This invention relates to exercising apparatus, and in particular relates to hydraulically controlled apparatus for barbell type exercises.

One object of the present invention is to provide apparatus of the character described including a hydraulically operable means for simulating various bar-bell lifting exercises, and provided with control means by which the user can automatically vary the amount of lifting effort required by manually varying the lifting speed applied to the barbell device.

Another object of the invention is to provide an apparatus of the character described by which the effort required to lower the barbell device is automatically minimized, so that the exerciser will not be subjected to possible injurious muscular strains due to sudden transfer of supporting energy from one set of muscles to another.

Another object of the invention is to provide a barbell device of the character described which is easily adjustable for use for isometric exercises.

Still another object of the invention is to provide a hydraulically operable barbell type of exercising device which is readily adaptable for use in various standing, squatting, sitting and lying-down types of exercises.

Another object of the invention is to provide an exercising device of the character described wherein is provided indexing means for quickly adjusting the effective lifting resistance of the device, within a wide range of pressures from zero, for isometric exercising through a substantial range of effective lifting weights.

Another object of the invention is to provide a weight-lifting type of exercising device of the character described, having improved means for vertically adjusting the effective height of the barbell means.

Other objects of the invention will be manifest from the following brief description and the accompanying drawings.

Of the accompanying drawings:

FIGURE 1 is a front elevation of a barbell exercising device embodying the features of the invention.

FIGURE 2 is an end elevation of the same, as viewed from the left of FIGURE 1.

FIGURE 3 is an enlarged vertical cross-section, partly broken away, through the left-hand hydraulic cylinder in FIGURE 3.

FIGURE 4 is a top plan view of the structure shown in FIGURE 3, and on the same scale.

FIGURE 5 is a cross-section corresponding to FIGURE 4 illustrating a modified type of hydraulic cylinder.

FIGURE 6 is a perspective view, on a reduced scale, of a modified form of barbell exercising device, adapted for use in a single-cylinder hydraulic unit.

FIGURE 7 is an enlarged cross-section taken substantially on the line 7-7 of FIGURE 6.

Referring to FIGURES 1 to 4 of the drawings, there is illustrated one embodiment of the invention, wherein a horizontal bar 10 is affixed to the upper ends of piston rods 11, 11 extending from a pair of laterally spaced hydraulic cylinders 12, 12. These cylinders may be pivoted at the lower ends thereof to pins 13 on U-shaped brackets 14, to be selectively swingable in vertical planes, between forwardly inclined, substantially upright, off-center positions of rest, shown in chain-dotted lines at the left of FIGURE 2 and angular positions, shown in chain-dotted lines on the right of FIGURE 2, more nearly approaching the horizontal, as for sitting or lying-down types of exercises. The cylinders are retained in the off-center, at rest positions by stop engagement of lower edges 15 of the cylinders with edge portions 16 of the brackets 13. Brackets 13 may be bolted or screwed to a suitable board or base 17 to be portable therewith, or they may be secured directly onto a floor.

As best shown in FIGURE 3, each piston rod 11 may have suitably affixed to the lower end thereof, a hollow piston head 18 to which is removably affixed a cup-type washer 19 of leather, rubber, or the like for sliding, fluid-sealing engagement with the cylinder wall 20, in known manner. By-pass means is provided for bypassing the hydraulic fluid between the upper and lower sides of the washer, which means may include passages 22, 22, in the head 18 above the washer communicating with a chamber 23 within the head, which in turn communicates with the lower side of the washer through an axial passage 24 in a downward extension of the head. For varying the amount of fluid to be by-passed, a valve pin 25 is axially slidable in a passage 26 through piston rod 11, toward and from closed, complementary sealing engagement of a conical lower end 27 with a conical seat 28 in the head at the upper end of passage 24. Thus, varying the effective size of the valve opening to passage 24 will correspondingly vary the power required to raise the piston rod 11. The size of the said valve opening, however, does not affect the downward stroke of the piston, because the hydraulic fluid is then free to flow past the edges of the upturned peripheral edge of the washer in known manner. In other words, the downward stroke of the piston is accomplished without substantial resistance whether the by-pass valve pin is closed or not.

For axially adjusting the valve pin 25 in piston rod 11, the upper end of pin 25 may be threadedly extended at 31 through a nut 32, removable threaded in the upper side of the horizontal bar 10. Pin 25 may be rotated through a series of axially adjusted positions, by means of a knob 33, affixed on the outer end of pin extension 31, and the knob may have thereon a dial 34 provided with a scale of lifting pressures in terms of pounds, whereby the effective lifting pressures may be indicated by a pointer 35 affixed on the bar 10. The effective upward pressures applied to each piston 12, by manual upward lifting action applied to the bar 10, otherwise may be manifested on a pressure gauge 36 affixed to the respective cylinders 12 (see FIGURES 3 and 4).

O-rings are provided in each cylinder unit, as indicated at 37 and 38, to seal against fluid leakage between valve pin 25 and piston rod 11, and between the latter and the top of cylinder 12, respectively.

In use of the device of FIGURES 1 to 4 for a barbell type of exercise, such as an arm curl, the assembly will be in the condition shown in full lines in FIGURES 1 and 2.

Grasping the bar 10 with both hands the user slowly raises the bar to a full curl position, as indicated in chain-dotted lines in FIGURE 1, against requisite heavy pressure of the two pistons required to force hydraulic fluid from the upper portion of the cylinders through the by-pass passages 22 and 24. If the effective lifting pres-
ures are too high or too low, the exerciser opens or closes the passages 24 correspondingly by turning knobs 33. The gauges 36 will indicate at least approximations of such changes in pressures. In any event, should the exerciser feel that he is exceeding his weight lifting capacity at any point, he need only ease the lifting rate to reduce the effective lifting weight. This instant control over the lifting pressures is particularly important because maximum effort is automatically released at normal completion of a given exercise or by discontinuing the exercise at any point of the movements thereof. This feature has a distinct advantage over use of standard barbell units, in that the danger of injury, due to sudden transfer of lifting loads from one set of muscles to another, is eliminated.

Various other types of barbell exercises may be practiced by changing the angle of the unit and/or standing on a stool or platform (not shown) placed beneath the bar 10. Rowing exercises may be practiced from a sitting position on base 17, while the assembly is angularly adjusted somewhat as shown in chain-dotted lines in FIGURE 2. Examples of other exercises possible with the device include the sitting press, knee bends, leg presses, shoulder shrugs, bench presses, and many others.

When isometric exercising is desired, the bar 10 is extended in the vertical direction and the weights adjusted to close the passages 24 of cylinders 12. This in effect locks the piston heads 18 and bar 10 in given positions. This type of exercising may be practiced with the pivotal assembly positioned at any desired angle about pivot pins 13, 13, as before. Even when the pistons are locked, as described, the gauges 36 will indicate the applied lifting effort against the fixed bar 10, because there will be corresponding pressure varyingly applied to the hydraulic fluid in the cylinders, which pressure will be indicated on the gauges 36. This principle serves as a means to determine the equivalent of pounds of weight resisted, as well as to show improvement made in lifting capacity.

FIGURE 5 illustrates a modified form of hydraulic cylinder unit, wherein the piston rod 11o does not include a bypass valve in the piston or piston head. A solid piston 18a on the lower end of a piston rod 11a has an O-ring 38 between the piston and the wall 28a of the cylinder, thereby to prevent passage of hydraulic fluid in either direction. Fittings 39 and 40 connected to the upper and lower ends, respectively, of the cylinder 12a have passages 41 and 42 adapted to communicate with each other through a connecting pipe or fitting 43. With upward urging of the piston 18a in cylinder 12a, the upper portion of cylinder 12a through passage 41 and a bypass passage 44 in fitting 39, pipe 43, and passage 42 of fitting 40, to the lower end of the cylinder. The passage 41 in fitting 39 is otherwise normally held closed intermediate inlet and outlet ends of the by-pass passage 44, as by a valve 45 including a spring-pressed ball 46 engaged an annular seat 47. Upward movement of the piston is thereby restricted by flow of fluid around the valve 45. The pressure required to move the piston 18a may be varied by operation of a valve pin 48 threaded in fitting 39 for adjustment toward and from seating a tapered end 49 with a valve seat 50. With the valve pin 48 in either open or closed positions, reverse movement of the piston toward the lower end of the cylinder 12a reverses the flow of fluid through spring-pressed valve 45, so that such movement of the piston is not substantially resisted. The piston 18a may be locked in any selected position by upward movement and the by-pass passage 44 completely, as for use of the device for isometric exercises. Use of the hydraulic device of FIGURE 5 in the system of FIGURES 1 and 2 is otherwise substantially the same as described above in connection with FIGURES 3 and 4.

Referring to FIGURES 6 and 7 there is illustrated a modified form of the invention utilizing a single cylinder unit. The numeral 51 designates a rigid immovable cantilevered T-bar having oppositely disposed hand-grip extensions 52, 52 from a centred central cylinder 53 which is vertically adjustably affixed to a vertical channel 54. A guide rod 55 is mounted parallel to the channel by being affixed between spaced plates 56 and 57, in turn affixed to the back of the channel, and a slide block 58 is mounted intermediate said plates to have said guide rod 55 vertically slide in the slide bearing 59 in the block. Block 58 is affixed on the upper end of a hydraulic cylinder 60 corresponding to the cylinder 12 of FIGURE 3, the lower end of cylinder 60 being affixed on the free end of an arm 62 pivoted on a pin 61 on a U-shaped bracket 63, which is secured to a floor, or to a base like the base 16 of FIGURES 1 and 2. A piston rod 64 extends from the cylinder and upwardly of the block 58, and is affixed at its upper end to the top plate 56 to move with the guide rod 55, in parallelism therewith. Adjustment means 66 is provided, corresponding to that shown at the upper portion of FIGURE 3, for adjusting the effective fluid pressure resisting upward movement of the channel and associated parts with respect to cylinder 60 and head 58, upon application of manual upward pressure to the T-bar 51. A channel-shaped portion on the block 58 slidably embraces the back of the channel 54 for greater stability of relative movements of the parts.

The T-hubs are vertically affixed and thus of course slidably affixed on channel 54, by engagement of a pin 66 through one pair of holes 67 of a vertically spaced series thereof in the channel flanges 65, 68, and through the inner end of leg 53 (see FIGURE 7). Rotational movement of T-bar 53 on pin 66 is prevented by reception of a reduced end 69 of leg 53 in one of a corresponding series of vertically spaced holes 70 in the back of the channel 54.

Vertical adjustment of the T-bar 51 may be made as necessary for different kinds of exercises and to suit persons of different sizes or arm reaches. The point of junction of the leg 53 and the extended hand grip extensions 52 is adapted, in the relationship shown in FIGURE 6, to be vertically aligned above the axis of pivot pin 61 and the center of bracket 63. This arrangement is such that the various types of exercises previously referred to may be practiced, by gripping the hand-grip extensions 52, substantially in the manner and for the exercises previously described in connection with FIGURES 1 to 4, including those accomplished while the body is erect, or in sitting or lying-down positions. Vertical adjustment of the T-bar 51 on the channel 54 makes it possible to perform pull-up types of exercises from the floor or supporting base, that is, fluid is forced downward through the cylinder, in the same means. Setting-up and lying-down exercises are accomplished by swinging the exercising device on pivot pin 61, to the left as viewed in FIGURE 6.

In the broadest aspects of the FIGURE 6 form of the invention the T-bar 51 is important because it provides a simple exercising device by which certain isometric exercises described above can easily be accomplished from standing, sitting, or lying down postures without interference with the relatively fixed upright unit.

Thus has been provided several forms of exercising devices which are compact and efficient in operation, and which are easily mounted and disassembled for exercising and storage purposes, respectively. For the said storage purposes, it is only necessary to remove respective pivot pins to permit removal of the exercising units from the U-shaped mounting brackets.

In the two modified forms of the invention exemplified in FIGURES 6 and 7, the piston gauges 44 may be provided at the tops of cylinders 12a and 60 for measuring pressure, substantially as shown in FIGURES 1 to 3. In all forms of the exercising units, when used as previously described for isometric exercises, the gauge 36 on each cylinder may be designed to indicate, on a dial thereof, the equivalent of a total weight, in pounds, lifted regardless of the number of cylinders used in the exercising units. In the unit of FIGURES 1 to 4, and in the locked positions of the
two pistons for isometric exercising, if the pressure at the top of each cylinder 12 is 50 p.s.i., the total weight lifted, as read on each gauge would be 100 pounds. Accordingly, the dial of each gauge may have a scale on which the total effective weights lifted would appear. The actual p.s.i. for each cylinder may also be indicated on a separate scale on its respective gauge. Accordingly, a person may determine exactly what progress he is making by means of isometric exercises, by reading the total weight lifted, as registered on one of the gauges 36 at the exact points at which the respective pistons are locked against upward movement in the cylinders.

By means of the above described equipment, it is possible to duplicate upwards of twenty standard exercises for strengthening and building different muscles of the body, and in a relatively small fraction of the time required by isotonic exercising methods.

Other modifications of the invention may be resorted to without departing from the spirit thereof or the scope of the appended claims.

What is claimed is:

1. An exercising device, comprising a hydraulic unit including a pair of on said cylinder hydraulic cylinders containing hydraulic fluid; attaching means pivotally anchoring said cylinders to a working surface to swing about an axis parallel thereto; a piston slideable in each said cylinder and each having a piston rod thereon slidably extended outwardly of the other end of the respective cylinder; rigid hand grip means affixed between the outward extensions of said piston rods for manually reciprocating said pistons in various selected positions of swinging movement of said unit about said axis; and selectively adjustable by-pass means in said cylinders for controlling the effective pressure required to be applied to said hand grip means to move pistons in said cylinders in unison at least one direction of the strokes thereof against the pressure of the fluid in the cylinders.

2. A device as in claim 1, said selectively adjustable means in each said cylinder including a first by-pass means for by-passing said fluid around said piston only, in one direction of the stroke of the same, independently of said first by-pass means; and valve means selectively operable to vary the flow of fluid through said second by-pass means, and thereby correspondingly to vary the manual power required to move the piston in said opposite direction.

3. A device as in claim 1, said selectively adjustable means in each said cylinder including a first by-pass means for by-passing said fluid around said piston only, in one direction of the stroke of the same; a second by-pass means for by-passing said fluid around said piston in the opposite direction of the stroke of the same, independently of said first by-pass means; and valve means selectively operable to vary the flow of fluid through said second by-pass means, and thereby correspondingly to vary the manual power required to move the piston in said opposite direction.

4. An isotropic exercising device, comprising: a bracket having means for attaching the same to a working surface; an arm pivotally attached at one end to said bracket and said cylinder being affixed at its lower end to the free end of said arm to be swingably supported thereby; a piston slideable in said cylinder and having a piston rod thereon slidably extended outwardly of the other end of the cylinder; a rigid frame mounted on said cylinder and including a portion affixed to the outward extension of said piston rod, whereby the frame is axially movable on said cylinder to reciprocate said piston; rigid hand grip means on said frame for manually moving the same axially with respect to said cylinder in various selected positions of said swinging movement of said arm; and selectively adjustable by-pass means in said cylinder for controlling the effective pressure required to be applied to said hand grip means to move said piston in the cylinder in at least one direction of the strokes thereof against the pressure of the fluid in the cylinder.

5. A device as in claim 4, including means for releasably affixing said hand-grip means to said frame at variable distances from said arm.

6. A device as in claim 4, said selectively adjustable means in each said cylinder including a first by-pass means for by-passing said fluid around said piston only, in one direction of the stroke of the same; a second by-pass means for by-passing said fluid around said piston in the opposite direction of the stroke of the same, independently of said first by-pass means; and valve means operable selectively to vary the flow of fluid through said second by-pass means, and thereby correspondingly to vary the manual power required to move the piston in said opposite direction.

7. An isotropic exercising device, comprising: a bracket having means for attaching the same to a working surface; an arm pivotally attached at one end to said bracket and said cylinder being affixed at its lower end to the free end of said arm to be swingably supported thereby; a rigid frame mounted on said cylinder and including a portion affixed to the outward extension of said piston rod, whereby the frame is axially movable on said cylinder to reciprocate said piston; rigid hand grip means on said frame for manually moving the same axially with respect to said cylinder in various selected positions of said swinging movement of said arm; and valve means operable selectively to vary the flow of fluid through said second by-pass means, and thereby correspondingly to vary the manual power required to move the piston in said opposite direction.

8. A device as in claim 7, said selectively adjustable means in each said cylinder including a first by-pass means for by-passing said fluid around said piston only, in one direction of the stroke of the same; a second by-pass means for by-passing said fluid around said piston in the opposite direction of the stroke of the same, independently of said first by-pass means; and valve means operable selectively to vary the flow of fluid through said second by-pass means, and thereby correspondingly to vary the manual power required to move the piston in said opposite direction.

9. An isotropic exercising device having a horizontal working surface, comprising: a rigid upright; means for mounting said upright at the situs to anchor the same generally in upstanding relation to the working surface of the situs to resist longitudinal compression and tension stresses applied to the upright while in said upstanding relation; said stress applying member adjustable rigidly connected to said upright; and cooperating adjustment means on said member and said upright for adjustment of the location of the rigid connection of the member on the upright to the variously spaced positions thereon above the working surface of the situs; said member including at each position rigid immovable arm means fixedly mounted on said upright and cantilevered from the situs forwardly of the upright and terminating in a laterally extending crossbar having gripping portions on each side of said rigid arm means; the space between said crossbar and the working surface of the situs being substantially free and unobstructed whereby in the variously spaced positions of the member above the working surface a person assuming various exercising postures on the said surface can engage parts of the body with the underside of said crossbar to apply upward exercising pressure thereto.

10. An exercising device as in claim 9, wherein said means for mounting includes a bracket for anchoring connection to said working surface and a forward extension on the lower end of said upright pivotally connected to said bracket whereby the upright is swingable in a vertical plane through said rigid arm means.

11. An exercising device as in claim 10 and wherein a line extending from the intersection of the rigid arm means and the cross-bar to the pivotal axis of the pivotal connection of said bracket remains parallel to the long-
tudinal axis of the upright as the upright swings in the vertical plane.

References Cited

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Inventor</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>676,637</td>
<td>6/1901</td>
<td>Spalding</td>
<td>88—166</td>
</tr>
<tr>
<td>1,707,449</td>
<td>4/1929</td>
<td>Rodale</td>
<td>73—379</td>
</tr>
<tr>
<td>2,068,578</td>
<td>1/1937</td>
<td>Stronach</td>
<td>272—79</td>
</tr>
<tr>
<td>2,921,791</td>
<td>1/1960</td>
<td>Berne</td>
<td>272—80 X</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Country</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>565,630</td>
<td>11/1964</td>
<td>Great Britain</td>
<td>8</td>
</tr>
</tbody>
</table>

ANTON O. OECHSLE, Primary Examiner.
RICHARD PINKHAM, F. BARRY SHAY, Examiners.
W. R. BROWNE, Assistant Examiner.