

Sept. 10, 1963

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3,103,357

RESISTANCE EXERCISING APPARATUS

Filed Nov. 28, 1961

3 Sheets-Sheet 1

FIG. 1

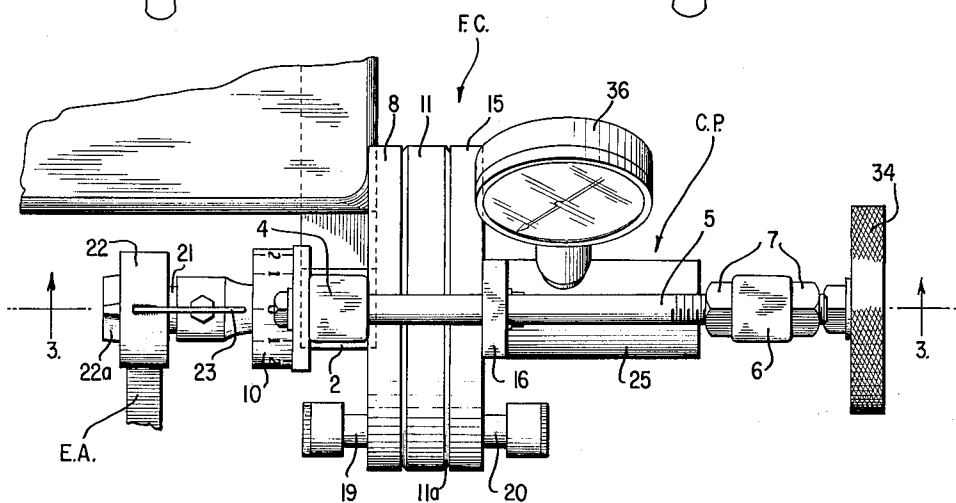
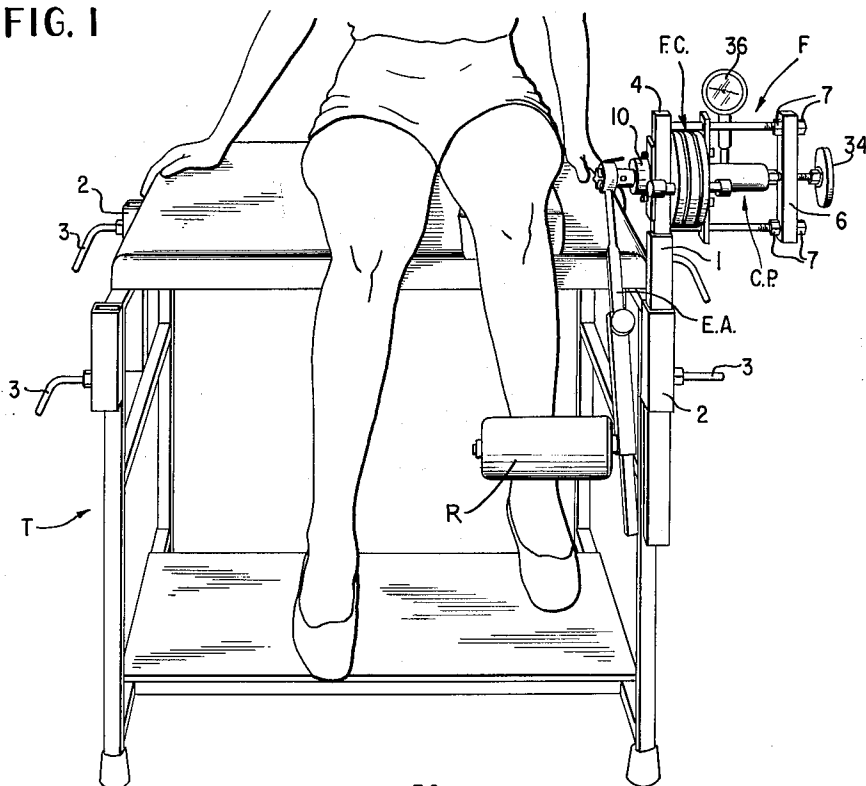


FIG. 2

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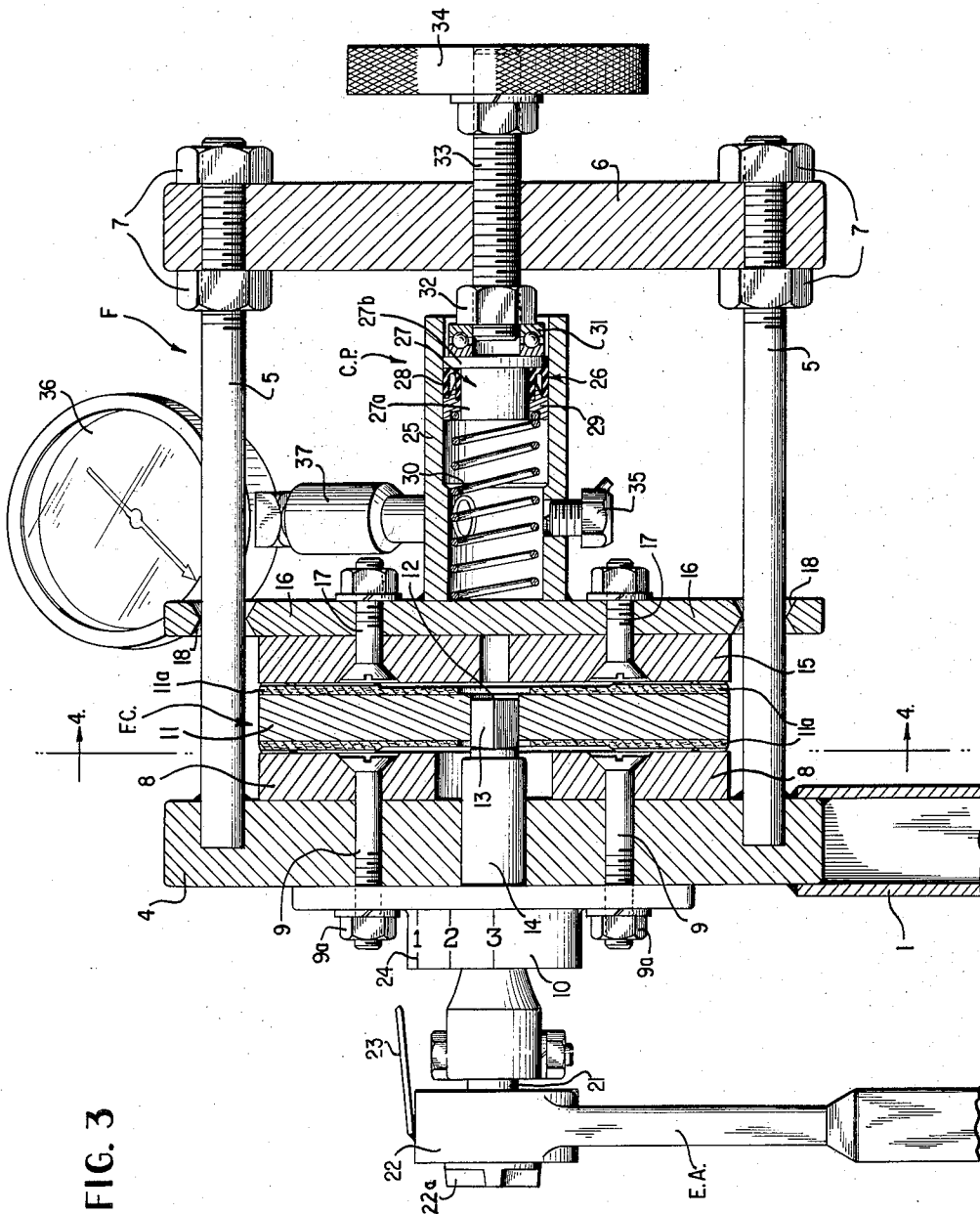


FIG. 3

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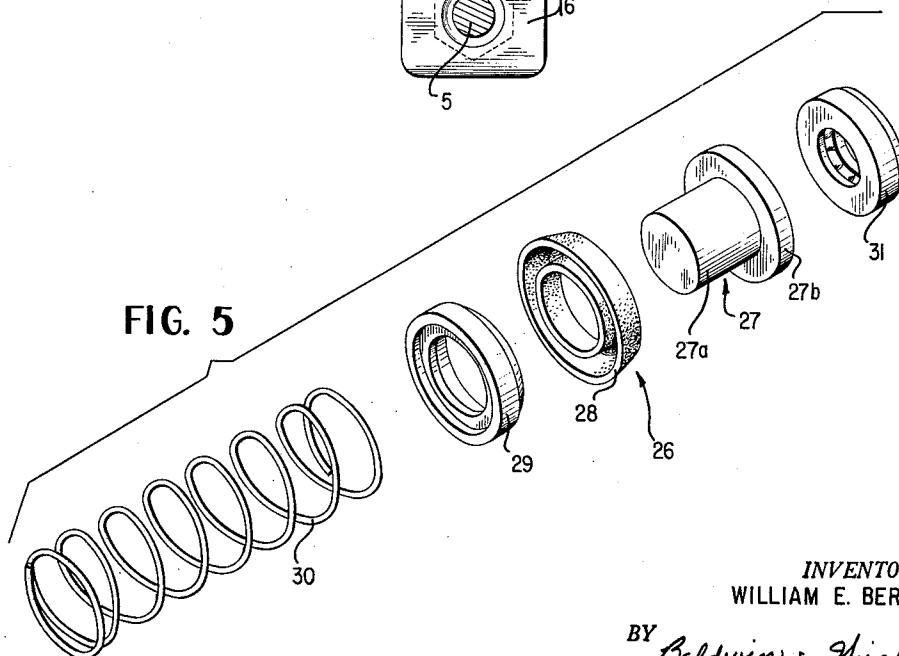
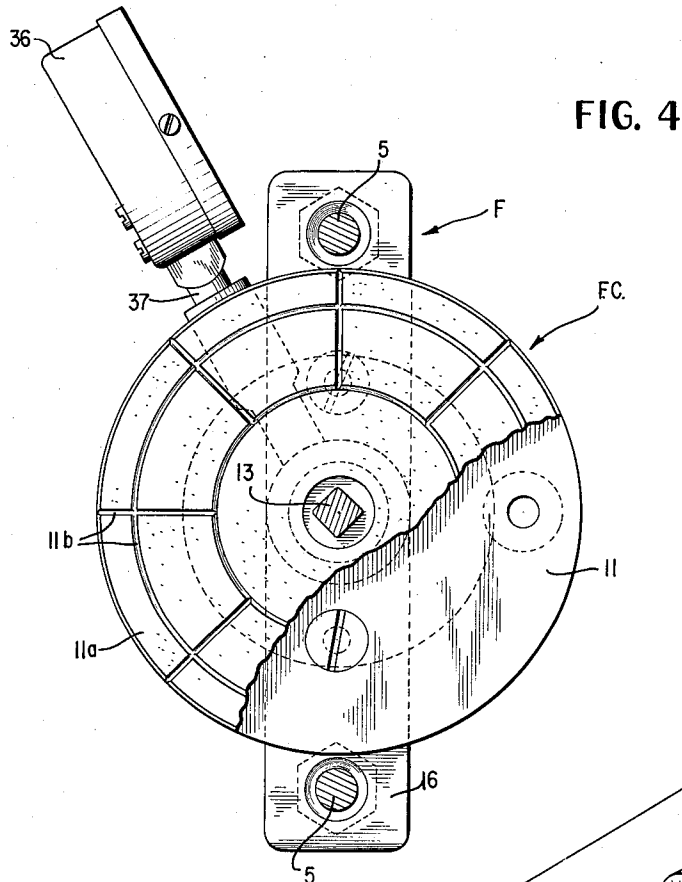
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3 Sheets-Sheet 3



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RESISTANCE EXERCISING APPARATUS

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5 Claims. (Cl. 272-79)

This invention relates to exercising apparatus, and more particularly to apparatus of the kind including parts operable by human movements against resistance or opposition which may be predetermined or selected with measured accuracy according to the exercise required or prescribed.

In Patent No. 2,921,791 issued to William E. Berne, January 19, 1960, the present applicant disclosed a flexible and versatile compact exercise unit which is suitable for home use and small establishments. The present invention provides an improved resistance unit adapted for use in connection with apparatus such as that disclosed in the Berne patent, as well as resistance exercising apparatus more generally considered.

Prior to this invention, the amount of frictional resistance set into exercising equipment was not accurately measurable. Friction clutches were either fixed or could not be adjusted to different resistances or they were adjustable by screw and nut pressure adjusting means, the screw and nut acting directly on the clutch plates either to increase or decrease pressure thereon, thereby either increasing or decreasing resistance to movement. The measure of resistance set into a friction clutch was largely a matter of rough guess or feel, aided, at best, by a scale and pointer or the like indication of the degree to which the nut and screw had been turned relatively. Since many clutch plates are compressible and may take on reduced thickness with age and use, the screw and nut indicating devices have not been continually reliable in reflecting clutch plate pressures and resistance to turning.

In order for a person to maintain a controlled exercising schedule, he must accurately know the resistance set into the exercising apparatus he is using. In limb rehabilitation exercise programs, therapists often prescribe certain known limb exercises to a patient which are to be carried out against a certain resistance. Sometimes, the therapists prescribe exercises with resistances increasing daily in small increments. In the past, resistance adjustments of exercising equipment have been only approximate and the measurement of the resistance inaccurate.

An object of the present invention is to provide an improved exercising apparatus which can easily be adjusted to any increment, either small or large, of increase or decrease in resistance to movement.

Another object of the invention is to provide an improved exercising apparatus which has a means of accurately measuring the amount of friction and resistance set into the clutch mechanism thereof.

Other objects of the invention will become apparent from a reading of the following description, the appended claims, and the accompanying drawings, in which:

FIGURE 1 is a front perspective view illustrating an embodiment of the invention in one form of resistance exercising apparatus;

FIGURE 2 is a fragmentary top plan view of the resistance mechanism illustrated in FIGURE 1, drawn on an enlarged scale;

FIGURE 3 is a vertical section on the line 3-3 of FIGURE 2, drawn on a still further enlarged scale and showing some parts in elevation;

FIGURE 4 is a vertical section on the line 4-4 of FIGURE 3, a clutch disk facing pad and certain other parts being shown in elevation; and

FIGURE 5 is an exploded perspective view of a hydraulic piston assembly.

Mechanism embodying the invention is adapted for use

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in connection with various kinds of resistance exercising apparatus. For the purpose of illustration, mechanism according to the invention is shown in FIGURE 1 in association with resistance exercising apparatus of the kind including a supporting means or table T on which a patient may sit for exercising the lower leg by pressing against a physically operable element, as shown an exercising arm generally designated EA equipped with a cushioned roller R, for example as shown in the application of William E. Berne, Serial No. 46,735 filed August 1, 1960, now abandoned. The construction shown in FIGURE 1 of the present application differs basically from the construction shown in the aforementioned pending application in that the construction depicted in FIGURE 1 of the present application includes a friction clutch generally designated FC for resisting the upward and outward movement of the exercising arm EA, whereas in the construction shown in the pending application the resistance against moving of the exercising arm is provided by a weighted arm disposed at an angle to the exercising arm.

As shown in FIGURE 1, the resistance exercising mechanism, including the friction clutch FC, is carried by a stationary frame structure or support member generally designated F having a downwardly extending standard 1 telescopically received within a receiving means, as shown a socket 2 fast with the table T, the standard 1 being held in vertically adjusted position by a set screw 3. The frame F further includes a strap or plate 4 secured to the standard 1 as by welding and serving fixedly to mount, as by welding, two guide rods or studs 5, 5 which project normally from the strap or plate 4 and are spanned at their outer ends by a yoke 6 held in place by nuts 7 on the threaded outer ends of the studs 5.

The frame F mounts the exercising arm EA for rocking movement which is resisted in one direction of rocking by the friction clutch FC, the arm being freely rockable in the opposite direction as permitted by a ratchet mechanism interposed between the operating arm member EA and the clutch FC.

As shown in FIGURE 3, the friction clutch FC includes an outer disk member 8 which is fixed to the strap or plate 4 by bolts 9 which pass through the plate 8, the strap or plate 4, and also through the flange of a flanged bearing 24, the bolts being provided with securing nuts 9a. The clutch further includes an intermediate disk member 11 which is formed with a non-circular, e.g., square, center opening 12, which receives the similarly shaped end 13 of a shaft 14 mounted to rock angularly in the bearing 10. The connection between the shaft end 13 and the inner clutch disk 11 is such as to permit relative movement of the disk 11 axially with respect to the shaft 14 for a purpose later to be explained, but so as to constrain the disk 11 and shaft 14 against relative turning movement. The shaft 14 also centers the disk 11 with respect to the fixed clutch disk 8.

Another outer clutch disk member 15 is mounted on a crosshead 16 by bolts 17. The crosshead is formed with openings 18 through which the guide rods 5, 5 extend for mounting the crosshead and hence the clutch disk 15 for sliding movement axially with respect to the clutch disks 8, 11 and 15 and the shaft 14 while constraining the clutch disk 15 against rotation.

It is, of course, necessary that the clutch disks be pressed together to provide frictional resistance to turning of the clutch disk 11 and hence the shaft 14. Furthermore, it is important that the clutch disk pressure be adjusted or regulated closely in order to provide just the right amount of resistance. In accordance with the present invention, the clutch disk pressure is applied by means of a hydraulic cylinder and piston assembly generally designated CP, the arrangement being such that the great-

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er the fluid pressure existing in the cylinder of the assembly CP, the greater the clutch disk pressure and resistance to rocking of the movable disk member 11. By maintaining the coefficient of friction between the movable clutch disk 11 and the relatively fixed clutch disks or members 8 and 15 substantially constant, the resistance to rocking of the movable disk 11 will be determined substantially solely by the clutch disk pressure applied normally to the planes of said disks by the pressure generating cylinder and piston assembly CP. In order to prevent changing of the coefficient of friction due to long use and wear, the clutch disk 11 is provided on its opposite surfaces with relatively compressible clutch disk facing material 11a formed with annular and radial lubricant grooves 11b. Lubricant fittings 19 and 20 mounted on the relatively fixed disks 8 and 15 for communication with the lubricant grooves 11a and 11b enable the contacting faces of the clutch elements to be maintained in such condition as to prevent substantial changing of the coefficient of friction.

The shaft 14 is provided with an extension 21 which projects into the hub 22 of the exercising arm EA and is drivingly connected with the arm EA through ratchet mechanism generally designated 22a and which may, for example, be of the kind illustrated in the aforementioned Berne Patent No. 2,921,791, although any other suitable ratchet or one-way-drive mechanism may be employed for coupling the arm EA to the shaft 14, 21 for driving the latter in one direction against the clutch resistance and permitting the arm EA to return freely in the opposite direction without being restrained by the shaft and clutch. The degree of swinging of the arm EA against the resistance afforded by the clutch may be measured with the aid of a pointer 23 on the exercising arm hub 22 and a scale indicated at 24 on the bearing 10.

It is essential, in achieving the objects and advantages of the present invention, for the clutch disk pressure to be very accurately settable, since the clutch disk pressure is the only variable determining the resistance to operation of the arm EA. Since, after long use, the clutch parts may wear somewhat, or the facing pads 11a may take on a permanently compressed condition, it is not possible to control the clutch disk pressure accurately by the mere relative axial positioning of the clutch disks. Through the provision of the hydraulic cylinder and piston assembly which determines the clutch disk pressure quite independently of relative clutch disk positioning, the resistance to operation of the arm EA may be determined and maintained very accurately.

It will be apparent that the cylinder and piston assembly for determining clutch disk pressure may be of various forms. In the illustrated embodiment, the assembly CP includes a hydraulic cylinder component or element 25 which is welded at one of its ends to the crosshead 16, the other end of the cylinder being open for receiving a piston assembly component or element generally designated 26. Referring especially to FIGURES 3 and 5, the piston assembly 26 includes a main piston member 27 comprising a stem 27a and a flange 27b. A resilient sealing ring 28 of rubber or other suitable resilient material, is fitted over the piston stem 27a and is pressed in place by and is held against the piston flange 27b by a relatively rigid pressure ring 29 which has a tapered end adapted to extend into a groove in the sealing ring 28. The pressure ring 29 is forced against the sealing ring 28 by a coiled compression spring 30 interposed between the ring 29 and the crosshead 16 which, in effect, provides the closed end of the cylinder 25.

The piston assembly 26, being mounted within the cylinder 25, is forced to the left, as viewed in FIGURE 3, by means of a ball bearing assembly 31 which, in turn, is pressed leftwardly by a nut 32 on an adjusting screw 33 having threaded engagement with the yoke 6 and being provided with a manually adjustable knurled wheel 34. The cylinder is adapted to be filled with hydraulic

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fluid through a filler opening closed by a plug 35. With the cylinder filled with and confining a body of fluid, turning of the hand wheel 34 will move the piston assembly toward the left so as to exert pressure on the fluid and to transmit pressure to the crosshead 16 and non-rockable clutch disk 15. In this way, the clutch disks 15, 11 and 8 are forced together under pressure dependent upon the positioning of the piston assembly by rotation of the hand wheel 34.

Since the resistance to operation of the exercising arm EA will depend almost entirely upon the fluid pressure within the cylinder 25, a visual indication of this pressure will serve very conveniently as an indication of the clutch resistance and exercising effort required to move the arm EA. Accordingly, a pressure gauge 36, which may be of any conventional form, is arranged to communicate through a tube or pipe connection 37 with the interior of the cylinder 25. In the form shown, the pressure gauge 36 is mounted on the cylinder and thus on the frame F and is arranged at such an angle that it may readily be observed, for example by a physician or therapist standing in front of the table T and setting the mechanism according to the requirements of a particular patient. It is apparent that the gauge 36 could be mounted elsewhere and connected to the cylinder by a tube of the necessary length.

The construction shown and described embodies the invention in a preferred form, but it is intended that the disclosure be illustrative rather than definitive, the invention being defined in the appended claims.

I claim:

1. An adjustable resistance means for use in exercising apparatus, comprising a support member; a multiple disk friction clutch mounted on said support member and including a relatively non-rotatable disk and a relatively rotatable disk; a hydraulic cylinder and piston means mounted on said support member with said multiple disk friction clutch and being operable for pressing the disks of said clutch against one another under variable pressure; hydraulic fluid within the hydraulic cylinder the pressure of which is controlled by the relative displacement of the piston in said cylinder; means for displacing said piston relatively within said hydraulic cylinder; means for measuring the fluid pressure in said hydraulic cylinder and thereby affording an indication of the clutch disk pressure and the force required to effect relative rotation of the clutch disks; an operating member; and a shaft connecting said relatively rotatable disk to said operating member.

2. An adjustable friction resistance means for use in exercising apparatus comprising a support member; a first outer clutch disk non-rotatably mounted on said support member; an inner clutch disk mounted on said support member for rotation adjacent and parallel to said first outer clutch disk; a second outer clutch disk disposed adjacent and parallel to said inner clutch disk; guide means mounting said second outer clutch disk on said support for movement of said second outer clutch disk normal to said inner clutch disk while constraining said second outer clutch disk against rotation; a hydraulic cylinder disposed to act normally on said second outer clutch disk so that when pressure is applied in said hydraulic cylinder said cylinder will push said second outer clutch disk against said inner clutch disk and resultantly said inner clutch disk against said first outer clutch disk; hydraulic fluid within said hydraulic cylinder; a piston means disposed within said hydraulic cylinder and movable longitudinally therein; manually operable means acting on said piston to displace said piston within said cylinder, thereby adjusting the hydraulic pressure within said cylinder; a fluid pressure gauge communicating with said hydraulic cylinder to measure the fluid pressure therein; an operating shaft connected to the inner clutch disk; and an exerciser arm connected to said operating shaft, whereby movement of said exerciser arm will be met with a set

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measurable amount of frictional opposition determined by the displaced position of said piston means in said cylinder.

3. In an exercising apparatus, an adjustable friction resistance means comprising a support member; a first outer clutch disk non-rotatably mounted on said support member; an inner clutch disk mounted on said support member for rotation adjacent and parallel to said first outer clutch disk; a second outer clutch disk disposed adjacent and parallel to said inner clutch disk; a first and a second clutch facing pad disposed one between said first outer clutch and said inner clutch disk and the other between said inner clutch disk and said second outer clutch disk, said clutch facing pads being formed with annular and radial lubrication control grooves; lubrication fittings disposed one on said first outer clutch disk and another on said second outer clutch disk whereby lubrication is supplied to said clutch disks; guide means mounting said second outer clutch disk on said support for movement of said second outer clutch disk normal to said inner clutch disk while constraining said second outer clutch disk against rotation; a hydraulic cylinder disposed to act normally on said second outer clutch disk so that when pressure is applied in said hydraulic cylinder said cylinder will push said second outer clutch disk against said inner clutch disk and resultantly said inner clutch disk against said first outer clutch disk; hydraulic fluid within said hydraulic cylinder; a piston means disposed within said hydraulic cylinder and movable longitudinally therein; manually operable means acting on said piston to displace said piston within said cylinder, thereby adjusting the hydraulic pressure within said cylinder; a fluid pressure gauge communicating with said hydraulic cylinder to measure the fluid pressure therein; an operating shaft connected to the inner clutch disk; and an exerciser arm connected to said operating shaft, whereby movement of said exerciser arm will be met with a set measurable amount of frictional opposition determined by the displaced position of said piston means in said cylinder.

4. In combination, an exerciser support means; socket means mounted on said exerciser support means and adapted to receive exercising apparatus; and exercising apparatus received and mounted by said socket means and comprising a multiple disk friction clutch, hydraulic cylinder and piston means acting on said multiple disk friction clutch for variably controlling the clutch disk pres-

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sure, means for applying lubricant to said clutch disks, means for manually adjusting the pressure in said hydraulic cylinder, a pressure gauge to measure the hydraulic pressure in said cylinder and hence said friction clutch disk pressure, and operating arm means operatively connected with said friction clutch, whereby a person exercising by moving said operating arm will encounter a preselected and measured amount of resistance.

5. In combination, an exerciser support means; socket means mounted on said exerciser support means and adapted to receive exercising apparatus; and exercising apparatus received and mounted by said socket means and comprising a multiple disk friction clutch, clutch facing means disposed between the disks of said clutch and provided with lubrication control grooves, a lubrication supply communicating with said lubrication control grooves whereby said lubrication control grooves can be kept supplied with lubricant thereby coating the clutch disk surfaces when said clutch is in use, hydraulic cylinder and piston means acting on said multiple disk friction clutch for variably controlling the clutch disk pressure, means for manually operating the piston to adjust the pressure in said hydraulic cylinder, and a pressure gauge to measure the hydraulic pressure in said cylinder and hence said friction clutch disk pressure, and operating arm means operatively connected with said friction clutch, whereby a person exercising by moving said operating arm will encounter a preselected and measured amount of resistance.

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