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## (54) Device for physical rehabilitation

(57) A device for physical rehabilitation exercises for a user's body, having a support base (1) connected to at least a support upright (4), includes pedals (19) and cranks (14) mechanically coupled to respective actuator means, first (15) and second (21), of electric type and independently controlled by a programmable control unit (22).

Said pedals (19) and said cranks (14) are fit to subject respectively the lower and upper limbs of a user to physical rehabilitation exercises.

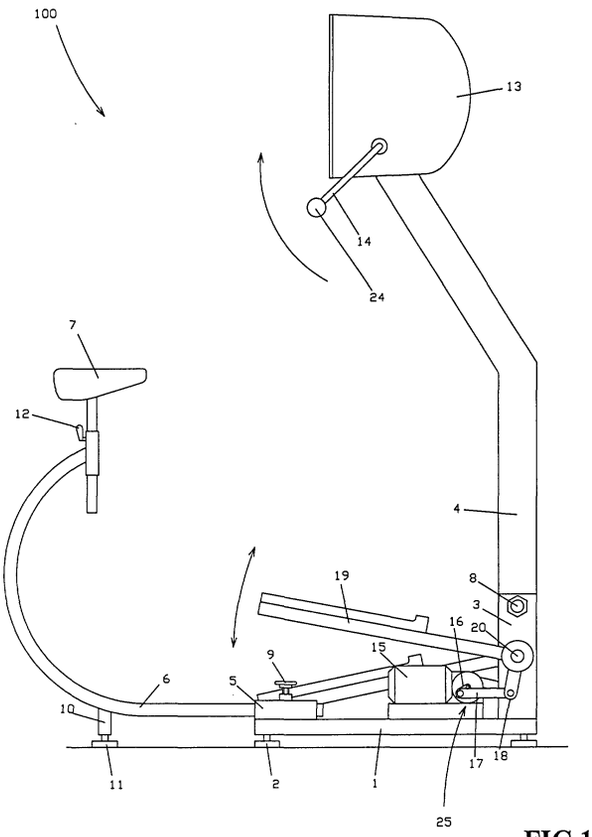


FIG.1

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## Description

**[0001]** The invention relates to medical devices and particularly refers to a device for physical rehabilitation exercises of a user's body, in particular for his lower and upper limbs.

**[0002]** The known devices for physical exercises must be operated by the person, which trains and has an active role during the exercise.

**[0003]** The handicapped people or the persons that must re-educate injured parts of the body, in many cases cannot have an active role, but they can perform only repetitive passive movements, with a continuous intervention of a physiotherapist or an assistant.

**[0004]** The main object of the present invention is to propose a device for physical rehabilitation exercises of a user's body, completely controlled by a programmable control unit.

**[0005]** Further object is to propose a device allowing to submit the user's lower and upper limbs to physical exercises of passive and active type.

**[0006]** Another object is to propose a device fit for allowing the adjustment of the application times, the speeds and the forces developed according to the user's demands, by means of manual controls or special programs.

**[0007]** The invention is now described in detail, with particular reference to the attached drawings, in which:

- figure 1 shows a side view of the device for physical rehabilitation, in which some parts have been removed for better showing other parts;
- figure 2 shows a front view of the figure 1 device;
- figure 3 shows a side view of a variant of the figure 1 device.

**[0008]** With reference to figures from 1 to 3, numeral 100 indicates a device for physical rehabilitation exercises essentially consisting of pedals 19, cranks 14, a support base 1 and a user's support.

**[0009]** The support base 1 has adjustable feet 2, a first connection 3 for an upright 4 and a second connection 5 for a frame 6 sustaining the user's support, consisting of a seat 7 or an armchair 23.

**[0010]** The pedals 19 and the cranks 14 are mechanically coupled to two actuator means, respectively first 15 and second 21, consisting of reversible electric devices, fit for working both as electric motors in a driving condition and as electric power generators and brakes in a braking condition.

**[0011]** The two actuator means are provided with respective reduction unit, not shown in the figures, of the type epicycloidal or with worm screw or with gear, for changing the rotation speed.

**[0012]** The upright 4 that holds a head 13 supporting a couple of rotating cranks 14, is rotatably and lockably connected to the base 1, by means of the first connection 3 provided with a pivot 8, to be moved near or removed to or from the seat 7.

**[0013]** The frame 6, supporting the user's support 7, 23 can be moved near or removed to or from the upright 4, by sliding said frame 6 into the connection 5 and stopping in the desired position by means of the threaded knob 9. The frame 6 further has a support element 10 with feet 11 leaning on the floor.

**[0014]** The seat 7 can be adjusted in height, acting on the lever 12, or it can be replaced with the armchair 23, according to the user conditions.

**[0015]** Removing the seat 7 or the armchair 23, a user, forced on a wheelchair, can be allowed to use the device from his chair.

**[0016]** The first actuator mean 15, fixed to the support base 1, in correspondence of a driving condition is powered by the command unit 22 and moves the pedals 19, with adjustable speed and for a predefined time, in order to subject the user's lower limbs to physical exercises of passive type.

**[0017]** The movement of the pedals 19 is made by rotating the crank mechanism 25, constituted by rods 16 which, through connecting rods 17, operate on levers 18, fixed to said pedals 19.

**[0018]** The two pedals 19 are hinged to the first connection 3 by means of a pivot 20 and they are connected to the crank mechanisms 25 with a 180° angle displacement, in such a way to oscillate in opposite directions.

**[0019]** When the user performs physical exercises of active type, by moving the pedals 19 with the lower limbs, the first actuator mean 15 works as generator and adjustable brake, transforming the mechanical energy into electric energy and being an adjustable resistance to the rotation, according to its electric load, settable by the control unit 22.

**[0020]** The electric current produced by the actuator mean 15 can be used by the control unit 22 to power the second actuator mean 21, that moves the cranks 14 to subject the user's upper limbs to passive physical exercises.

**[0021]** The second actuator mean 21 is located in a head 13, fixed to the support upright 4.

**[0022]** If the user performs physical exercises of active type, moving with the upper limbs the cranks 14, the second actuator mean 21 may works as generator and adjustable brake.

**[0023]** The electric current produced by the second actuator mean 21 in correspondence of a braking condition can be used for powering the first actuator mean 15, that in a driving condition moves the pedals 19 to subject the user's lower limbs to passive physical exercises.

**[0024]** The control unit 22, positioned in the head 13, controls the duration and the operational parameters of the driving and braking conditions of each actuator means 15, 21.

**[0025]** The adjustments of the control unit are manually made or using predefined programs stored inside said unit.

**[0026]** A variant of the device 100, not shown in the figures, provides pedals 19 adjustable and articulated, in such a way to allow the user's lower limbs to assume positions forward or backward or sideways inclined.

**[0027]** A second variation of the device, not shown in the figures, provides rotating pedals 19, directly connected to the first actuator mean 15, with functionality similar to those above described.

## Claims

1. Device for physical rehabilitation having a support base (1) connected to at least an support upright (4), said device (100) being **characterized in that** includes pedals (19) and cranks (14) mechanically coupled to respective actuator means, first (15) and second (21), of electric type and independently controlled by a programmable control unit (22); said pedals (19) and said cranks (14) being fit for subjecting respectively the lower and upper limbs of an user to physical rehabilitation exercises.

2. Device according to claim 1 **characterized in that** the control unit (22) electrically powers at least one of the actuator means, first (15) and second (21), to subject the respective user's limbs to physical exercises of passive type in a driving condition of the actuator mean (15, 21).

3. Device according to claim 1 or 2 **characterized in that** at least one of the actuator means, first (15) and second (21), transforms mechanical energy, provided by respective user's limbs subjected to exercises of active type, into electric energy in a braking condition of the actuator mean (15, 21).

4. Device according to claims 2 and 3 **characterized in that** the control unit (22) powers one of the actuator means (15, 21) with electric energy provided by the other actuator mean (21, 15) to subject the user's lower or upper limbs of the to physical exercises of passive type and the remaining limbs to exercises of active type.

5. Device according to claim 1 **characterized in that** the pedals (19) and the cranks (14) oscillate or rotate.

6. Device according to claim 1 **characterized in that** the actuator means (15, 21) are fixed respectively to the support base (1) and to the support upright (4).

7. Device according to the claim 1 **characterized in that** includes a head (13) fixed to the support upright (4) and supporting the cranks (14).

8. Device according to claim 1 **characterized in that** the support upright (4) is rotatably connected to the support base (1) by means of a first connection (3).

9. Device according to the claim 1 **characterized in that** further includes a user's support (7, 23) connected through a frame (6) to the support base (1).

10. Device according to claim 9 **characterized in that** said user's support (7, 23) is interchangeable and vertically adjustable, while the frame (6) is detachable and adjustable in horizontal direction.

11. Device according to claim 1 **characterized in that** the pedals (19) are adjustable in position and in the range of the oscillation movement.

12. Device according to the claim 1 **characterized in that** the pedals (19) are articulated, in such a way to allow the feet assuming forward or backward or laterally inclined positions.

13. Device according to claim 1 **characterized in that** each crank (14) includes a handle (24) adjustable in position in order to change the rotation radius of the crank (14).

14. Device according to claims 2 and 3 **characterized in that** the control unit (22) control duration and operational parameters of the driving and braking conditions of each actuator mean (15, 21).

15. Device according to claim 14 **characterized in that** the adjustments of the control unit (22) are manually made or using predefined programs stored inside said unit (22).

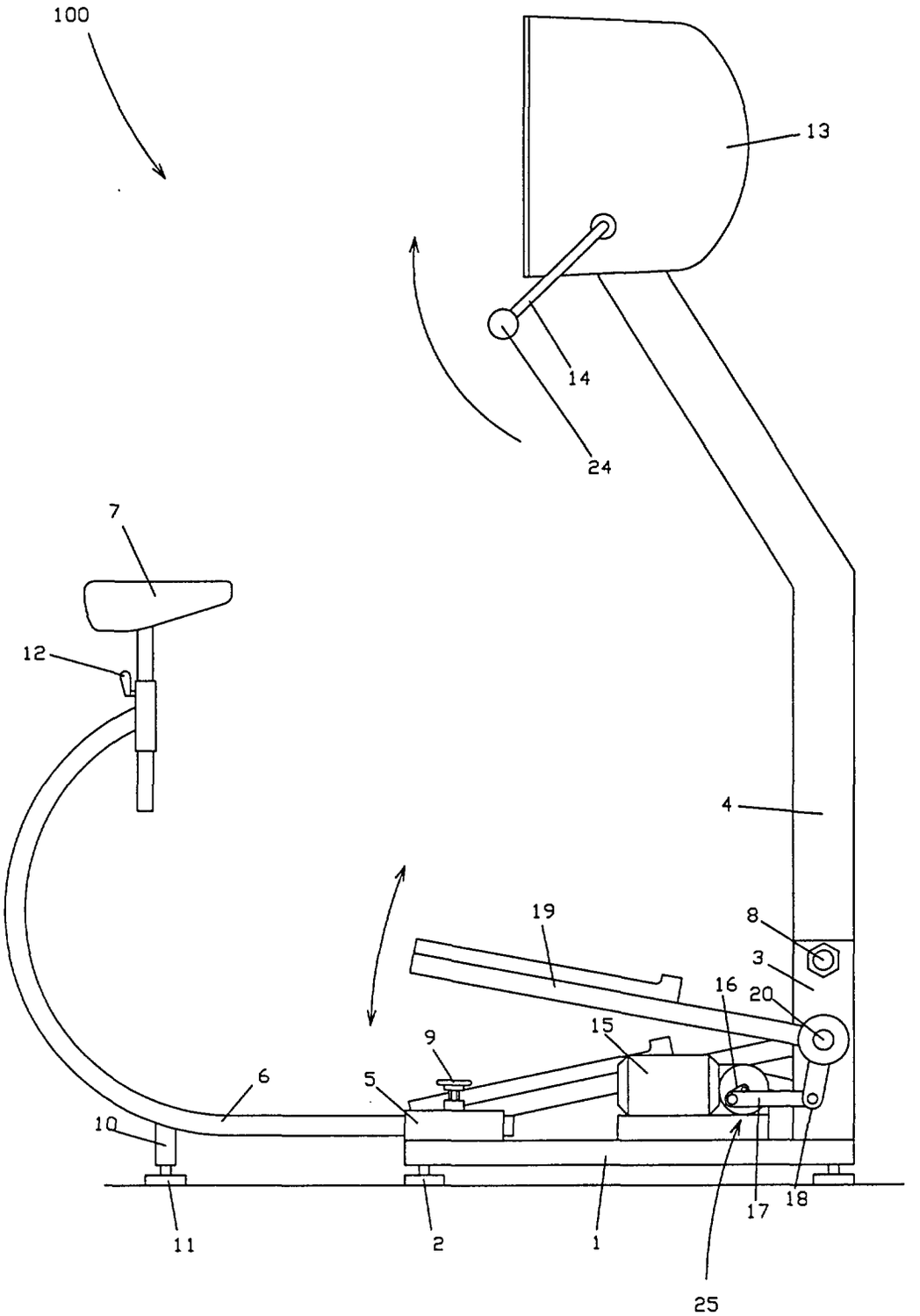


FIG.1

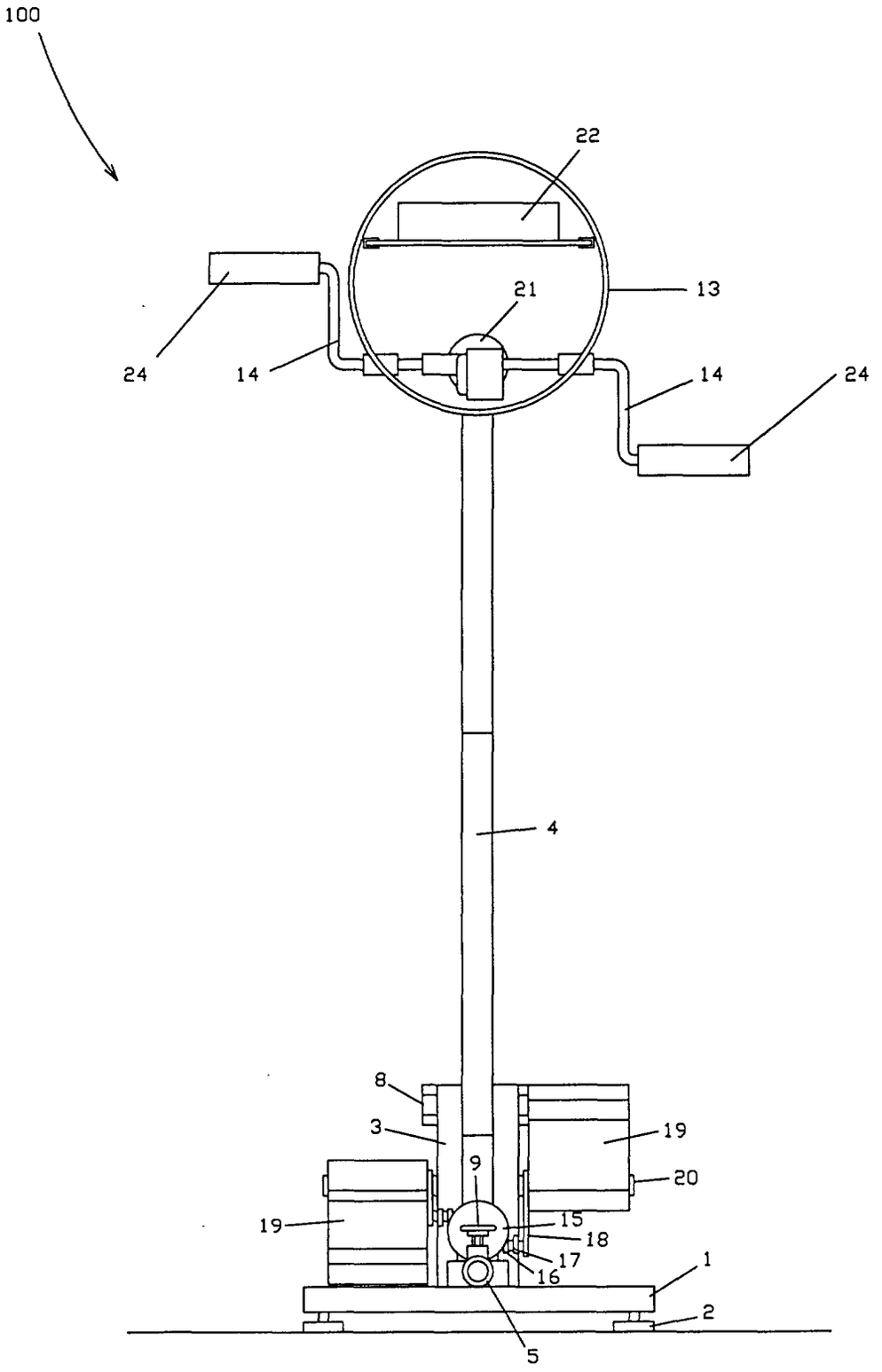


FIG.2

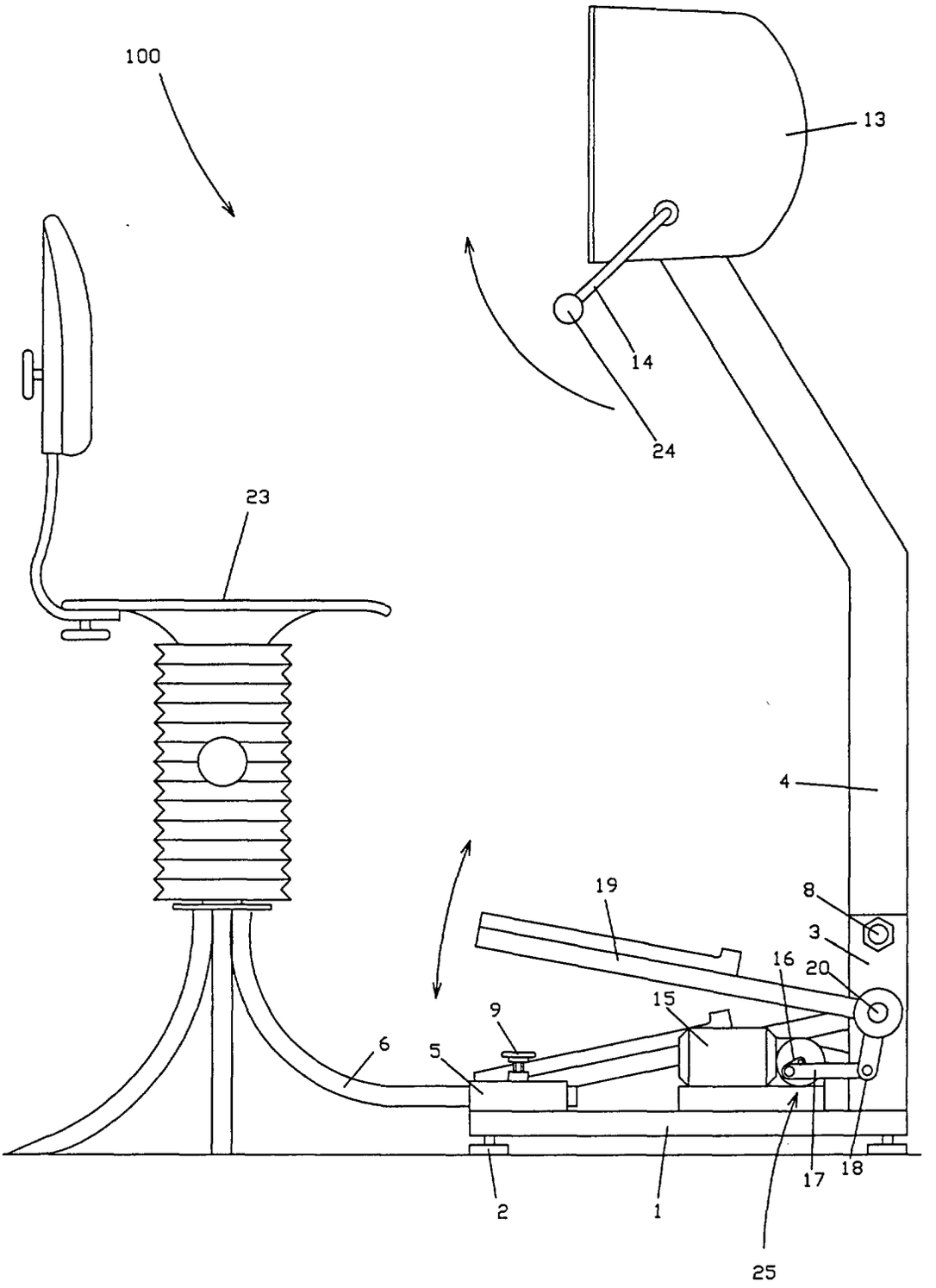


FIG.3