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EXERCISING MACHINE

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3 Sheets-Sheet 1

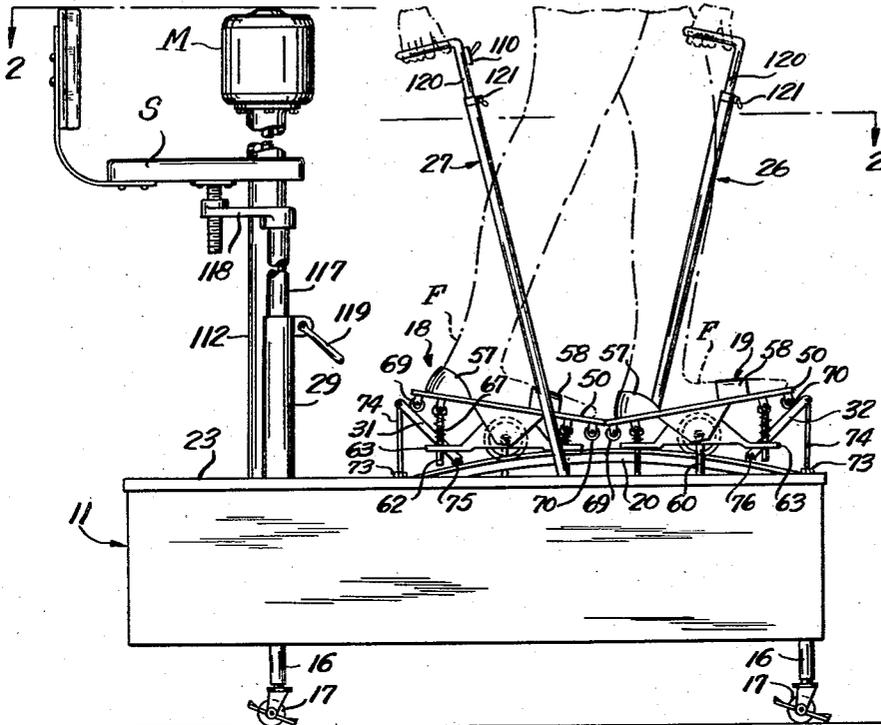


FIG. 1

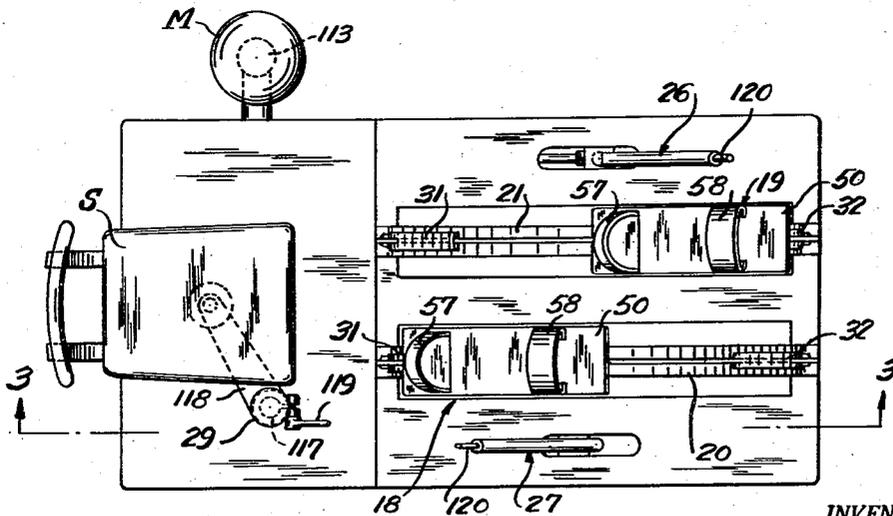


FIG. 2

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3 Sheets-Sheet 2

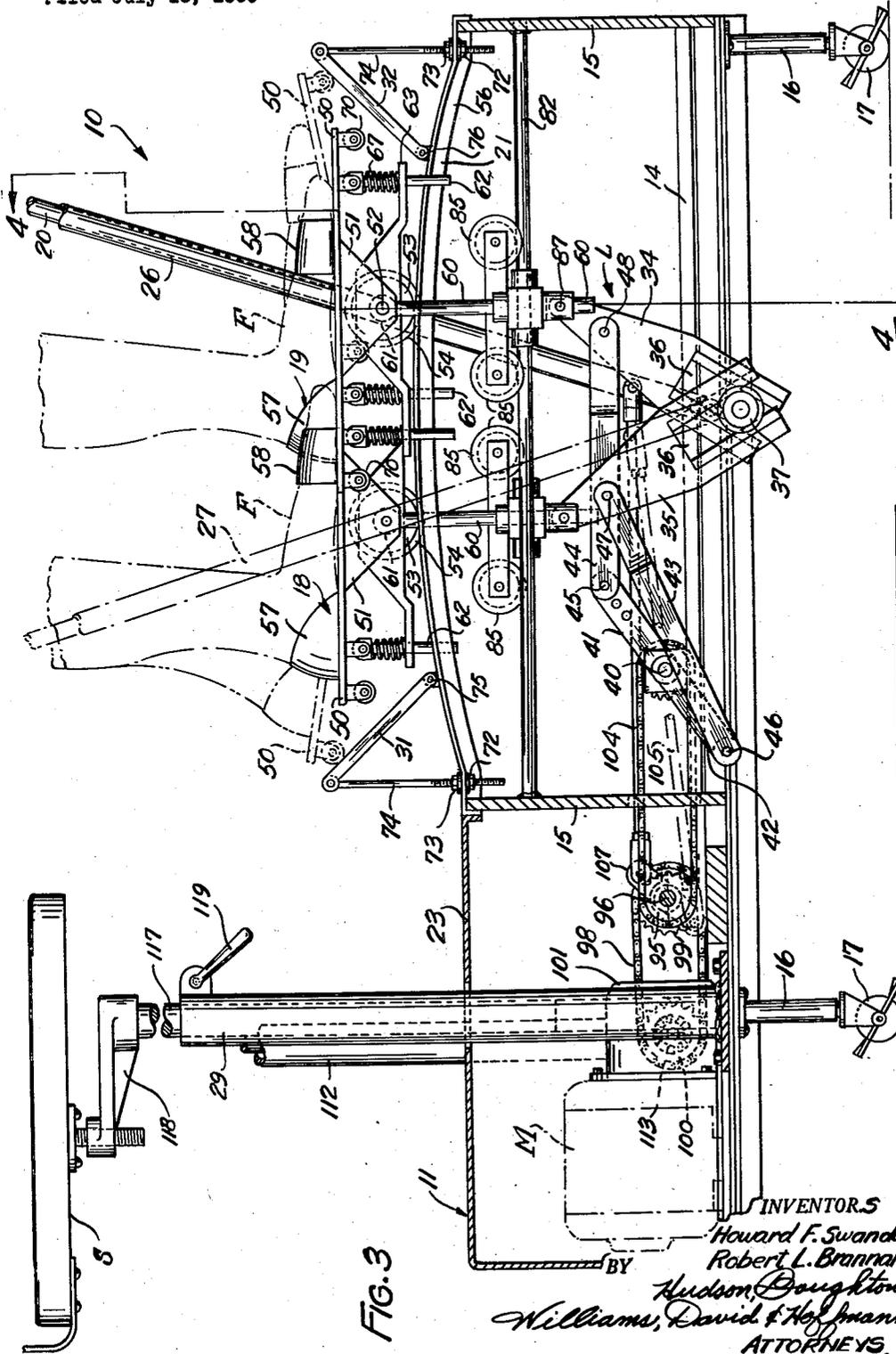


FIG. 3

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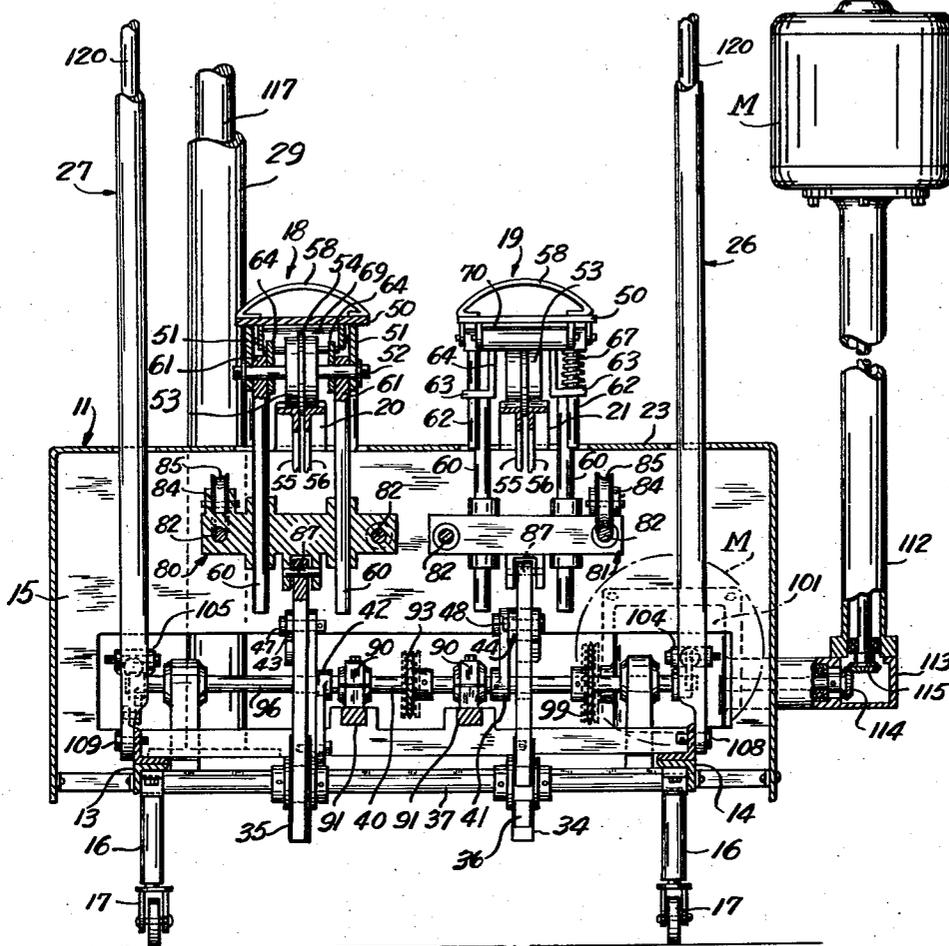


FIG. 4

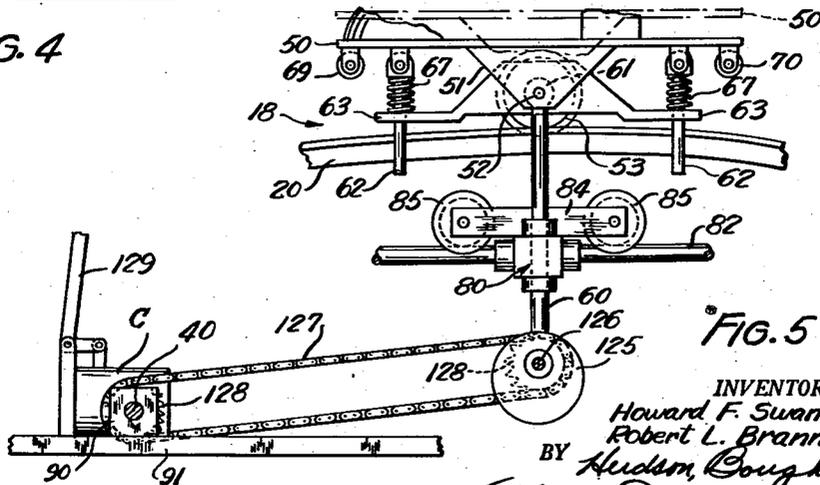


FIG. 5

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## EXERCISING MACHINE

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9 Claims. (Cl. 128—25)

This invention relates to exercising machines, and more particularly to a mechanism for exercising the limbs of persons such as polio victims, arthritics, aged people and others who are either incapable of motivating their own limbs or who may be endangered by the exertion normally attendant physical exercise, for example as in the case of some heart ailments.

It is an object of the invention to provide an exercising machine having motor driven foot and arm supporting means which are operable to produce repeated movements in a user's limbs simulating natural movements of the various joints and muscles thereof, and wherein the supporting means are adjustable to different positions and to provide differing motions, to thereby accommodate a variety of patients exhibiting individual physical conditions and stages of progress in recovery.

Another object of the present invention is the provision of a novel machine of the above mentioned character having reciprocable foot support means mounted for movement along arcuate guideways, and motion producing linkages for actuating the foot support means from an electric motor or the like, the linkages including crank and lever means employing sliding or shifting fulcrums whereby the motion of the foot support means approximates that of the foot of a person when walking.

A further object is the provision of an exercising mechanism which can be readily adapted to be operated while submerged in water for use in hydrotherapeutic treatment of patients, means being provided whereby the driving motor is arranged to extend above the surface of the water.

Still another object is the provision in a mechanism for producing motions in a user's limbs, of hand or arm supporting means which operate in synchronized relation to the motion of foot supporting members, and wherein the latter travel on guides or tracks having upwardly directed convex surfaces or paths, the ends of which are provided with cam means engageable by the foot supporting members to rock or pivot those members and create ankle movements in the foot of the user.

Additionally, the invention aims to provide a novel exercising machine which is efficient and smooth acting, and which will operate for long periods of time with little attention or maintenance.

Further objects and advantages of the exercising machine of this invention will be apparent from the following detailed description of a presently preferred embodiment taken in conjunction with the accompanying sheets of drawings forming a part of this specification, and in which:

Fig. 1 is a side elevation of an exercising machine embodying the present invention.

Fig. 2 is a plan view of the exercising machine of Fig. 1.

Fig. 3 is an enlarged sectional view of the machine embodying the invention taken substantially along line 3—3 of Fig. 2.

Fig. 4 is an enlarged sectional view of the same taken along line 4—4 of Fig. 1, and

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Fig. 5 is a partial view of another embodiment of the invention.

The exercising machine 10 illustrated in the drawings comprises a generally box-like housing indicated generally at 11 and having a framework therein including parallel side rails 13 and 14 and upright plate members 15. The housing 11 is preferably supported by legs 16 having locking casters 17 thereon.

A pair of reciprocable foot support members indicated generally as 18 and 19 are mounted for reciprocation along a pair of arcuate guideways or tracks 20 and 21, respectively, a user's feet being indicated at F. The guides or tracks 20 and 21 present upwardly directed convex guide surfaces above the upper surface 23 of the housing 11. The foot support members 18 and 19 are reciprocated by linkages L, described hereinafter, within the housing 11 and driven by electric motor means M.

A pair of hand or arm supports 26 and 27 extend upwardly from the housing 11 and are adapted to oscillate in synchronized relation to the movement of the foot support members 18 and 19, the relation being to effect, in one manner of use, a simulation of the normal walking and arm swinging body movements. A seat member S is adjustably supported by a pillar or post 29 above the surface 23 of the housing 11 and may be positioned for the use of patients who are not capable of using the machine in a standing position. To further approximate the normal motion of a person's feet during walking, and to assure the proper flexing of the ankle joints, adjustable inclined cam members 31 and 32 are provided at the opposite ends of each arcuate guideway 20 and 21 and are engageable by the foot support members 18 and 19 to rock or pivot the latter during the terminal portions of their reciprocating strokes.

The linkages L by which the reciprocating strokes of the foot supporting members 18 and 19 are effected comprise levers 34 and 35 each having a slot 36 cooperating with a transverse shaft 37 to provide a sliding or shifting fulcrum. The effective lengths of the levers 34 and 35 vary during each oscillation thereof lending a non-uniform movement to the foot supporting members 18 and 19.

The levers 34 and 35 are oscillated by a crankshaft 40, which is rotated by the motor M in a manner later described, and which has crank throws or arms 41 and 42 which are adjustably pivoted to connecting rods or links 43 and 44 respectively as at 45 and 46. The connecting rods 43 and 44 are pivoted at their other ends to the lever members 34 and 35 as at 47 and 48.

The foot support members 18 and 19 which are reciprocated by the oscillating lever members 34 and 35 each comprise a foot plate 50 having depending side flange members 51 providing bearing means for pivotally supporting the plate 50 upon the axle 52 of a wheel or roller 53. The rollers 53 are adapted to ride on the convex guiding surface of the arcuate guides or tracks 20 and 21 and are provided with a central rib or flange 54 which runs between spaced angle members 55 and 56 of which the tracks are formed. Each foot plate 50 has heel and toe retaining means 57 and 58, respectively, which may conveniently be in the form of leather or molded rubber and fit the user's feet F in the manner of slippers or shoes.

A pair of vertical slide rods 60, having eye portions 61 at their upper ends and surrounding the axles 52 of the foot support members, extend down through the surface 23 of the housing for engagement or connection with the motion producing linkage L, and serve to transmit the horizontal reciprocating motion thereof to the foot support members while permitting those members to move up and down with respect to the surface 23 as they reciprocate along the arcuate tracks 20, 21.

The foot plates 50 whose depending side flanges 51 are pivoted for rotation about the axle 52 are provided at either end with guide rods 62 extending through openings in generally horizontally extending guide plates 63. The guide plates 63 are provided with upwardly extending side portions 64 through which the axles 52 extend and to which the eye portion 61 of the rods 60 are secured as by welding or the like. The guide plates 63 are, by their connection to the rods 60, prevented from rotation about the axles 52 and serve as abutments for compression springs 67 surrounding the outer guide rods 62 and serving to resiliently bias the foot plates 50 into normally horizontal positions.

The foot plates 50 are provided with rollers 69 and 70 at the heels and toes thereof, which rollers are adapted to engage the previously mentioned cam members 31 and 32 to rock the foot plates 50 to the positions shown in dot-and-dash lines in Fig. 3. The rocking motion serves to flex the ankle joints of the person using the machine, and the extent of the flexing so achieved may be adjusted or varied by changing the inclination of the cam members 31, 32 through the use of stop nuts 72 and 73 which may be advanced along the threaded portions of the vertical support members 74 of the inclined cam members which are pivoted at 75 and 76 to the arcuate guides 20 and 21.

The connection by which the vertical slide rods 60 derive horizontal reciprocating motion from the linkages L for transmission to the foot support means 18 and 19, includes sliding blocks 80 and 81 respectively. The blocks 80 and 81 are each slidably mounted on a pair of horizontal rods or bars 82 extending between the vertical frame plate members 15, and are provided with vertical bores 83 slidably receiving the vertical slide rods 60.

The outer ends of the blocks 80 and 81 are provided with trucks 84 having spaced grooved wheels 85 riding on the adjacent rods 82 and serving to prevent any likelihood of the blocks canting or tilting and binding upon the slide rods 82. The blocks are pivotally connected as at 87 to the upper ends of the oscillating forks or levers 34 and 35 and are reciprocated thereby along the rods 82 and impart movement to the foot support means.

It will be observed here that the distance between the pivot points 87 and 47, 48 on the levers 34, 35 is fixed during operation of the device 10, but that the distance between the pivots 47, 48 and the fulcrum shaft 37 varies during each stroke resulting in differing effective lever arm lengths. The resulting motion of the foot supports 18 and 19 is thereby made to be more uniform in speed throughout each traverse of the tracks 20, 21, with a more abrupt reversal in direction than could be achieved with a simple crankshaft directly connected to the sliding blocks 80 and 81. The motion produced by the combination of the reciprocation just described, the arcuate path of travel of the foot support means 18, 19 along the guide tracks 20, 21, and the additional rocking movement resulting from the engagement of the heel and toe rollers 69, 70 with the cam members 31, 32 approximates the relative movement between the feet of a person when walking, thereby moving the joints and muscles to exercise them in a normal manner.

The crankshaft 40 is preferably mounted for rotation on the frame by bearing blocks 90 conveniently secured to support bars 91 extending between the upright frame plates 15. A sprocket 93 is fixed to the crankshaft 40 for rotation thereof by a chain 94 or the like driven by a sprocket 95 carried on an intermediate, or arm support operating, eccentric or crankshaft 96.

The crankshaft 96 is in turn rotated by a drive chain 98 and sprocket 99, the chain 98 being driven from a sprocket 100 rotated by the motor M through a reduction gear assembly 101. The hand or arm supporting members 26, 27 are connected by connecting rods 104, 105 to crank arms 106, 107, respectively, on the crank-

shaft 96. The members 26, 27 are pivoted to the frame rails 13, 14 for oscillation about points provided by pivot pins 108, 109, and it will be noted that the crankshafts 96 and 40 are so synchronized that when the support member 27 for the right-hand is in its rear position, as shown in Figs. 2 and 3, the foot support means 18 for the right-foot is likewise in its rear position.

The electric motor M is preferably controllable by an on-off switch 110 and by speed controlling means such as variable resistances or the like in a manner which is well understood by those skilled in the art to which the invention relates. The switch 110 may be conveniently placed on one of the hand supporting members and is here shown on the member 27.

In some instances it is desirable to operate the machine embodying this invention submerged in water, as during hydrotherapeutic treatment of polio patients. When so operated the motor M is mounted on an upright extension 112 fitted to a socket 113 extending from the side of the machine and in which a bevel gear 114 is engaged by a similar gear 115 carried on an extended shaft of the motor M. In other instances the machine is operated without being submerged in which case the motor M and extension 112 are removed and a motor M mounted in the dotted line position of Fig. 3.

The post 29 of the seat S has an adjustable portion 117 having a swingable arm 118 which may be changed in height and direction and be clamped in position by a clamp handle 119.

The hand or arm support members 26, 27 have adjustable or extendable portions 120 which may be positioned and clamped by clamps 121. When a person is seated on seat S the supports 26, 27 may be elevated to manipulate the arms and shoulders with the arms and hands in an overhead position if desired.

A different embodiment of the invention is illustrated in Fig. 5 and includes cam means 125 positioned for engagement with the ends of the vertical slide rods 60 when the foot support means 18, 19 are stopped in their center position, and having a cam shaft means 126 rotatable as by a chain 127 driven from sprocket means 128 on the crankshaft 40. A clutch C having a selector handle 129 selectively engages either the sprocket 93, described heretofore, or the sprocket 128 for rotation with the shaft 40. With the sprocket 128 engaged, and the cam means 125 rotating, the foot plates 50 will be alternately moved up and down, the motion being substantially that of a person marching in place.

From the foregoing description and the accompanying drawings, it will now be readily understood that this invention provides a novel exercising machine of simple and rugged construction and which will be effective and reliable in operation. It will now also be understood that the foot support means which may be moved along arcuate pathways by linkages employing sliding fulcrum levers, together with the synchronized arm or hand supports, provide a particularly versatile exercising device for persons afflicted as mentioned previously.

Although the exercising machine of the present invention has been illustrated and described herein to a somewhat detailed extent, it will be understood, of course, that the invention is not to be regarded as limited correspondingly in scope, but includes all changes and modifications coming within the terms of the claims hereof.

Having thus described our invention, we claim:

1. In an exercising machine, a frame, parallel arcuate guideways on said frame presenting upwardly directed convex surfaces, a pair of foot support means mounted for reciprocation along said guideways, motor drive means mounted on said frame, and drive linkages operably connecting said motor means to each of said foot support means for alternating reciprocation thereof, said linkages comprising a rotary crankshaft, levers each pivotally connected at one end to one of said foot support means and having a sliding fulcrum connection with said frame at the

other end, connecting rods connecting said crankshaft to each of said levers at a position between said ends for oscillation of said levers and reciprocation of said foot support means upon rotation of said crankshaft.

2. In an exercising machine, a frame, first and second track means defining upwardly directed convex guideways, first and second foot support means mounted for reciprocation along said guideways, first and second hand support means extending generally upwardly from and pivoted to said frame, motor drive means mounted on said frame, and drive linkages operably connecting said motor means to said foot support means for alternating reciprocation thereof and connecting said motor means to said hand support means for alternating oscillation thereof, said linkages comprising rotary crankshaft means, a first lever pivotally connected to said first foot support means, a second lever pivotally connected to said second foot support means, said levers having slotted ends slidably engaging a shaft extending transversely with respect to said guideways to form sliding fulcrum connections, connecting rod means connecting said crankshaft means to said levers and to said hand support means for oscillation thereof and reciprocation of said foot support means.

3. An exercising machine as defined in claim 2 and wherein said foot support means each includes a foot plate pivoted about a roller and supported thereby on said track means, sliding block means mounted for horizontal reciprocation on rods supported by said frame adjacent to said track means, vertical slide rods pivotally connected to said foot plate and roller and slidably received in said sliding block means, and spring biasing means urging said foot plate to a normally horizontal position.

4. An exercising machine as defined in claim 3 and including cam means at the ends of said track means and inclined with respect thereto, said cam means being engageable by said foot plates for rocking thereof about said rollers at the ends of each stroke of reciprocation of said foot supporting means.

5. An exercising machine comprising a frame support-

ing a pair of upwardly convex tracks, foot support means reciprocably mounted on said tracks, said foot support means including foot plates and rollers, said rollers adapted to ride on said tracks and said foot plates adapted to rock about said rollers, spring means normally biasing said foot plates into horizontal positions, cam means disposed at the ends of said tracks and adjustably inclined with respect thereto, adjustable drive means for reciprocating said foot support means through strokes of alternating direction, said cam means being engageable by said foot plates at the ends of each stroke to rock said foot plates about said rollers, and adjustable seat means mounted on said frame adjacent said tracks.

6. An exercising machine as defined in claim 5 and adjustable hand support means mounted on said frame for synchronized oscillation with respect to said foot support means.

7. An exercising machine as defined in claim 5 and wherein said adjustable drive means includes an electric motor supported above said frame at a level whereby said machine may be immersed in water while said motor remains above the surface thereof.

8. An exercising machine as defined in claim 5 and wherein said drive means includes rotary cams and a clutch means whereby said strokes of alternating direction may be selective between vertical motion and motion along said tracks.

9. An exercising machine as defined in claim 6 and wherein said hand support means include a pair of upright handles and one of which is adapted to move in one direction while the other moves in the opposite direction.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

219,439	Blend	Sept. 9, 1879
326,247	Root	Sept. 15, 1885
2,453,771	White	Nov. 16, 1948
2,826,192	Mangas	Mar. 11, 1958