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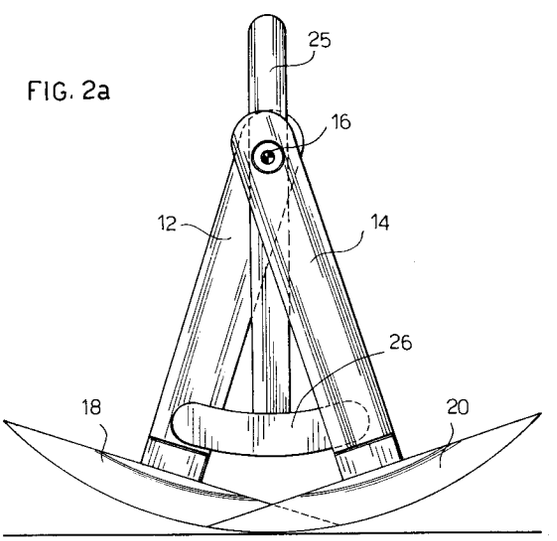
(54) Walking movement device.

(57) The device comprises two leg elements (12, 14) fastened at the top along an axis (a) around which they are able to oscillate; each element ends with a support foot (18, 20) whose lower surface is arched both longitudinally and transversely.

A means or an individual user operates the device by imparting to it a slight oscillation around a horizontal longitudinal axis and, in various ways, a traction or thrust in the direction of movement.

The device can be realized as a toy, or as an aid for paraplegics, or as part of a robot or as a piece of sports equipment.

FIG. 2a



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The aim of the present invention is a device capable of carrying out a stepping movement, approximately like the movement a person makes when walking.

In the toy sector, many varied types of simple movement devices are known; we mention here, as an example, a toy consisting of a transparent sphere containing a doll pivoted on a diameter of the sphere; the sphere moves by rolling and/or oscillating and the doll always stays in the upright position.

In the field of aids for paraplegics, walking devices are known which substantially comprise a frame for supporting the patient, to the bottom of whose support base two feet are integral, the lower surface of which slopes to form a dihedral angle, with its point towards the inside and its opening towards the side of the base plate. The user proceeds by imparting to the apparatus a movement which combines an oscillation around a horizontal, longitudinal axis and a rotation around the vertical axis of his trunk.

The aim of the present invention is to obtain movements similar to those of a person walking, by means of a simple versatile device.

Such aims have been obtained with the device of the present invention, as is defined in claim 1, while the subsequent claims refer to additional distinctive details of the device.

The device comprises two leg elements, linked together at an upper location in an oscillating way round a substantially horizontal axis; this linkage or connection can consist of a single pin around which the legs can rotate, or of two coaxial pins fastened in turn by a rigid structure or linked by an interposed mechanism. Each leg ends at the bottom with a foot integral with it, which has a support surface at the bottom, which is usually relatively wide and is arched in the longitudinal direction (that is in the moving forward direction) and in the transverse direction.

The centre of gravity of the whole toy or, in the case of a therapeutic aid, by the aid plus the patient, is located below the pivoting axis.

The device is moved by imparting to it an oscillating movement in a transverse direction, substantially an oscillation around a longitudinal axis, in such a way as to disengage first one foot and then the other alternatively from the support surface; and a traction or thrust movement substantially in the direction for moving where it is desired to go.

The new device realizes in a simple way a walking movement relatively similar to that of a human being moving forward. It can be realized as an aid for paraplegics, as a piece of sports equipment, as a toy, as a gadget or as a robot for use in industry or for transport.

Embodiments of the invention are described below, for the sake of example only and not restrictively, with reference to the appended drawings, in which they are illustrated, and in which:

figure 1
is a front view of a first embodiment of the device in the rest condition;
figure 2
is a view from the right, with respect to the view in figure 1;
figure 2a
is a view similar to the one in figure 2, but illustrates the device during a walking movement;
figure 3
is top plan view of the device in the rest condition; figures 4 and 5 are, respectively, a front view and a side view of a modified embodiment of the device;
figure 6
is a front view of a third embodiment of the device;
figure 7
is a perspective view of an embodiment of the device, structured to receive a person, so as to act as a toy, as a piece of sports equipment or as an aid for paraplegics;
figure 8
is a side view of another embodiment of the device;
figure 9 and figure 10
are respectively a front view and a side view of a further embodiment;
figure 11
is a front view of the device of figures 9 and 10, realized as an aid for paraplegics.

With reference to the figures, a first exemplary embodiment of the device is shown as a whole with 10 and comprises a pair of leg elements, respectively 12 and 14, linked together in an upper position, in the example by means of a single pin 16 with horizontal axis a, around which they can rotate. Each leg is rigidly integral at its lower end with a foot part, respectively 18, 20. Each foot part has a relatively wide bottom surface 18', 20', which serves as a support, and has an arched shape both on a longitudinal plane (that is on a plane extending in the direction of movement - arrow F - that is on the plane shown in figure 2) and on planes transverse to the said longitudinal plane (that is on the plane shown in figure 1 and parallel to it).

In this text, the word "arched" is used to indicate a curve which is not necessarily a circumference arc (respectively, not necessarily like a spherical cap), but any curve whatsoever. It should also be noted that the curve of the support surface of the feet can have a different radius in longitudinal section and in transverse section. It is appro-

priate, however, that the two lower surfaces 18', 20' should be symmetrical mirror images and it is preferable that, at least near the symmetry plane, the longitudinal curve should have a circular profile with its centre on the axis a.

In addition, an arm 25 is mounted in a rotating way on the pin 16, said arm carrying a weight 26 at its end. The arm 25 can be rigid with an articulated joint on the axis a which allows only rotation, or of the spherical type with the possibility of transverse oscillation, possibly limited by an elastic device. The arm 25 can also be of the flexible type, consisting of an elastic rod or a wire, and it is used to arrange the weight 26 in an appropriate position so that the centre of gravity of the assembly is at a desired level below the axis a.

In figure 1 a roughly anthropomorphic shell 28 is drawn with a broken line, such as could be used to realize the device in toy form. In such a case, the arm 25 may be omitted, the weight consisting of or being carried by the shell 28.

The device can move in various ways, for example: it can be placed on a surface sloping downwards and a slight transverse oscillation can be imparted to it, which is sufficient to release one foot after the other alternatively. According to another way of working, traction can be applied to the device, on a surface sloping upwards or downwards or horizontal, for example by means of a wire applied to the rod 25 or to the weight 26, and a transverse oscillation will be imparted to the device itself as for the previous case. It can also be moved with an internal source of energy, for example with the user's hands.

In figures 4 and 5 a variation of the device is illustrated, in which the weight carried has its centre of gravity located above the axis a (the centre of gravity of the whole assembly is, on the other hand, still below the axis a for the sake of stability).

The elements of the device 100 which correspond to the homologous elements of the device 10 have the same reference numbers and will not be described in detail.

It will be noted that, in this case, an additional bond for the legs consists in the fact that they have slots 30, 32 through which a transverse rod 34 is positioned in a loose way, said rod integral with the weight 36 to be carried, by means of an arm 35. The arm 35 is idle on the pin 16, as the arm 25 is in the previous embodiment.

In figure 6, a further embodiment is shown with 200 and it is similar to the one illustrated in the figures 4 and 5, with a weight 36 to be carried in a position above the axis a, except that the additional bond between the leg elements 12, 14 consists of a crown wheel 40 which meshes with two pinions 42, 44, each one integral with a respective leg 12, 14, and idle on the pin 16.

Figure 7 illustrates an embodiment of the device as an aid for paraplegics or as a sports implement. The device is indicated as a whole with reference number 300 and essentially comprises a support framework 302, in the shape of a box for example, carried on two substantially vertical leg elements 312 and 314, both of which are pivoted with pins 326 and 328 outside on the walls 303 and 304 of the box framework 302 around one and the same axis a.

As in the case of the previous embodiments, each leg ends at the bottom in a foot, respectively 318, 320, whose lower support surface is curved both in a backwards and forwards direction and in a transverse direction.

Each leg 312, 314 is also provided with a means for determining and controlling the movement which, merely for the sake of example, has been illustrated as a hand grip 322, 324 respectively, but can consist of hand grips 322', 324' or some other.

The frame 302 has, in addition, a support base 306 for the user's feet and possibly a resting or abutment surface 308 to avoid bending of the knees.

The user, suitably fastened to the device 300 by means not shown, by moving his head and/or shoulder imparts a transverse oscillation (makes the axis a oscillate around a longitudinal axis) in such a way as to weight and release one foot after the other alternatively, and he acts manually on the moving means relating to the momentarily released foot and, usually, also on the one supported.

With reference to figure 7, it should be noted that the box framework 302 can be suspended on the axis a by means of the interposition of elastic suspensions; the alignment of the pins 326, 328 must be ensured in such a case with a rigid additional structure.

In the figures 2, 2a and 5 devices are shown in which the curving of the foot in a forward and backward direction has its curve axis coincident with the pivot axis of the legs.

Figures 8 shows a device 400 similar to the one in figures 1-3, in which the forward and backward curve of the rest surface of the feet 418, 420 has its axis c positioned above the pivot axis a of the legs 412, 414; or, in other words, the radius (R) of the forward to backward curve of the foot on the inner vertical plane of the foot is greater than the distance (H) between the pivot axis of the legs and the rest surface: $H/R<1$, for example $H/R = 0.96$.

This conformation has the following advantages: in the situation where the feet are spaced apart (see figure 2a) lateral stability is maintained, even with the centre of gravity of the system relatively high. This allows the device to be realized with smaller vertical dimensions.

The further embodiment in figures 9 and 10 is shown with 500. The feet 518 and 520 are rigidly integral with the legs 512 and 514 respectively, and each of these carries, on each side, three wheels positioned offset 515, 516, 517; in all, each leg is provided with three wheels on each side, the homologous wheels being coaxial and preferably pivoted on the same pin, that is to say, preferably 516 is coaxial with 516', 516'' and 516''' etc.

The three wheels 515, 516, 517 are engaged in a sliding way on a semicircular track 521, integral with a side wall 522 of a body 524. The wheels 515', 516', 517' of the leg 514 and the wheels 515'', 516'', 517'' of leg 512 are engaged with and run on opposite edges of a track 526 which is integral with the intermediate wall 528 of the body 525. The wheels 515'', 516'', 517'' are engaged with and run on the edges of the track 536 shaped as part of a circle which is integral with the side wall 532, fixed in its turn to the plate 525 of the body. The body 524 obviously can be of any shape whatsoever. In particular, to its brackets 534, 536 a structure can be fixed with a seat, of the rocking-horse type or the like, for its use as a toy; or a so-called support 'cage' (figure 11) can be fixed to the body 524 for its use as an aid for paraplegics or as a piece of sports equipment.

The feet 518, 520 are curved in the forwards and backwards directions (a vertical longitudinal section shows a curve having the shape of part of a circle) and in the transverse direction (a transverse section shows a curve with the shape of an arc of a circle).

The device 500 works in the same way as the above devices; that is to say, by imparting to it thrust or traction in a longitudinal direction, as is illustrated with the arrow in figure 10, and a transverse oscillation in the said direction, the foot which is in the raised position slides along the track in the direction of the thrust, then it is subsequently rested and the other foot is lifted, which proceeds in the same way, and so on. The rotation axis a for the feet, in this case, is the axis of the cylinder defined by the tracks 520, 526, 530. With respect to other embodiments, figure 10 offers the advantage of particularly small vertical dimensions.

The embodiment in figure 10 can be used as the base for an aid for paraplegics or as a piece of sports equipment. With respect to the embodiment in figure 7, it would offer the following advantages:

- smaller transverse dimensions since the mechanism is below the support cage;
- greater ease in realization of folding embodiment which can fold at the level of the users' knees, useful for allowing the seated position.

Obviously other equivalent embodiments are possible, as for example sliding shoes on the legs, concentric with the tracks of the body, or a solution with wheels integral with the body and tracks integral with the legs.

Claims

1. A stepping movement device, characterized in that it comprises a first (12; 312; 512) and a second (14; 314; 514) leg, fastened to each other in such a way that they oscillate one with respect to the other, around one and the same axis (a); each leg being rigidly integral with a respective foot, whose lower resting surface is curved, both in a longitudinal direction, that is in the direction of the movement and in a direction transverse to the longitudinal direction.

2. A device according to claim 1, characterized in that the lower surfaces of the said feet are identical mirror images.

3. A device according to claim 1, characterized in that the centre of gravity of the device is located below the axis of rotation of the legs.

4. A device according to claim 1, characterized in that the said legs are rigid and the sections of the resting surface are circular, with their centre on the axis a, at least along the longitudinal planes parallel to the plane of symmetry.

5. A device according to claim 1, characterized in that it carries a load (26) having its centre of gravity located below the axis (a) of rotation of the legs.

6. A device according to claim 5, characterized in that the load is supported free to rotate on the axis of rotation (a).

7. A device according to claim 1, characterized in that it carries a load (36) located above the axis of rotation (a) of the legs, and has an additional linking system for the legs.

8. A device according to claim 7, characterized in that the said additional linking system consists of a lower transverse axis (34) passing in slots (30, 32) in the legs (12, 14).

9. A device according to claim 7, characterized in that the said additional fastening system consists of system of gears (40, 42, 44) comprising a pinion (42, 44) integral with each leg and a crown wheel (40) engaging with both the pinions and through which passes an arm (35) for supporting the load (36).

10. A device according to claim 1, characterized in that it is a toy or a piece of sports equipment.

11. A device according to claim 1, characterized in that it comprises a framework or cage (302) for supporting the user's body, onto which the said two legs (312, 314) are pivoted in such a way that the centre of gravity of the framework is below the pivoting axis (a).

12. A device according to claim 11, further comprising control means for each leg, which are capable of being operated by the user.

13. A device according to claim 11, as an aid for paraplegics.

14. A device according to claim 11, as a toy or piece of sports equipment.

15. A device according to claim 11, characterized in that the said support framework (302) comprises a resting base (306) for the feet and a rest or abutment (308) for the knees.

16. A device according to claim 1, characterized in that the legs are pivoted on a pivot (16).

17. A device according to claim 4, characterized in that the centre of the forward and backward curve of the feet is above the pivot axis of the legs.

18. A device according to claim 4, characterized in that the centre of the forward and backward curve is above the pivoting or fulcrum axis of the legs.

19. A device according to claim 1, characterized in that the legs are slidable on tracks (521, 526, 530) integral with a body, the said tracks being circular around the oscillation axis (a).

20. A device according to claim 19, characterized in that the legs are provided with wheels which engage tracks in the shape of a part of a cylinder on the body.

21. A device according to claim 19, characterized in that a support cage, for supporting the user's body, is integral with the body of the device for use as a sports implement or as an aid for paraplegics.

FIG. 2

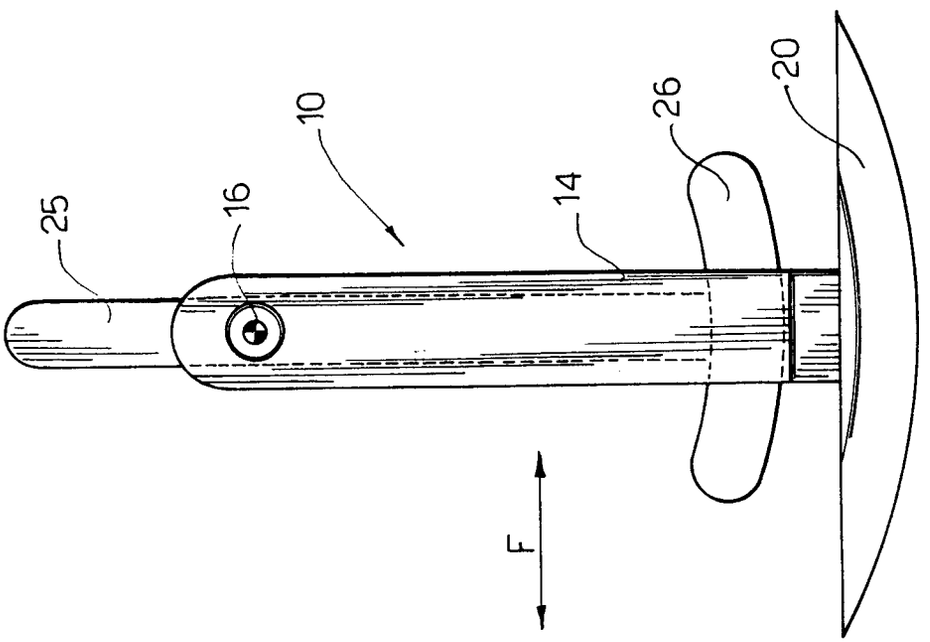


FIG. 1

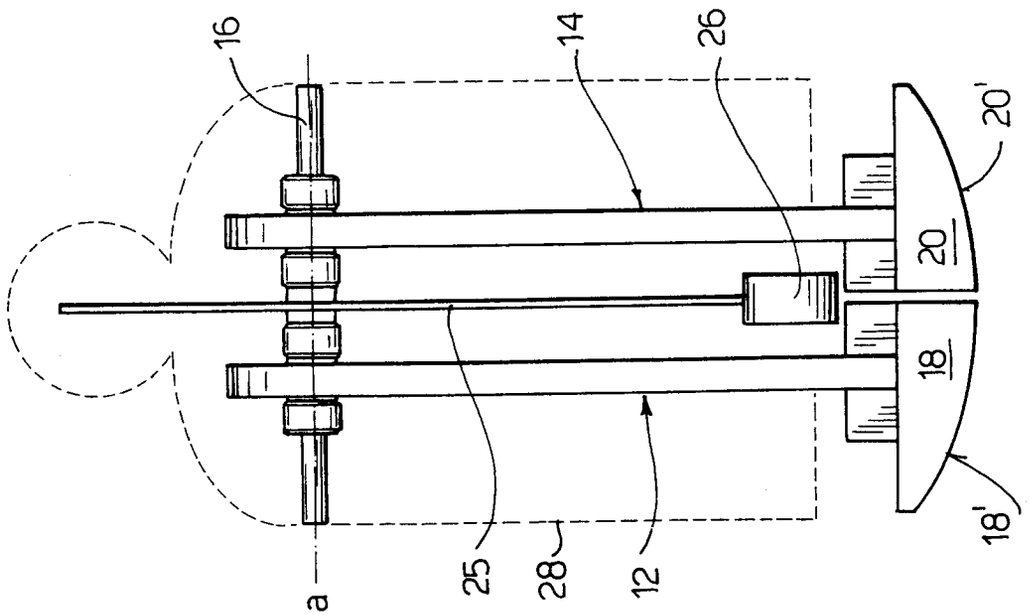


FIG. 3

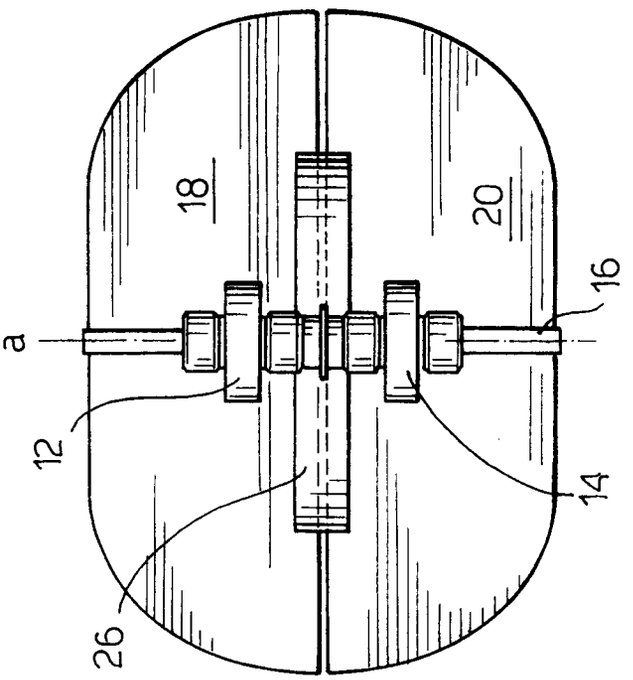


FIG. 2a

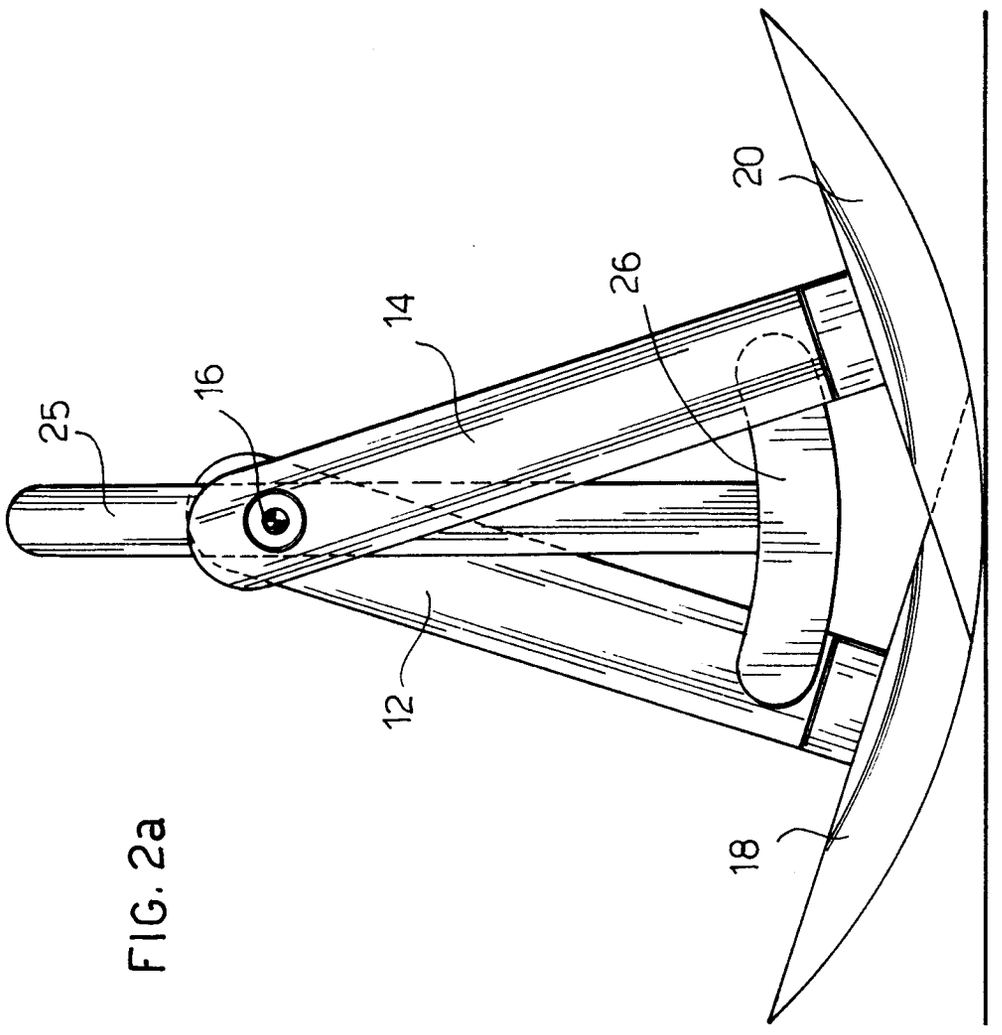


FIG. 5

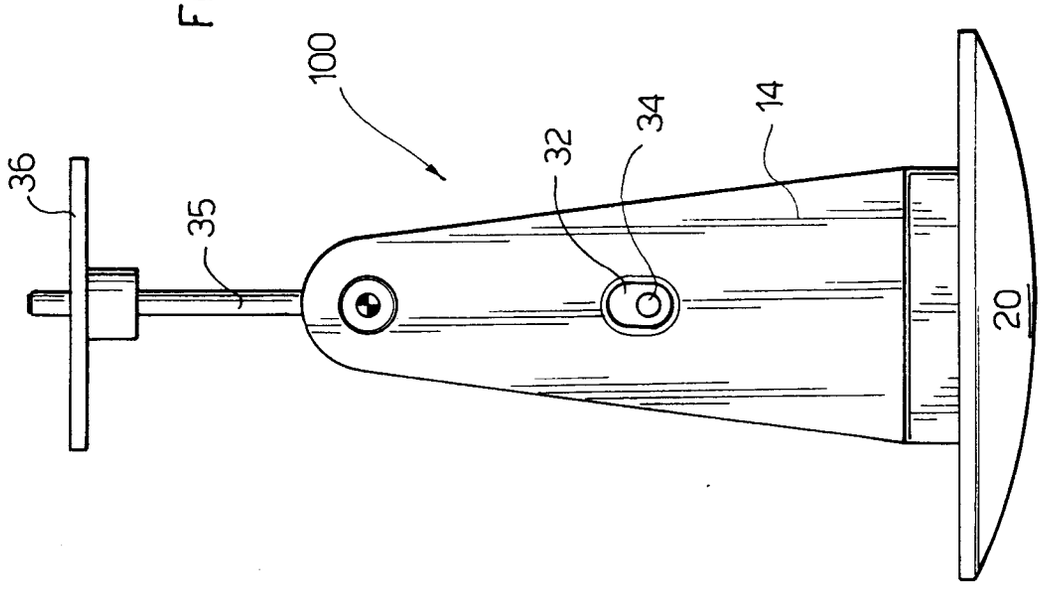


FIG. 4

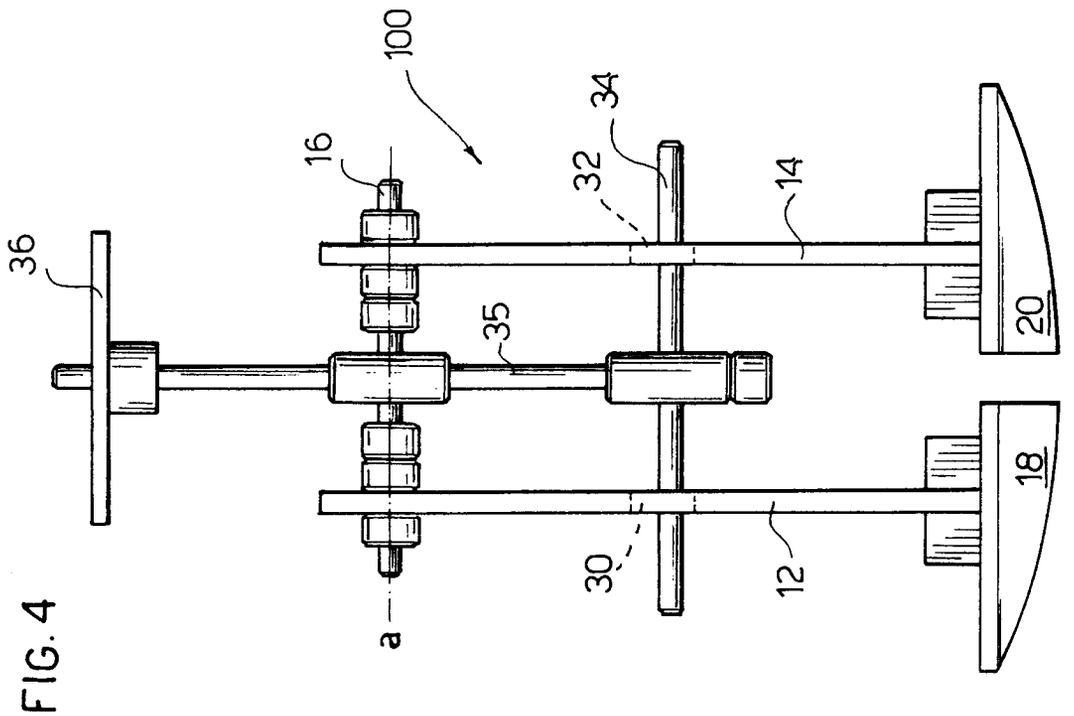


FIG. 7

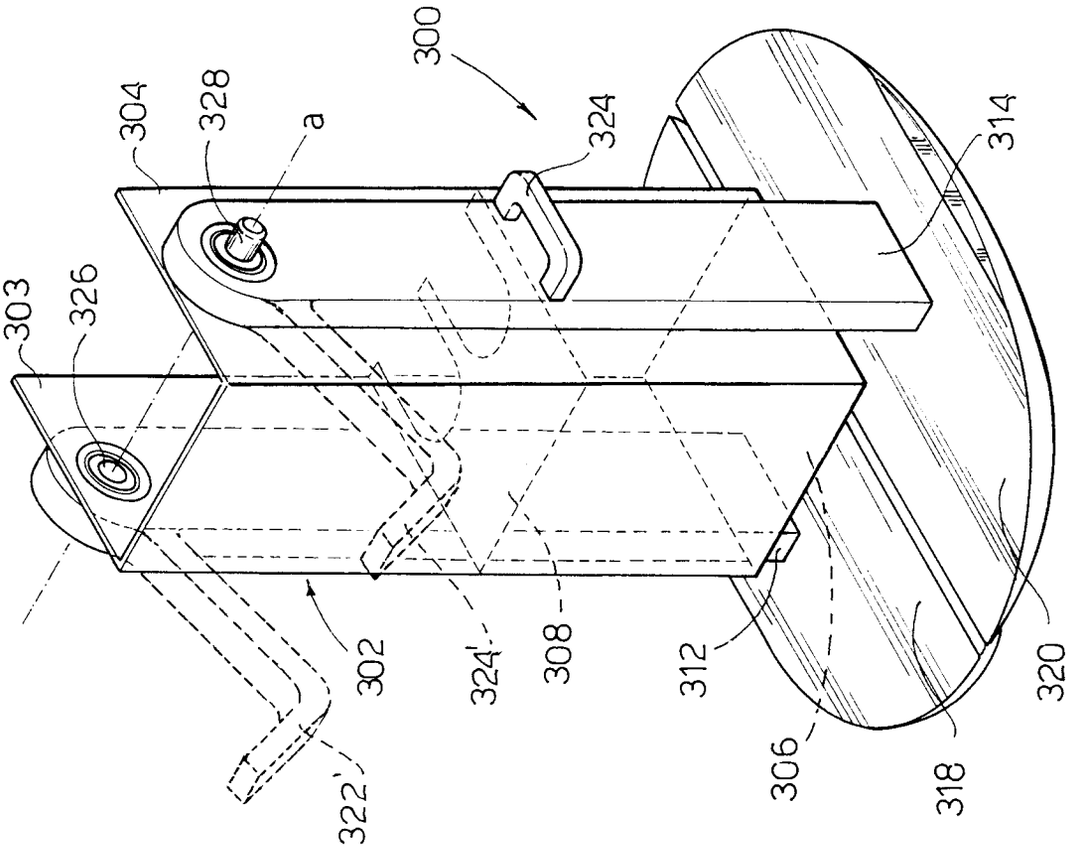

300
304
328
a
324
314
303
326
302
324'
308
312
320
322'
306
318

FIG. 6

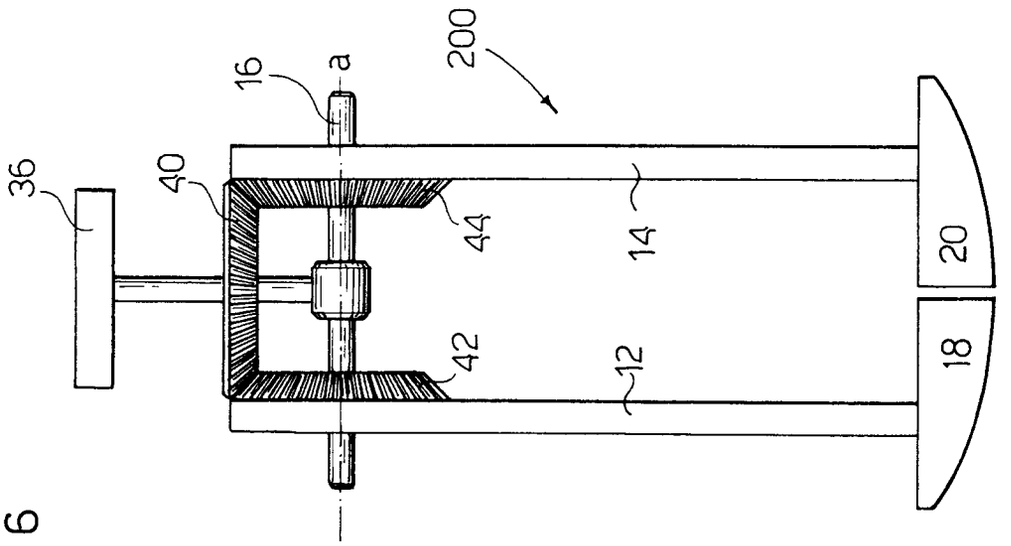
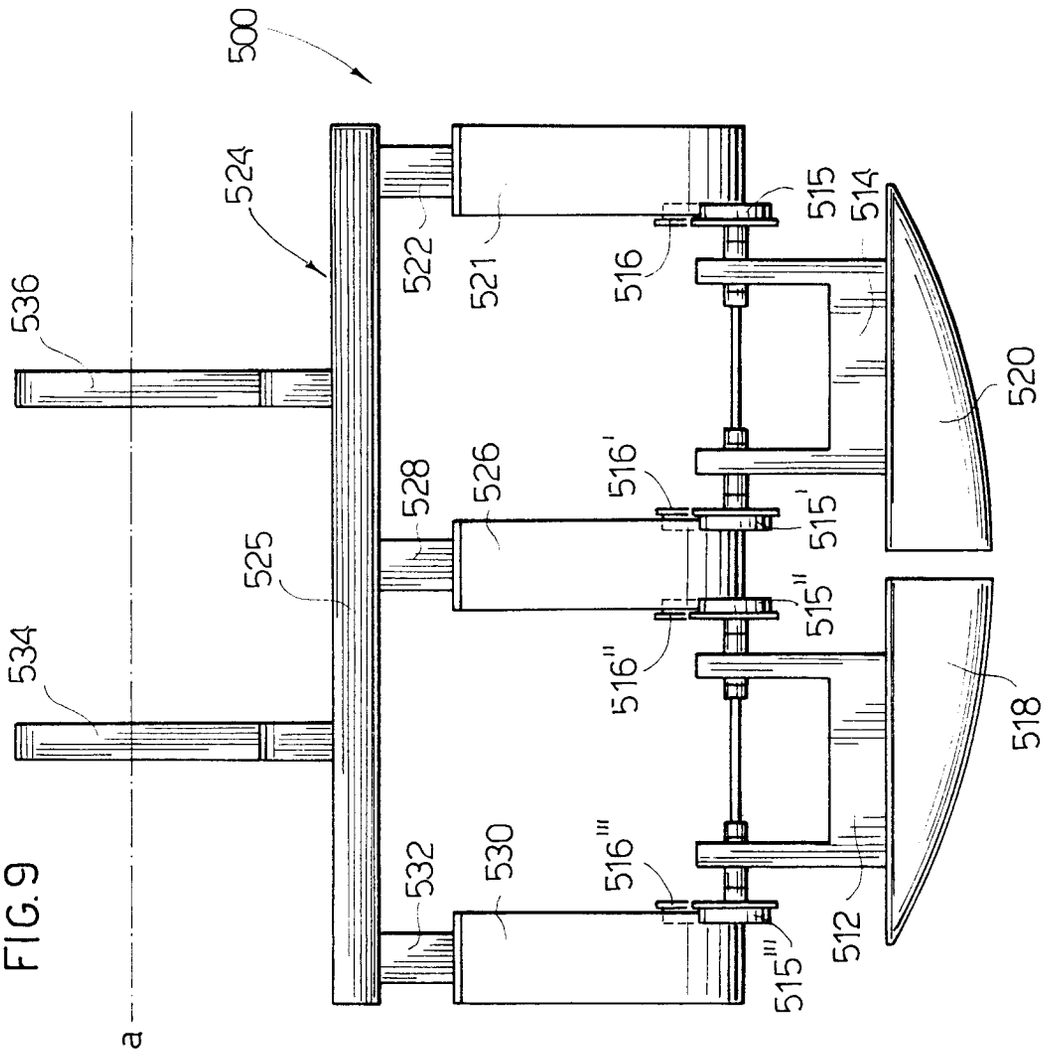

200
16
a
36
40
44
14
20
42
12
18

FIG.9


500
524
536
534
525
522
521
516
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514
520
528
526
516'
515'
515''
516''
518
532
530
516'''
515'''
512
a

FIG.8

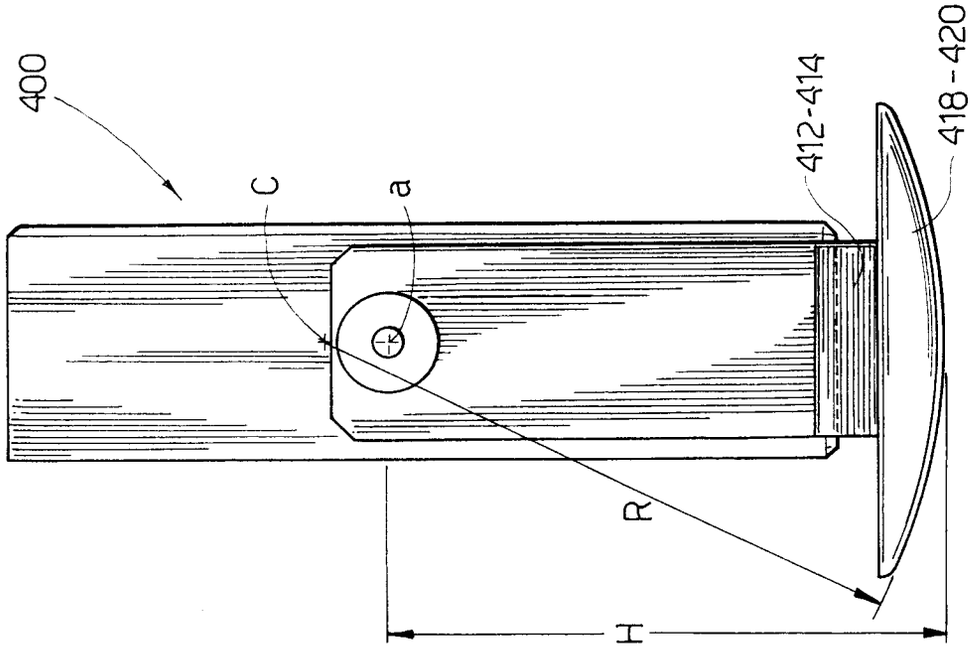

400
C
a
412-414
418-420
R
H

FIG. 11

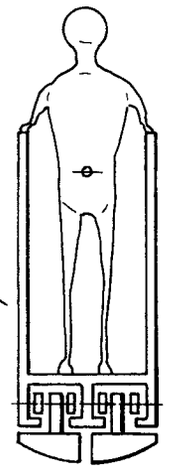
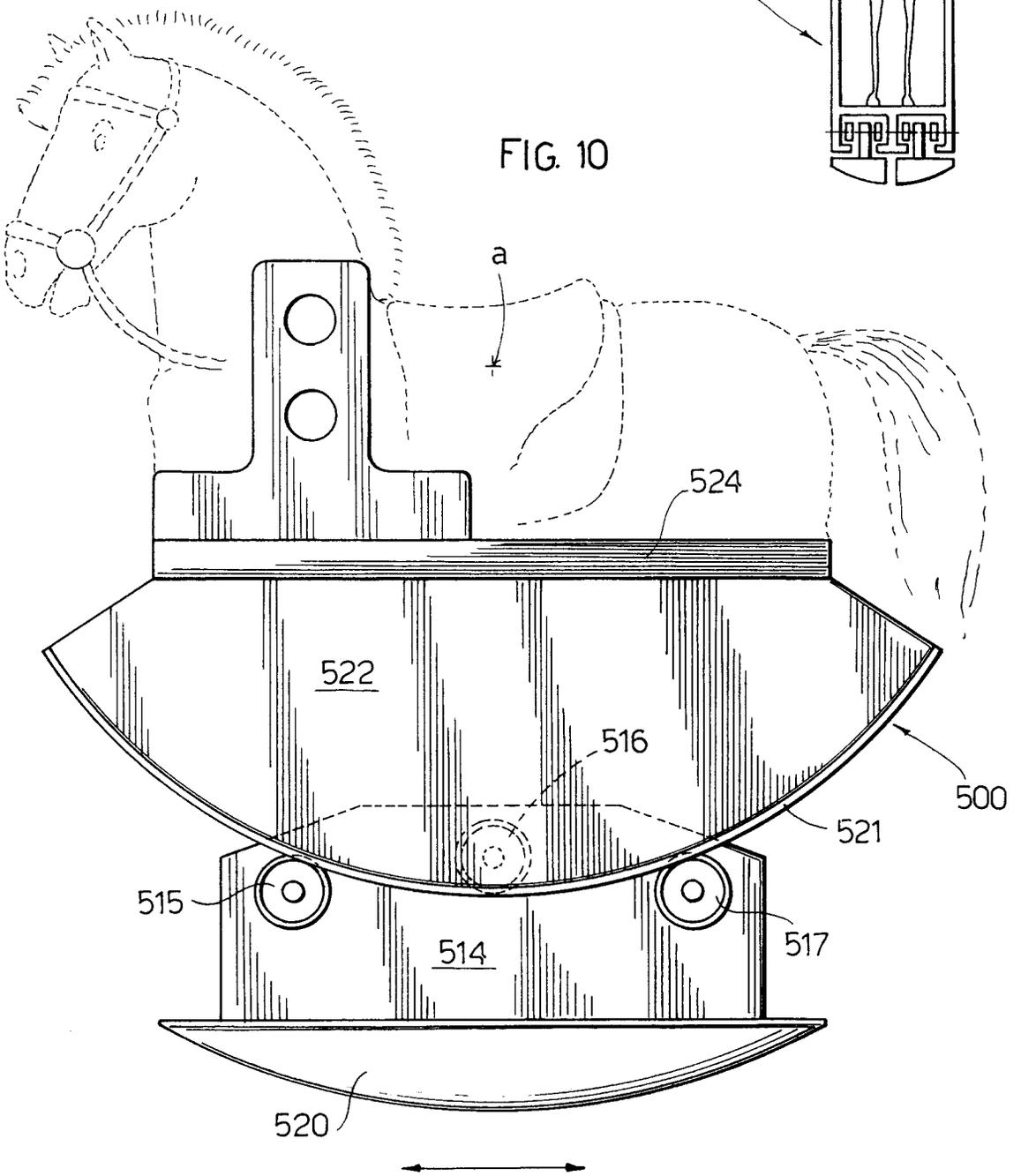


FIG. 10



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EUROPEAN SEARCH REPORT

Application Number

EP 92 11 3650

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	FR-A-1 002 057 (KUSKE) * page 2, right column, line 33 - page 3, left column, line 7 * * page 3, right column, line 25 - line 45; figures 1,2,6,7,13 *	1-5,7,9, 10,16	A63H11/18 A63H7/02 A61H3/00
A	---	8	
X	US-A-1 724 170 (BARRY) * page 2, line 11 - line 71; figures 1,4,6 *	1,2,7,8, 10,16	
A	---	4	
A	US-A-4 302 903 (KWOK-WAH PUN) * column 3, line 16 - line 27; claim 1; figure 1 *	1-3,5,6, 10	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A63H A61H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	12 NOVEMBER 1992	ROLAND A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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