United States Patent [19]

Schnell

[11] **3,856,297**

[45] **Dec. 24, 1974**

[54] **FRICTIONAL TYPE EXERCISING DEVICE**

[76] Inventor: **Josef Schnell,** 8889 Peutenhausen, Germany

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[30] **Foreign Application Priority Data**

Mar. 20, 1972 Germany 2213440

[52] **U.S. Cl.** ..... **272/79 D,** 272/DIG. 3, 272/81, 272/58, 272/DIG. 5

[51] **Int. Cl.. A63b 21/00,** A63b 23/00, A63b 23/04

[58] **Field of Search** ..... 272/81, 80, 83 R, 83 A, 272/58, 57 R, 57 D, DIG. 3, DIG. 5, 79 B, 79 R; 188/164; 74/405

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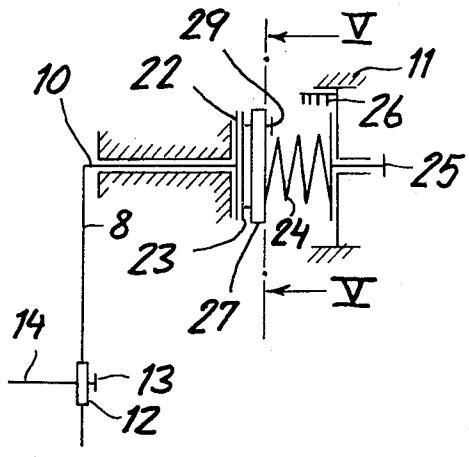
Assistant Examiner—William R. Browne
Attorney, Agent, or Firm—Karl F. Ross; Herbert Dubno

[57] **ABSTRACT**

An exercise apparatus having two crank arms attached respectively to a spaced apart rotatable shafts that are carried on a support. Rotation of each shaft is resisted with a generally uniform torque during displacement of the crank arm through its travel arc of about 180°. A frictional resistance is provided to produce this torque. A freerunning clutch may be employed so that the friction only resists rotation of the shaft in one direction. Each shaft carries a pinion that can mesh with or be disengaged from a large-diameter gear on another shaft. The crank arms may be connected together so that the crank arms will move in unison when acted upon by a user.

13 Claims, 9 Drawing Figures



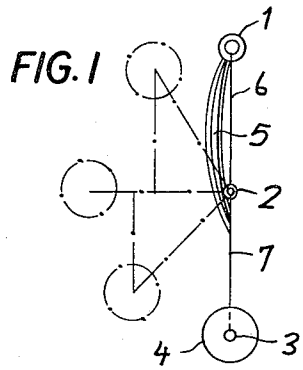


FIG. 1

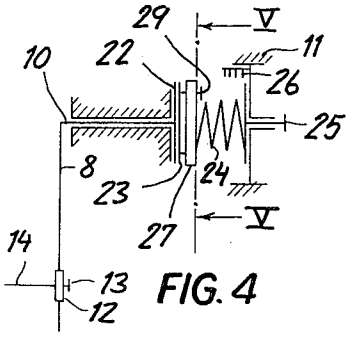


FIG. 4

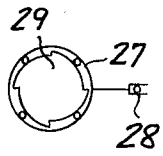


FIG. 5

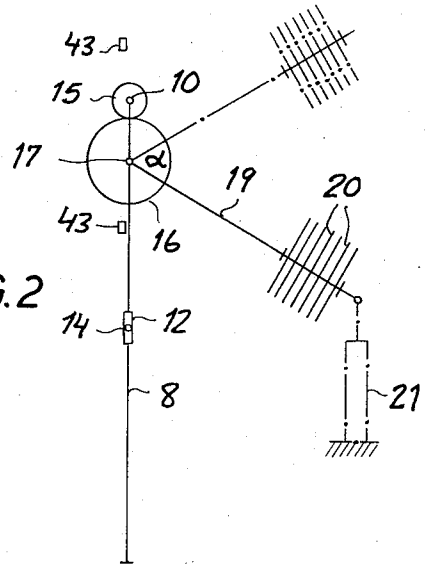


FIG. 2

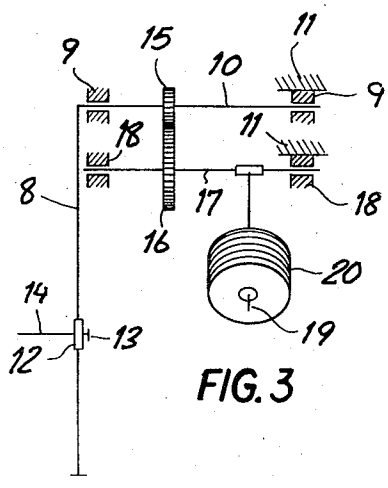


FIG. 3

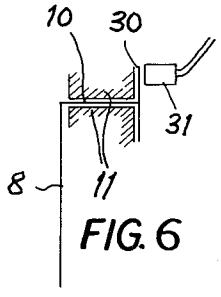


FIG. 6

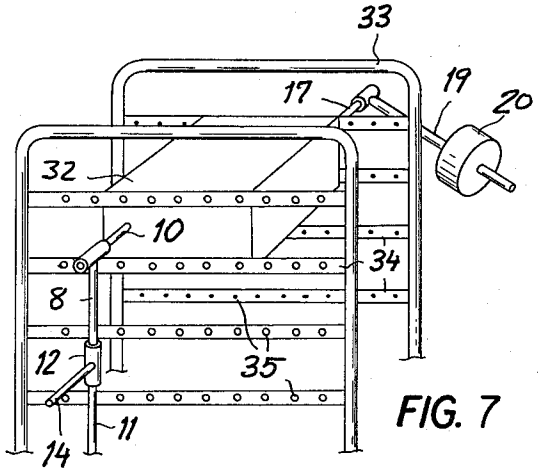


FIG. 7

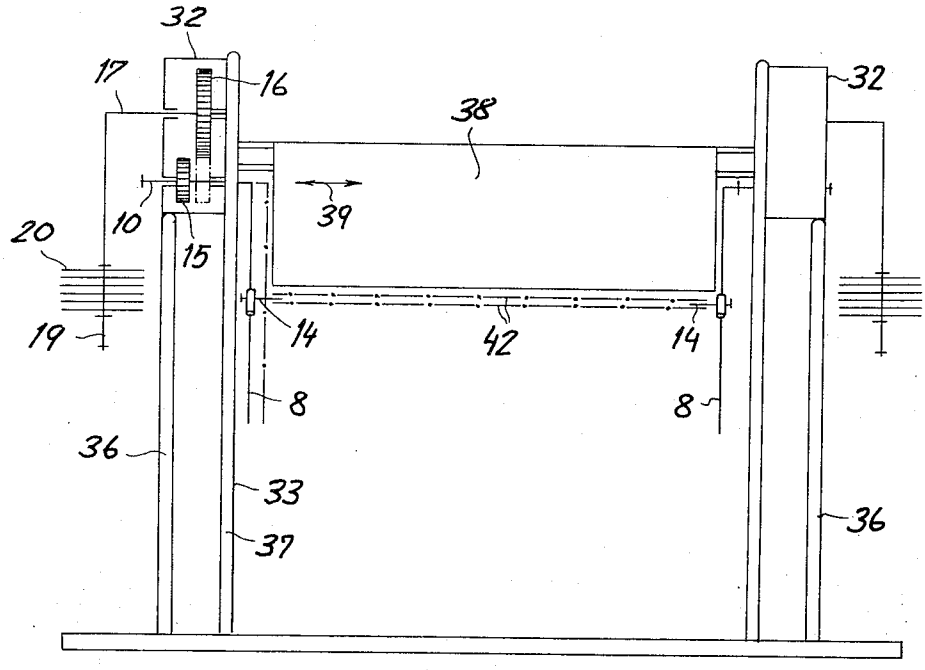

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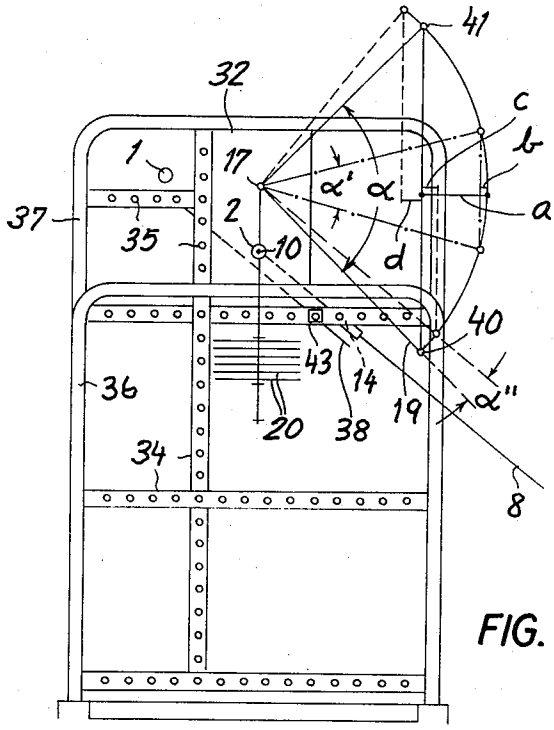
FIG. 8


41
32
c
b
1
17
α'
α
a
37
2
35
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d
40
43
14
36
19
α"
20
38
34
8

FIG. 9

FRICTIONAL TYPE EXERCISING DEVICE

FIELD OF THE INVENTION

The present invention relates to an exercise apparatus. More particularly this invention concerns an exercise apparatus for developing muscle tone which is usable both by athletes in training and by persons in need of rehabilitation after injury or disease.

BACKGROUND OF THE INVENTION

One of the most efficient methods of developing muscle tone in both athletes and in persons recovering from a debilitating disease or injury involves the use of equipment which forces the muscles to exert more force than they are customarily called upon to exert. The simplest type of such equipment is in that class known as weights, including barbells, dumbbells and the like. The simplicity of working out with weights is a distinct advantage, but such systems tax the muscles unevenly and are often dangerous.

Other various types of equipment employing springs and the like have been introduced, but none of them has been found to be altogether as versatile, effective, or safe as could be desired.

OBJECTS OF THE INVENTION

It is, therefore, an object of the present invention to provide an improved exercise apparatus.

Another object is the provision of an exercise apparatus which is safe to use and which taxes the muscles being used very evenly.

A further object is the provision of an exercise apparatus which is fully adjustable for use in training virtually any muscles.

SUMMARY OF THE INVENTION

I attain these objects in my present invention in an apparatus having a crank which operates a shaft journaled in a support. Means is provided for applying between the shaft and the support a constant torque. The shaft is rotatable through about 180° and the resisting torque is substantially the same over the whole travel of the crank so that the muscles of the person utilizing the apparatus are taxed substantially equally for any displacement of the crank.

In accordance with another feature of this invention means is provided for varying this torque so that, for instance, light resistance can be used for training the arm muscles of a convalescing invalid, while heavy force can be used to train the leg muscles of an athlete.

According to yet a further feature of the present invention the means for applying torque to the shaft can be a counterweight arrangement, a mechanical or electrical brake, a fluid cylinder or the like, or even a spring, so long as the torque remains generally the same over the entire travel of the crank.

When counterweights are used according to the present invention they are carried on an arm connected ot a large gear meshing with a much smaller pinion on the crank shaft. Thus rotation of the shaft of the crank through **180°** will only rotate this large gear through a smaller arc. If the displacement arc of the counterweight arm is bisected by the horizontal, the change in effective length of its lever arm, which is proportional to the resistance it will offer to rotation of the crank shaft, is nominal so that the weight will offer substantially constant resistance.

Thus the apparatus according to the invention may comprise a stationary clutch member on the apparatus support, a rotatable clutch member frictionally engaging the stationary clutch member and operatively connected to the shaft (to which the crank is coupled), a spring biasing the rotatable clutch member against the stationary clutch member, means for adjusting the pressure applied by the spring to the rotatable clutch member, indicating means providing means between the clutch members blocking relative rotation thereof in one sense. Locking means is selectively operable for coupling these members against relative rotation in the opposite sense.

The crank is provided with a handle (engageable by the hand of the exerciser) or with a tube or sleeve (adapted to receive a foot of the user), and means for varying the distance between the sleeve or handle and the axis of the shaft. Means is provided for selectively varying the height of the shaft on the support. The latter may comprise a pair of horizontally spaced uprights adapted to receive an exerciser between them. The apparatus can include a rest bridging the uprights and adjustable horizontally and vertically thereon for bracing the exerciser. The torque-controlling means can include a pair of arms swingably mounted on the uprights and lying along outer sides thereof, the crank lying between the uprights.

DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. **1** is a schematic diagram illustrating the arm of a person exercising with a dumbbell;

FIG. **2** is a schematic diagram of a first embodiment of the present invention;

FIG. **3** is a side view of the embodiment of FIG. **1**;

FIG. **4** is a schematic view of a second embodiment of the present invention;

FIG. **5** is a section taken along line V — V of FIG. **4**;

FIG. **6** is a schematic view of a third embodiment of the present invention;

FIG. **7** is a perspective view of the present invention built according to the embodiment of FIG. **1**; and

FIGS. **8** and **9** are end and side views of another apparatus built along the lines of the first embodiment of this invention.

SPECIFIC DESCRIPTION

As shown in FIG. **1**, a person exercising with a dumbbell **4** has, to start with, his shoulder **1**, elbow **2**, and hand **3** in vertical alignment. As he starts to raise the dumbbell **4** the muscle **5** of his upper arm **6** shortens, moving his forearm **7** from the vertical. The closer the forearm **7** is to the horizontal, the greater is the component of force generated by the weight on the muscle **5**, so that at the start and end of the lift the force exerted by the dumbbell is minimal and, hence, little effective.

The present invention has, as shown in FIGS. **2** and **3**, an arm **8** extending as a crank from a shaft **10** supported in bearings **9** of a support **11**. A sleeve **12** is slidable along the arm **8**, which is a profiled steel member

so that this sleeve **12** cannot rotate on the arm **8**, and a crank **14** extends from this sleeve **12** parallel to the shaft **10** and can be secured at any position along the arm **8** by a locking screw **13.**

The shaft **10** carries a small pinion gear **15** which meshes with a larger gear wheel **16** carried on a shaft **17** also journaled in the support **11** at **18.** This shaft **17** is provided with a rigid radially extending arm **19** on which a plurality of weights **20** are carried. A hydraulic or pneumatic dashpot **21** may be connected between the free end of the arm **19** and the ground or the support.

The gears **15** and **16** are dimensioned such that displacement of the arm **8** from the vertical downwardly extending position shown in FIG. **2** to a vertically upwardly extending position displaces the weight through an angle α of about 90°, this angle α being bisected by the horizontal. Stops **43** are provided to limit the travel of the arm **8** to about 180°.

In FIG. **4** structure is identified with the same reference numerals as are employed in FIGS. **2** and **3** where it is functionally identical. Here the shaft **10** is provided with a disk **22** engaged by another disk **23** which is urged against it by a spring **24.** This spring can be displaced to bear against the disk **23** by means of an adjustment screw **25.** A scale **26** is provided on the support **11** to indicate the amount of bias.

A one-way clutch **27** whose outer member is prevented from rotating by a rod **28** and which can be connected by a pin **29** to the disk **23** so that both its members are rotationally linked in both directions is provided between the spring **24** and plate **23.** In this manner as the crank **14** is lifted the two plates **22** and **23** rub together, but as the arm **14** is dropped the clutch allows free rotation of the shaft **10.** Of course with the pin **29** pushed in the brake resists rotation of the shaft **10** in both directions.

In FIG. **6** the shaft **10** is shown carrying a disk **30** which is juxtaposed with an electromagnet **31** that resists rotation of this disk. The amount of current supplied to the electromagnet **31** determines the braking effect.

The arrangement of FIG. **7** has a gearbox **32** suspended between horizontal braces **34** on a pair of upright supports **33.** The bars **34** are formed with holes **35** so that the gearbox **32** can be mounted at any height in order that the arm **14** can be operated by either hands or feet (e.g., via a tube or sleeve receiving the latter).

In FIGS. **8** and **9** a pair of gearboxes **32** are each supported on a short support **36** and a tall support **37** built similarly to the ladderlike supports **33** with perforated crosspieces **35.** The two shafts **10** are here coaxial and in line and are each axially shiftable as shown by arrow **39** so as to be able to bring the gears **15** and **16** out of mesh with each other if desired. In FIG. **8** the left-hand weights **20** are shown hanging straight down, as the gears **15** and **16** are on that side decoupled.

The arms **8** are between the frames **36, 37** and the projecting fingers **14** are interconnected by a sleeve **42.** A planar support **38** can be mounted by use of the holes **35** in any position in order that the person between the uprights using the device may sit or lean on it so as to use the device to best effect for training leg, back or arm muscles.

Stops **43** are positioned in the holes **35** so as to limit the travel of the arms **8** so that the center of gravity **40** of the weights **20** is only moved through an arc α up to a point **41.** In its displacement from toward point **41** the center of gravity is moved by distance a relative to the shaft **17,** this distance *a* representing the change in the effective lever arm supporting the weights **20.** Clearly the distance *a* is not more than a third of the overall lever length so that the force applied by the weights **20** will be relatively uniform.

If, by means of suitable gearing or by limiting the travel of the arms **8,** the arc of displacement of the weights is reduced to the angle α', which is here 30° compared to 90° for α, the change in lever length is only *b*, which is almost unnoticeable for the user. Even displacing the arc **40–41** downwardly by α'' only increases the length of the lever arm by *d*, which has a nominal effect on the torque exerted on the shaft **10** by the weights **20.**

FIG. **9** shows how the apparatus can be set up so that a person lying against the inclined support **38** has his shoulder at **1** and his elbow at **2,** using his forearms to move the weights **20.** Since these weights lie outside the uprights, it is impossible for him to drop them on himself and in any case the bar when released would only rise. The torque is adjusted by adding or removing individual weights. Furthermore disengagement of one of the sets of weights entirely allows the user to work out with a very light load.

I claim:

1. An exercise apparatus comprising:

a support including a pair of horizontally spaced upright frames;

respective horizontal actuating shafts rotatable on each of said frames;

a respective crank arm attached to each of said shafts and lying in a vertical plane formed by rotation of said respective crank arm along an inner side of each frame between a user and one of the upright frames, said arms being displaceable through arcs of approximately 180° by a person positioned between said frames to rotate said shafts;

respective horizontal load shafts journaled on said frames;

respective force receiving members affixed to each of said load shafts externally of said frames and rotatable in respective vertical planes;

a large-diameter gear on each of said load shafts;

a small-diameter gear on each of said actuating shafts in mesh with the respective large-diameter gear;

means for applying a variable force to said force-receiviing members; and

means enabling decoupling of each actuating shaft from the respective load shaft to permit relative angular displacement of said actuating shafts independently of the respective load shafts allowing rotation of only a single actuating shaft and its associated load shaft when a user acts on one of said crank arms, the meshing gears being dimensioned for maintaining a generally uniform torque therebetween in at least one direction over said arcs; and

means connected to said first means for varying said torque means removably attachable to the crank arms so that both arms may be rotated in unison when a user applies a force thereto through an arc during an exercise program.

2. The apparatus defined in claim **1** wherein one of said shafts carries a disk, said apparatus further com-

prising a mechanism mounted on said support and engaging said disk for resisting rotation of said force-receiving member.

3. The apparatus defined in claim **2** wherein said mechanism includes a unidirectional clutch, whereby said mechanism is effective against said disk in only one direction of rotation thereof.

4. The apparatus defined in claim **2** wherein said mechanism includes an element engaging said disk and a spring braced between said support and said element.

5. The apparatus defined in claim **2** wherein said mechanism is electromagnetic.

6. The apparatus defined in claim **1** wherein said gears are so dimensioned that a displacement through 180° of said large-diameter gear wheel displaces said small-diameter gear wheel through an arc of at most substantially 90°.

7. The apparatus defined in claim **1** wherein said force receiving member is displaceable in response to movement of said crank arm through an arc substantially bisected by a horizontal plane, said force receiving member being inclined to said plane at both ends of its arc.

8. The apparatus defined in claim **1** wherein one of said shafts is axially displaceable relative to the other to disengage said gear wheels.

9. The apparatus defined in claim **1,** further comprising stops on said support for limiting displacement of said crank arm.

10. The apparatus defined in claim **1** wherein said crank arm is provided with a handle spaced drom the axis of said shaft, and means for adjusting the distance between said handle and said axis.

11. The apparatus defined in claim **1** wherein said crank arm is provided with a foot-receiving sleeve adjustably mounted thereon for varying the distance between the point at which a user applies a force and the axis of said load shaft.

12. An exercise apparatus comprising:

a support;

a shaft rotatable on said support;

a crank attached to said shaft and displaceable through an arc of approximately 180° by a person to rotate said shaft;

first means operatively connected between said shaft and said support for maintaining a generally uniform torque therebetween in at least one direction over said arc; and

means connected to said first means for varying said torque, said first means including a stationary clutch member on said support, a rotatable clutch member frictionally engaging said stationary clutch member and operatively connected to said shaft, a spring bracing said rotatable clutch member against said stationary clutch member, means for adjusting the pressure applied by said spring to said rotatable clutch member, indicating means providing a visible reading of said spring pressure, and means between said clutch members blocking relative rotation thereof in one sense of rotation.

13. The apparatus defined in claim **12,** further comprising locking means selectively operable for coupling said members against relative rotation in the opposite sense.

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