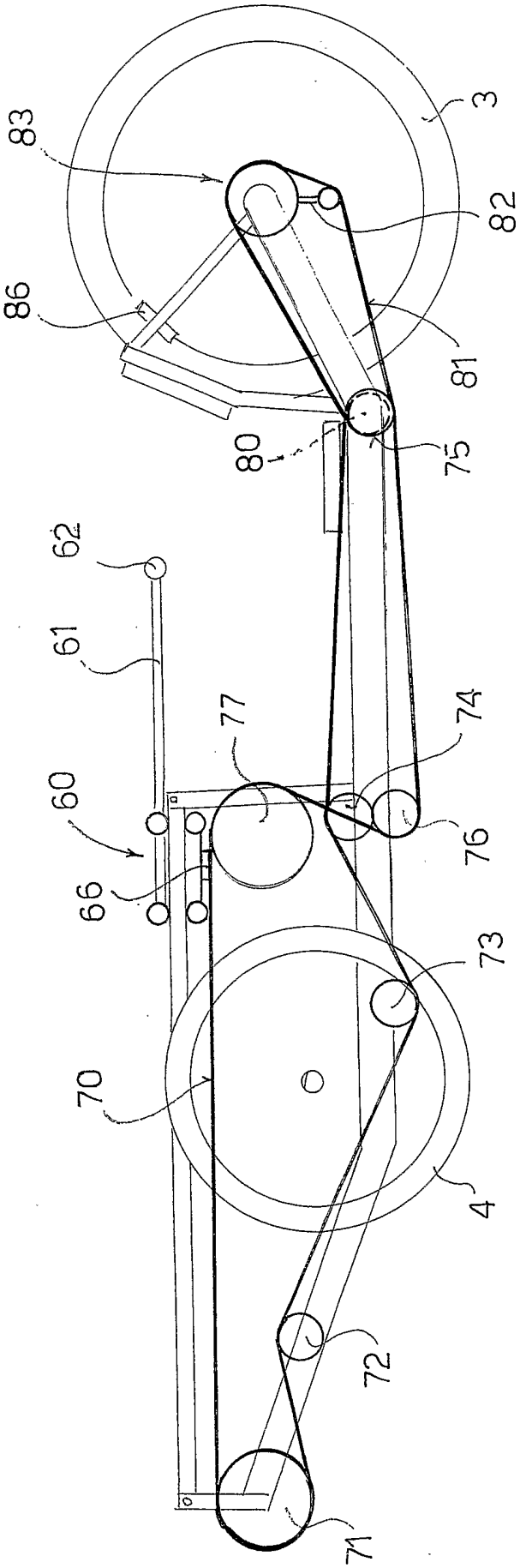


FIG.3

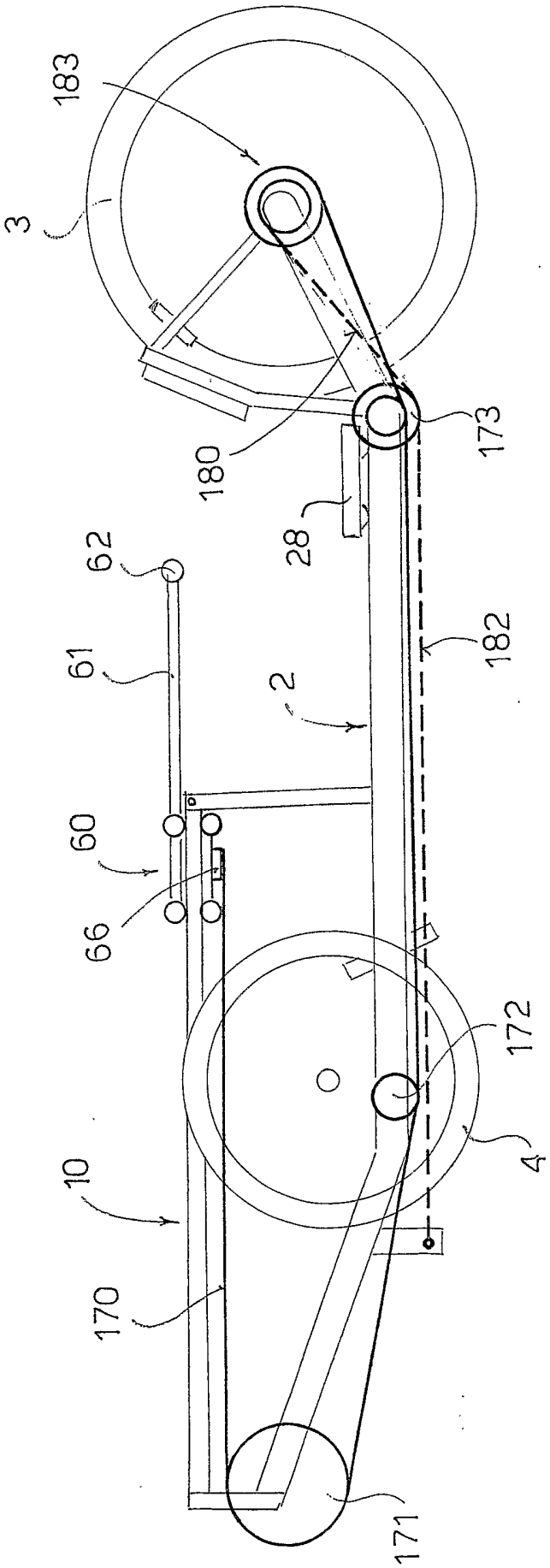


FIG. 3A

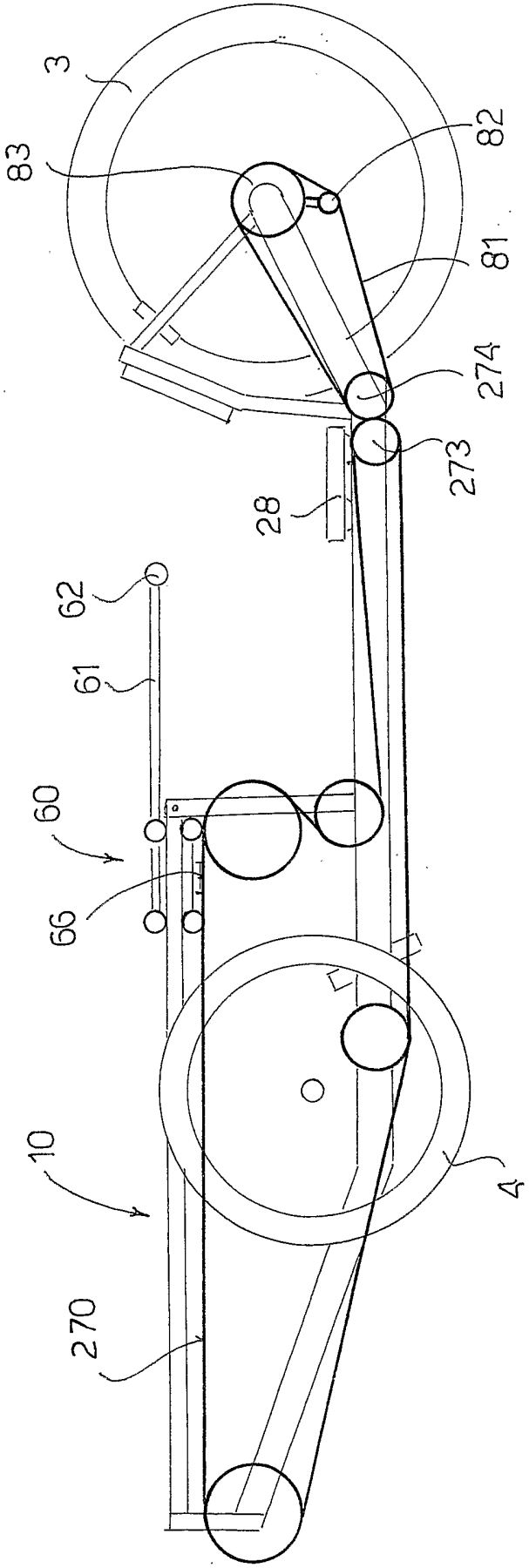


FIG. 3B

FIG. 4

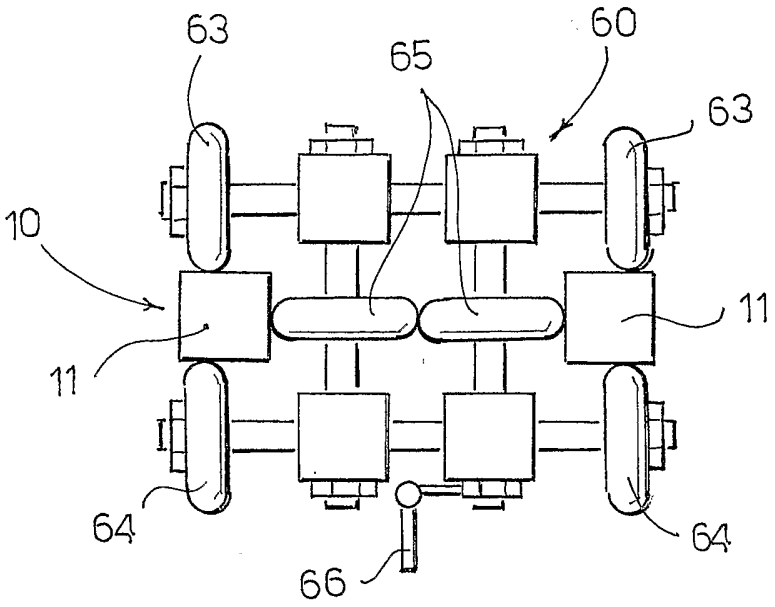
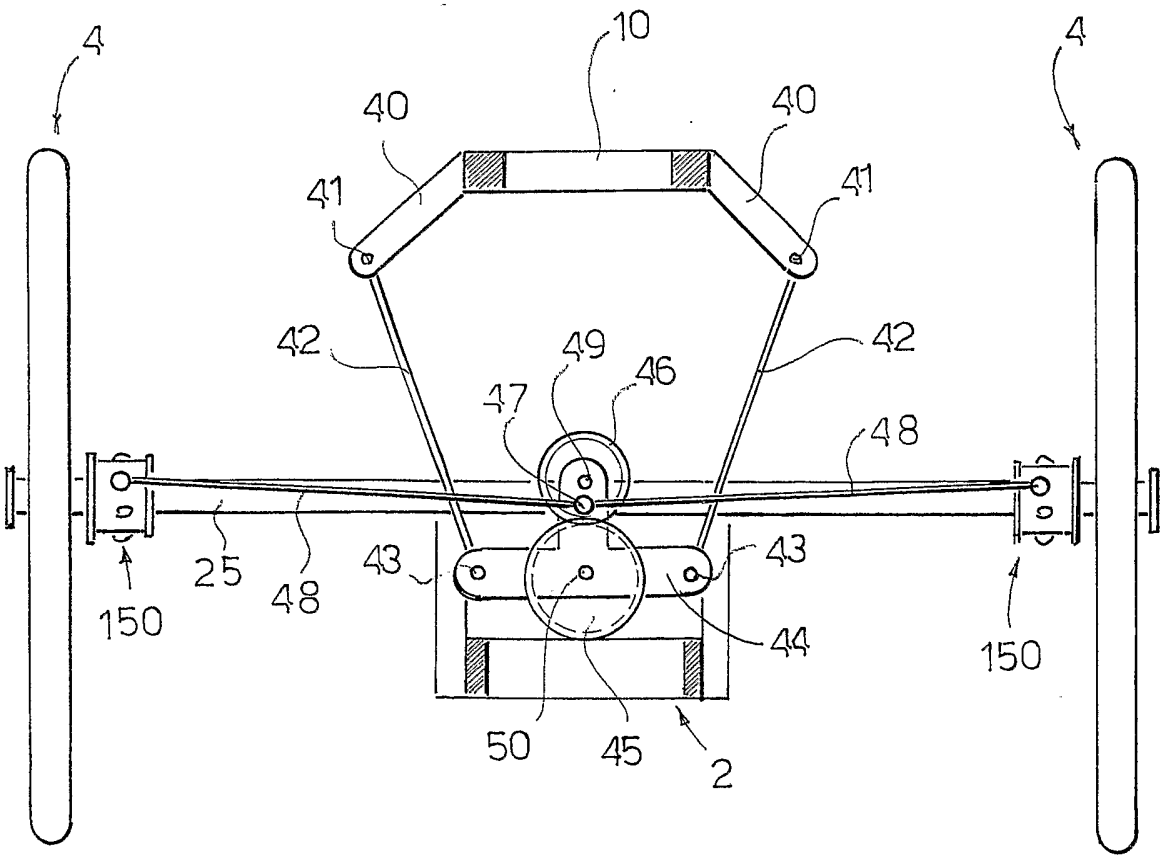

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FIG. 5


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INTERNATIONAL SEARCH REPORT

Inte al Application No
PCT/IB 02/03210

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B62M1/16 B62K3/00 B62K5/04

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)
IPC 7 B62M B62K

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 practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	DE 196 14 836 A (RAATZ ERICH) 16 October 1997 (1997-10-16) column 2, line 19 -column 3, line 22; figure 1	1-3,5,6 7,10,11, 14-16 4,12
X	EP 0 197 569 A (WEERT PAUL H DE) 15 October 1986 (1986-10-15) claims; figures	1
Y A	DE 199 34 817 A (SCHIBALSKY WALTER) 1 February 2001 (2001-02-01) column 1, line 58 - line 66; figures	7,10 8,9
Y	US 4 632 414 A (ELLEFSON MARK W) 30 December 1986 (1986-12-30) column 2, line 66 -column 3, line 40; claims; figures	11,14

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
21 November 2002	28/11/2002

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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Y	GB 2 315 250 A (HUGGETT JOHN PHILIP) 28 January 1998 (1998-01-28) claim 1; figures	16

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