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Muir

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[54] **FLUID FLOW RESISTANCE EXERCISER HAVING SELECTIVELY REVERSIBLE FLUID FLOW CONTROL MEANS**

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[52] **U.S. Cl.** ..... **272/79 C;** 137/493.3; 137/504

[51] **Int. Cl.**[2] **A63B 21/00**

[58] **Field of Search** 272/79, 83; 137/504, 493.3, 137/493

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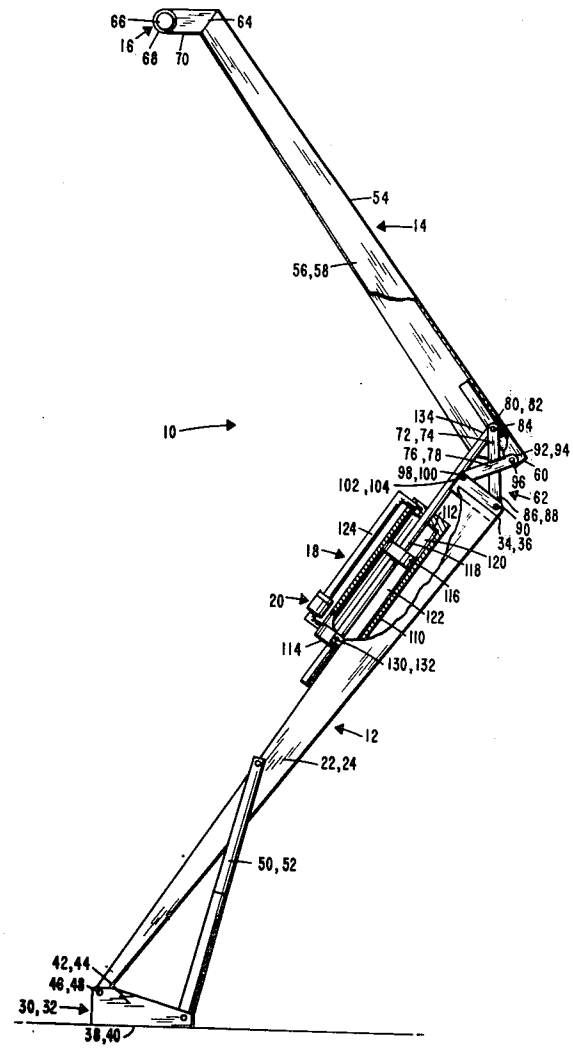
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Primary Examiner—Paul E. Shapiro
Attorney, Agent, or Firm—Jones, Tullar & Cooper

[57] **ABSTRACT**

A fluid flow resistance exercising device having a base arm, an operating arm attached to the base arm for relative movement therewith, and utilizing a pair of hydraulic chambers separated by a slideable piston is disclosed. A fluid flow control device is positioned in the flow path between the two chambers which are, in the preferred embodiment, contained in a single hydraulic cylinder. The fluid flow control device is preferably located at a point in the flow line external to the cylinder and is selectively reversible so that the direction of fluid flow in which substantial resistance is encountered may be from either chamber to the other thereby providing an exercise device in which movement of the operating arm and hence of the fluid from either chamber to the other is accomplished only by the exertion of substantial effort. The exercise device is adaptable to be useable in the performance of a number of various exercises.

16 Claims, 5 Drawing Figures



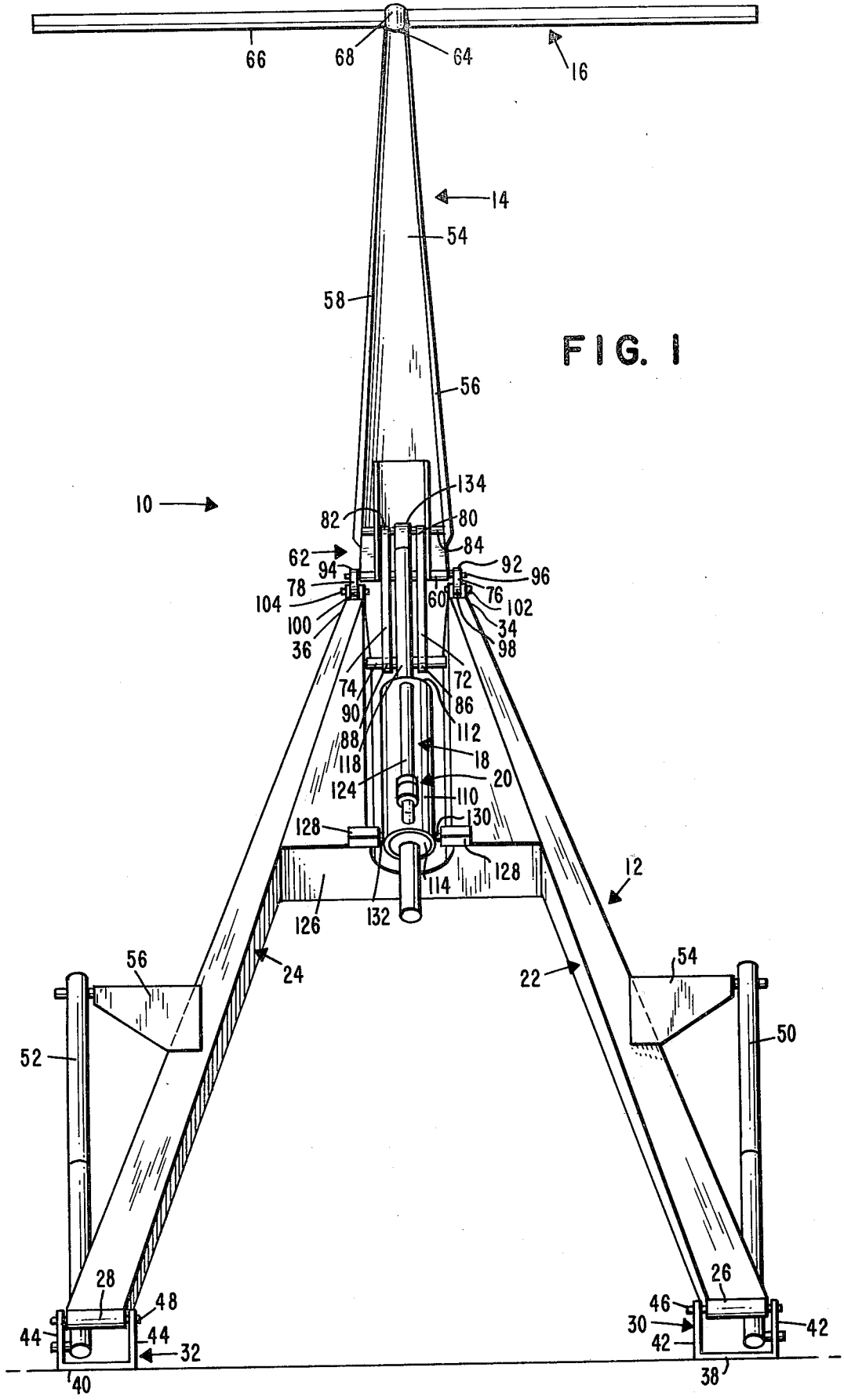

66
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64
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FIG. 1

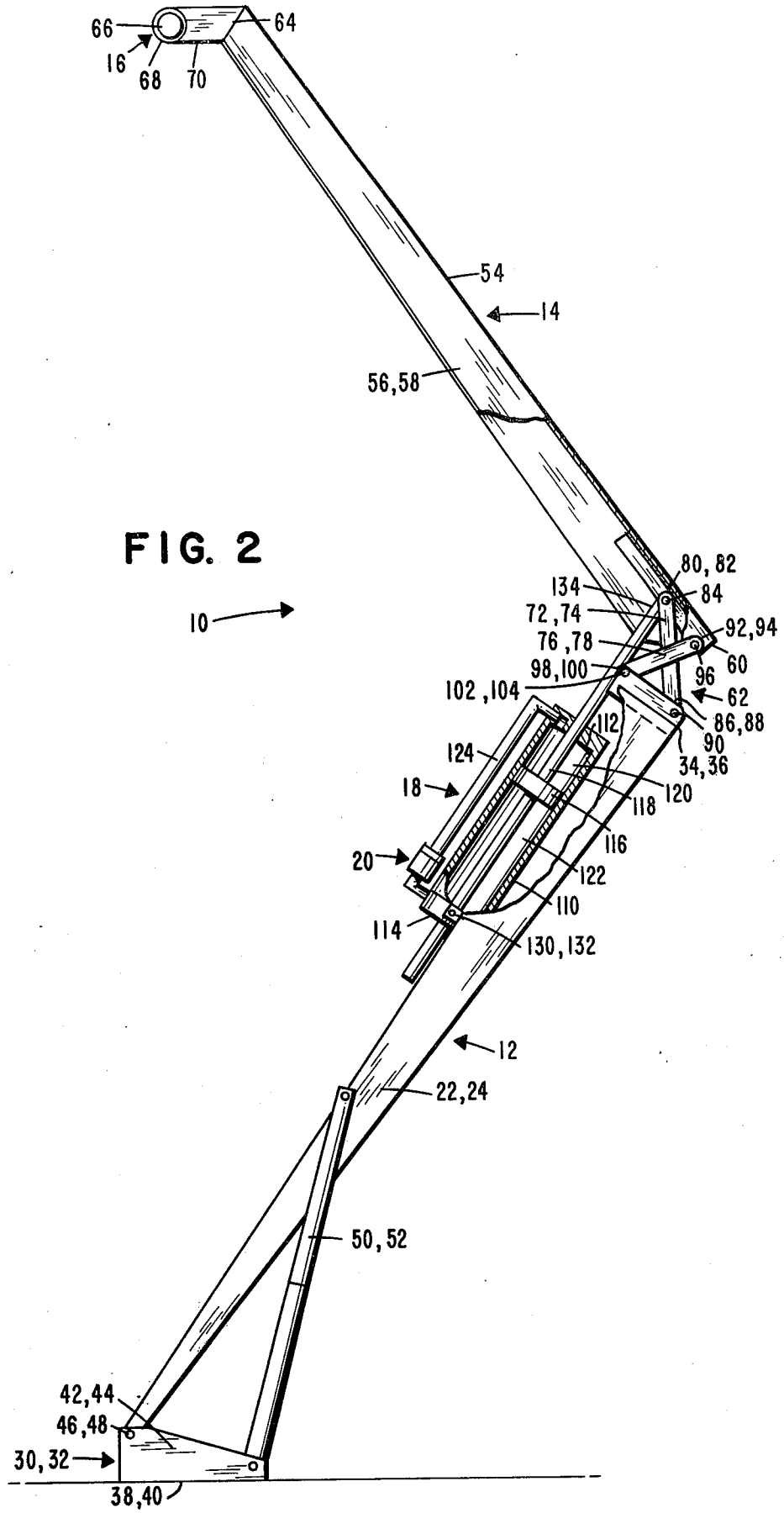
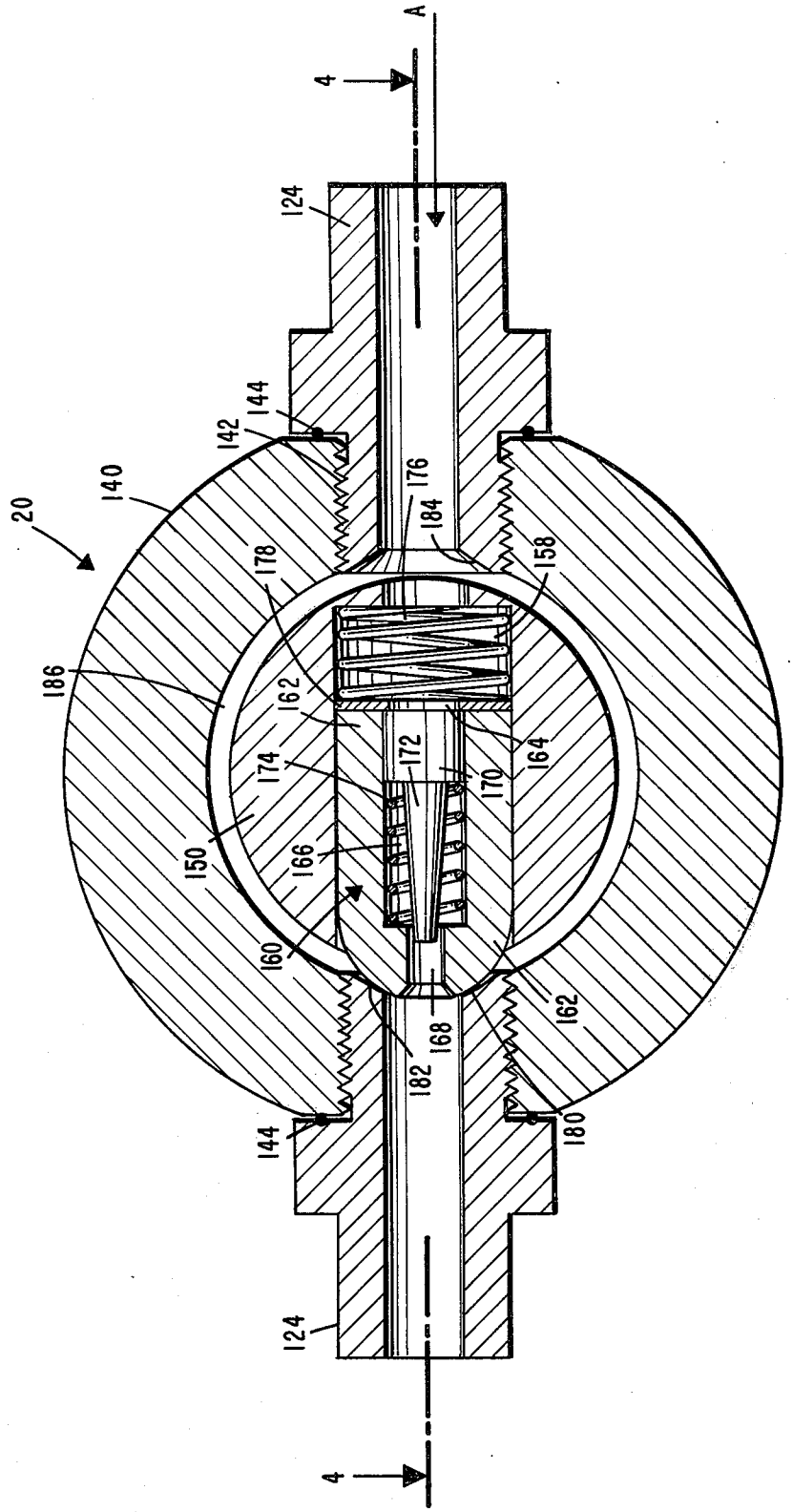

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14
56,58
80,82
134
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72,74
92,94
76,78
60
98,100
96
62
102,104
86,88
112
90
124
34,36
18
120
118
116
20
122
110
114
130,132
12
22,24
50,52
42,44
46,48
30,32
38,40
10

FIG. 2

FIG. 3


A
4
124
144
142
140
20
176
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186
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172
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174
170
150
166
160
168
182
162
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124
4

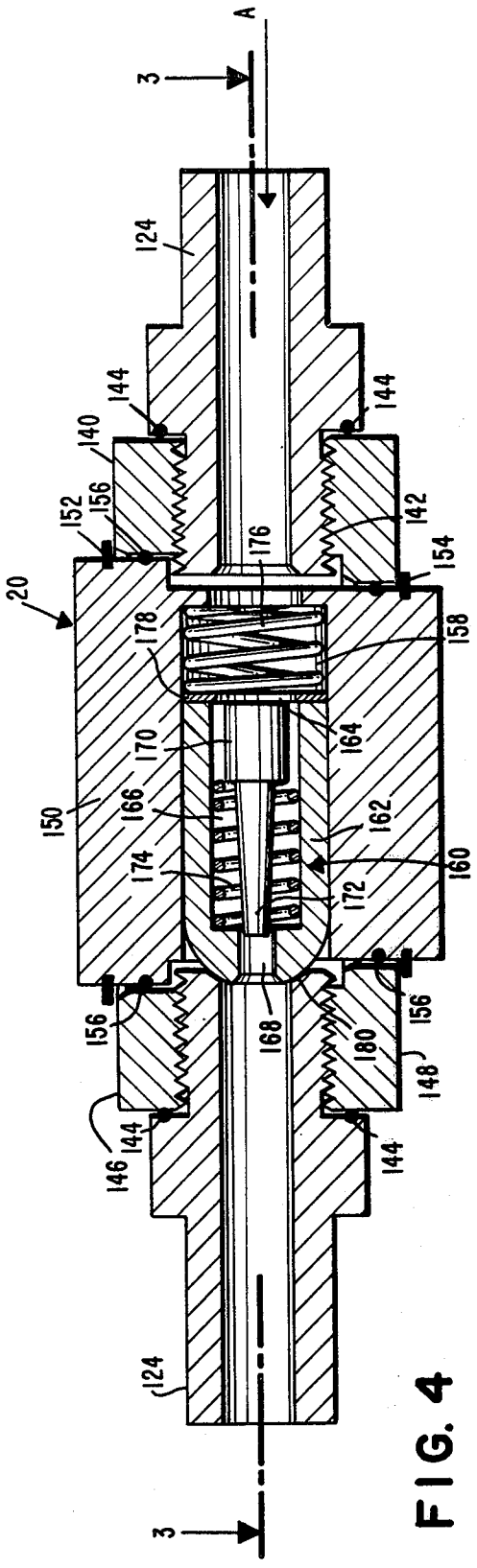

A
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124
144
140
152
156
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172
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FIG. 4

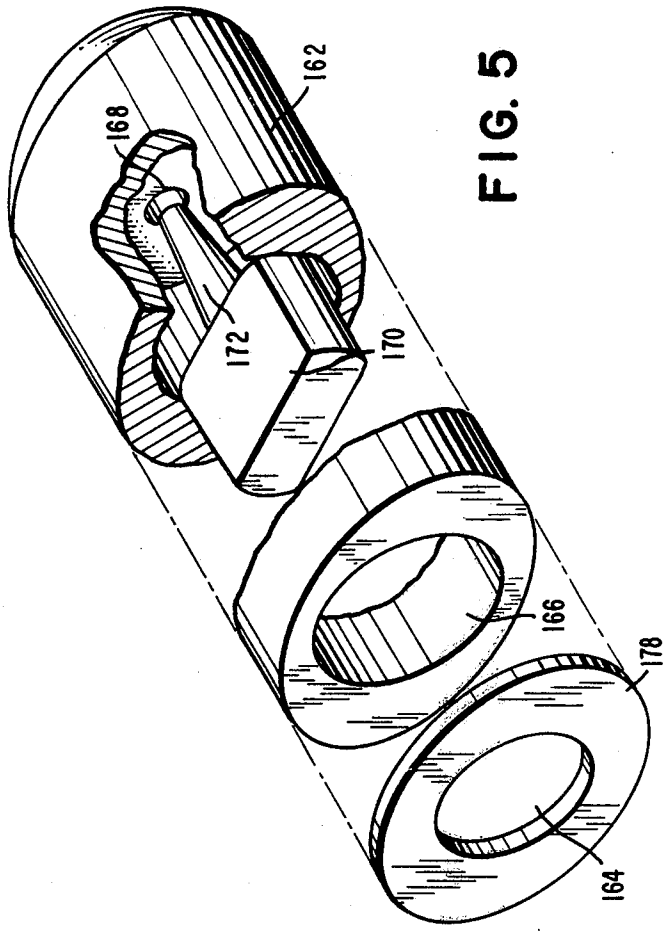

162
168
172
170
166
178
164

FIG. 5

FLUID FLOW RESISTANCE EXERCISER HAVING SELECTIVELY REVERSIBLE FLUID FLOW CONTROL MEANS

FIELD OF THE INVENTION

The invention is directed generally to a fluid flow resistance or hydraulic exercise device. More particularly, the invention is directed to such an exercise device in which there is provided a selectively reversible fluid flow control means such as a valve. Most specifically, the invention is directed to an exercising device in which the direction of fluid flow wherein substantial resistance is encountered is reversible by a control valve means to provide an exercise device that will be capable of resisting movement in either of two directions of movement of a portion of the exerciser.

The exercise device is comprised of a base arm which engages the floor or support surface by suitable means, and an operational arm which is joined at a first end to the free end of the base arm. The operating arm carries, at its free end, a suitable handle structure so that a person may grasp the handle and use the exerciser. The operational arm is joined to the free end of the base arm by suitable primary and secondary links which pivot about their connections to the base and operational arms. A hydraulic cylinder, having an internal piston mounted on a rod which extends through the ends of the cylinder, is pivotably attached to the base arm with the piston rod being affixed, at an end exterior to the cylinder, to the operational arm. The hydraulic cylinder is provided, in the preferred embodiment, with an external fluid flow line in communication with the chambers of the cylinder. A selectively reversible fluid flow control valve, which is placed in the flow line, serves to reverse the direction in which the fluid flow encounters resistance, thereby providing an exercising apparatus capable of resisting movement in either of two directions of movement of the operational arm.

DESCRIPTION OF THE PRIOR ART

A wide variety of exercising machines and devices are presently available to persons desiring to use them. These range from simple, inexpensive, barbells and weights, to highly complex, and often expensive, multipurpose devices which are usually found only in health clubs and the like. One type of exercise machine, with which the present invention is generally concerned, is the one person apparatus in which the device, or a portion thereof, is caused to move by the application of force by the user.

Initially these devices, in which the user often grasps a handle and pulls or pushes, were comprised of a system of weights connected to the device through a network of ropes, pulleys, gear trains and the like. The user exerted a force on the machine which caused these weights to move, thus exercising and strengthening his musculature. If it were desired to vary the capacity of the machine, weights could be added or removed. Aside from the necessity of maintaining a large supply of weights to provide a machine of widely variable capacity, the early machines of this type were apt to get out of repair due to breakage of ropes, cables, pulleys, gears and the like. If such a breakage occurred during usage of the device, the user ran the risk of injuring himself or others. In addition, these machines were heavy, bulky, cumbersome, and expensive to the point where their use was limited to health clubs and the like.

A more recently available exercising device is the fluid flow resistance or hydraulic type of apparatus. In these machines, of which there are a large number and variety, the weights of the prior devices have been replaced or supplemented by a fluid flow device in which resistance to movement of a portion of the exercise is provided by the forcing of a fluid, such as emulsified water, oil, or the like through an orifice. While these devices are superior to the weight and pulley types, they also suffer from several drawbacks.

The principal deficiency of many of the fluid flow resistance exercisers is that they are limited to a one-way operation. The fluid, which is forced through the orifice by a means such as a piston, must then be returned to its initial location before the device can be used again. This return of the fluid is accomplished by a reversal of the direction of movement of a portion of the machine, such reverse movement being had against little or no fluid flow resistance. This has limited the types of exercises which may be done on the machine and hence the muscles exercised by using such a machine.

A related shortcoming of these fluid flow exercisers has been their unadaptability to use by persons of varying degrees of strength. Since the fluid is forced through an orifice, usually of constant size, an increase in force applied by the user results in an increased rate of fluid flow through the orifice. A person possessing a high degree of strength would require a machine provided with a hydraulic system where a great deal of force were necessary to force the fluid through the orifice, while a person of lesser physical ability would be unable to use the device. The usual solution to this problem has been to compromise and to construct machines useable by an "average" person resulting in a machine having either too little or too great a force requirement for a large number of potential users.

Prior exercise devices of both the fluid flow and spring or weight types have, as have been alluded to, be characterised by their heavy weight, unreliability, high cost and lack of portability. These factors have limited the use and acceptance of these devices and have resulted in the limitation of their use to health clubs, gymnasiums, and the like. The few devices available at a cost not prohibative to individuals have usually been of inferior quality and have not met with much success. These devices have also not been adaptable for use in performing a number of different exercises.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a fluid flow resistance exercise apparatus which overcomes the problems of prior devices.

A further object of the invention is to provide a fluid flow resistance exerciser wherein resistance to fluid flow may be had in either of two directions by means of a selectively reversible flow control valve.

Yet another object of the invention is to provide a fluid flow resistance exerciser provided with a variably sized fluid flow orifice whereby application of increased force by the user results in increased resistance to movement.

Still another object of the invention is to provide a fluid flow resistance exercise which is strong, durable and dependable, yet light weight and inexpensive.

The exerciser of the present invention, which is of the fluid flow resistance type, is comprised of a base arm and an operational arm. These arms are joined to each

other through primary and secondary links to allow relative movement of a free end of the operational arm with respect to the base arm. A hydraulic cylinder, divided into two chambers by a slideable piston carried by a piston rod, is secured to the base arm with the piston rod extending through an end of the cylinder and being affixed to the operational arm. An external flow line connects the two chambers of the cylinder so that fluid, displaced by movement of the piston, will flow from one chamber to the other. A selectively reversible fluid flow control valve is placed in this line and serves to regulate the direction of fluid flow in which substantial flow resistance is encountered. The valve is provided with a variable sized orifice so that an increase in pressure creating an increased fluid flow will result in increased resistance to such flow.

The exerciser of the present invention does not depend on weights and their associated pulleys, connecting ropes, or wires and the like to provide resistance to movement and is hence superior to devices of that type since there is no possibility of harm to the user or others caused by the breakage of various connecting elements that occurs in weight machines. Since these weights are no longer used, there is a resultant decrease in the weight of the device and hence its portability is greatly increased. A ready supply of weights in also no longer necessary to vary the capacity of the machine.

The exerciser of the present invention is characterised by the substitution of a hydraulic piston and cylinder arrangement for the weights of prior devices. While this general concept is known, the present exerciser is superior to other available fluid flow devices in its reversibility and response to an input force. As discussed previously, prior fluid flow resistance exercisers provided resistance to flow in only one direction, or, if capable of providing resistance in two directions, required multiple hydraulic cylinders. The present exerciser utilizes a single hydraulic cylinder to provide resistance to flow in two directions. This is accomplished by the inclusion of a selectively reversible fluid flow control valve assembly in the flow line from one chamber of the cylinder to the other. Resistance to flow in either direction of movement of the operational arm is thus provided so that the exerciser is effective in both directions of movement. This feature makes the present exerciser superior to other fluid flow resistance exercisers which provide resistance to movement in one direction only. The present exerciser, because of its ability to resist movement in both directions of operation arm travel, is adaptable to the performance of many more exercises than are prior devices. The reversible fluid flow control valve, which is positioned in the flow line exteriorly of the hydraulic cylinder, is readily accessible so that the direction of fluid flow wherein substantial resistance is encountered may be quickly and easily selected.

The fluid flow control valve is provided with a means for varying the size of the orifice through which the fluid flows. An increase in force, which will act to cause an increase in flow rate, will result in a decrease in the size of the orifice so as to increase the force required to move the operational arm. This provision makes the device suitable for use by persons of various physical capacities since a stronger person will have to expend more energy to force the fluid from one chamber to the other because the area of the orifice will decrease in response to increased pressure placed on the fluid. Conversely, a person of lesser strength will not be capable of exerting as much pressure on the fluid and consequently, the orifice will not be as reduced in effective size. However, each person will have to exert force to move the fluid and will obtain beneficial results from the use of the exerciser.

The fluid flow resistance exerciser of the present invention is strong, durable, dependable and not expensive. It is useable by persons of varying abilities and may be used in an individual's home. The exerciser is also suitable for use in performing a wide variety of exercises and, by the addition of various accessories, may provide a device suitable for the performance of additional exercises previously requiring the use of several devices.

BRIEF DESCRIPTION OF THE DRAWINGS

While the novel features of the invention are set forth with particularity in the appended claims, a full and complete understanding of the exerciser of the present invention may be had by referring to the description of a preferred embodiment as set forth hereinafter, and as shown in the accompanying drawings, in which:

FIG. **1** is a front elevation view of a preferred embodiment of the exerciser of the present invention showing the exerciser in a raised position;

FIG. **2** is a side elevation view, partly in section, of the exerciser in a raised position;

FIG. **3** is a top plan view, partly in cross section and taken along line **3—3** of FIG. **4,** of the reversible fluid flow control valve assembly of the present invention;

FIG. **4** is a side elevation view, partly in cross section and taken along line **4—4** of FIG. **3,** of the reversible fluid flow control valve assembly of the present invention; and

FIG. **5** is an exploded perspective view, partly in cross section, showing the orifice passage and orifice mandrel and plunger portion of the valve assembly of the present invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

Turning now to FIGS. **1** and **2,** there is shown generally at **10** a preferred embodiment of the fluid flow resistance exerciser of the present invention. Exerciser **10** is comprised generally of a base arm **12,** an operating arm **14** attached to base arm **12,** a handle assembly **16** carried at the end of operating arm **14** and a hydraulic cylinder assembly **18** having a selectively reversible fluid flow control valve means **20.**

Base arm **12** is comprised of a pair of legs **22** and **24** each of which carries, at a first end **26, 28** thereof, a support foot **30** and **32,** respectively. Legs **22** and **24** are similar and are each generally rectangular in cross-sectional shape. However, as may be seen in FIGS. **1** and **2,** as legs **22** and **24** extend from their first ends **26** and **28** toward their second ends **34, 36,** their cross sectional shapes vary from a shape at their first ends **26,** 28 wherein the width is greater than the height, to a shape at their second ends **34, 36** where the height is greater than the width. Legs **22, 24** additionally, as is shown in FIG. **1,** are spaced further apart at their first ends **26, 28** than at their second ends **34, 36,** thereby providing a wider and more stable base for exerciser **10.** Legs **22** and **24** are preferably made of strong, light weight metal, although other suitable materials may be used, so long as the required strength is provided.

Support feet **30** and **32** are each generally channel shaped, and each has a bottom **38, 40** and upstanding walls **42** and **44.** The bottom portions **38, 40** of feet **30,** 32 are of sufficient area to insure that exerciser **10** will be stable when at rest. These feet may be provided with suitable spaced holes (not shown) so that the exerciser may be secured to a platform or floor, if desired by suitable fasteners. The first ends **26, 28** of legs **22, 24** are pivotably attached to support feet **30, 32** by suitable hinge rods **46, 48,** which pass through the lower portions of legs **22, 24** and walls **42, 44** of support feet **30,** 32. Any suitable connectors and bearings or sleeves (not shown) may be used to secure rods **46** and **48** in place and to insure that they allow legs **22, 24** to pivot freely about feet **30, 32.**

As is also shown in FIGS. **1** and **2,** a pair of compressional coil springs (not shown) are enclosed in a pair of telescoping housings **50, 52** which are affixed, at one end, to support feet **30, 32** and at a second end to suitable brackets **54, 56** extending outwardly from legs **22,** 24 at points intermediate the first and second ends of the legs. These spring assemblies are pivotably connected to feet **30, 32** and to brackets **54, 56** by any conventional means. They serve to support the exerciser in a generally upright position, as may be seen in FIGS. **1** and **2,** when the device is not in use, and also counter balance the weight of the exerciser apparatus in any position, so that the person operating the apparatus is not lifting its weight but only meeting the resistance provided by the hydraulic system. Housings **50** and **52** telescope so that the angular relation of legs **22, 24** with respect to the ground or support platform upon which exerciser is placed may vary, as would be the case when the exerciser **10** is in use.

Operational arm **14** is of generally channel shape, having a web portion **54** and a pair of downwardly extending side walls **56** and **58,** as may be seen in FIGS. **1** and **2.** Operational arm **14** is affixed, at a first end **60,** to the second ends **34, 36** of base legs **22, 24** by a set of linking arms generally at **62,** as will more fully be described hereinafter. The web portion **54** of arm **14** is of its greatest width at its first end **60** and decreases in width as it extends to a second or free end **64.** While the generally channel shape of operational arm **14** is preferred as it provides the necessary structural rigidity without undue weight, other shapes may be utilized for arm **14** if desired.

Handle assembly **16** is carried on the free end **64** of operational arm **14** and is comprised of, in the preferred embodiment, an elongated grip bar **66** passing through a ball and socket assembly **68** which is attached to free end **64** of operational arm **14** by a suitable connector member such as a secondary arm **70.** It will be understood that grip bar **66** is exemplary of any number of bars and the like which may be attached through ball and socket assembly **68** to the exerciser. For example, grip bar **66** may be replaced by a Z bar or the like or may be modified with foot pads (not shown) should the user wish to exercise his legs. Ball and socket assembly **68** is provided so that grip bar **66,** or its equivalent, will be free to rotate in response to a twist exerted thereon by the user as various exercises are performed.

As alluded to above, base legs **22** and **24** are joined to operating arm **14** through a link arm assembly generally indicated at **62.** As can be seen in FIGS. **1** and **2,** link arm assembly **62** is comprised of a pair of primary links **72** and **74** and a pair of secondary links **76** and **78.** Primary links **72,** and **74** are pivotably secured, at a first end thereof **80, 82,** to a hinge rod **84** passing therethrough and secured to walls **56, 58** of operational arm **14,** adjacent its first end **64.** Second ends **86, 88** of primary links **72, 74** are pivotably secured to the second ends **34, 36** of base legs **22, 24,** respectively, by a suitable hinge rod **90.** Secondary links **76** and **78** are pivotably secured, at a first end **92, 94** thereof, to a suitable hinge rod **96** which is similar to hinge rod **84** and is also affixed to walls **56, 58** of operational arm **14** adjacent the arm's first end **60.** Similarly, second ends **98, 100** of secondary links **76, 78** are pivotably secured by hinge rods **102, 104** to second ends **34, 36** of base legs **22, 24,** respectively. It will be understood that, while not specifically shown or described, these primary and secondary links are secured to their respective hinge rods and that these rods are secured to arm **14** and legs **22** and **24** by the use of suitable bearings, sleeves, and the like so that pivotable motion of the various links and rods may be afforded.

The purpose of the connection of operational arm **14** to base arm assembly **12** through the above-described primary and secondary links is to allow the smooth movement of operating arm **14** and base arm assembly **12** about each other upon the application of force by the user of the exerciser. As the user raises the second end of operational arm **14,** both arm **14** and base arm assembly **12** are moved to a position where they are both generally vertical. Link arm assembly **62,** which joins the first end of arm **14** to the second ends **34, 36** of legs **22, 24** of base arm assembly **12,** serves to securely join the two portions of the exerciser together while allowing for their relative movement as grip handle **66** is either raised or lowered.

Resistance to relative movement of base arm **12** and operational arm **14** is provided by hydraulic cylinder assembly **18.** As may be seen in FIGS. **1** and **2,** cylinder assembly **18** consists of a fluid tight cylinder **110** having end walls **112** and **114.** As may be seen in FIG. **2,** a slideable piston **116** is carried by a piston rod **118** which may pass through end walls **112** and **114** of cylinder **110.** Suitable seals (not shown) are provided to ensure a fluid tight seal between rod **118** and end walls **112,** and **114.** Piston **116** serves to divide cylinder **110** into first and second chambers **120** and **122.** An external flow line **124** is in communication with chambers **120** and **122** whereby movement of piston **116** will displace fluid from one chamber, through flow line **124,** to the other chamber. Fluid control valve **20,** to be described in fuller detail hereinafter, is placed in fluid flow line **124.** Cylinder assembly **18** is pivotably affixed, at one end thereof, to a suitable bracket **126** formed between legs **22** and **24** of base assembly **12.** Such pivotable connection is afforded by suitable bushing means **128** and rods **130, 132.** Cylinder assembly **18** is thus free to pivot about this connection with regard to bracket **126** and hence legs **22** and **24.** Piston rod **118** is attached at a first end **134** to hinge rod **84** which also carries first ends **80, 82** of primary links **72, 74.** Since hinge rod **84** is connected to operating arm **14,** movement of arm **14** will result in movement of piston rod **118,** thereby causing movement of piston **116** with a resultant fluid flow from one chamber of cylinder assembly **18** to the other through exterior fluid passage **124.** As arm **14** is moved upwardly, as seen in FIG. **2,** piston **116** moves in the cylinder toward cylinder end

112, thereby displacing fluid from chamber 120 through external flow line 124 and valve assembly 20, into chamber 122. As arm 14 is moved downwardly, the above-described fluid flow is reversed. Control valve assembly 20 restricts the rate of fluid flow from one chamber to the other and is selectively reversible so that fluid flow in either direction may be restricted, thereby allowing for resistance to movement of operational arm 14 in either the up or down direction.

Referring now to FIGS. 3 and 4, the structure of fluid flow control valve 20 may be more clearly seen. With the valve assembly as shown in FIGS. 3 and 4, substantial resistance to fluid flow is encountered in the direction of the arrow A in the figures. As may be seen in FIG. 3, valve assembly 20 consists of a housing 140 secured at either end to flow line 124 by suitable means such as threads 142. Suitable resilient seals 144 are interposed between housing 140 and flow line 124 to prevent leakage of hydraulic fluid. Housing 140 is of generally annular shape, and has generally planar top and bottom surfaces 146, 148. A cylindrical check valve rotor 150 is positioned in the central portion of annular housing 140 and is retained therein by suitable means such as a pair of retaining rings 152, 154, as may be seen most clearly in FIG. 4. Suitable seals 156 are provided to insure the fluid tight integrity of rotor 150 with respect to housing 140. A central bore 158 is provided in rotor 150 and provides a fluid path through valve assembly 20. A reversible check valve assembly 160 having a cylinder 162 provided with a fluid inlet 164, a fluid passage 166 and a fluid outlet in the form of an orifice passage 168 is carried in bore 158. A generally oval shaped plunger 170, including a tapered orifice mandrel 172 is carried in fluid passage 166 within cylinder 162, with plunger 170 and hence mandrel 172 being biased away from orifice passage 168 by a first spring 174. A second spring 176 is placed in bore 158 exteriorly of cylinder 162 and acts to bias cylinder 162 in the direction of fluid flow. A washer 178 is interposed between spring 176 and cylinder 162 and serves to restrict the rearward motion of plunger 170 caused by first spring 174. As may be seen in FIGS. 3 and 4, cylinder 162 is provided with a generally rounded nose portion 180 which is forced by the action of spring 176 acting on washer 178 and hence on cylinder 162 into engagement with either of two recesses 182, 184 located at the interior portions of flow passage 124, as may be seen in FIGS. 3 and 4.

In operation of control valve means 20, rotor 150 is rotated so that orifice hole 168 will be downstream in the direction of fluid flow, as is illustrated in FIGS. 3 and 4. The rounded nose portion 180 of cylinder 162 will be held in recess 182 by the force of spring 176. Spring 176 is of sufficient strength to hold nose 180 in recess 182 until rotor 150 is grapsed and rotated. Then spring 176 will be compressed by the camming action between nose 180 and recess 182 so that the assembly may be rotated until nose 180 engages recess 184 thereby securing the valve assembly in the reverse operative position for use if resistance to fluid flow in the direction opposite that indicated by arrow A were desired.

As fluid is forced through line 124 in the direction A, it enters bore 158 and passes through fluid inlet 164 in washer 178. Any fluid passing around the rotor in passage 186 will be stopped at the point of engagement between nose portion 180 and recess 184. Thus fluid flow is through passage 166 and orifice passage 168. Since passage 168 is of reduced size, increased effort is required to force the fluid therethrough. As increased pressure is placed on the fluid, plunger 170 is displaced against spring 174 to insert the tapered orifice mandrel 172 into orifice passage 168, thereby decreasing the effective area of the passage and requiring more force to cause fluid to pass therethrough. Since tapered mandrel 172 increases in diameter, as the mandrel is forced further into orifice passage 168 the effective area of passage 168 is further reduced, thereby requiring more exertion on the part of the user to move operating arm 14 and hence piston 116 to displace more fluid. Thus, there is provided a check valve assembly in which the strength of a person does not allow him to displace fluid at a more rapid rate the stronger he is, but instead presents more resistance to movement due to a decrease in the effective area of orifice passage 168.

If fluid flow against little resistance is desired in the direction opposite that of arrow A, as would be the situation when it is desired to return operating arm 14 to its initial position, this may be done easily since fluid will now enter orifice 168, force plunger 170 rearward, thereby compressing spring 176 and unseating nose 180 from recess 182 thus allowing fluid to flow through passage 186 and back through flow line 124 opposite the direction of arrow A. As may be seen in FIG. 5, washer 178 has an aperture 164 of smaller diameter than the width of oval-shaped plunger 170, thus plunger 170 will be retained in cylinder 162 and will not be displaced past washer 178. Should it be desired to provide resistance to the return movement of operating arm 14, rotor 150 is rotated 180° so that nose portion 180 will seat in recess 184. Thus it will be seen that control valve 20 serves as a selectively reversible means for providing substantial resistance to fluid flow in a first flow direction while allowing relatively little resistance to fluid flow in the reverse direction.

To use the exerciser apparatus, the user grasps grip bar 66 with his hands, positions check valve rotor 150 to provide resistance to fluid flow in the desired direction, and commences to exercise. The user may reverse rotor 150 at the end of each stroke of operating arm 14 to provide resistance for the return stroke, or may leave rotor 150 in one position, thereby allowing arm 14 to return to its initial position with little resistance. A suitable pressure gauge or gauges (not shown) may be connected to external fluid flow line 124. This gauge or gauges, which will register the pressure in whichever of the chambers 120 or 122 that is under pressure during each stroke of operating arm 14, may be calibrated to show the actual pressure at the grip bar 66. The position of the gauge is such that it may be viewed by the user while he is exercising.

The exercise of the present invention is suitable for use in performing a large number of exercises since the user, by contacting bar 66 with either his hands or feet, can perform a wide variety of exercises. By substituting various other bars and the like for the grip bar 66, even more exercises are possible. The reversible control valve 20 allows the user to determine in which direction of movement of operating arm 14 he will encounter substantial resistance and the variable orifice aspect of the valve provides that an increase in force on the part of the user will result in an increased resistance to fluid flow thereby making the exerciser useable by persons of widely varying strengths.

While a preferred embodiment of a fluid flow resistance exerciser has been hereinabove fully and completely described, it will be obvious to one of ordinary skill in the art that numerous changes and modifications in, for example, the shape of the base legs and of the operating arm; the structure of the link means between the arms; the material used to construct the exerciser; and the like may be made without departing from the true spirit of the invention and that the present invention is to be limited only by the scope of the claims as set forth hereinafter.

I claim:

1. A fluid flow resistance exerciser comprising:

means for supporting the exerciser base arm pivotally secured to said support means;

an operating arm pivotably attached to said base arm

hydraulic means for resisting relative movement between said base and operating arms pivotably secured between said base arm and said operating arm, said hydraulic means including first and second fluid chambers therewith, said chambers having a fluid flow passage therebetween; and

selectively reversible fluid flow control means in said fluid flow passage.

2. The apparatus of claim **1** wherein said hydraulic means includes a hydraulic cylinder having an internal slideable piston, said piston separating said cylinder into said fluid chambers.

3. The apparatus of claim **2** wherein said piston carries a piston rod, said rod extending exteriorly of said cylinder and being pivotally affixed to one of said base arm and operating arm.

4. The apparatus of claim **3** wherein said fluid flow passage extends exteriorly of said cylinder.

5. The apparatus of claim **4** wherein said fluid flow control means is carried in said exterior portion of said fluid flow passage whereby said control means may be selectively positioned to control the flow of fluid between said chambers in response to said relative movement of said operating arm and said base arm.

6. A fluid flow resistance exerciser comprising:

a base arm, said base arm having a first end provided with means for supporting said exerciser, said base arm being pivotally attached to said support means;

an operating arm, said operating arm being pivotally attached at a first end therof to a second end of said base arm;

a grip bar secured to a second end of said operating arm;

a hydraulic cylinder assembly pivotably attached to one of said base and operating arms and having first and second internal fluid chambers, said chambers being separated by a slideable internal piston and being in fluid communication with each other through a fluid flow passage, said piston carrying a piston rod having a portion exterior of said cylinder, said exterior portion of said rod being pivotably secured to the other of said base and operating arms; and

a selectively reversible fluid flow control means positioned in said fluid flow passage between said chambers and providing resistance to fluid flow between said chambers.

7. The apparatus of claim **6** wherein said base arm is comprised of first and second base legs, each of said legs having said support means at a first end thereof.

8. The apparatus of claim **6** wherein said operating arm is attached to said base arm by primary and secondary links, each of said links being pivotably secured at a first end to said operating arm and at a second end to said base arm.

9. The apparatus of claim **6** wherein said grip bar is secured to said operating arm by a ball and socket assembly said grip bar passing through said ball.

10. The apparatus of claim **6** wherein said fluid flow passage between said chambers of said hydraulic cylinder assembly extends exteriorly of said cylinder assembly.

11. The apparatus of claim **10** wherein said selectively reversible fluid flow control means is located in the portion of said passage exterior of said cylinder assembly whereby said control means may be selectively reversed to provide resistance to fluid flow from either of said chambers to the other of said chambers in response to movement of said piston caused by relative movement of said base and operating arms.

12. The apparatus of claim **11** wherein said reversible fluid flow control means further includes a variable area orifice, said area of said orifice varying in response to variation in rate of fluid flow therethrough whereby said resistance to said fluid flow increases with an increase in rate of said fluid flow caused by an increase in the rate of movement of said operating arm and the force applied thereto.

13. The apparatus of claim **11** wherein said selectively reversible fluid flow control means includes an annular housing in fluid communication with said exterior fluid flow passage, said housing carrying a check valve rotor, said rotor being in fluid communication with said housing, said rotor being rotatable in said housing whereby said selectively reversible action of said fluid-flow control means is provided by rotation of said rotor in said housing.

14. The apparatus of claim **13** wherein said check valve rotor includes a cylinder having a fluid passage, said cylinder being disposed within a central bore portion of said rotor, said cylinder including an orifice passage and means for varying the area of said orifice passage.

15. The apparatus of claim **14** wherein said means for varying the area of said orifice passage includes an orifice mandrel disposed in said cylinder, said mandrel being slideable in said cylinder into said orifice passage whereby said mandrel varys the area of said orifice passage to cause said variation in said area of said orifice in response to variation in said rate of fluid flow through said fluid flow control means.

16. The apparatus of claim **15** wherein said annular housing includes recessed inner wall portions in said fluid communication with said exterior fluid flow passage, said cylinder having a rounded nose portion, said nose portion being seatable in a selected one of said recesses and biased thereinto whereby said check valve rotor is retained in a selected position by said biased seating of said nose in said selected one of said recesses.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,912,265
DATED : October 14, 1975
INVENTOR(S) : Arthur M. Muir

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE CLAIMS

Claim 1, line 2, after "exerciser" insert --a--.

Signed and Sealed this

twenty-third Day of December 1975

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks