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Root

[45] Nov. 27, 1973

[54] **METHOD AND APPARATUS FOR
SIMULATING THE ACT OF WALKING**

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[21] Appl. No.: 226,149

[52] U.S. Cl. 128/25 B
[51] Int. Cl. A61h 1/02
[58] Field of Search 128/25, 25 B, 24

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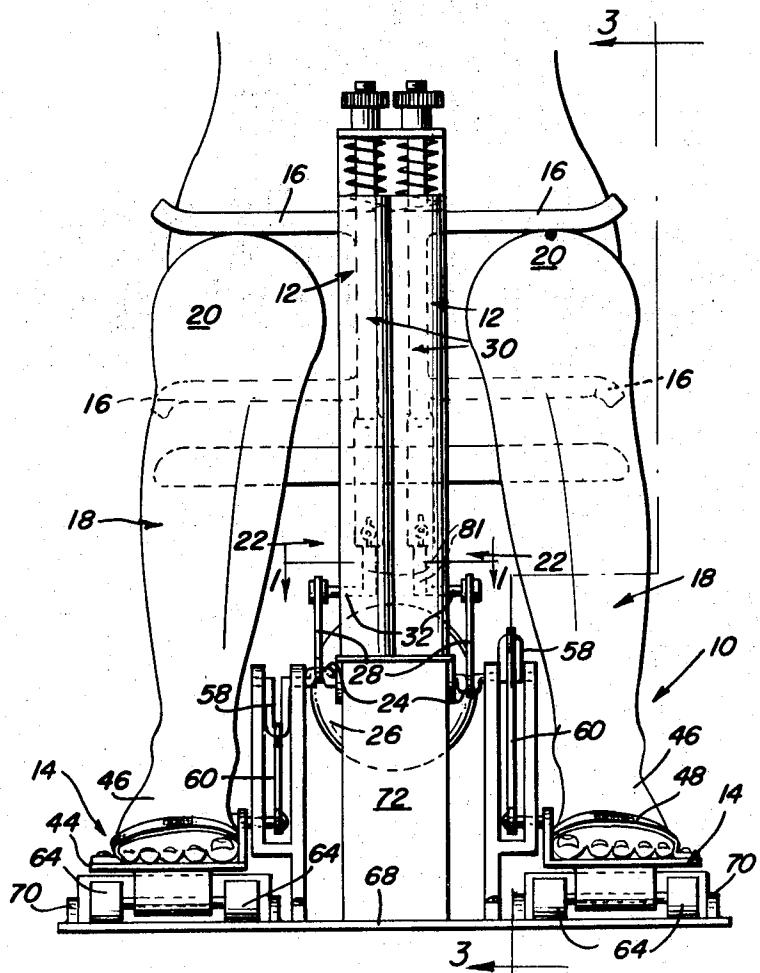
Primary Examiner—Lawrence W. Trapp

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ABSTRACT

A method and apparatus for simulating the act of walking by holding a knee substantially stationary while sequentially elevating a heel of a foot associated with the knee, depressing the unsupported arch, and flexing the toes. The foot is moved during the sequential operations in a direction parallel to a line through the toes and heel thereof, and is raised so that the arch returns to its normal position and returned to its original position following the sequential operations. Apparatus for carrying out the method has a pair of spaced members for engaging a leg and controlling the movement of the knee thereof, and a plate adapted to receive the foot associated with the knee for performing the sequential operations. Cams are provided for imparting motion to the plate for carrying out the sequential operations.

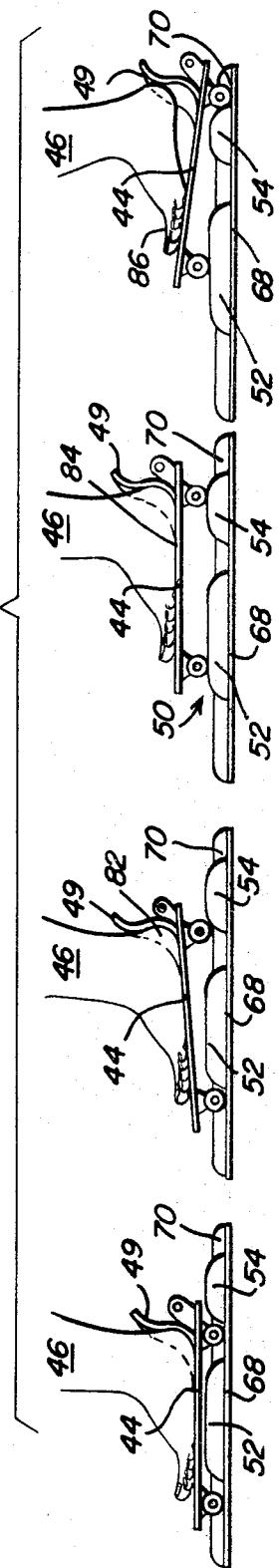
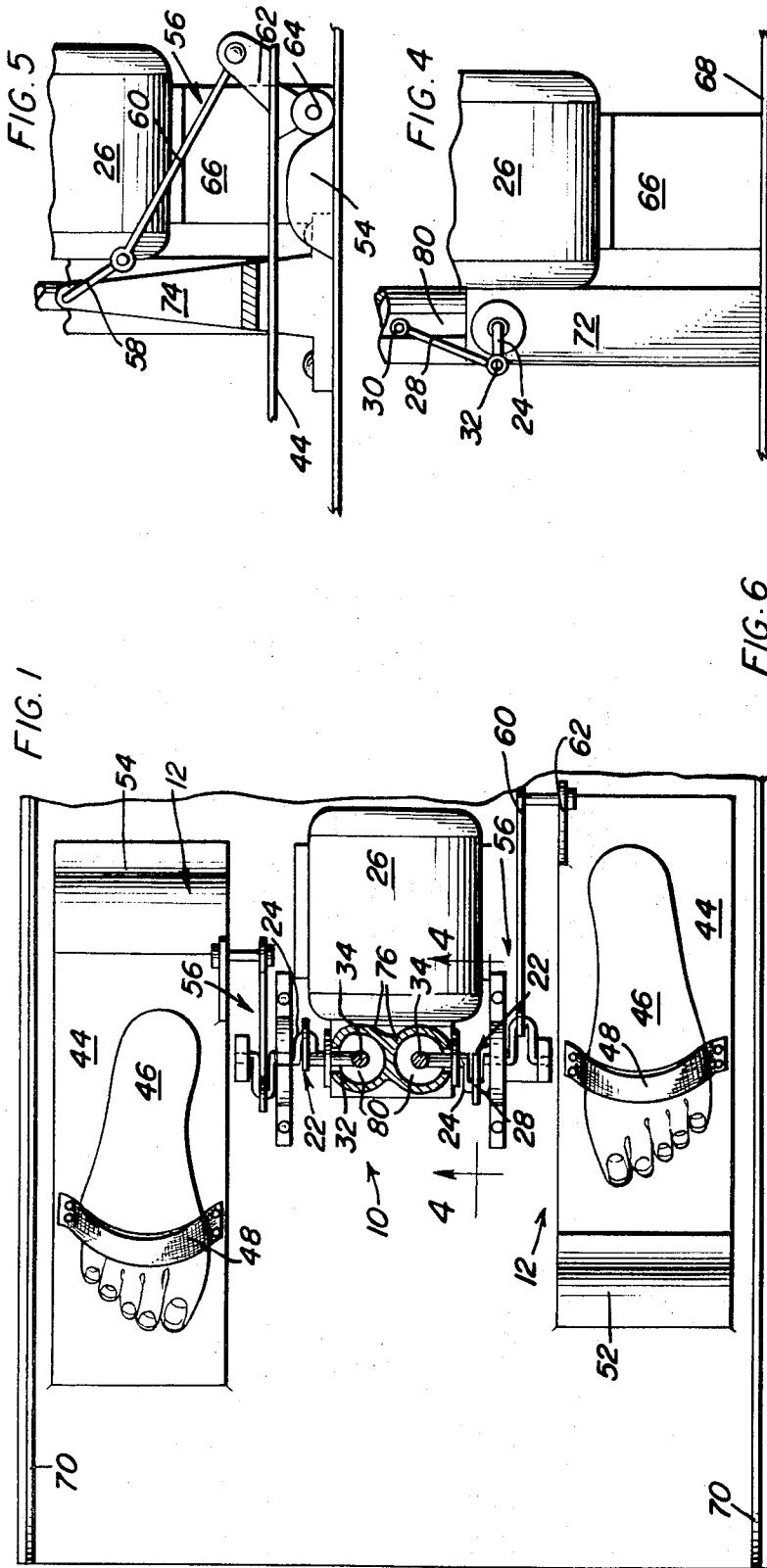
19 Claims, 6 Drawing Figures



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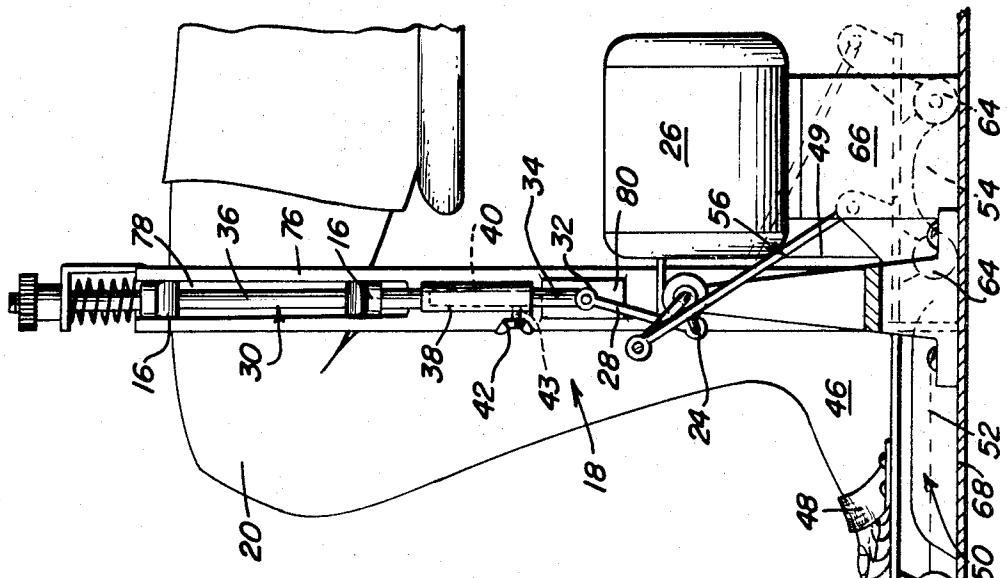


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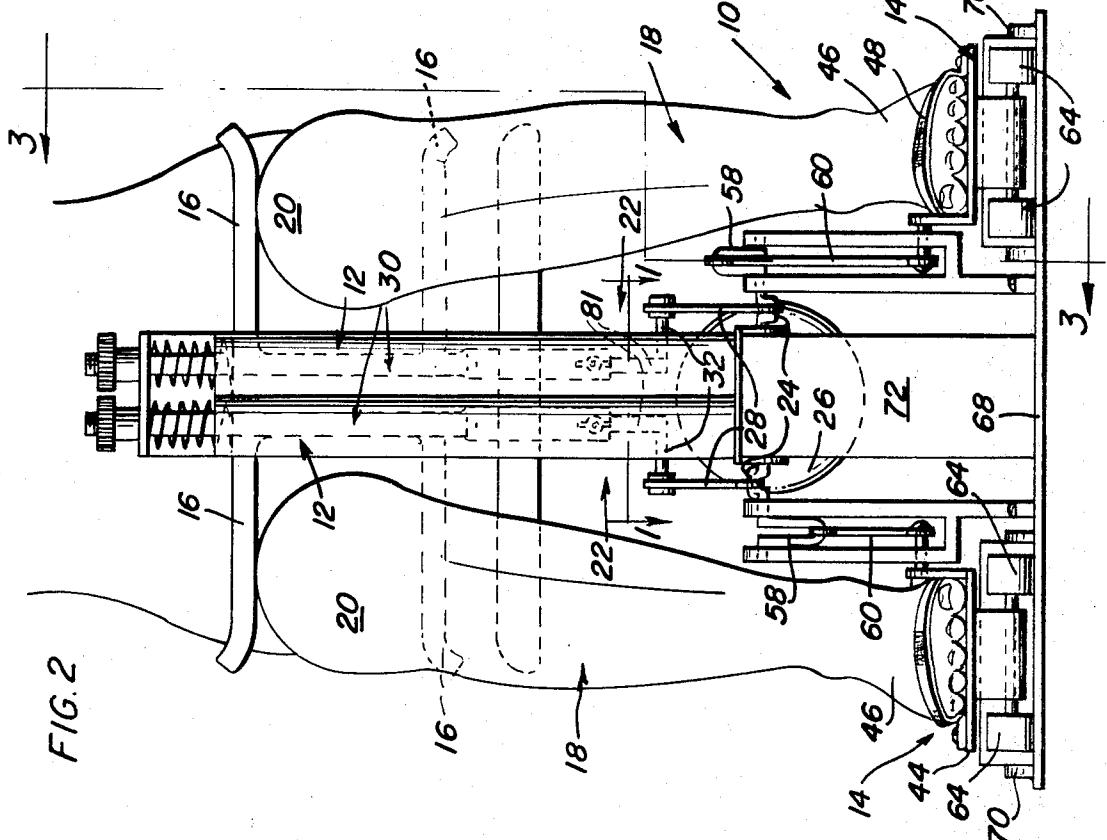
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FIG. 3



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METHOD AND APPARATUS FOR SIMULATING THE ACT OF WALKING

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method and apparatus for simulating the act of walking by causing the foot to move as it would when walking. In particular, it relates to an exerciser method and apparatus for use by invalids, semi-invalids and the like.

2. Description of the Prior Art

Motor operated exercising devices are known which move the feet of a sitting person back and forth. Examples of such devices may be found in, for example, U. S. Pat. No. 3,419,001, issued Dec. 31, 1968 to J. F. Woods, U.S. Pat. No. 3,316,898 issued May 2, 1967 to J. W. Brown, U.S. Pat. No. 2,924,214 issued Feb. 9, 1960 to A. J. Zak, and U.S. Pat. No. 2,616,416, issued Nov. 4, 1952 to J. A. Gillmeier.

Foot-exercising devices are known in which the heel is retained while the toes are exercised. An example of such a device may be found in U.S. Pat. No. 2,397,428, issued Mar. 26, 1946 to C. C. Moshier.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a method and apparatus for simulating the act of walking that overcomes the disadvantages discussed above with the foot being bare or provided with a covering that does not support the arch thereby enabling depression of the arch in a sequential manner to act somewhat in the nature of a pumping device to facilitate blood circulation in the feet and legs.

This and other objects are achieved according to the present invention by providing a method having the steps of holding a knee substantially stationary, and sequentially elevating the heel of a foot associated with the knee, depressing the arch thereof, and flexing the toes thereof. The step of sequentially operating on the foot includes the step of moving the foot in a direction parallel to a line through the toes and heel thereof and in the direction of the heel. The method according to the present invention further includes the step of raising the knee and moving the foot to its original position. Both legs may be exercised by performing the above steps with the other leg of the person in opposed phase with the one leg.

Exercising apparatus for carrying out the method according to the present invention has means for controlling the movement of a knee, and means for sequentially elevating the heel of a foot associated with the knee, depressing the arch thereof, and flexing the toes thereof while the knee is held substantially stationary.

In a preferred embodiment of the exercising apparatus according to the present invention, the sequential means has a plate adapted to receive the sole of the foot. The sequential means further has means for imparting motion to the plate. Preferably, this imparting means has cam surfaces, and means for moving the plate relative to the cam surfaces. This means for moving may have a crank, means for turning the crank, and a link pivotally mounted to the crank and plate. A plurality of rollers may be connected to the plate and arranged to engage the cam surfaces.

A preferred embodiment of the means for controlling has a pair of spaced members arranged to engage front and rear surfaces of a leg adjacent to and above the

knee. The means for controlling further has means for reciprocating the members in a direction generally perpendicular to the plate. This means for reciprocating may have a crank, means for turning the crank, a link pivotally connected to the crank, and a longitudinally extending rod pivotally connected to said link and restrained for longitudinal movement. The spaced members are rigidly connected to the rod.

Apparatus may be provided for a pair of legs to be engaged and their feet moved in opposed phase.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

Brief Description of the Drawings

FIG. 1 is a fragmentary, horizontal longitudinal sectional view of an apparatus for simulating the act of walking according to the present invention, and taken generally along the line 1—1 of FIG. 2.

FIG. 2 is a front elevation view showing the apparatus of FIG. 1.

FIG. 3 is a fragmentary vertical longitudinal sectional view taken generally along the line 3—3 of FIG. 2.

FIG. 4 is a fragmentary vertical longitudinal sectional view taken generally along the line 4—4 of FIG. 1.

FIG. 5 is a fragmentary side elevation view, partly in section, showing a detail of a plate and cam surface according to the present invention.

FIG. 6 is a schematic grouped view showing a sequence of operations on a foot.

35 Description of the Preferred Embodiments

FIGS. 1-3 of the drawings show an exercising apparatus 10 for simulating the act of walking which has a pair of means 12 for controlling the movement of a knee, and a pair of related means 14 for sequentially elevating the heel of a foot associated with the knee, depressing the arch thereof, and flexing the toes thereof while the knee is held substantially stationary.

Each means 12 has a pair of spaced members 16 arranged to engage front and rear surfaces of a leg 18 adjacent to and above a knee 20 thereof. A means 22 is provided for reciprocating spaced members 16 in a generally, for example, vertical direction. For simplicity, FIG. 2 shows both pairs of members 16 in the same position. Means 22 has a crank 24, a motor 26, which may be, for example, a known electric motor, for turning crank 24, a link 28 pivotally connected to crank 24, and a longitudinally extending rod 30 pivotally connected to link 28 by means of a portion 32 and restrained for longitudinal movement in a direction generally perpendicular to plate 44. FIG. 4 shows these elements more clearly. Spaced members 16 are rigidly connected to rod 30 in a known manner.

Rod 30 is made up of a rod portion 34 (FIG. 3) connected to portion 32, and a rod portion 36 forming an enlarged end 38 defining a bore 40. A clamp 42, such as a screw threaded bolt with a winged head, is provided in a threaded bore 43 defined in end 38 to hold portions 34 and 36 in a desired relationship with respect to one another. In this manner, the height of spaced members 16 may be adjusted for different people.

Each means 14 has a plate 44 adapted to receive a foot 46 and provided with a strap 48 and a heel support 49 (FIG. 3), and means 50 for imparting motion to plate 44. Both plates 44 are shown in the same position in FIG. 2 for simplicity.

Means 50 forms cam surfaces 52, 54, and a means 56 for moving plate 44 relative to cam surfaces 52, 54. Means 56 (FIG. 5) has a crank 58 turned by motor 26, and a link 60 pivotally mounted to crank 58 and to plate 44 by means of a projection 62. A plurality of rollers 64, four being shown in the drawings, may be mounted to the bottom of plate 44 in a known manner and arranged to engage cam surfaces 52, 54 for providing an anti-friction cam follower.

Motor 26 is mounted on a support 66, which is in turn mounted on a base plate 68 having side walls 70 on which cam surfaces 52, 54 are arranged. A support housing 72 houses a transmission (not shown) and mounts cranks 24, 58. A pair of upright brackets 74 bridge cranks 58 for additional support. A guide 76 defining longitudinally extending slots 78, 80 and a bore 81 for receiving rod portion 34 is mounted on top of support housing 72. This guide 76 retains rod 30 for longitudinal movement.

OPERATION

FIG. 6 shows schematically the four different positions of each plate 44. The left hand sketch of FIG. 6 shows the foot in its normal position. Actuation of motor 26, such as by, for example, a line cord (not shown) causes cranks 24, 58 to turn. Crank 58 will move link 60, and thus plate 44, toward the right in FIGS. 3 and 5. This will bring plate 44 onto cam surface 54, as shown in the second sketch from the left in FIG. 6. This performs the sequential operation of elevating heel 82 of foot 46. Crank 24 is arranged relative to crank 58 so that spaced members 16 hold knee 20 of the respective leg 18 substantially stationary. Although spaced member 16 will actually be moving slightly during the sequential operation, the movement will be away from plate 44. Further turning of crank 58 will move plate 44 onto cam surface 52 while still being on cam surface 54, as shown in the third sketch in FIG. 6. This position depresses arch 84 of foot 46. Finally, crank 58 turns sufficiently for plate 44 to drop off cam 54 as shown in the right hand sketch of FIG. 6. This position flexes toes 86 of foot 46. Now crank 24 will remove the pressure from leg 18 and raise knee 20, releasing the pressure from foot 46. Crank 58 will now go to the other half of its cycle and return plate 44 to the position shown in the left hand sketch of FIG. 6. The above cycle will now repeat itself. The other leg 18 is manipulated in a similar manner in opposed phase with the one leg 18. In this manner, walking is simulated in a process which closely duplicates the forces applied during actual walking and improves the tone and circulation resulting from the exercise.

The speed of operation of the device may be varied by a suitable switch control for the motor 26. In addition to an "off" position, the switch may have a "walk", "jog" and "run" positions. If desired, infinitely variable speed may be provided by a suitable reostat control over the like so that a person using the device may adjust the speed of operation to his own particular requirements.

In certain instances, it may be desirable for the device to be operable while standing or reclining. This is

accomplished by using a hold down device attached to the shoulders or hip or pelvic areas. In other words, rather than using the members 16 which engage the knees when in the position illustrated in FIGS. 2 and 3,

5 the apparatus for moving the feet and causing them to flex in the manner illustrated in FIG. 6, a structure such as a shoulder harness or the like may be employed for holding downwardly on a person at the shoulder area. In addition thereto or in lieu of, a waist or hip area 10 circling strap assembly or any other suitable mechanism may be provided for holding the hip or pelvic area stationary insofar as upward movement is concerned thus enabling the device to be operated effectively while the person using the device is standing in an erect position or reclining on a bed or similar supporting surface in which event the plate and its related cam structures would be oriented vertically rather than horizontally as illustrated in the drawings.

In other installations, it may be desirable to move the feet while retaining the knees stationary without flexing the feet which could be accomplished by removal of the cam members. In other instances, it may be desirable to move the legs without reciprocating the feet in which event the members 16 would be adapted to engage the upper and lower surface of the legs adjacent the knee thus raising and lowering the knee as the cranks 24 are rotated. FIG. 2 illustrates the engagement of the members 16 with both the upper and lower surfaces of the leg adjacent the knee 20 and this operation could be easily obtained by disconnecting the connecting rods 60 between cranks 58 and the plate 44 and of course leaving the feet 46 disengaged from the straps 48.

35 The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

I claim:

1. A method of facilitating blood circulation in the 45 feet and legs by simulating the act of walking, comprising the steps of:

- engaging the bottom of each foot with a supporting surface while the arch is unsupported,
- urging each foot and an associated supporting surface toward one another with sufficient force to depress the arch of the foot,
- removing the force urging a foot and supporting surface toward one another and permitting the arch to return to normal arched position; and
- repeating steps (b) and (c) sequentially causing a pumping action by sequential depression and return to normal position of the arch and facilitating blood circulation.

2. A method as defined in claim 1, wherein step (b) includes the step of moving each foot in a direction parallel to a line through the toes and heel thereof and in the direction of the heel and step (c) includes the step of raising the knee and moving the foot to its original position.

3. A method as defined in claim 2 further including the step of performing steps (b), (c) and (d) for each foot in opposed phase to the other foot.

4. A method as defined in claim 3, wherein the engaging step (a) includes the step of restraining the body of a person from movement while retaining the feet and associated portions of the legs of the person in a condition free to move.

5. A method as defined in claim 1 further including the step of performing steps (b), (c) and (d) for each foot in opposed phase to the other foot.

6. Exercising apparatus for simulating the act of walking, comprising, in combination:

a. means for controlling the movement of a knee; and means for sequentially elevating the heel of a foot associated with the knee, depressing an arch thereof and flexing the toes thereof while the knee is held substantially stationary.

7. Apparatus as defined in claim 6, wherein the sequential means includes a plate adapted to receive a foot, and means for imparting motion to said plate.

8. Apparatus as defined in claim 7, wherein the motion imparting means includes cam surfaces and means for moving said plate relative to said cam surfaces.

9. Apparatus as defined in claim 8, wherein said means for moving includes a crank, means for turning said crank, and a link pivotally mounted to said crank and said plate.

10. Apparatus as defined in claim 9, wherein said sequential means further includes a plurality of rollers connected to said plate and arranged to engage said cam surfaces.

11. Apparatus as defined in claim 10, wherein said means for controlling includes a pair of spaced members arranged to engage front and rear surfaces of a leg adjacent to and above the knee, and means for reciprocating said members in a direction generally perpendicular to said plate.

12. Apparatus as defined in claim 11, wherein said means for reciprocating includes a crank, means for turning said crank, a link pivotally connected to said crank, and a longitudinal extending rod pivotally connected to said link and restrained for longitudinal movement, said members rigidly connected to said rod.

13. Apparatus as defined in claim 12, wherein there are a pair of plates and a pair of spaced members each engaging a leg and moving an associated foot in opposed phase.

14. Apparatus as defined in claim 8, wherein said sequential means further includes a plurality of rollers connected to said plate and arranged to engage said cam surfaces.

15. Apparatus as defined in claim 6, wherein said means for controlling includes a pair of spaced members arranged to engage front and rear surfaces of a leg adjacent to and above the knee, and means for reciprocating said members in a direction generally perpendicular to said plate.

16. Apparatus as defined in claim 15, wherein said means for reciprocating includes a crank, means for turning said crank, a link pivotally connected to said crank, and a longitudinally extending rod pivotally connected to said link and restrained for longitudinal movement, said members being rigidly connected to said rod.

17. Apparatus as defined in claim 6, wherein there are a pair of said plates and a pair of said spaced members each engaging a leg and moving an associated foot in opposed phase.

18. An exercising device for moving the feet and associated portions of the legs of a person comprising means restraining the body of a person from movement while retaining the feet and associated portions of the legs in a condition free to move, and means for sequentially moving the feet and associated portions of the legs in a manner sequentially depressing the arches and returning same to normal position and simulating the act of walking while the person is restrained from translatory movement.

19. A method as defined in claim 1, wherein the engaging step (a) includes the step of restraining the body of a person from movement while retaining the feet and associated portions of the legs of the person in a condition free to move.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,774,597

Dated November 27, 1973

Inventor(s) Viotti E. Root

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

Page 1, in the heading, delete the address for patentee

Viotti E. Root "Cadis Stage Rd., Owego, N.Y." and substitute -- 7 Orchard Street, Hurley, New York 12443 --.

Signed and sealed this 30th day of April 1974.

(SEAL)

Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents