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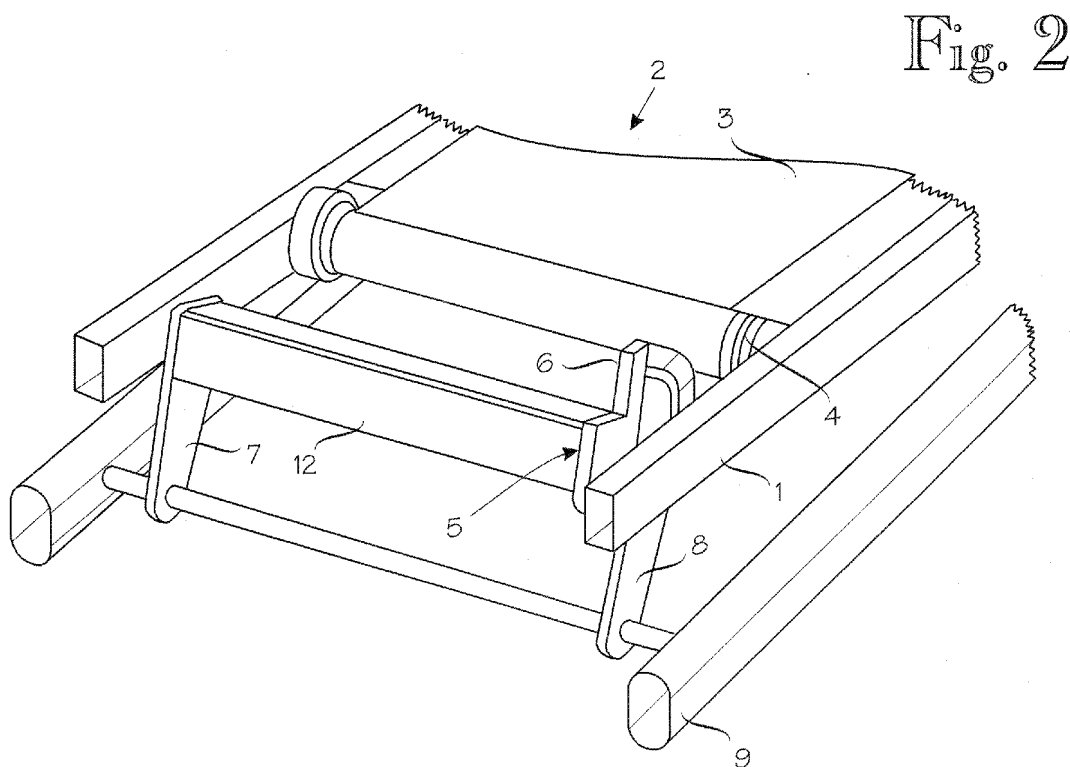
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(54) **Treadmill**

(57) The invention relates to a treadmill that comprises a frame (1), a belt section (2) arranged on the frame and comprising a belt (3) arranged in an endless loop around two rolls at a distance from each other, first means (14) for turning the belt around a front roll and a back roll (4) at a desired speed, and second means for

adjusting the tilt of the belt section (2) with respect to the horizontal. The second means comprise a rotary actuator (5) arranged in the frame (1) and having a support arm (6) arranged to rest against the frame (1), and lifting arms (7, 8), the angle of which is arranged to change with respect to the frame (1) when the rotary actuator (5) is working.



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Description

[0001] The invention relates to a treadmill that comprises a frame, a belt section arranged on the frame and comprising a belt arranged in an endless loop around two rolls at a distance from each other, first means for turning the belt around a front roll and a back roll at a desired speed, and second means for adjusting the tilt of the belt section with respect to the horizontal.

[0002] Treadmills are today very popular devices, and they are used at gyms and at home for keeping fit and for exercises related to top athletics. Treadmills provide the advantage that they make it possible to do running exercises indoors, whereby the user is independent of weather conditions and large hall space. In addition, the advantage of treadmills when used for keeping fit is that they make it possible to combine exercises with some other activity, such as watching television, which in a way allows for more time for the fitness exercise, because it can be combined with watching a specific television programme, for example.

[0003] During home usage in particular, it has been noticed that the space required by a treadmill is relatively large in comparison with the available space, so the possibility to turn the treadmill upright into what is known as the transport position, when the device is not used, is in practice an important feature. In addition to the above-mentioned feature, the total weight of the device should also preferably be reasonable so as to make moving it simple.

[0004] During the years, a variety of treadmills have been manufactured starting from simple basic devices to very versatile devices intended for testing purposes. Examples of known treadmill solutions are devices described in US patents 5,855,537; 5,899,834; 5,921,893; 6,273,843; 6,325,745; 6,461,275; and 6,475,12, and in published US application 2002/0183169.

[0005] In known devices, the angle of tilt, or running angle, of the belt section is usually adjusted by a motor-gear-screw combination or, in addition to it, a mechanical solution that alters the linear movement of the screw to a turning movement. These solutions require space and limit considerably the placement of the mechanics in the treadmill. The problem with the prior art is the complexity of the solutions, which in several cases has led to large and heavy structures. The complex structure has also increased the manufacturing costs, which has affected the price of the device. The complexity of the structure has, at least in some cases, led to high operating costs, since a complex structure easily results in an extensive need for maintenance. In addition, it is known that a complex structure also requires a correct attitude from a user; in other words, a solution designed for expert use is not in all cases suitable for an average enthusiast.

[0006] It is an object of the invention to provide a treadmill, by means of which the drawbacks of the prior art can be eliminated. The treadmill of the invention

achieves this.

[0007] A first embodiment of the treadmill of the invention is characterized in that the second means comprise a rotary actuator arranged in the frame and having a support arm arranged to rest against the frame, and lifting arms, the angle of which is arranged to change with respect to the frame when the rotary actuator is working.

[0008] A second embodiment of the treadmill of the invention is characterized in that the second means comprise a rotary actuator arranged in a separate subframe and having a support arm arranged to rest against the subframe, and lifting arms, the angle of which is arranged to change with respect to the subframe when the rotary actuator is working.

[0009] A third embodiment of the treadmill of the invention is characterized in that the second means comprise a rotary actuator arranged in a subframe and having a support arm arranged to rest against the frame, and lifting arms arranged in the subframe, the angle of which is arranged to change with respect to the frame when the rotary actuator is working.

[0010] The invention provides above all the advantage that by means of the invention, it is possible to provide a simple and functional structure. Due to the simple structure, the maintenance need of the treadmill is small, whereby the operating costs of the device are low. As a result of the simple structure, the weight of the device does not become unreasonable, and the handling and moving of the device is easy.

[0011] In the following, the invention will be described in more detail by means of the preferred embodiments of the invention described in the attached drawing, in which

Figure 1 shows a general view of the basic principle of the treadmill of the invention by means of an embodiment and in a situation, in which the frame is lowered to its low position;

Figure 2 is a general view of the embodiment of Figure 1 in a situation, in which the front end of the frame is lifted to a high position;

Figure 3 shows an additional feature of the treadmill of the invention in a situation, in which the frame is lowered to its low position;

Figure 4 shows a detail of Figure 3 on a larger scale; Figure 5 shows the solution of Figure 3 in a situation, in which the front end of the frame is lifted to a high position;

Figure 6 shows a detail of Figure 5 on a larger scale; Figure 7 shows an embodiment of the treadmill of the invention in a situation, in which the frame is in its low position;

Figure 8 shows the embodiment of Figure 7 in a situation, in which the frame is lifted to a high position; Figure 9 shows a second embodiment of the treadmill of the invention in a situation, in which the frame is in its low position;

Figure 10 shows the embodiment of Figure 9 in a situation, in which the frame is lifted to a high position;

Figures 11 to 13 show a third embodiment of the invention in situations, in which the frame is in different positions;

Figures 14 and 15 show a fourth embodiment of the treadmill of the invention in situations, in which the frame is in different positions;

Figures 16 to 18 show a fifth embodiment of the treadmill of the invention in situations, in which the frame is in different positions;

Figures 19 to 20 show a sixth embodiment of the treadmill of the invention in situations, in which the frame is in different positions;

Figures 21 to 23 show a seventh embodiment of the treadmill of the invention in situations, in which the frame is in different positions;

Figures 24 and 25 show a eighth embodiment of the treadmill of the invention from different directions; and

Figures 26 to 28 show the ninth embodiment of the treadmill of the invention in situations, in which the frame is in different positions.

[0012] Figures 1 and 2 show the basic principle of the treadmill of the invention. In the example shown in Figures 1 and 2, reference number 1 marks the frame of the device and reference number 2 marks the belt section arranged on the frame. The belt section 2 comprises a belt 3 arranged in an endless loop around two rolls, a front roll and a back roll, located at a distance from each other. Figures 1 and 2 only show the front roll 4.

[0013] The treadmill further comprises first means for turning the belt 3 around the front roll and the back roll, and second means for adjusting the tilt of the belt section. In addition to the above-mentioned parts, the treadmill also comprises rail structures and adjusting means, by means of which the user of the device can adjust the rotation rate of the belt and the tilt angle of the belt section as desired.

[0014] The above-mentioned matters are fully known to a person skilled in the art, so they need not be described in greater detail herein. With respect to the matters in question, reference is made to the US publications mentioned earlier.

[0015] An essential matter of the invention is that the tilt angle of the treadmill is adjusted by a rotary actuator, in which the fast rotary motion of an electric motor is changed by means of a planetary gear or another corresponding compact and powerful gear into a high-torque turning movement of a lever. The turning movement and turning angle is detectable by a sensor in the actuator or one attached to it. An advantage of the rotary actuator is that it provides a small, compact and powerful adjustment arrangement for the running angle. The above-mentioned fact enables a free placement of the actuator and thereby also implementation alternatives

of various kinds. Any suitable device can be used as the rotary actuator. An example of suitable devices is a device known by the name of Linak Rotary Actuator RA40.

[0016] The above-mentioned essential matter of the invention is shown in Figures 1 and 2, which show that the second means, which are intended for adjusting the tilt of the belt section 2, comprise a rotary actuator 5 arranged in the frame, a support arm 6 of which is, in the example of Figures 1 and 2, arranged to rest against the frame 1. The solution also comprises lifting arms 7, 8, the angle of which is, in the example of Figures 1 and 2, arranged to change with respect to the frame 1 when the rotary actuator 5 is working. In the solution of Figures 1 and 2, the ends of the lifting arms 7, 8 are arranged to rest against a subframe 9.

[0017] Figure 1 shows the treadmill in its low position; in other words, in a position, in which the belt section 2 is lowered to its low position. Figure 2 shows a situation, in which the tilt of the belt section is increased by rotating the rotary actuator 5, whereby the movement of the lifting arms 7, 8 lifts the belt section to the position of Figure 2.

[0018] Figures 3 to 6 show an essential additional feature of the treadmill of the invention. The same reference numbers as in Figures 1 and 2 are used in the corresponding points in Figures 3 to 6. Figures 3 to 6 do not show, nor do any other figures showing different embodiments of the invention, any parts of the treadmill, such as rails, or corresponding elements, that are inessential for the invention. The back roll is marked with reference number 11. The example of Figures 3 to 6 shows that the support arm 6 of the rotary actuator 5 is arranged to flexibly support itself against the frame 1. The flexible support is implemented by means of a flexible element 10. The flexible element 10 can be a steel spring, a piece of elastomeric material, a gas spring, or the like. The flexible element can also be an adjustable element so that the springing characteristics of the element can be adjusted as necessary.

[0019] The idea behind the above-mentioned flexible support is that by means of the flexible element 10, it is possible to affect the flexibility of the treadmill for users of different weights. The support arm 6 of the rotary actuator can also be fixed to the frame, and it is also possible to use an articulated solution or one that moves freely into one direction. With the solution that moves freely into one direction, it is possible to decrease the danger of compression between the treadmill and the structures below it.

[0020] According to a preferred additional feature of the treadmill of the invention, the rotary actuator 5 is fastened to a profile section 12, the ends of which are fitted with bearings / pivoted to the frame 1. The lifting arms 7, 8 are arranged in the area of the ends of the profile section 12. The motor and gears of the rotary actuator 5 can then preferably be arranged inside the profile section. This type of solution is shown in the examples of Figures 1 and 2 and 3 to 6.

[0021] The above-mentioned basic solution can be modified in many ways. The above-mentioned rotary actuator 5 can be located for instance in the front section of the treadmill, as is done in the example of Figures 7 and 8. In the example of Figures 7 and 8, the lifting arms 7, 8 are arranged to rest against the floor. If necessary, the ends of the lifting arms can be equipped with wheels or rollers, as shown in the figures. The lifting arms 7, 8 can also be arranged to rest against a separate subframe, as is done in the example of Figures 3 to 6, for instance.

[0022] The rotary actuator 5 can also be located between the front roll 4 and the back roll 11, as is done in the example of Figures 9 and 10. In the example of Figures 9 and 10, the rotary actuator 5 is arranged in the back part of the treadmill. In such an embodiment, the treadmill can be pivoted at its front section to the subframe 9, as is done in the example of Figures 9 and 10, or propped directly to the floor. In this embodiment, too, the support arm of the rotary actuator rests against the frame 1.

[0023] The rotary actuator 5 can also be located between the rolls in the front part of the device, as shown in Figures 11 to 13. In the example of Figures 11 to 13, the rotary actuator 5 is located in the front part of the device, between the front roll 4 and a base plate 13. The lifting arms 7, 8 are pivoted to the subframe 9. In this embodiment, too, the lifting arms can be arranged to be directly propped to the floor. In this embodiment, the support arm 6 of the rotary actuator rests against the frame 1 as in the previous examples. By means of the rotary actuator 5, the treadmill can be lifted to its transport position, in which the frame is upright, as shown in Figure 13, when the lifting arms 7, 8 are locked to the subframe so that they cannot turn as shown in Figures 11 and 12. The lifting arms can be locked in any suitable locking manner, for instance by using locking pins that settle in suitable openings.

[0024] Figures 14 and 15 show an embodiment of the invention, in which the rotary actuator is arranged to the front part of the treadmill frame and the lifting arms 7, 8 are pivoted to the subframe 9. The support arm of the rotary actuator is arranged to rest against the frame 1. In this embodiment, the lifting arms 7, 8 turn backward when the frame 1 is lowered to its low position. The lifting arms can naturally also turn forward in said situation, as shown in the earlier examples.

[0025] Figures 16 to 18 show an embodiment of the invention, in which the rotary actuator is arranged to the front part of the frame 1 of the treadmill and the lifting arms 7, 8 are pivoted to the subframe 9. The support arm of the rotary actuator is arranged to rest against the frame 1. In this embodiment, the lifting arms 7, 8 of the rotary actuator turn backward when the frame 1 is lowered to its low position. The embodiment according to the example of Figures 16 to 18 can be lifted upright by means of the rotary actuator by locking the lifting arms 7, 8 to the subframe. The upright position is shown in

Figure 18.

[0026] Figures 19 and 20 show an embodiment, in which the rotary actuator is located in the front part of the treadmill, between the front roll 4 and base plate 13 of the treadmill, providing a structure known as a run-through structure. In the example of Figures 19 and 20, the lifting arms 7, 8 are pivoted to the subframe 9, but they can also be propped directly to the floor. The support arm of the rotary actuator is arranged to rest against the frame 1. The lifting arms 7, 8 can be either forward- or backward-turning elements, as shown in the previous examples.

[0027] Figures 21 to 23 shows an embodiment of the invention, in which the rotary actuator is fastened to the front part of the treadmill in a separate subframe 9. The lifting arms 7, 8 are pivoted to the front part of the treadmill frame 1. In this embodiment, the support arm of the rotary actuator is arranged to rest against the subframe 9. In this embodiment, the frame 1 can be lifted by means of the rotary actuator to the transport position, in which the frame is in an upright position when the lifting arms 7, 8 are locked to the frame 1. The lifting arms can be locked by any suitable locking device, such as the conventional pin lock. Figure 23 shows a situation, in which the frame 1 is turned into its transport position.

[0028] Figures 24 and 25 show an embodiment of the invention, in which the rotary actuator 5 is located in the subframe 9 and the support arm 6 of the rotary actuator is arranged to rest against the frame 1. The lifting arms 7, 8 are arranged to the subframe 9 and their angle is arranged to change with respect to the frame 1 when the rotary actuator is working. First means 14 intended to rotate the belt are also fastened to the subframe 9. In this embodiment, too, the rotary actuator 5 can be arranged inside the profile section 12, as earlier described in connection with the previous embodiments. In the embodiment of Figures 24 and 25, the joint between the subframe 9 and the frame 1 is a joint turning around an articulated shaft and allows a positional shift between the subframe 9 and frame 1. The first means 14 and the rotary actuator 5 are fastened coaxially to the subframe 9 so that the articulated shaft is linear with the common axis of the first means 14 and the rotary actuator 5. With such a solution, the tightness of the treadmill belt remains unchanged despite the rotary motion. The above-mentioned matter is especially clearly seen in Figure 24. In the embodiment of Figures 24 and 25, the lifting arms 7, 8 are arranged to be propped to the floor. If necessary, the ends of the lifting arms 7, 8 can be equipped with wheels or rollers, as shown in Figures 24 and 25.

[0029] The embodiments of the invention described above are in no way intended to limit the invention, and the invention can be freely modified within the scope of the claims. Thus, it is clear that the treadmill of the invention or its details need not be exactly as described above, but solutions of other kind are also possible within the scope of the basic idea of the invention. For instance, when using a subframe 9, it is completely pos-

sible to pivot or fit with bearings the ends of the lifting arms 7, 8 to the subframe 9, at points above the frame so that the frame 1 and the lifting arms 7, 8 form a suspended structure. This type of embodiment is shown in Figures 26 to 28. Figure 26 in particular shows how the frame 1 is suspended from the turning arms 7, 8, etc. An advantage of this embodiment is that the structure does not strain the gears when the frame is horizontal, as shown in Figure 26. Another advantage is that when turning the frame into a high position, the frame moves slightly backward. Even with this embodiment, it is possible to use the earlier mentioned locking of the lifting arms 7, 8 so that the treadmill can be lifted by means of the rotary actuator to the transport position shown in Figure 28. The lifting arms 7, 8 can be locked using locking pins, for instance, as earlier described. The locking can be manual or a system operated by means of a suitable actuator.

Claims

1. A treadmill that comprises a frame (1), a belt section (2) arranged on the frame and comprising a belt (3) arranged in an endless loop around two rolls at a distance from each other, first means (14) for turning the belt around a front roll and a back roll (4, 11) at a desired speed, and second means for adjusting the tilt of the belt section (2) with respect to the horizontal, **characterized in that** the second means comprise a rotary actuator (5) arranged in the frame (1) and having a support arm (6) arranged to rest against the frame (1), and lifting arms (7, 8), the angle of which is arranged to change with respect to the frame (1) when the rotary actuator (5) is working.
2. A treadmill as claimed in claim 1, **characterized in that** the support arm (6) of the rotary actuator (5) is arranged to flexibly support itself against the frame (1).
3. A treadmill as claimed in claim 1 or 2, **characterized in that** the rotary actuator (5) is fastened to a profile section (12), the ends of which are fitted with bearings / pivoted to the frame (1), and that the lifting arms (7, 8) are arranged to the area of the ends of the profile section (12).
4. A treadmill as claimed in claim 3, **characterized in that** the motor and gears of the rotary actuator (5) are arranged inside the profile section (12).
5. A treadmill as claimed in any one of claims 1 to 4, **characterized in that** the rotary actuator (5) is arranged to the front part of the treadmill.
6. A treadmill as claimed in any one of claims 1 to 4,
- characterized in that** the rotary actuator (5) is arranged to the back part of the treadmill.
7. A treadmill as claimed in claim 5 or 6, **characterized in that** the rotary actuator (5) is arranged between the front roll and the back roll (4, 11).
8. A treadmill as claimed in any one of claims 1 to 7, **characterized in that** the lifting arms (7, 8) are arranged to rest against the floor.
9. A treadmill as claimed in any one of claims 1 to 7, **characterized in that** the lifting arms (7, 8) are arranged to rest against a separate subframe (9).
10. A treadmill as claimed in claim 9, **characterized in that** the ends of the lifting arms (7, 8) are pivoted to the subframe (9).
11. A treadmill as claimed in claim 10, **characterized in that** the ends of the lifting arms (7, 8) are pivoted to the subframe (9), to points above the frame (1).
12. A treadmill that comprises a frame (1), a belt section (2) arranged on the frame and comprising a belt (3) arranged in an endless loop around two rolls (4, 11) at a distance from each other, first means (14) for turning the belt around a front roll and a back roll (4, 11) at a desired speed, and second means for adjusting the tilt of the belt section (2) with respect to the horizontal, **characterized in that** the second means comprise a rotary actuator (5) arranged in a separate subframe (9) and having a support arm (6) arranged to rest against the subframe (9), and lifting arms (7, 8), the angle of which is arranged to change with respect to the subframe (9) when the rotary actuator (5) is working.
13. A treadmill as claimed in claim 12, **characterized in that** the lifting arms (7, 8) are arranged to rest against the frame (1).
14. A treadmill as claimed in claim 13, **characterized in that** the ends of the lifting arms (7, 8) are pivoted to the frame (1).
15. A treadmill as claimed in any one of claims 12 to 14, **characterized in that** the rotary actuator (5) is fastened to a profile section (12), the ends of which are fitted with bearings / pivoted to the subframe (9), and that the lifting arms (7, 8) are arranged in the area of the ends of the profile section (12).
16. A treadmill as claimed in claim 15, **characterized in that** the motor and gears of the rotary actuator (5) are arranged inside the profile section (12).
17. A treadmill that comprises a frame (1), a belt section

(2) arranged on the frame and comprising a belt (3) arranged in an endless loop around two rolls (4, 11) at a distance from each other, first means (14) for turning the belt around a front roll and a back roll (4, 11) at a desired speed, and second means for adjusting the tilt of the belt section (2) with respect to the horizontal, **characterized in that** the second means comprise a rotary actuator (5) arranged in a subframe (9) and having a support arm (6) arranged to rest against the frame (1), and lifting arms (7, 8) arranged to the subframe (9), the angle of which is arranged to change with respect to the frame (1) when the rotary actuator (5) is working.

18. A treadmill as claimed in claim 17, **characterized in that** the first means (14) intended for rotating the belt are also fastened to the subframe (9).

19. A treadmill as claimed in claim 18, **characterized in that** the joint between the subframe (9) and frame (1) is a joint turning around an articulated shaft and allows a positional shift between the subframe (9) and frame (1), and that the first means (14) and the rotary actuator (5) are fastened coaxially to the subframe (9) so that the articulated shaft is linear with the common axis of the first means (14) and the rotary actuator (5).

20. A treadmill as claimed in any one of claims 17 to 19, **characterized in that** the lifting arms (7, 8) are arranged to rest against the floor.

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Fig. 1

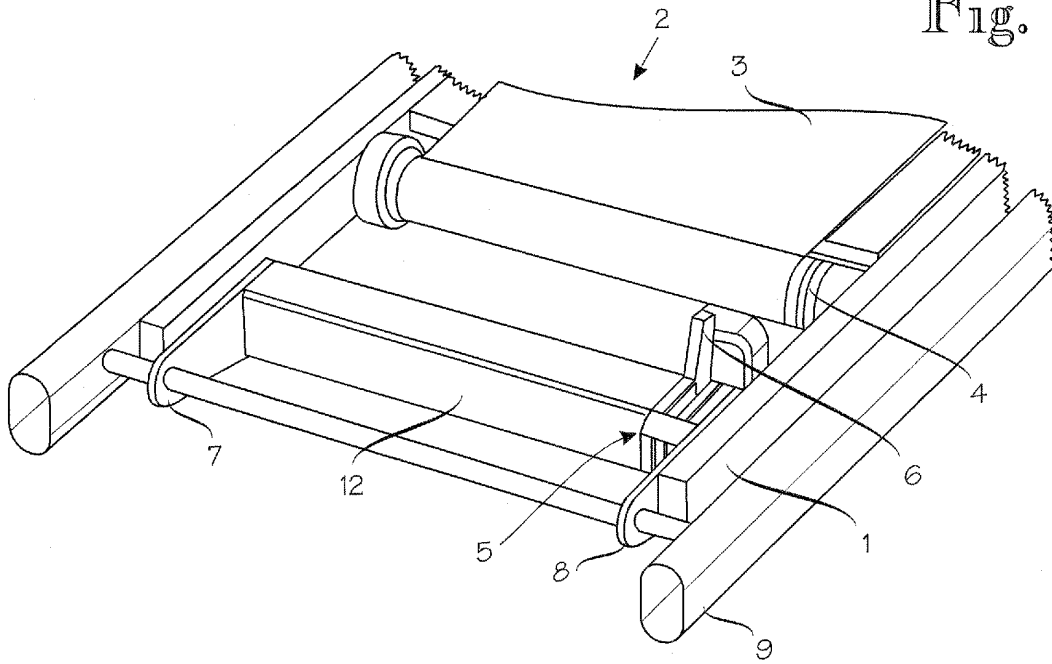
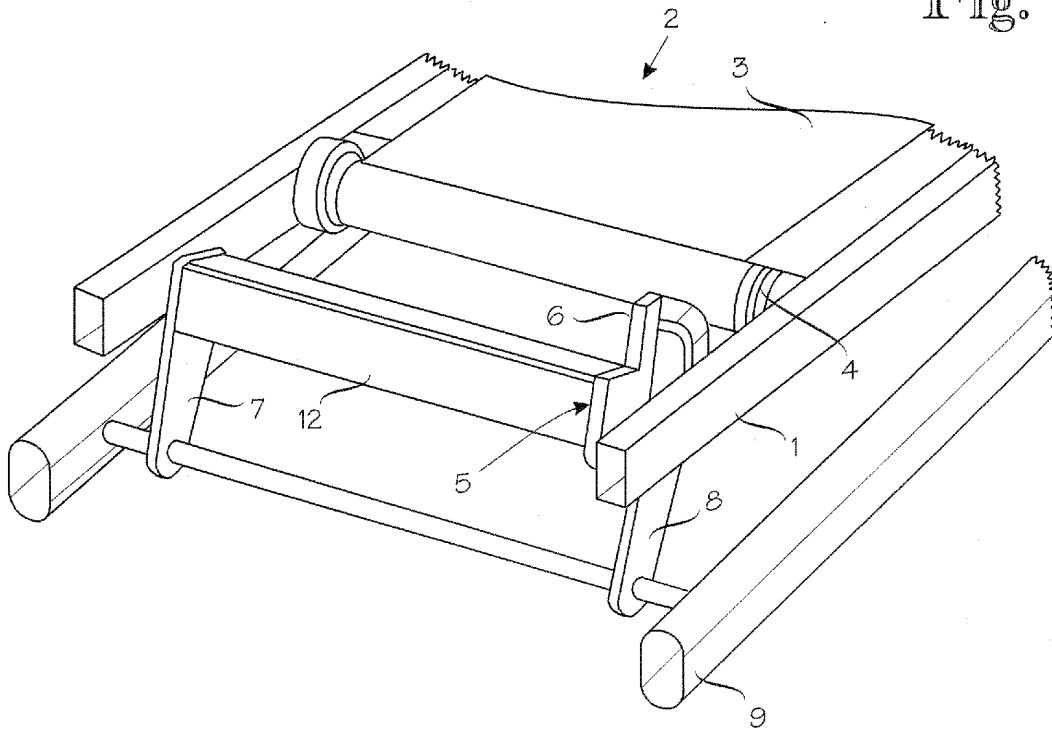


Fig. 2



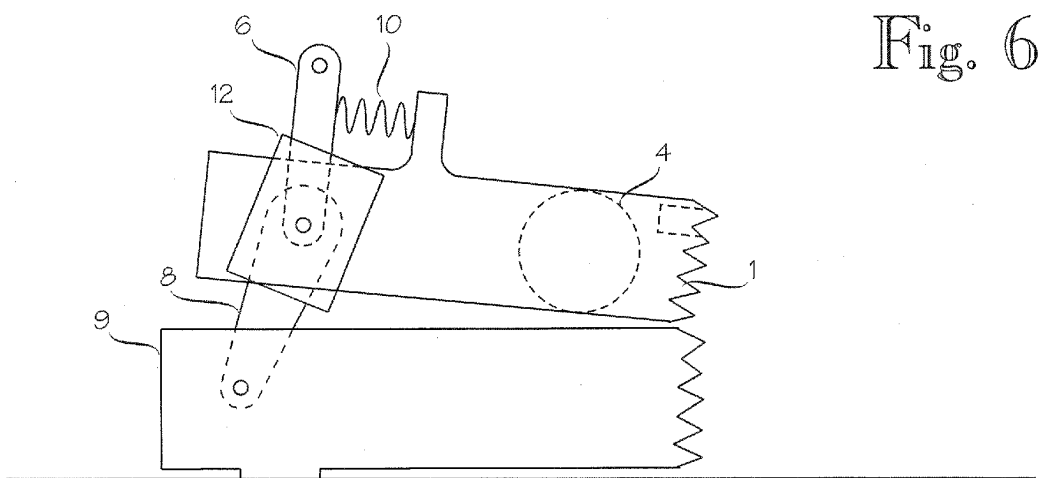
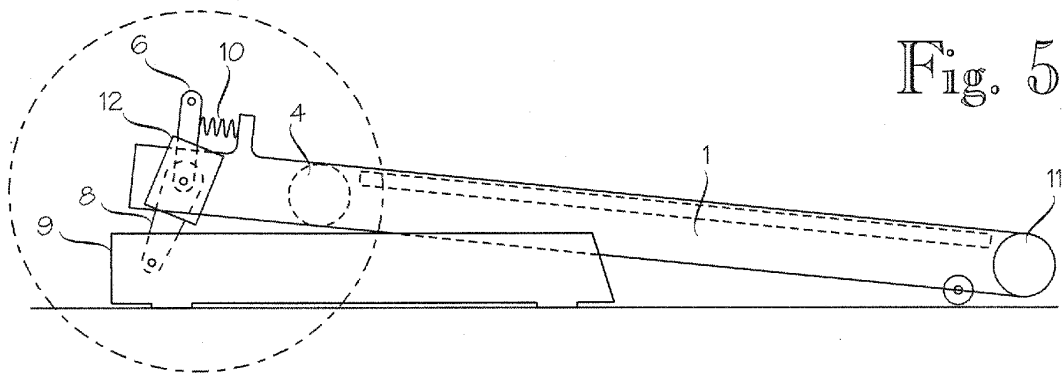
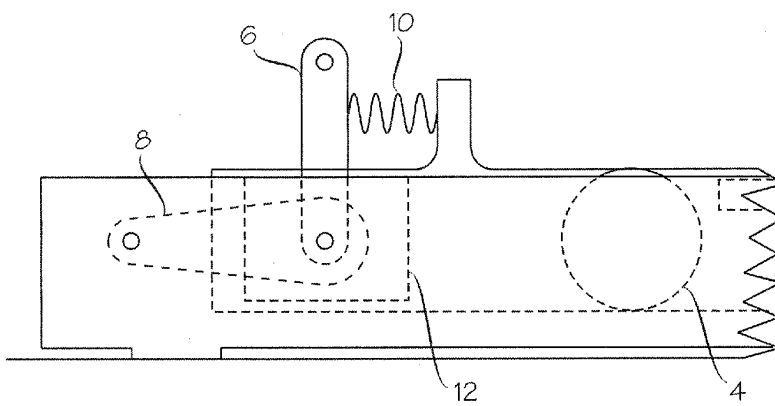
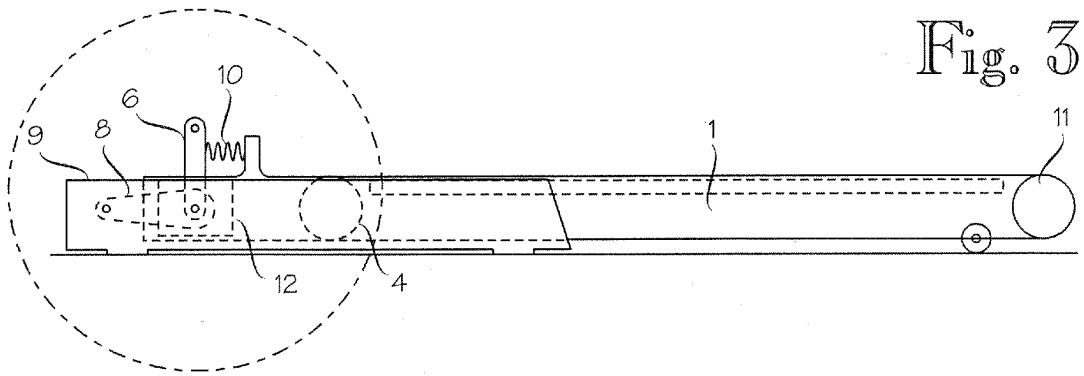


Fig. 7

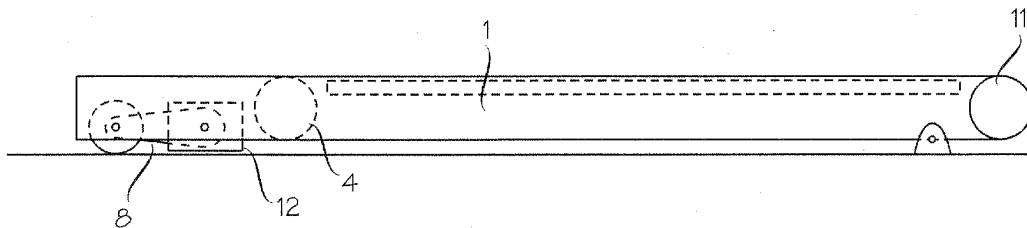


Fig. 8

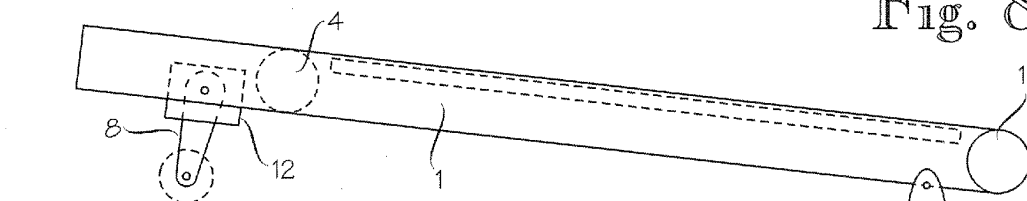


Fig. 9

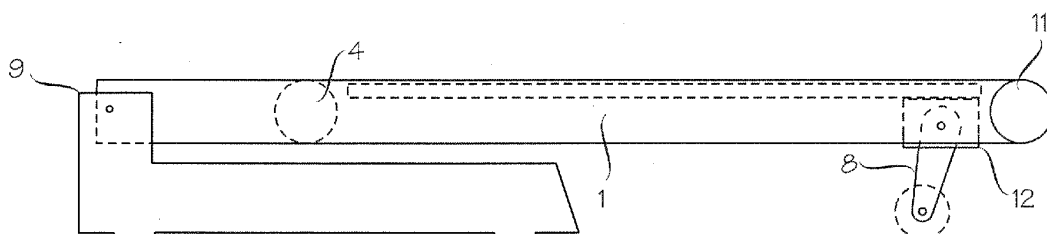


Fig. 10

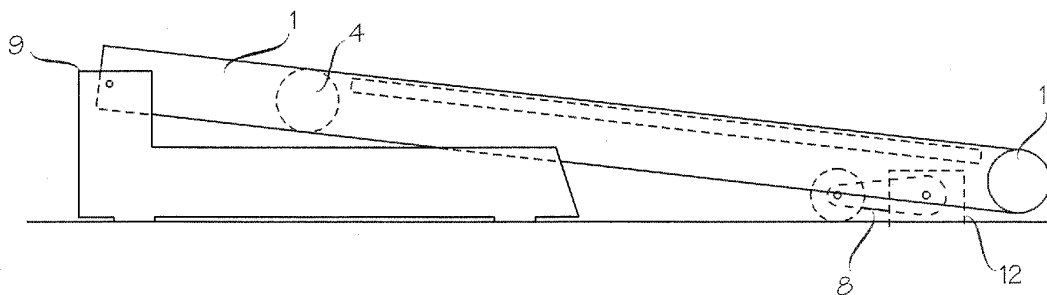


Fig. 11

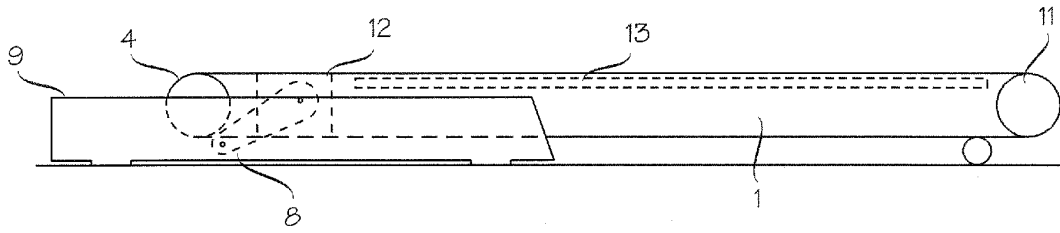


Fig. 12

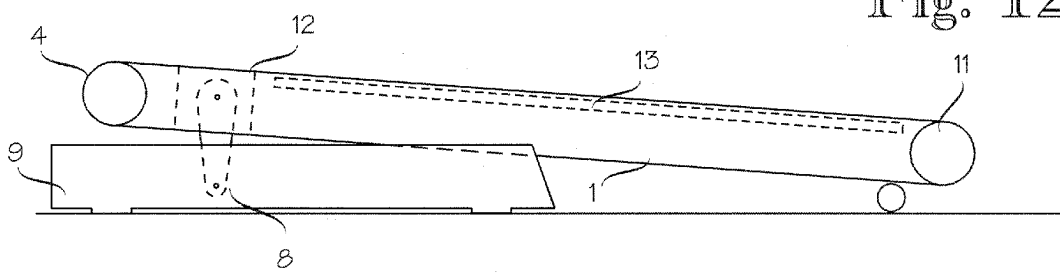


Fig. 13

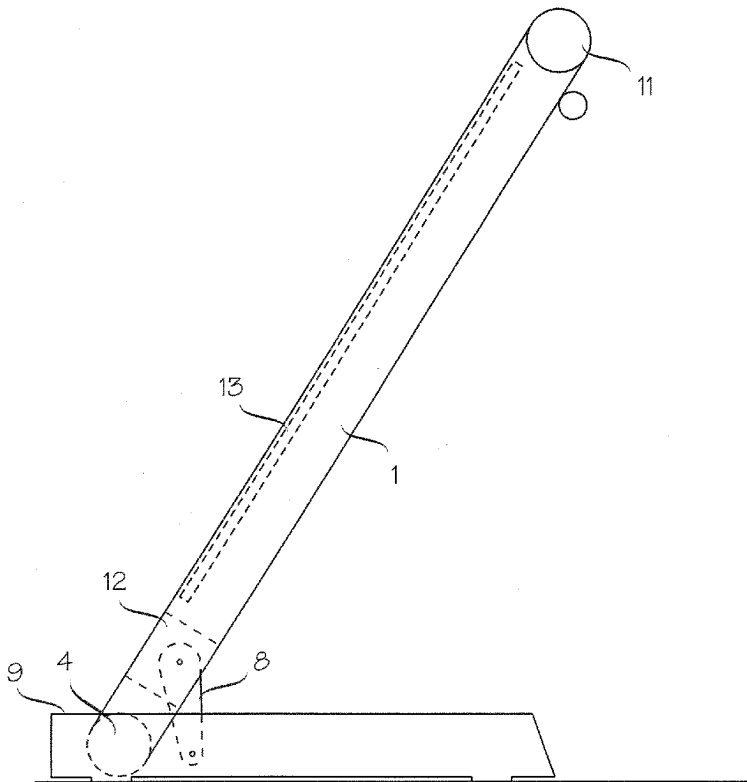


Fig. 14

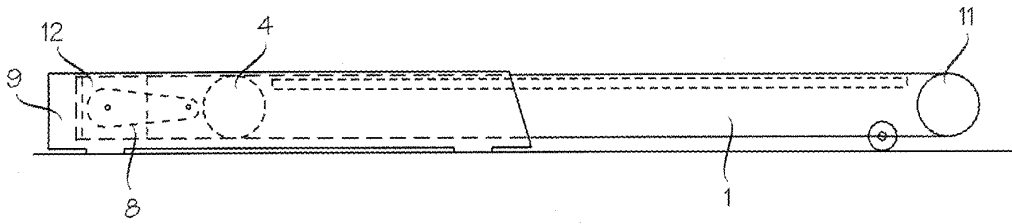


Fig. 15

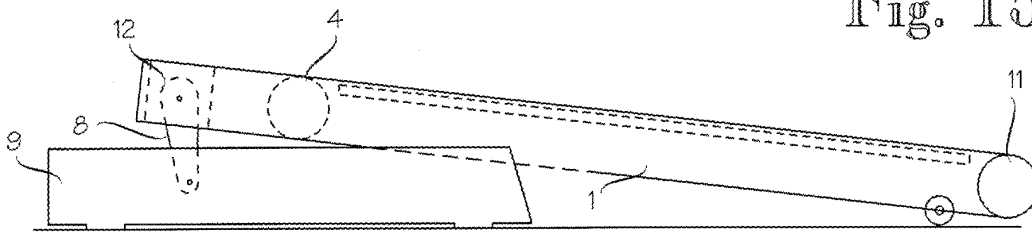


Fig. 16

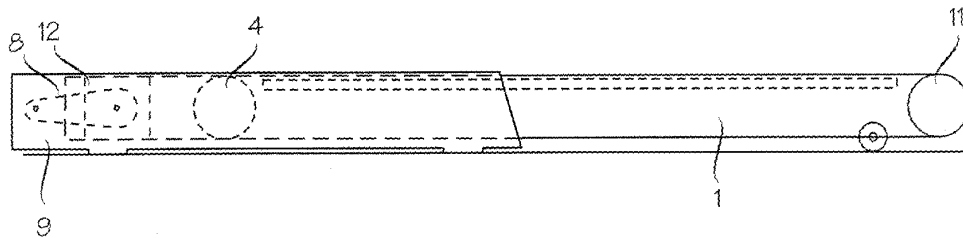


Fig. 17

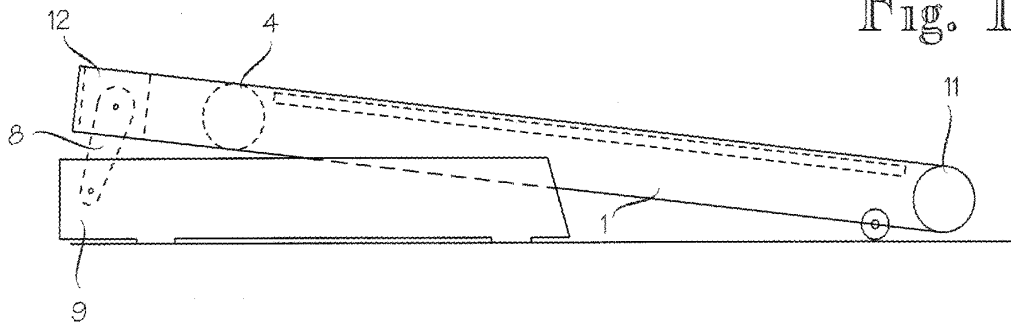


Fig. 18

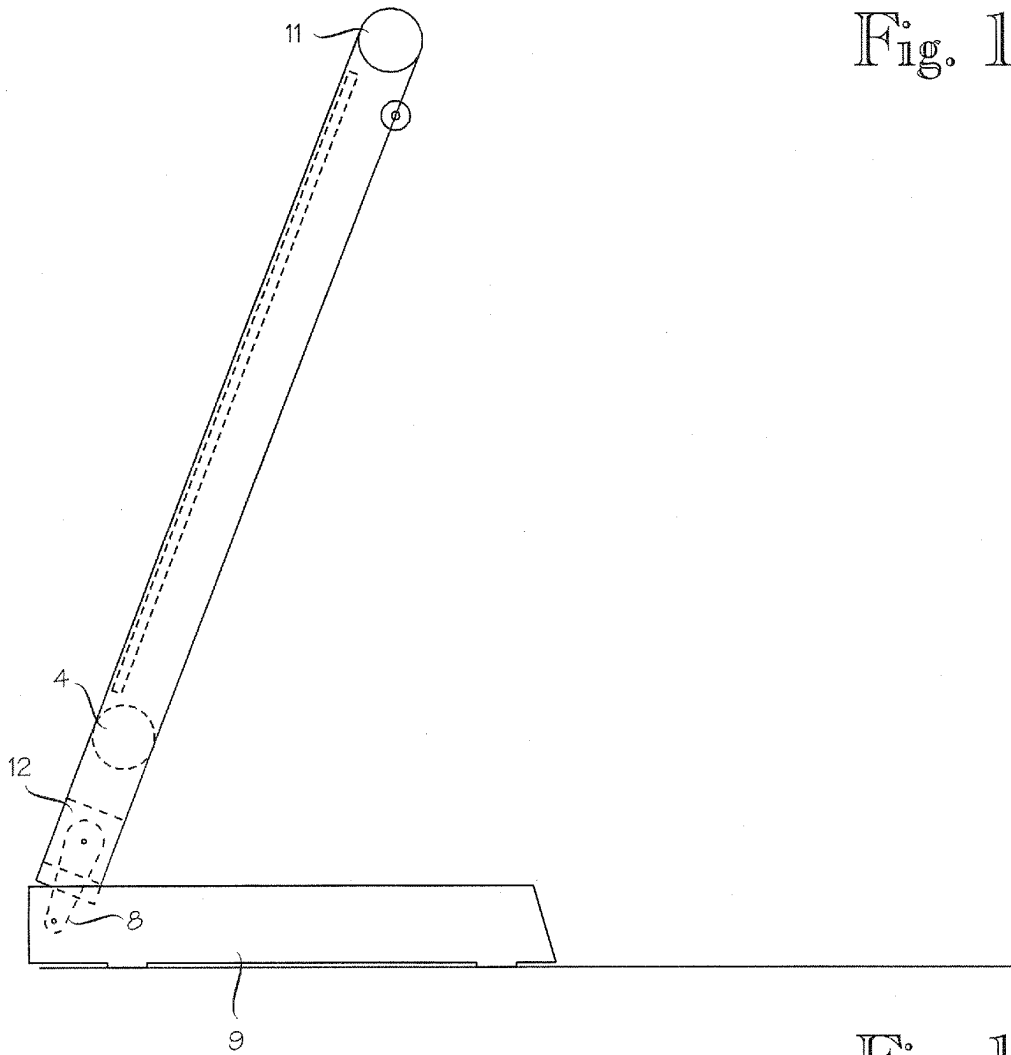


Fig. 19

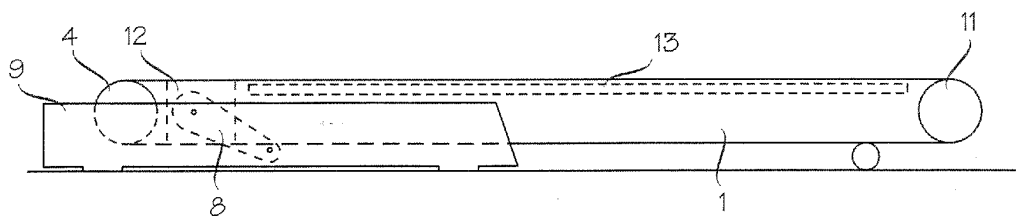


Fig. 20

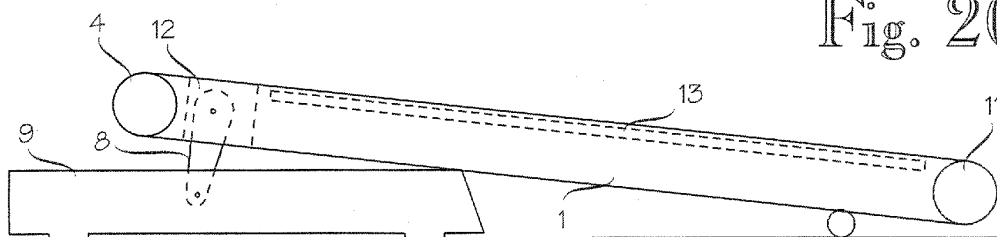


Fig. 21

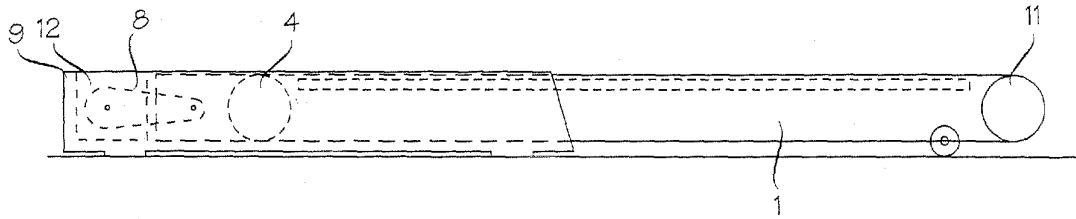


Fig. 22

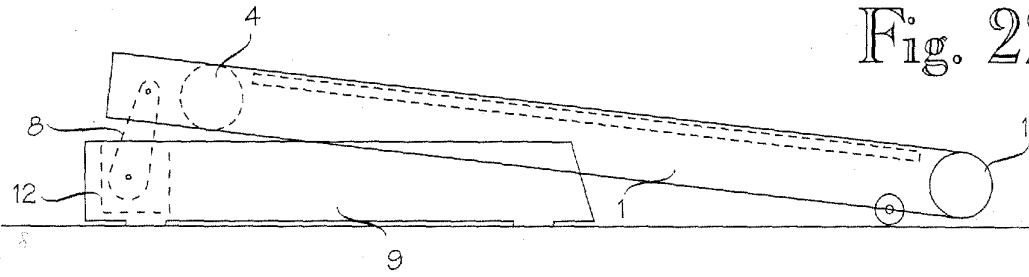


Fig. 23

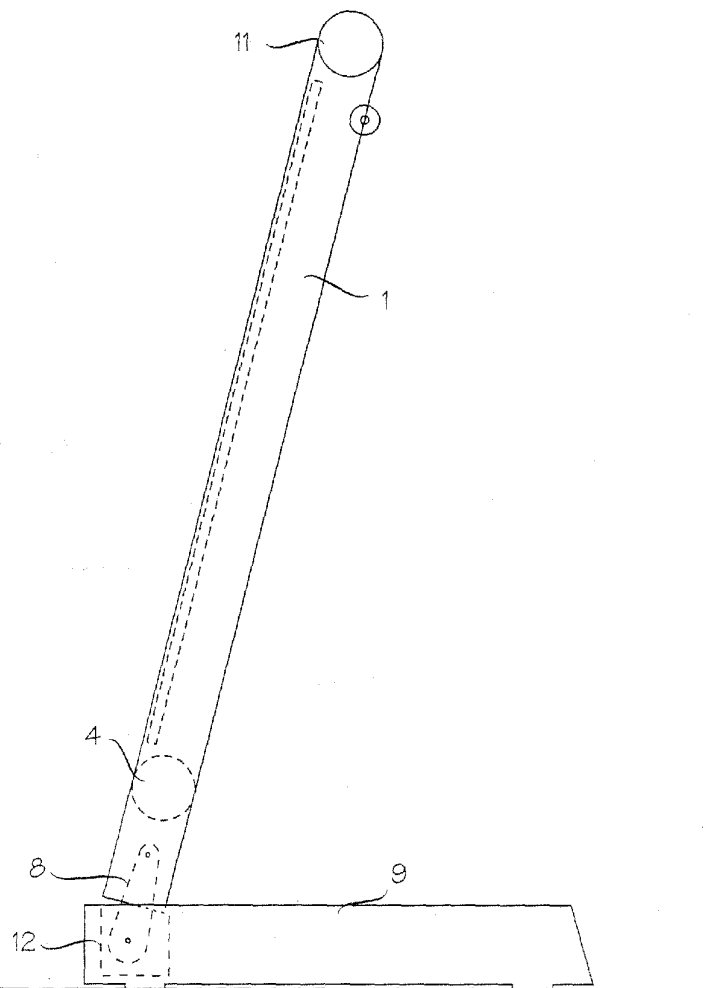


Fig. 24

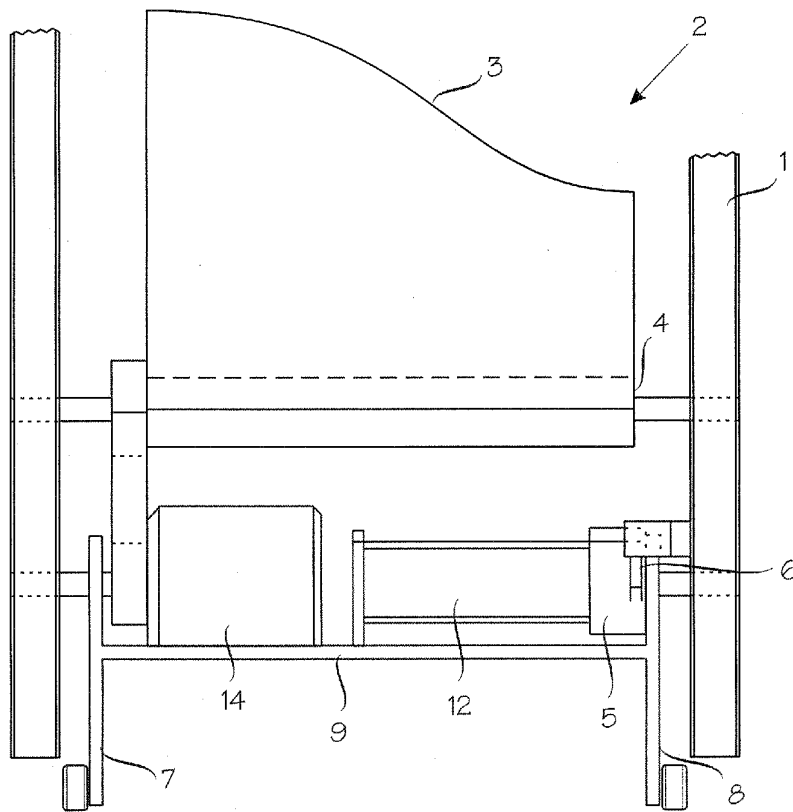
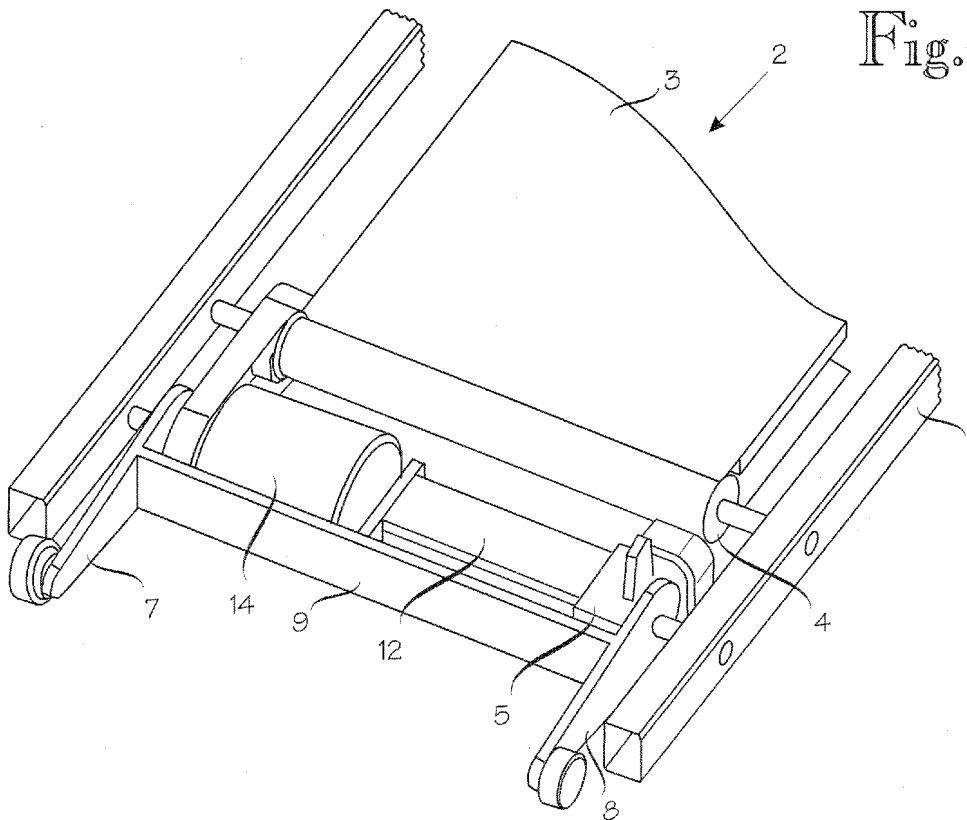
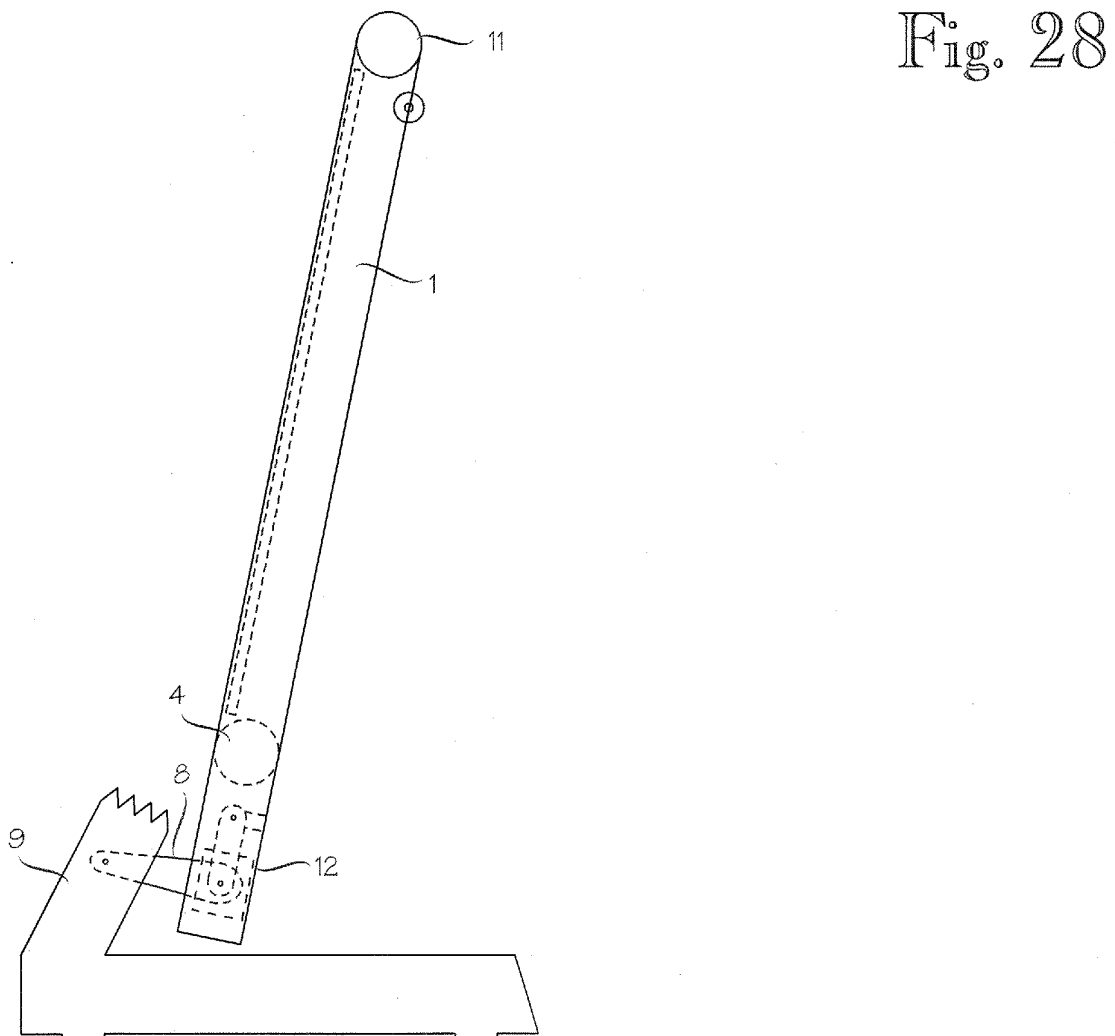
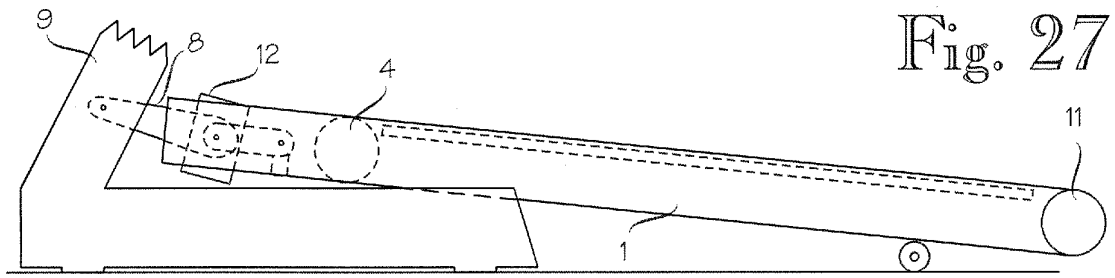
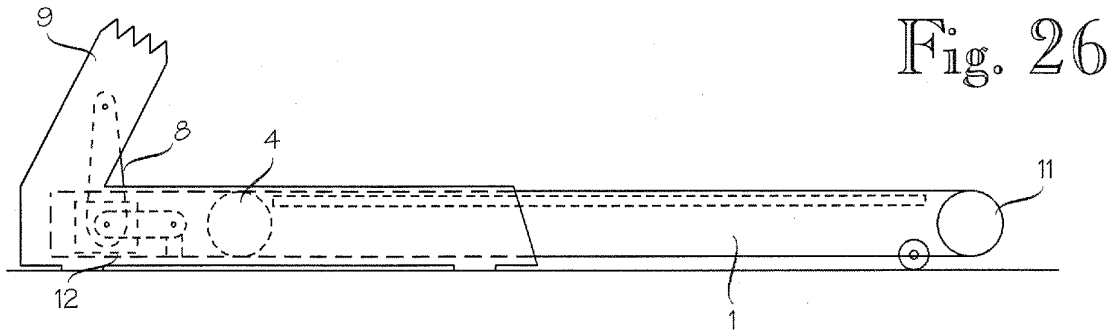


Fig. 25







European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 10 0843

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.7)
X A	US 6 273 842 B1 (WANG LEAO ET AL) 14 August 2001 (2001-08-14) * column 2, line 3 - column 3, line 5; figures 1-3 *	1,5,9, 10,12-14 3,15,17	A63B22/02
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			A63B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 14 July 2004	Examiner Levert, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P/4C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 04 10 0843

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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14-07-2004

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