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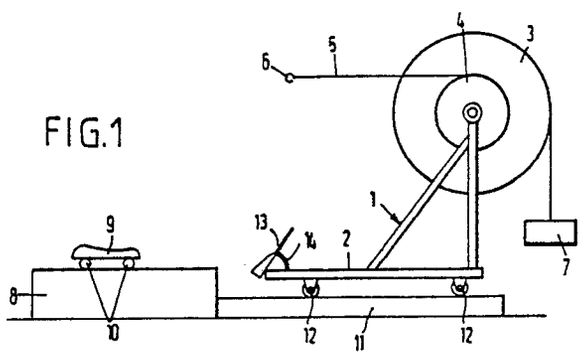
(54) Rowing ergometer.

(57) A rowing ergometer comprising a first portion (1) having a frame (2) wherein there is arranged a flywheel (3) which is drivable by means of a chain or rope (5) through a suitable transmission mechanism. Said chain or rope, at the end remote from the flywheel, is connected to a handgrip (6) simulating an oar, while the flywheel is further provided with an adjustable friction mechanism and a freewheel clutch. The arrrangement is such that when the handgrip is pulled, the flywheel is set in motion. The ergometer also includes a footrest (13) or brace connected to the first portion or to the frame, a second portion (8) arranged beside or adjacent the first portion with a top surface and a seat (9) having means (10) for moving it over the top surface of the second portion in a direction substantially towards and away from the frame with flywheel. The assembly includes means (12) for rendering the frame with flywheel movable relative to the second portion of the device.

FIG.1



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A rowing ergometer

The invention relates to a rowing ergometer comprising a first portion having a frame wherein is arranged a flywheel which is drivable by means of a chain or rope through a suitable transmission mechanism, said chain or rope being connected at an end remote from the flywheel to a handgrip simulating an oar, said flywheel being further provided with an adjustable friction mechanism and a freewheel clutch, in such a manner that when the handgrip is pulled, the flywheel is set in motion, a footrest or brace connected to the first portion or to the frame, a second portion arranged beside the first portion and having a top surface and a seat having means for moving it over the top surface of the second portion in a direction substantially towards and away from the frame with flywheel.

A rowing ergometer of this type is known from USP 4.396,188. In the known device, the frame comprises a kind of fork wherein the flywheel is arranged and to which the footrest or brace is attached. The fork is affixed to the second portion, having the form of a monorail along which the seat slides. The chain for driving the flywheel extends alongs the transmission mechanism to the monorail. The chains' end is attached to an elastic cable which, in its turn, is secured to the monorail.

A rowing ergometer is a rowing simulator used by rowers as training replacing rowing if this is excluded by weather conditions, e.g. in the winter. It is desirable for an effective training that the power distribution characteristic of the rowing ergometer corresponds optimally with that of the boat type for which the training is done, so as to prevent wrong movement patterns from being rooted. When rowing in a boat the rowing movement, as may be deemed known, can be divided into two parts, i.e. the stroke, during which the rower pulls the oar through the water, thereby propelling the boat, and the recovery, during which the oar is lifted out of the water into the starting position for a new stroke. The force exerted by the rower on the oar is not constant. During the stroke, a power maximum occurs. The power distribution characteristic occurring in the stroke during rowing, is typical of the type of boat in which rowing takes place and of the physique of the rower.

A drawback of the known rowing ergometer is that the power distribution characteristic differs strongly from the power distribution occurring normally in a boat during the stroke. The known device, consequently, fails to meet the above defined requirement and is therefore suitable for rowing replacing trainings to a limited extent only. True, it has been tried to remove this drawback in certain types of rowing ergometers by providing the transmission with a mechanism effecting a variation of the transmission ratio during the stroke according to a fixed profile. A drawback thereof, however, is that the power distribution characteristic depends on the stroke length and hence on the physique of the rower. In such modified rowing ergometers, the stroke is only reasonably simulated for one specific physique and for one specific type of boat. The applicability of such a type of ergometer is only highly limited, consequently.

It is an object of the invention to provide a rowing ergometer which lacks or substantially lacks the above drawback. This object is achieved according to the invention with a rowing ergometer of the above described type comprising means for rendering the frame with flywheel movable relative to the second portion of the device.

Surprisingly, it has been found according to the invention that the power distribution characteristic of the rowing ergometer can be drastically improved and that said characteristic can be made better adjustable if the portion of the rowing ergometer containing the flywheel is rendered movable relative to the second portion of the device, e.g. by providing this portion with wheels or rollers by means of which it can move over a flat foundation. With such a construction, there is obtained a power distribution characteristic true to nature which is independent of the length of the stroke. Furthermore, said characteristic, in the device according to the invention, can be adjusted in a simple manner to that of the type of boat for which training is desired, while, moreover, also the power level can be chosen freely.

In a suitable embodiment of the rowing ergometer according to the invention, the mobility of the frame with flywheel is realized by providing a lengthened portion of the stationary second portion of the device with a more or less flat top surface, while the frame with flywheel and the interconnected footrest are fitted with means for moving said frame over said surface in a direction substantially towards and away from the second portion.

In another suitable embodiment of the device according to the invention, the second portion comprises a beam or monorail on standards over which both the seat and the frame with flywheel are movable in a direction towards and away from one another. Preferably, the handgrip-averted end of the chain or rope, through a suitable pulley system attached to the stationary second portion and a pulley secured to one end of an elastic element, is attached to one side of the frame with flywheel, while the elastic element extends via another suitable pulley system attached to the stationary sec-

ond portion, and is attached with the other end to the opposite side of the frame with flywheel in such a manner that the forces exerted by the chain or rope and by the elastic element on the frame with flywheel are opposed and practically eliminate each other. For it has been found that it is not well possible to connect the handgrip-averted end of the chain or rope directly to the elastic element and this, in turn, directly to the stationary second portion. The complicated assembly of forces extend in that case by the rower, the chain or the rope and the elastic element on the moving frame results in that said moving frame is pulled towards an end position, so that it is no longer movable and hence exhibits the same drawbacks as the known rowing ergometer. The problem outlined seems to be solved by the above construction, wherein the chain or rope and the elastic element are interconnected only indirectly, i.e. via a pulley, and both in turn only indirectly, via pulleys to the stationary portion, while the respective ends are attached directly to opposite sides of the movable frame.

Of the device according to the invention, the mass of the mobile portion, of which the frame with flywheel forms part, is suitably less than 50 kg, preferably, that mass is 7.5 - 25 kg. In general, it is preferred in the device according to the invention if the mass of the profile portion, of which the frame with flywheel forms part, is variable and can be set to a desired value, for it has been surprisingly found that in the device according to the invention, the initiation of the stroke is found heavier according as the mass of the portion incorporating the flywheel is less. This is entirely contrary to what happens normally in a rowing boat, where the stroke becomes heavier according as the boat is heavier. By providing the device according to the invention with a variable and adjustable mass of the movable portion with flywheel, the characteristic of the stroke is thus variable and adjustable.

It is desirable that the mass of the movable frame with flywheel is not too large. Preferably, this mass is not more than the weight of a boat with helmsman averaged over the rowers. A suitable upper limit therefore is at any rate about 50 kg and in many cases even about 25 kg. The lower limit of 7.5 kg is dictated only by the weight of the parts used.

In a further preferred embodiment of the device according to the invention, the construction is such that the friction level of the friction mechanism and/or the transmission ratio of the transmission mechanism and/or the mass inertia of the flywheel are variable and can be set to a desired value. Preferably, the transmission mechanism and/or the friction mechanism are constructed in such a manner that the transmission ratio and/or the friction level, in operation, vary in a presettable manner. A change in friction factor and/or transmission ratio during the stroke has been found useful for optimizing the adjustment to reality. The friction of the flywheel of the device according to the invention is basically proportional to the square of the speed. In a boat, the friction in actual practice is likewise proportional to the square of the speed, but there is moreover the resistance of the waves. This additional friction can be approximated with the present device by increasing the friction factor during the stroke, in dependence upon e.g. the speed or upon the stroke length. Furthermore, the mass inertia of the flywheel can be adjustable suitably and be varied during the stroke with similar effect.

The friction mechanism of the device according to the invention can be constructed in different manners. For instance, it may be a mechanism based on mechanical friction or a mechanism based on fluid friction, or a mechanism based on eddy current braking.

In operation, the device according to the invention is "hard" to the touch of the user, since contrary to a real rowing boat, no elastic parts form part thereof. In actual practice, the oar of a boat is resilient. The handgrip in the device according to the invention is not. This could result in injuries upon prolonged use. According to the invention, this appears avoidable by constructing the device in such a manner that the footrest is resiliently connected to the first portion of the device. By thus making the footrest resilient, e.g. by providing a spring underneath said footrest, the resilience of the oar is simulated and injuries of the user are thus prevented.

The invention will now be explained, with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic view of a first embodiment of the device according to the invention; and

Fig. 2 is a similar view of another embodiment of the device according to the invention.

In the figures like or corresponding parts are indicated by like reference numerals.

The embodiment of the device according to the invention highly diagrammatically shown in Fig. 1 comprises a frame 1 arranged on and attached to a suitable bottom plate 2. Arranged or suspended in frame 1 is a flywheel 3. Wound about a pulley 4 connected to the flywheel is a chain or rope 5 to one end of which a handgrip 6 is attached. By pulling at handgrip 6, pullley 4 and hence flywheel 3 is brought in rotation. The attachment of pulley 4 to flywheel 3 has a freewheel mechanism, so that at the moment when handgrip 6 is no longer pulled, the pulley performs no further rotation but the flywheel continues to rotate. Furthermore, the pulley is provided with a spring mechanism, so that the rope or chain 5 is rewound as soon as less

pulling force is exerted on handgrip 6. Flywheel 3 is also provided with a suitable friction mechanism 7, illustrated in the figure as a block overhanging the flywheel on a rope, but which, in practice, may be any suitable mechanism. The construction described so far is known and is used in this form or in a slightly modified form in existing rowing ergometers.

Arranged at some interspace from frame 1 with flywheel 3 is the second portion 8 of the device according to the invention, which second portion 8 is illustrated diagrammatically as a block having a flat top surface. The seat 9, having suitable wheels or rollers 10, is adapted to move over the flat upper surface of the second portion 8 in a direction towards and away from frame 1. It will be clear that the construction shown is indicated only highly diagrammatically and that other constructions are quite well possible. For instance, the second portion 8 of the device may also have the form of a beam on standards, over which beam the seat will then slide reciprocatingly as a monorail train.

The second portion 8 of the device is connected to a lengthened, lowered portion 11 having a flat top surface, extending to underneath bottom plate 2, on which frame 1 is erected. Bottom plate 2 is provided with suitable wheels or rollers 12 by means of which the assembly of bottom plate 2 and frame 1 with flywheel 3 can move over the flat surface of the lowered portion 11. It will be clear that a different construction is possible as well, provided that there is mobility of the portion with flywheel relative to the surroundings in a direction towards and away from the second portion, on which or over which the seat is moving. For instance, when the device includes a rail construction over which the seat is moving, also the frame with flywheel can be such that it moves likewise over said rail construction. In that case, the lengthened portion 11 of the second portion 8 is no lowered portion but a single long rail construction.

Connected to bottom 2 is a footrest 13, which according to the invention is effected preferably by means of a spring 14.

In the embodiment of the device according to the invention, which is shown in Fig. 2, the stationary second portion of the device comprises a beam or monorail 8 on standards 15. Both the seat 9 having suitable rollers 10, and the frame 1 with flywheel 3 and footrest 13, having suitable rollers 16, are adapted to reciprocate over the beam or monorail 8. Frame 1 is provided with an upwardly directed arm 17, on which flywheel 3 is mounted. The chain or rope 5 extends from handgrip 6 over a suitable transmission mechanism 4, having a freewheel clutch and being connected to flywheel 3, a pulley 18 attached to the upright arm 17, a first pulley 19 attached to monorail 8, a pulley 21 attached to an elastic element 20, and a second pulley 22 attached to monorail 8 towards the front of the movable frame 1, where the chain or rope 5 is attached.

Pulley 21 is attached to the one end of the elastic element or the elastic cable 20. Said element 20 extends via a set of pulleys 23, 24, again 23 and 25, attached to monorail 8, to the rearmost portion of the movable frame 1, to which it is attached with the other end. The construction, consequently, is such that the forces exerted by chain or rope 5 and by elastic element 20 are opposed and eliminate each other practically.

It will be clear that the precise manner of construction of the device according to the invention is not of essential importance, on condition only that the frame with flywheel is movable relative to the surroundings in a direction towards and away from the user of the device. If this condition is met, there will be obtained a power distribution characteristic more or less true to nature, which is independent of the length of the stroke, while said characteristic can be adjusted in a simple manner to the type of boat for which the user wishes to train. As explained earlier, said adjustment can be effected by adjusting the mass of the mobile portion, of which frame 1 with flywheel 3 forms part, e.g. to a mass corresponding with the weight of boat plus helmsman calculated by rower. The beginning of the stroke as a matter of fact seems to be experienced heavier according as the mass of said portion is less. Adjustment can also take place by modifying the friction level of the friction mechanism, the transmission ratio of the transmission mechanism and of the mass inertia moment of the flywheel. A combination thereof is also possible, naturally.

Claims

1. A rowing ergometer comprising a first portion having a frame wherein there is arranged a flywheel which is drivable by means of a chain or rope through a suitable transmission mechanism, said chain or rope, at one end remote from the flywheel, being connected to a handgrip simulating an oar, while the flywheel is further provided with an adjustable friction mechanism and a freewheel clutch, the arrangement being such that when the handgrip is pulled, the flywheel is set in motion, a footrest or brace connected to the first portion or to the frame, a second portion arranged beside or adjacent the first portion with a top surface and a seat having means for moving it over the top surface of the second portion in a direction substantially towards and away from the frame with flywheel, characterized in that the device is pro-

vided with means for rendering the frame with flywheel movable relative to the second portion of the device.

2. A device as claimed in claim 1, characterized in that a lengthened portion of the stationary second portion of the device is provided with a more or less flat top surface, while the frame with flywheel and the interconnected footrest include means for moving said frame over said surface in a direction substantially towards and away from the second portion.

3. A device as claimed in claim 1, characterized in that the second portion includes a beam or monorail on standards over which both the seat and the frame with flywheel are movable in a direction towards and away from one another.

4. A device as claimed in claim 3, characterized in that the handgrip-averted end of the chain or rope, through a suitable pulley system attached to the statationary second portion and a pulley secured to one end of an elastic element, is attached to one side of the frame with flywheel, while the elastic element extends via another suitable pulley system attached to the stationary second portion, and is attached with the other end to the opposite side of the frame with flywheel in such a manner that the forces exerted by the chain or rope and by the elastic element of the frame with flywheel are opposed and practically eliminate each other.

5. A device as claimed in claims 1-4, characterized in that the mass of the movable portion, of which the frame with flywheel forms part, is less than 50 kg.

6. A device as claimed in claim 5, characterized in that said mass is 7.5 - 25 kg.

7. A device as claimed in claims 1-6, characterized in that the mass of the movable portion, of which the frame with flywheel forms part, is variable and can be set to a desired value.

8. A device as claimed in claims 1-7, characterized in that the friction level of the friction mechanism and/or the transmission ratio of the transmission mechanism and/or the mass inertia of the flywheel are variable and can be set to a desired value.

9. A device as claimed in claim 8, characterized in that the transmission mechanism and/or the friction mechanism are constructed in such a manner that the transmission ratio and/or the friction level, in operation, vary in a manner to be preset.

10. A device as claimed in claims 1-9, characterized in that the mass inertia of the flywheel can be set in such a manner that the mass inertia, if desired during the stroke when the device is being used, varies in a manner desired by the user.

11. A device as claimed in claims 1-10, characterized in that the footrest is connected resiliently to the first portion of the device.

FIG.1

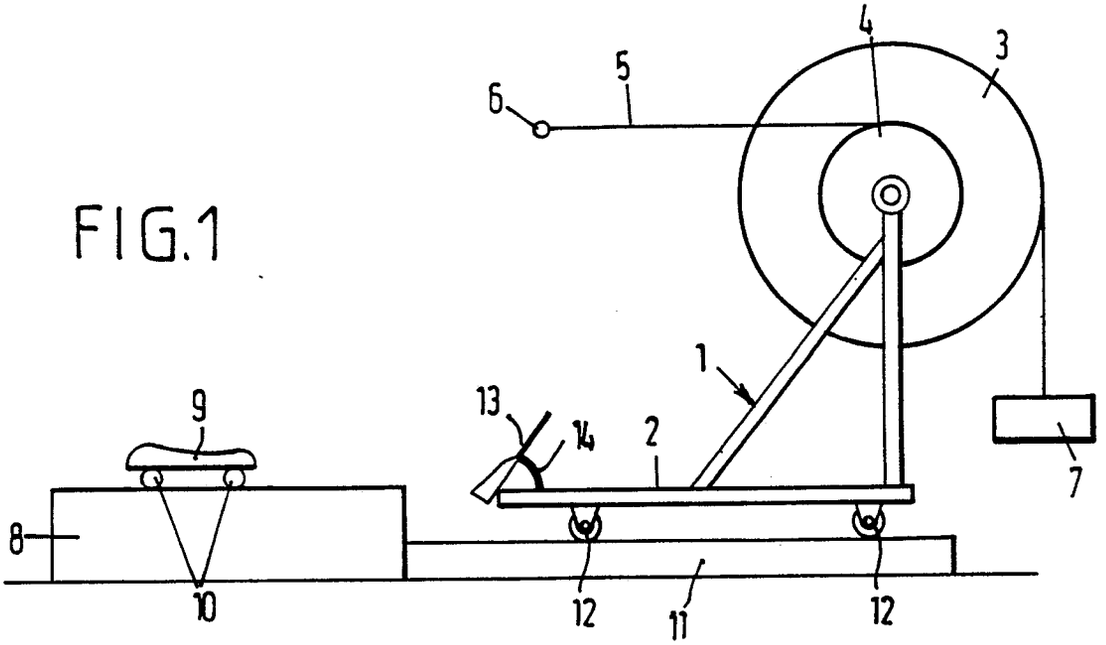
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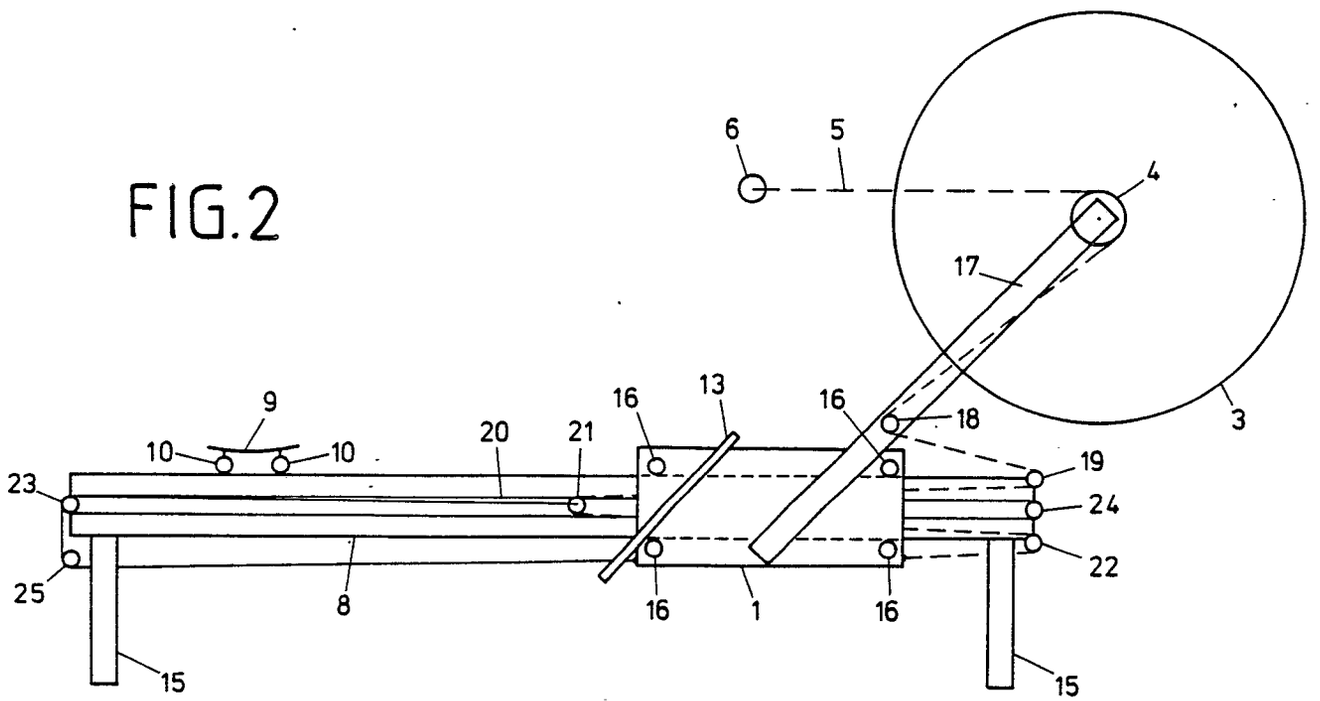
FIG.2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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 20 3317

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 647 035 (R. YELLEN)(03-03-1987) * Column 2, lines 52-62; column 3, lines 14-40; figures *	1,8	A 63 B 69/06
D,A	US-A-4 396 188 (P. DREISSAGACKER et al.)(02-08-1983) * Figure 2; column 1, lines 60-68 *	1	
X	CH-A- 164 228 (W. TRUMPFHELLER)(30-09-1933) * Figures; page 2, left-hand column, lines 9-28 *	1,8	
A	DE-A-2 335 544 (FEUERLAND)(30-01-1975) * Figure 1; page 9, line 17 - page 10, line 6 *	9	
P,A	US-A-4 798 378 (R. JONES)(17-01-1989) * Figure 4; column 4, lines 1-33 *	4	
A	DE-A-1 703 771 (R. SEYBOLD)(07-03-1972)		TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	GB-A- 481 004 (C.H. TIDBURY)(31-03-1938)		A 63 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	01-03-1990	VEREECKE A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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