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Gert [NL/NL]; Bolskamp 41, NL-7576 GJ Oldenzaal (NL). **GOUDSMIT, Josephus, Anton** [NL/NL]; Bakboord 9, NL-1316 VA Almere Stad (NL).

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(74) Agent: **JORRITSMA, Ruurd**; Nederlandsch Octrooibureau, Scheveningseweg 82, P.O. Box 29720, NL-2502 LS The Hague (NL).

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(71) Applicant (for all designated States except US): **BANDAGE- EN CORSETINDUSTRIE BASKO B.V.** [NL/NL]; P.O. Box 8359, NL-1005 AJ Amsterdam (NL).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

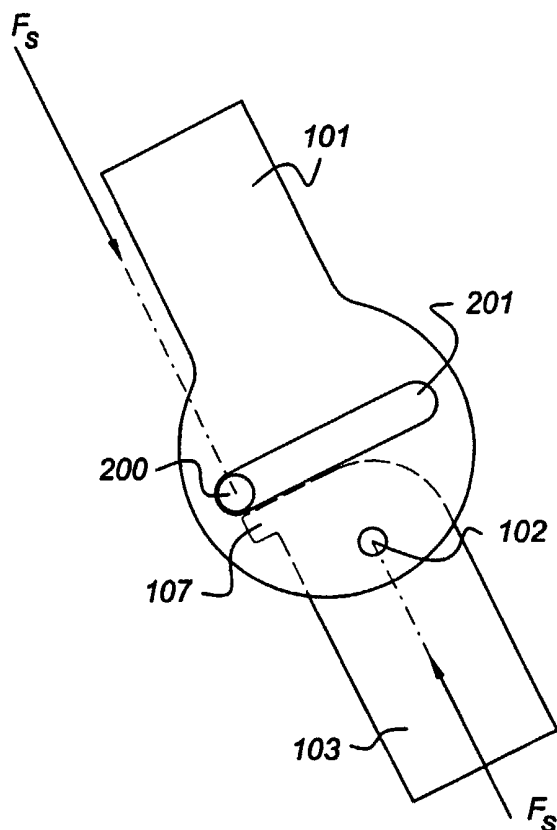
(72) Inventors; and

(75) Inventors/Applicants (for US only): **NIJENBANNING,**

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(54) Title: GRAVITY OPERATED LOCKING HINGE



(57) Abstract: The present invention relates to a hinge provided with a first part and a second part, which parts are able to turn relative to one another from a first position of the hinge into a second position of the hinge, the hinge being provided with a locking element for locking the hinge in the first position thereof, which locking element can move between a first position for releasing the hinge and a second position for locking the hinge. The invention is characterised in that a locking element is fitted in a movable manner for moving under the influence of gravity, between the first position and the second position when the hinge sways.



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Title: GRAVITY OPERATED LOCKING HINGE

The invention relates to a hinge provided with a first part and a second part, which parts are able to turn relative to one another from a first position of the hinge into a second position  
5 of the hinge, the hinge being provided with a locking element for locking the hinge in the first position thereof, which locking element can move between a first position for releasing the hinge and a second position for locking the hinge.

The hinge according to the present invention is in particular suitable as an orthopaedic knee  
10 joint. Orthopaedic knee joints are, for example, used by patients who are not capable of stabilising the knee joint without aids. Without aids, the knees of such patients would give way when they walk. When walking, the leg moves from the point in time that the heel makes contact with the ground from a position in which it is stretched forward into the so-called mid-position stage in which the leg is essentially perpendicular under the body.  
15 Because the body is moving forward relative to the leg, the leg will then be pointing somewhat backwards with respect to the body. The leg then returns via the so-called swinging stage back to the initial position in which the heel makes contact with the ground.

For paralysis patients, for example, in order to be able to walk safely it is necessary that an  
20 orthopaedic knee joint stabilises the patient's knee at the end of the standing stage, but in any event from the point in time when the heel of the foot comes into contact with the ground to at least the mid-position stage. The simplest solution for achieving this is to make use of an orthosis that fixes the thigh relative to the lower leg when walking. This can be effected, for example, by means of a hinge that is locked while walking. At the point in  
25 time when a user sits down, the user can unlock the hinge in order to make it possible to bend the leg. A significant disadvantage of a hinge of such simple construction is that the user has to walk with a stiff leg. The ease of use of orthopaedic knee joints is appreciably improved if the orthopaedic knee joint is automatically unlocked when the swinging stage starts. With automatic unlocking of the hinge, a user is able to walk in a normal manner. At  
30 the point in time when the leg is placed on the ground, the knee is stabilised with the aid of the orthopaedic knee joint, so that the user can bear safely on the locked knee. The hinge is unlocked at the point in time when the swinging stage has to start. This can take place safely because the weight of the user has then been transferred to the other leg.

Orthopaedic knee joints with which the joint can be unlocked at the start of the swinging stage are known in the state of the art. US Patents US 5 490 831 and 2 943 622 and European Patent Application EP 0 872 224 disclose knee joints with which the presence of stress on a user's heel is used as a signal for locking the knee joint. According to these publications a detection element is present in the heel, which detection element is, for example, connected by a cable or rod to a locking element. As long as the detection element detects that stress is being exerted on the heel, the joint is locked by means of the locking element. However, as soon as there is no longer any stress on the heel, the knee joint is released. A significant disadvantage of the solution according to the said documents is that the knee joint will also be unlocked if stress is exerted on, for example, the front of the user's foot. If the user is negotiating an obstacle, such as, for example, a kerb, with his/her leg, the detection element will not detect any stress on the heel and will release the hinged joint. The user's knee joint will consequently give way. As a result of this limitation, the solution according to the abovementioned documents is impractical and, moreover, dangerous. An alternative solution for providing automatic unlocking of the joint is disclosed in US Patent US 3 826 251. According to this US Patent the presence of an axial force on the hinge is used to either lock or release the hinge. A significant disadvantage of this solution is that the bulk of the reactive force from the ground is absorbed by the leg. That is to say this reactive force is not absorbed by the hinge and can also be not be detected by the hinge. This means that these hinges do not work well in practice.

US Patent US 4 632 096 discloses a hinge that can be released by turning the foot relative to the leg. A cable is attached to the foot, which cable is connected to a locking element in the knee joint. By turning the foot, locking of the hinge can be released with the aid of the cable.

The disadvantage of the solution according to this US Patent is that unlocking can take place only by active turning of the foot. This means that the user must be prepared to turn his/her foot at every step. Furthermore, in this solution a coupling is always needed between the knee joint and the foot or the ankle joint. This makes the system susceptible to malfunctions and in the majority of cases the aid in which the knee joint is incorporated

will have to be equipped with a foot section. Moreover, here again the functioning of the system is dependent on the ground surface.

In view of the abovementioned disadvantages of the solutions according to the prior art, the aim of the present invention is to provide a hinge of the abovementioned type, and in particular an orthopaedic knee joint that is provided with a hinge of the type mentioned in the preamble, wherein the hinge is provided with a construction such that locking and release of the hinge takes place automatically while walking, without the user actively having to deactivate the locking.

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Said aim is achieved according to the present invention in that a locking element is fitted in a movable manner for moving under the influence of gravity between the first position and the second position when the hinge sways.

15 If the hinge according to the present invention is used as an orthopaedic knee joint, the hinge as a whole will sway with respect to the vertical during use. During swaying of the hinge, the locking element will be moved under the influence of gravity between, respectively, the first position for releasing the hinge and the second position for locking the hinge.

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When the hinge is used in an orthopaedic knee joint, the hinge is moved into the first position in the swinging stage. In order for the hinge to function well, it is necessary that the hinge is then locked with the aid of the locking element. This means that the locking element must have been brought into the second position at least by the end of the swinging stage. The user will then exert stress on the leg, and thus on the hinge. Because the hinge is locked with the aid of the locking element, the user is able to walk safely. Because the hinge will sway with respect to the vertical during the walking movement, it is possible for the locking element to be moved into the first position under the influence of gravity, in order to release the hinge, just before a new swinging stage starts. This movement of the locking element into the first position thereof takes place under the influence of gravity and thus occurs automatically. The user does not have to take any further measures in order to move the locking element. Because the locking element is in the first position, the locking element will release the hinge and it is possible to move the first part of the hinge relative

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to the second part. That is to say, the user's thigh is able to pivot with respect to the lower leg. As a result a user is able to bend his/her knee in a normal manner and to walk in a normal manner. As a result of the swinging stage, the hinge returns to the first position thereof, the hinge again being locked in the first position with the aid of the locking  
5 element.

For the sake of clarity it is pointed out that in the present invention specific reference is made to the use of the hinge according to the invention in an orthopaedic knee joint. It is clear that the hinge according to the present invention is also suitable for other joints, such  
10 as, for example, an orthopaedic elbow joint, an ankle joint or a hip joint. The present invention is therefore explicitly not restricted to orthopaedic knee joints.

According to the invention it is advantageous that when the hinge is in the first position the second part is essentially in the extension of the first part, the second part being at an angle  
15 with respect to the first part when the hinge is in the second position.

In order to be able to use the hinge according to the invention as an orthopaedic knee joint it is necessary to connect elements for coupling the knee joint to the user's leg or leg prosthesis to the first part and the second part of the joint. In use, it is advantageous that the  
20 first part and the second part are essentially in line in the first position of the hinge with this arrangement.

According to the invention it is advantageous that the locking element is fixed in the hinge in such a way that it is able to turn or slide, the locking element being able to move or pivot  
25 about the axis of rotation thereof under the influence of gravity.

The locking element can be fitted in the hinge in various ways. By fixing the locking element such that it can turn, the position of the locking element is unambiguously defined at all times. Furthermore, the construction is relatively simple.  
30

What is achieved as a result of this measure is that the locking element has two stable end positions. Depending on the position of the hinge, the locking element will be moved into either the first position thereof or the second position thereof.

According to the invention, it is furthermore advantageous that the centre of gravity of the locking element is some distance away from the axis of rotation of the locking element.

- 5 It is furthermore advantageous that the centre of gravity of the locking element is located above the axis of rotation of the locking element when the hinge is in the use position.

In order to increase the force with which the locking element locks the joint it is furthermore possible that the second part is provided with a projection, which projection  
10 describes a path when the second part pivots relative to the first part, the locking element allowing the projection a free movement path when it is in the first position thereof and being present in the movement path of the projection when it is in the second position thereof.

- 15 It is pointed out that mechanical reversal, that is to say the projection is fixed to the first part instead of to the second part, is also possible. What is achieved by making use of a projection that describes a path and moving the locking element respectively into or out of the path is that the locking element can be arranged some distance away from the axis of rotation of the first part of the hinge relative to the second part of the hinge.

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According to the invention it is furthermore advantageous that the hinge is provided with a first and a second stop in order to limit the movement of the locking element in, respectively, the first and the second position thereof.

- 25 The presence of these stops ensures that the maximum stroke of the locking element from, respectively, the first position into the second position thereof is restricted, so that what is achieved is that the locking element indeed moves at the point in time when the hinge is swayed with respect to the vertical.

- 30 According to the invention it is advantageous that the hinge is provided with a displacement mechanism for forcing the locking element into, respectively, the first or the second position thereof.

In this context it is advantageous that the displacement mechanism comprises a control element that can be operated by hand.

5 In practice, situations are conceivable where a user will him/herself want to be able to exert influence on whether or not the hinge in a knee joint is unlocked or locked. This is the case, for example, when a user wants to sit down. In this context it is advantageous if the user has, for example, a control element that can be operated by hand in order to move the locking element from the second position, in which the hinge is locked, into the first position of the locking element, in which the locking element releases the hinge.

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The opposite case is also conceivable. In this case the user wants, for example, to lock the hinge when the user takes a step backwards. For both of these applications it is advantageous if the user is able, for example, to change the position of a pawl by hand, which pawl is connected to the locking element with the aid of a cable or another  
15 mechanism.

According to the invention it is advantageous that the first and the second stop are arranged on a disc, it being possible to rotate or to move the disc with the aid of the displacement mechanism in order to force the locking element into, respectively, the first or the second  
20 position thereof.

The disc with the stops thereon is, for example, arranged in the hinge in such a way that the axis of rotation of the disc is coincident with the axis of rotation of the locking element. By this means, by rotating the disc with respect to the axis of rotation the extreme positions of  
25 the stops for limiting the locking element in both the first and the second position thereof are changed at the same time. By rotating the disc in a first direction the locking element can be so moved, with the aid of the stops, that it always releases the hinge. By rotating the disc in the opposing direction the locking element is so manipulated by the stops that it locks the hinge at all times.

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According to the invention it is furthermore advantageous that the locking element is constructed as a body for transmitting forces from the second part via the locking element to the first part.

As a result of this measure, forces which are exerted on the first part are transmitted via the locking element to the second part. In order to prevent the pivot pin of the locking element being subjected to excessive stress as a result of the transmission of the forces from the first part to the second part, it is advantageous that the locking element is connected to the pivot pin thereof via a flexible element, such as a rubber ring.

According to the invention, it is furthermore advantageous that the locking element is provided with an adjusting body for adjusting the centre of gravity of the locking element with respect to the axis of rotation thereof.

It is possible to adjust the hinge with the aid of the adjusting body. The user can him- or herself, according to need, select the point in time at which the locking element swings under the influence of gravity from the first position into the second position thereof.

The invention further relates to an orthosis provided with a first part that is provided with means for attaching the first part to a first part of the body or replacement body part and a second part that is provided with means for attaching the second part to a second part of the body or replacement body part. The particular feature of the orthosis according to the invention is that this is provided with a hinge according to the invention.

As already indicated above, the hinge according to the present invention is in particular suitable for use in an orthopaedic knee joint.

The invention will be further explained with reference to the appended figures, in which:

Figure 1 shows a view of the hinge according to the invention incorporated in an orthopaedic leg orthosis.

Figures 2 shows a detail of an exposed view of a hinge according to the invention in the first position thereof, in which the locking element locks the hinge.

Figure 3 shows an exposed view of the hinge according to the invention in the second

position thereof, in which the locking element releases the hinge.

Figure 4 shows a perspective view of the first part of the hinge according to the invention from a first side.

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Figure 5 shows the first part of the hinge according to the invention in a perspective view from the second side.

Figure 6 shows the second part of the hinge according to the invention in a perspective  
10 view, seen from a first side.

Figure 7 shows a second view of the second part according to Figure 6.

In Figures 8, 9 and 10 the operating principle of a knee joint according to the invention is  
15 shown diagrammatically, a rotatable coupling element being fitted in the hinge within a guide.

Figures 11, 12 and 13 show, diagrammatically, the principle of a corresponding knee joint,  
where the locking element is now provided with a pawl that can be accommodated in a  
20 guide slot.

Figures 14, 15 and 16 show, diagrammatically, a knee joint with a pivotable locking  
element, the centre of gravity of which is located above the pivot pin.

25 Figures 17 and 18 show, diagrammatically, a further development of the joint according to  
Figures 14, 15 and 16.

Figures 19, 20 and 21 show a joint as in Figures 14, 15 and 16, where use is made of a  
lever, for enhancing the power, between the pivotable locking element and a blocking  
30 projection.

Figures 22, 23 and 24 and Figures 25, 26 and 27 show knee joints in which the position of  
the blocking mechanism is assisted by means of spring tension.

Figures 28, 29 and 30 show an embodiment of a knee joint in two mutually perpendicular views and in a cross-section along the line XXX-XXX in Figure 28.

5 Figs 31 - 33 show a further variant.

Figure 1 shows the hinge 1 that is incorporated in an orthopaedic knee joint. The orthopaedic knee joint is attached to one leg 2 of a user. The orthopaedic knee joint 1 comprises a first part 11 and a second part 12 that are connected to one another such that they can turn. The first part 11 is provided with a bracket 13 on which a fixing element 14 is mounted. Said fixing element 14 is used to attach the orthopaedic knee joint to a user's thigh. In the same way, the second part 12 of the hinge 1 is provided with a bracket 15 on which a second fixing element 16 is fixed for attaching the orthopaedic knee joint to the user's lower leg. In addition, a support 17, for supporting the user's foot, is fitted at the end of the bracket 15. The hinge 1 can be locked with the aid of a locking element. This is further explained with reference to Figures 2 and 3. During the walking movement of a user, this locking element can be moved from a first position for releasing the hinge 1 into a second position for locking the hinge 1. When the hinge 1 is locked, the first part 11 is fixed with respect to the second part 12. That is to say, a user can safely place weight on the leg 2 in the knowledge that the knee is locked. At the point in time when the user has moved his/her body so far that the leg 2 extends somewhat towards the rear with respect to the body, that is to say the end of the stage in which stress is placed on the leg 2, the locking element (see Figures 2 and 3) will move into the first position thereof in order to release the hinge 1. That is to say from the point in time when the swinging phase of the leg starts, the second part 12 is able to pivot with respect to the first part 11. This is shown in broken lines in Figure 1. By making use of the hinge 1 according to the present invention, a user who him- or herself is unable to stabilise his/her knee is able to walk normally as if he/she had a normal leg.

30 Situations are conceivable in which the user him- or herself wants to be able to influence whether or not the hinge 1 is locked. The hinge 1 according to the present invention is therefore provided with an element 20 (Fig. 1) that can be operated by hand. With the aid of this element 20, the locking element in the hinge 1 can be deliberately moved into the

first position in order to release the hinge or into the second position in order to lock the hinge. In this context consideration can be given, for example, to a point in time when a user wants to sit down. In this case the user will want to unlock the hinge him- or herself. If a user wants to place weight on the leg, for example as he or she takes a step backwards,  
5 the user can deliberately lock the knee with the aid of the control element 20. The element 20 is, for example, connected to the first part 11 of the hinge 1 with the aid of a cable 21.

The hinge 1 according to the present invention is again shown in Figure 2. In Figure 2 the hinge 1 is shown in a somewhat exposed view so that the interior of the hinge 1 can be  
10 seen. A locking element 30 fitted such that it can pivot. This locking element 30 is fixed to a pivot pin 31 so that it can turn. The locking element 30 is fixed to the pivot pin 31 with the aid of a flexible element, such as, for example, a rubber ring. The turning movement of the locking element 30 is limited by means of a stop 32. This stop 32 is mounted on a disc  
15 33. This disc 33 has the same point of rotation as the locking element 30. The extreme positions of the turning movements of the locking element 30 are determined by the presence of the stop 32. Because the stop 32 is itself fixed to a disc 33, the position of the stop 32 relative to the hinge 1 can be moved. The locking element 30 can be brought into the first or into the second position thereof by rotating the disc 33. According to Figure 2, the locking element 30 is in the second position. The locking element 30 is then in the path  
20 of a projection 34 on the second part 12. This path is shown with the aid of a dotted line 35. When the hinge 1 is swayed in its entirety, the locking element 30 will be able to pivot in the anticlockwise direction under the influence of gravity. As a result the locking element 30 comes into the first position thereof in order to release a hinge. This situation is shown in Figure 3. The hinge 1 according to the invention is again shown in Figure 3. According  
25 to Figure 3, the second part 12 has pivoted relative to the first part 11. This is possible because the locking element 30 has now moved out of the path 35 of the projection 34.

A perspective view of a possible embodiment of the first part 11 according to the present invention is shown in Figures 4 and 5. A possible embodiment of the second part 12 of the  
30 hinge according to the invention is shown in Figures 6 and 7. As can be seen if Figures 4 - 7 are taken together, the second part 12 extends at least partially through the body of the first part 11. With this arrangement the projection 34 on the second part 12 extends into the opening 37 that has been made in the body of the first part 11.

The principle of a knee joint is shown diagrammatically in Figs 8, 9 and 10, which joint comprises a upper part 101 that can be attached to a user's thigh via an extension piece, which is not shown, or via a pin. The upper part 101 is connected via hinge 102 to a lower part 103 that can be connected via an extension piece, which is not shown, to a user's lower leg or lower leg prosthesis. As has already been stated above, in order to obtain a walking movement that is as natural as possible the upper part must be locked with respect to the lower part during that part of the walking movement in which the leg is pointing forwards; see Fig. 8. This locking must be maintained until approximately the mid-position, see Fig. 9, and thereafter the two parts must be unlocked during the backward swing, so that the lower leg is able to swing backwards, see Fig. 10. In this embodiment this is achieved by a blocking mechanism which comprises a cylinder or ball 200 that is able to execute a rolling or sliding back-and-forth movement between two stable positions in guide 201. In the position in Figure 8, a torque  $F_s$ - $F_s$  is acting in the joint, the one force of which passes through the hinge 102 and the other force of which passes through the cylinder/ball 200 and projection 107, as a result of which the two parts are locked with respect to one another. When the leg is swung backwards, just beyond the mid-position, in Figure 9, gravity forces the cylinder/ball into its other stable position, as a result of which the upper and lower parts are unlocked so that, as shown in Figure 10, the lower leg part is able to pivot relative to the thigh part. The leg can now be bent. In this way a knee joint is obtained that makes a virtually natural walking movement possible.

A variant of this embodiment is shown in Figures 31 – 33, with a blocking mechanism which comprises a pawl 104 that can be pivoted about a pin 105 and on one side of pin 105 is coupled to a weight 106. On the other side pawl 104 is provided with a projection 107 that is able to engage in a recess in the upper part. In the position in Fig. 31, a torque  $F_s$ - $F_s$  acts on the leg, the one force of which passes through hinge 102 and the other force of which passes through projection 107. Gravity  $F_g$  acts on the weight 106 along a line that is located a distance  $x$  to the right of the pin 105 of the pawl 104, so that a torque acting to the right is exerted on this pawl, which torque forces the projection 107 into the recess and thus locks upper and lower part with respect to one another. When the leg is swung backwards, the distance  $x$  becomes zero in the mid-position, Fig. 32, and, when the leg is swung further backwards,  $x$  is to the left of the pin 105, as a result of which a torque acting to the

left is then exerted on pawl 104, as a result of which the pawl pivots to the left and the projection 107 disengages from the recess and upper and lower part are unlocked.

One problem that can arise with this embodiment is that the pawl 104, with pendulum  
5 weight 106 attached thereto, starts to oscillate freely at its natural frequency. The question then is whether the pawl will return to the correct position at the correct point in time. In order to overcome this problem, in the embodiment according to Figs 11, 12 and 13 the pawl 4, which is now pivotably attached to the upper part, is provided with a projection 107 that in one position, Fig. 11, bears on a surface of the lower part to produce locking and in  
10 the unlocked position is accommodated in a slot 108 in the lower part and is guided in said slot. In this way the movement of the pawl 104 is controlled in both positions.

Another embodiment of the joint is shown in Figs 14, 15 and 16, a bi-stable element 114, which has a centre of gravity 116 located above the pivot pin 115 thereof, now being used  
15 as locking element. When the leg is in the position according to Fig. 14, where the leg is pointing forwards, the centre of gravity 116 is to the left of the pin 115, so that the element has flipped over to the left and is in contact with a first stop 118 and in that position locks upper and lower part to one another. When the leg is in the position according to Fig. 15, the centre of gravity 116 is virtually above the pin 115, but still to the left thereof, so that  
20 the joint is still locked. As the leg continues to swing, the centre of gravity 116 will move to the right of the pivot pin 115 and as a consequence the element 114 will flip over into its second position in Fig. 16, the element then bearing on a second stop 119 and the two parts of the joint being unlocked. Free oscillation of the element 114 will not be possible with  
this embodiment.

25

A further embodiment of the principle described above is also shown in Figs 17 and 18, identical components being indicated by the same reference numerals in these figures. The construction and mode of operation of this embodiment will be clear following the above. It is also pointed out that the tilting moment of element 114 can be influenced by, for  
30 example, making a hole 116 in one side of the element.

Figs 19, 20 and 21 show, diagrammatically, an embodiment of the joint in which the locking element 114 again has a centre of gravity 116 that is located above the pivot pin

and thus will assume two positions depending on the position of the leg. In this case the element 114 cooperates with a lever 124, so that the power of element 114 is enhanced and the projection 125 at the end of the lever 124 will be forcefully pushed into the recess in the other joint part. The mode of operation of this embodiment should be clear from the  
5 operating positions A, B and C.

Figs 22, 23 and 24 show the same embodiment of the joint as in Figs 17, 18, except that the locking element 114 is now coupled via an extension spring 130 to a point 131 on the lower part 103 and specifically is coupled in such a way that in the situation in Fig. 22 the  
10 locking element 114 is in contact with stop 118, the two joint parts are locked and the extension spring 130 is not under strain. With this arrangement, the element 114 is trapped between the two joint parts and shocks will have no influence on its position. In the situation in Fig. 24, the two joint parts are unlocked and the extension spring 130 is stretched by bending of the lower leg, so that the element 114 is pulled towards the curved  
15 surface of the lower part. Any shocks to the leg will now not result in the element 114 switching to a different position.

Figs 25, 26, 27 also show an embodiment which has extension springs 130 and 132 in order to ensure that shocks to the leg do not result in any undesired change in position of  
20 the element 114. One difference compared with the embodiment according to the preceding figure is that the element 114 now interacts with a lever 124 that is connected to a pawl 133 which provides the final locking.

Figs 28, 29, 30 show an embodiment in two mutually perpendicular views and a cross-  
25 section along the line XXX-XXX. In this embodiment the two joint parts 101 and 103 are again connected by hinge 102. A locking element 114 is once again mounted in a bearing, using a ball bearing 135, on the upper part 101 such that it can pivot. The location of the centre of gravity above the pivot pin 115 again ensures that the element 114 is again able to assume two positions, in which it is then in contact with the stop 118 depending on the  
30 position of the leg. With this arrangement, in the one position the joint is again locked whilst in the other position the joint is unlocked. In order to ensure that the element in the unlocked situation will not execute any undesired movement under the influence of shocks, with this embodiment as well a spring 136 is fitted that at one end is pulled by an auxiliary

spring 137 into contact with a projection 138 on the lower part 103 and at the other end engages by a part 139 into a recess 140 in the locking element 114. In this way the effect of shocks on the position of the locking element is effectively and simply eliminated.

- 5 In order to prevent the pin 115 from being damaged when the joint is in the locked position, as a result of the forces exerted thereon by the lower part, the ball bearing 135 is accommodated via an elastic layer, which is not shown, preferably in the form of an O-ring, in the bore in the upper part. If forces are now exerted by the lower part 103 on the element 14, the bearing 115 will, as a consequence of the elastic layer, move to some extent in its
- 10 bore until the other side of the element is in contact with the surface of the upper part and the forces are absorbed by this.

Claims

1. Hinge provided with a first part and a second part, which parts are able to turn relative to one another from a first position of the hinge into a second position of the hinge, the hinge  
5 being provided with a locking element for locking the hinge in the first position thereof, which locking element can move between a first position for releasing the hinge and a second position for locking the hinge, characterised in that a locking element is fitted in a movable manner for moving under the influence of gravity between the first position and the second position when the hinge sways.
- 10
2. Hinge according to Claim 1, characterised in that when the hinge is in the first position the second part is essentially in the extension of the first part, the second part being at an angle with respect to the first part when the hinge is in the second position.
- 15
3. Hinge according to Claim 1 or 2, characterised in that the locking element is fixed in the hinge in such a way that it is able to turn, the locking element being able to pivot about the axis of rotation thereof under the influence of gravity.
4. Hinge according to Claim 3, characterised in that the centre of gravity of the locking  
20 element is some distance away from the axis of rotation of the locking element.
5. Hinge according to Claim 3 or 4, characterised in that the centre of gravity of the locking element is located above the axis of rotation of the locking element when the hinge is in the use position.
- 25
6. Hinge according to one of the preceding claims, characterised in that the second part is provided with a projection, which projection describes a path when the second part pivots relative to the first part, the locking element allowing the projection a free movement path when it is in the first position thereof and being present in the movement path of the  
30 projection when it is in the second position thereof.
7. Hinge according to one of the preceding claims, characterised in that the hinge is provided with a first and a second stop in order to limit the movement of the locking

element in, respectively, the first and the second position thereof.

8. Hinge according to one of the preceding claims, characterised in that the hinge is provided with a displacement mechanism for forcing the locking element into, respectively,  
5 the first or the second position thereof.

9. Hinge according to Claim 8, characterised in that the displacement mechanism comprises a control element that can be operated by hand.

- 10 10. Hinge according to Claim 7, 8 or 9, characterised in that the first and the second stop are arranged on a disc, it being possible to rotate the disc with the aid of the displacement mechanism in order to force the locking element into, respectively, the first or the second position thereof.

- 15 11. Hinge according to one of the preceding claims, characterised in that the locking element is constructed as a body for transmitting forces from the second part via the locking element to the first part.

- 20 12. Hinge according to Claim 11, characterised in that the locking element is connected to the pivot pin thereof via a flexible element, such as a rubber ring.

13. Hinge according to one of the preceding claims, characterised in that the locking element is provided with an adjusting body for adjusting the centre of gravity of the locking element with respect to the axis of rotation thereof.

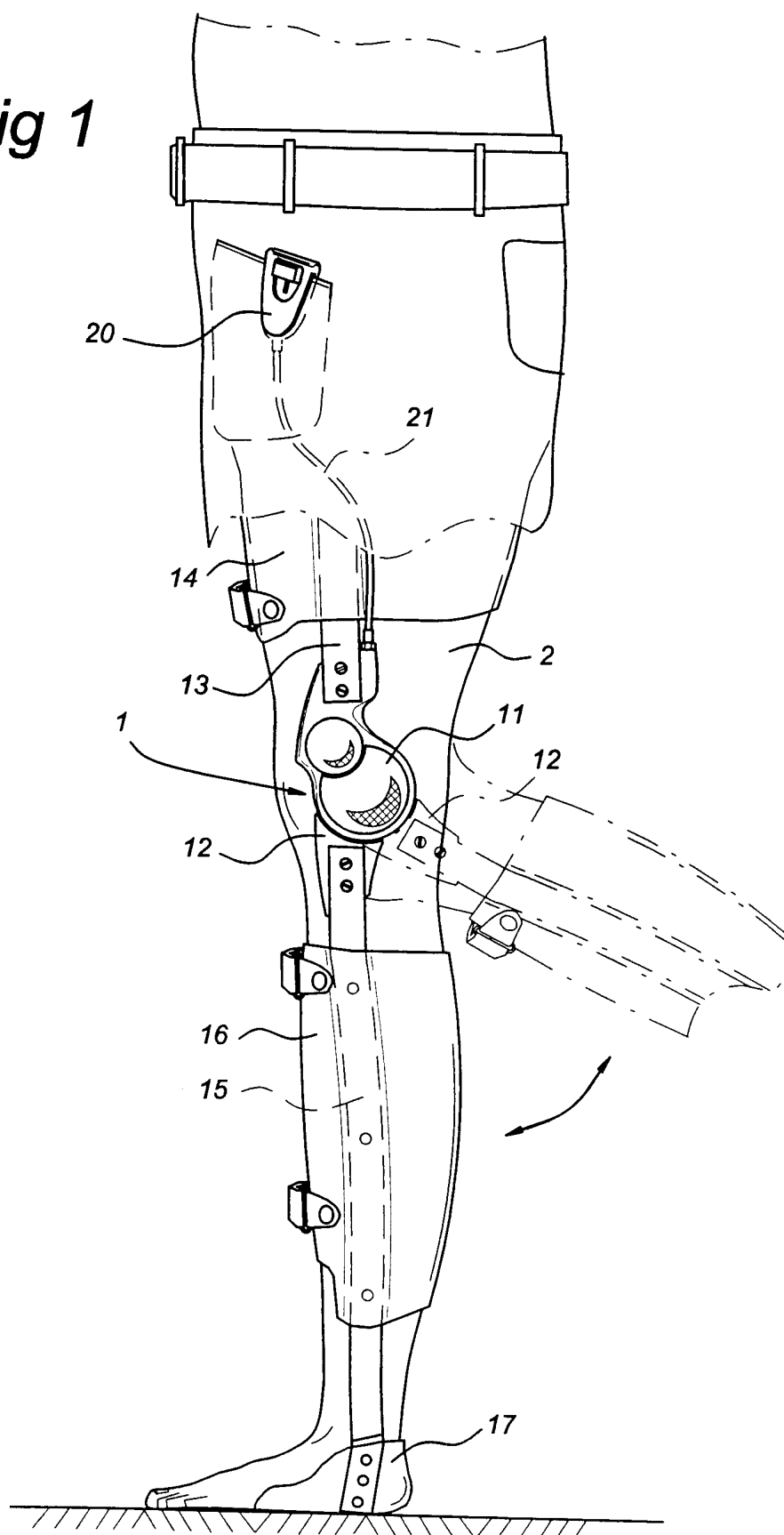
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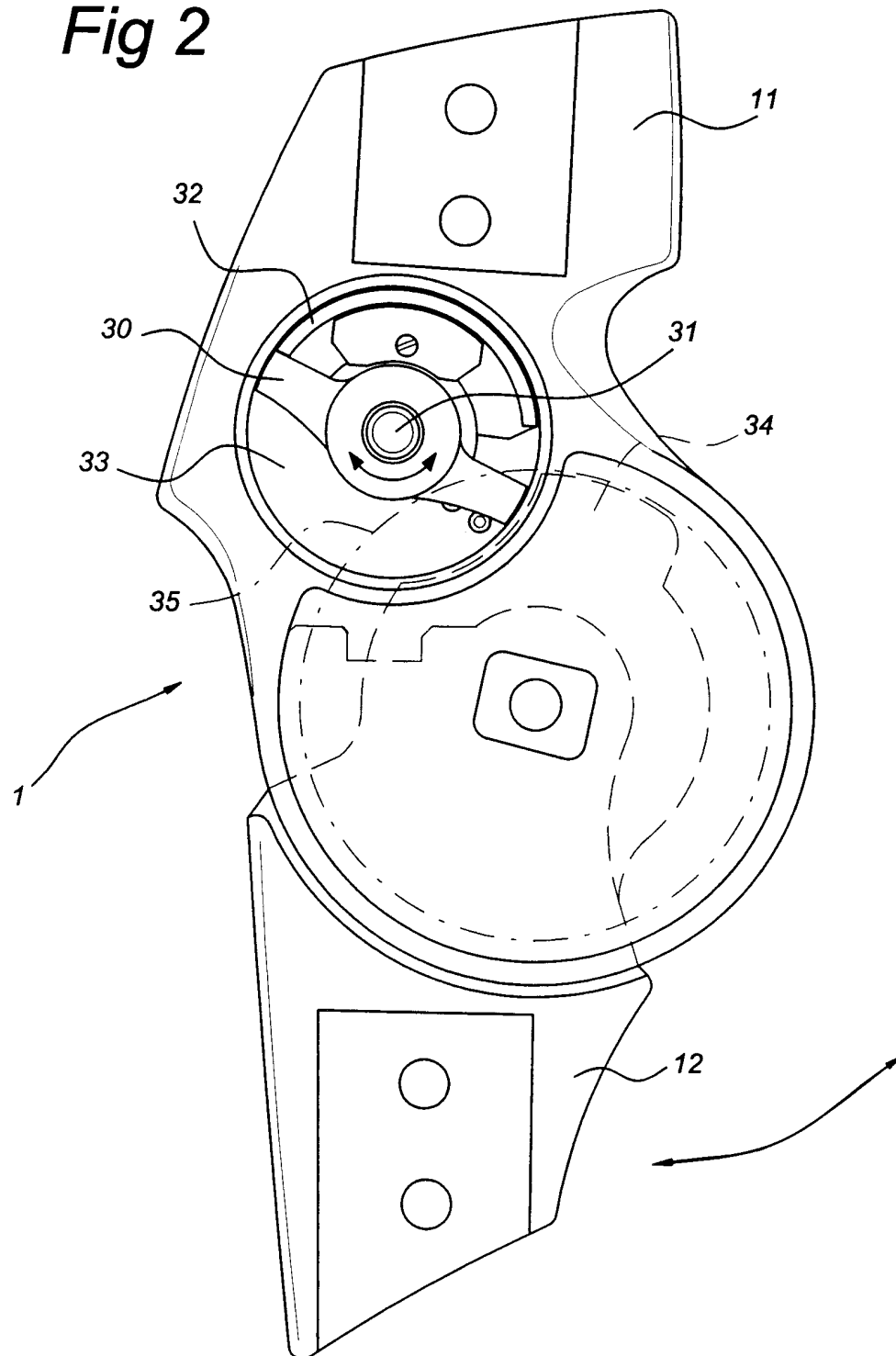
14. Hinge according to Claim 1 or 2, characterised in that the locking element is fixed in the hinge in such a way that it is able to slide, the locking element being able to move about the axis of rotation thereof under the influence of gravity.

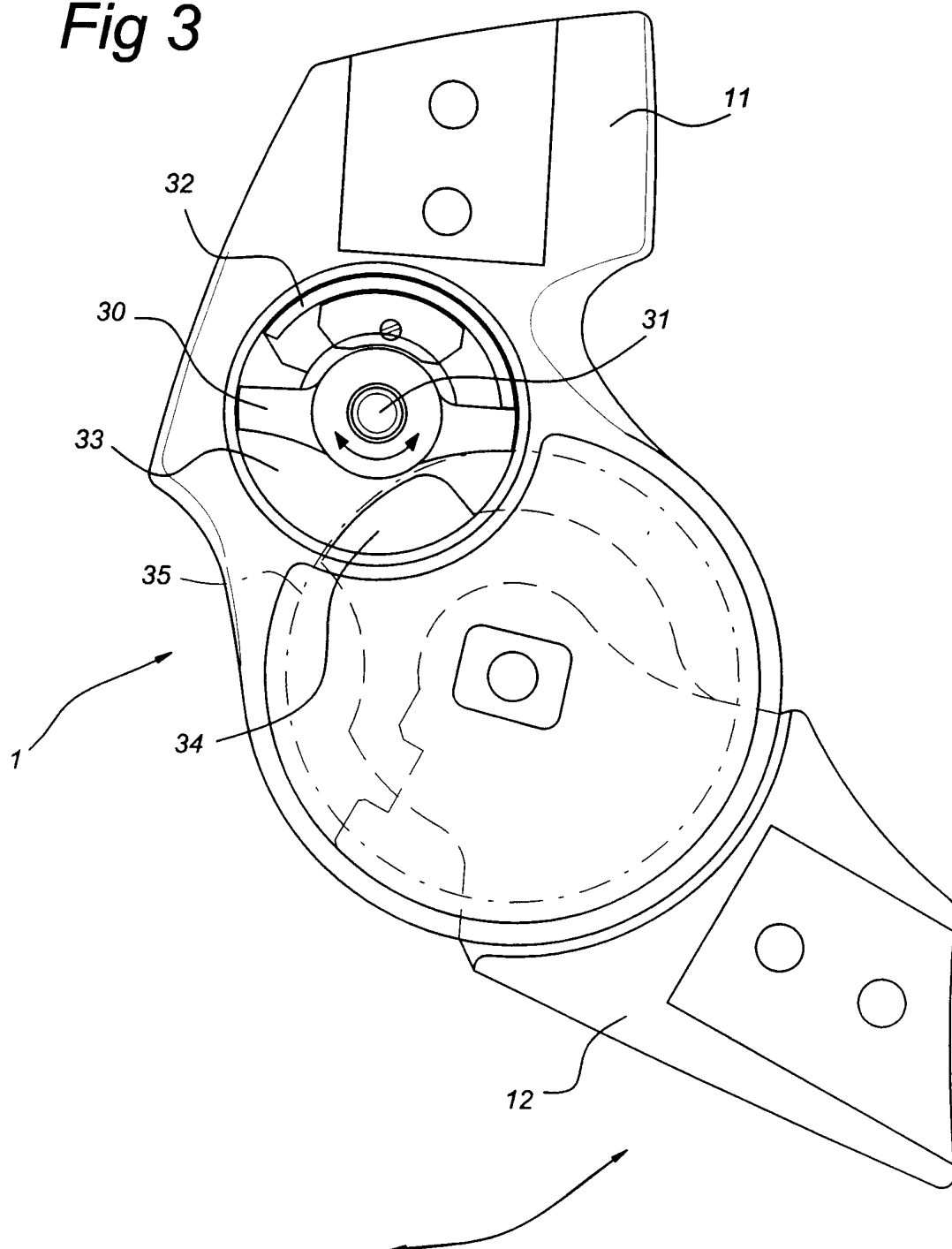
- 30 15. Hinge according to Claim 14, characterised in that the first and the second stop are arranged on a disc, it being possible to move the disc with the aid of the displacement mechanism in order to force the locking element into, respectively, the first or the second position thereof.

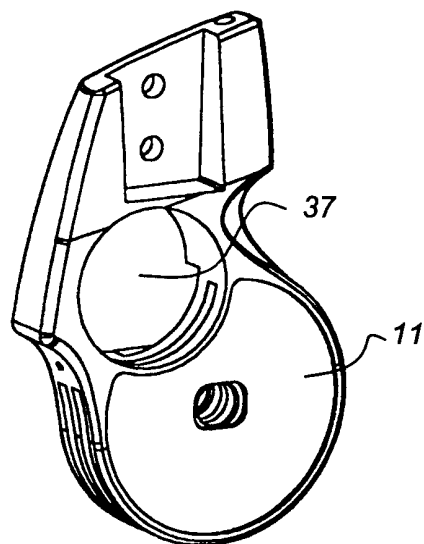
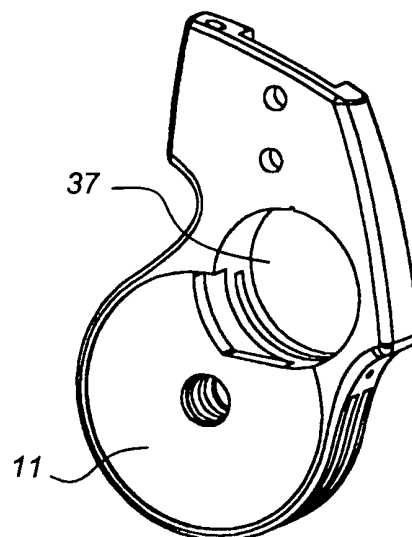
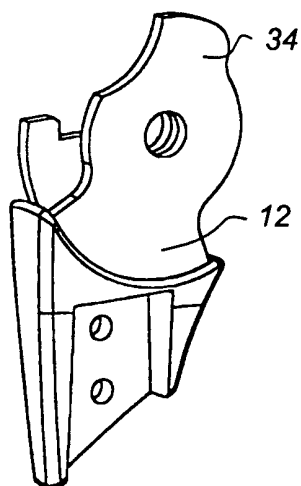
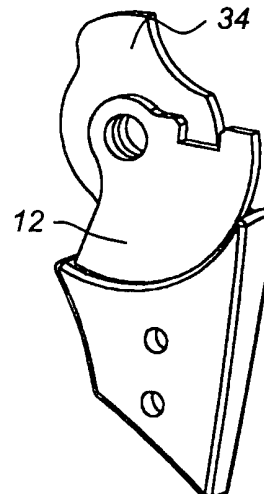
16. Prosthesis or orthosis provided with a first part that is provided with means for attaching the first part to a first part of the body or replacement body part and a second part that is provided with means for attaching the second part to a second part of the body or replacement body part, characterised in that the orthosis is provided with a hinge according to one of the preceding claims.
- 5
17. Orthopaedic orthosis or prosthesis, characterised in that the orthopaedic knee joint is provided with a hinge according to one of Claims 1-15.

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**Fig 1**

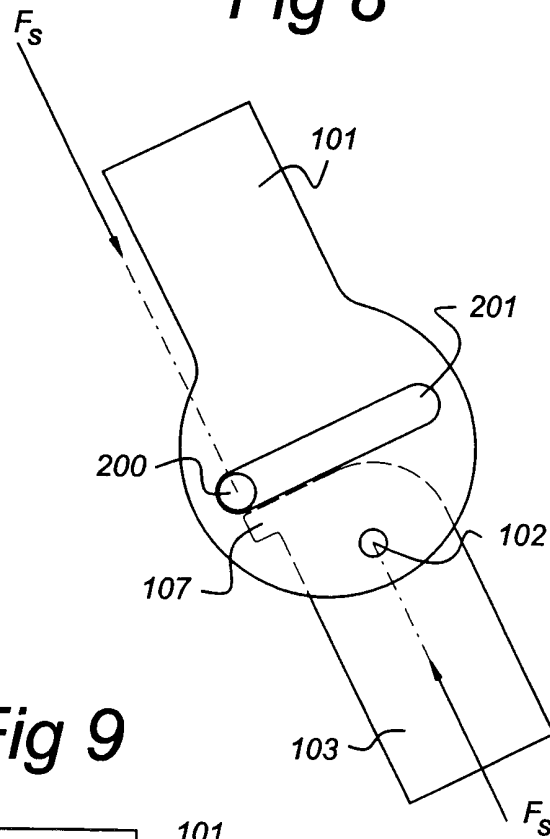
**Fig 2**

**Fig 3**

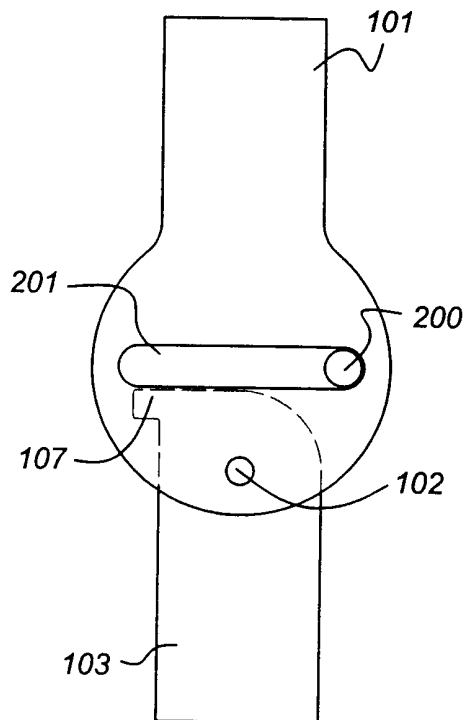
*Fig 4**Fig 5**Fig 6**Fig 7*

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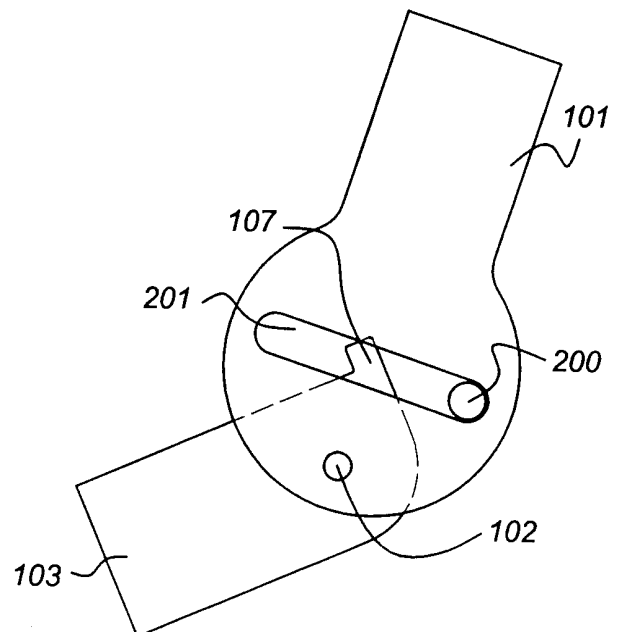
**Fig 8**



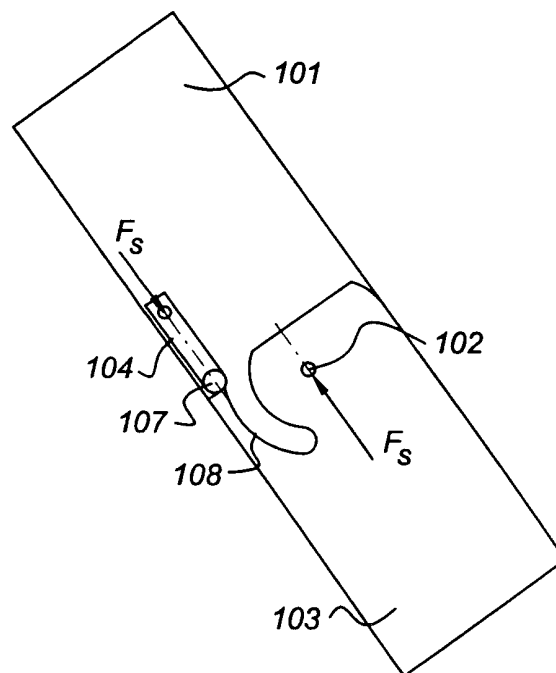
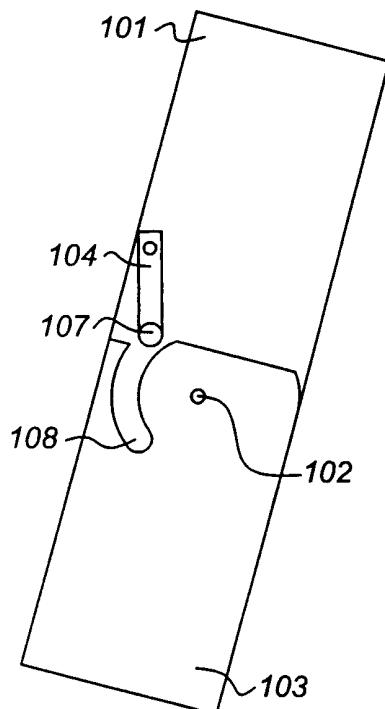
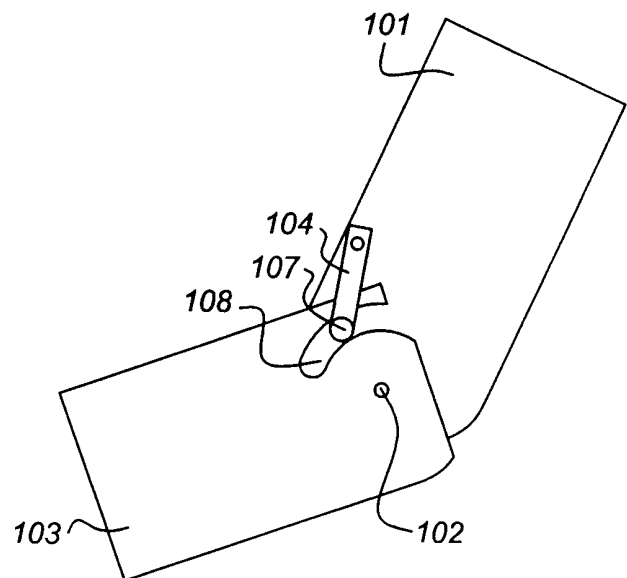
**Fig 9**



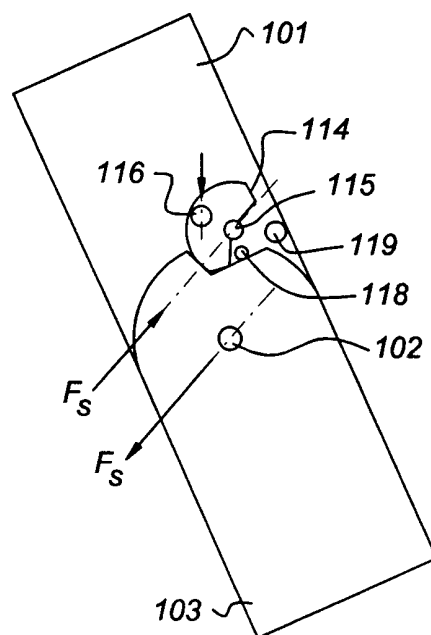
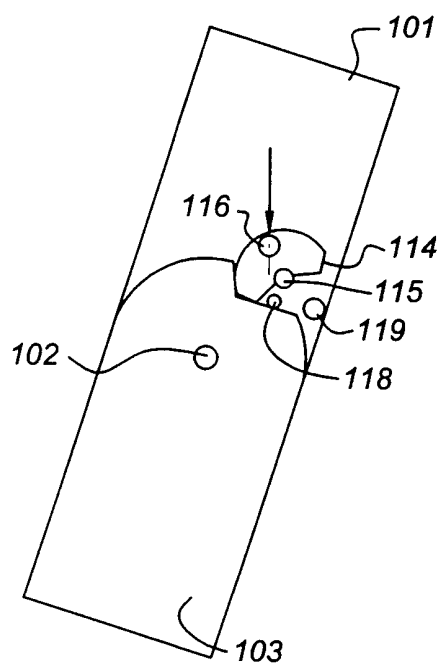
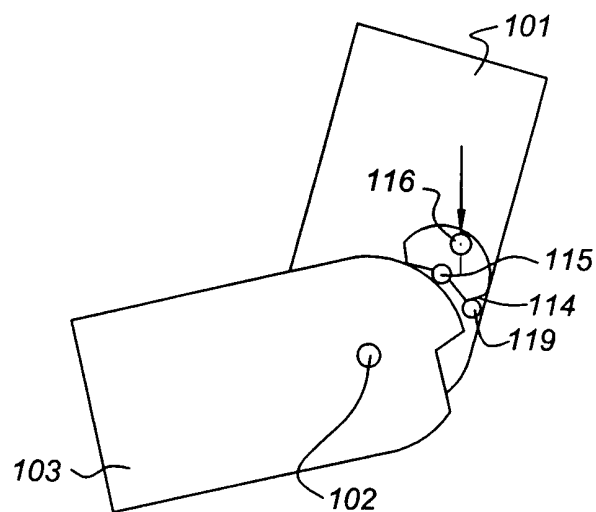
**Fig 10**



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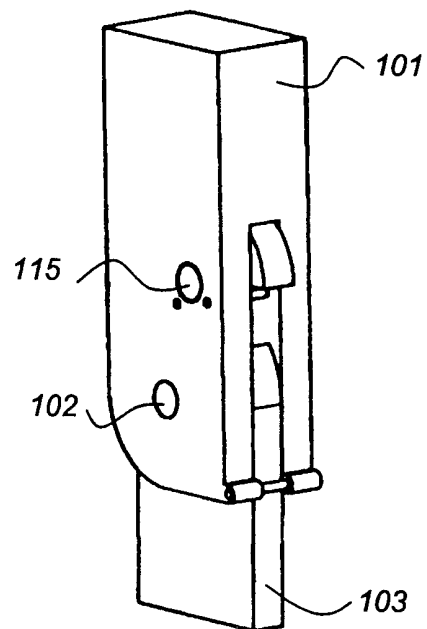
**Fig 11****Fig 12****Fig 13**

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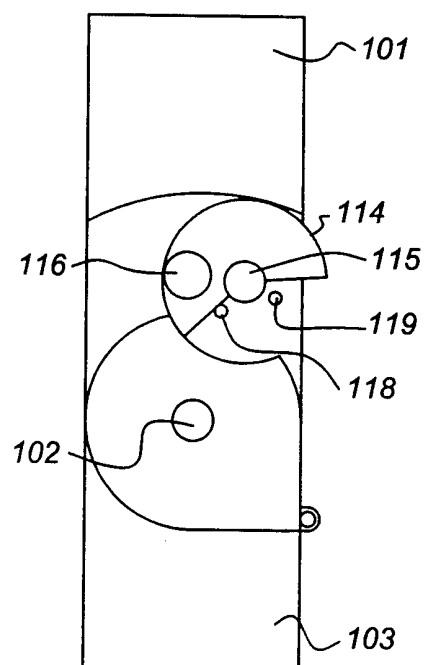
**Fig 14****Fig 15****Fig 16**

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*Fig 17*

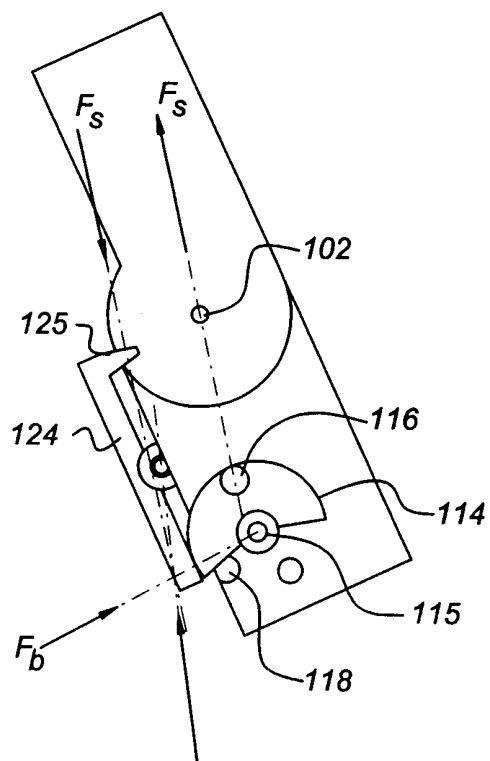


*Fig 18*

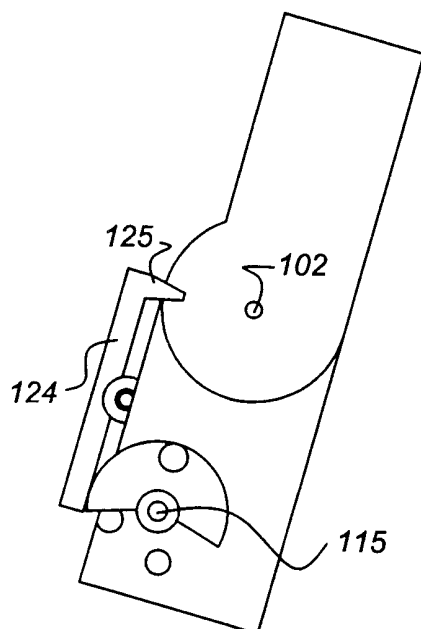


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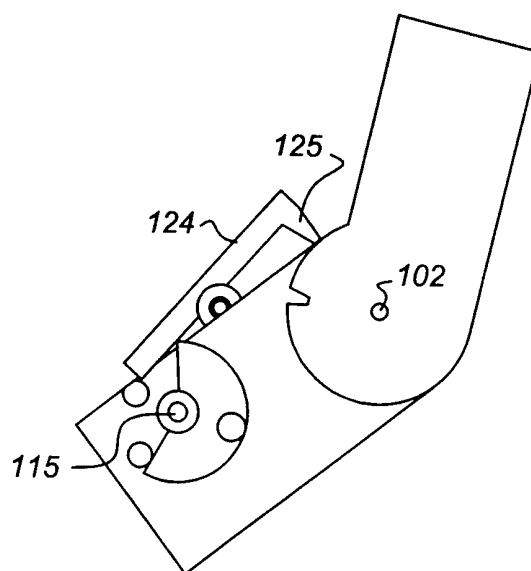
**Fig 19**



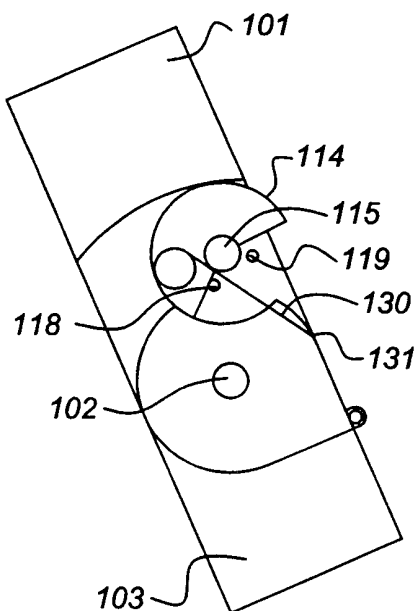
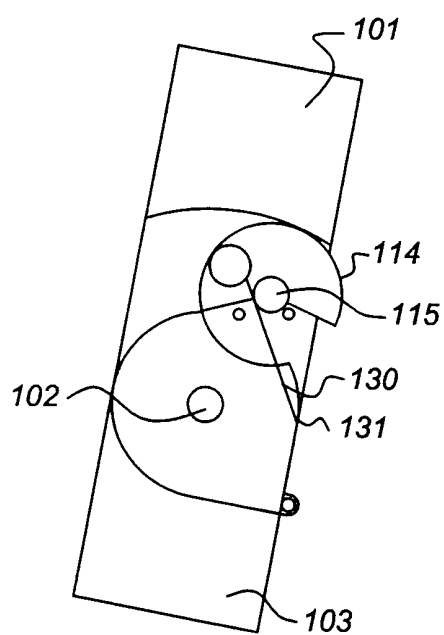
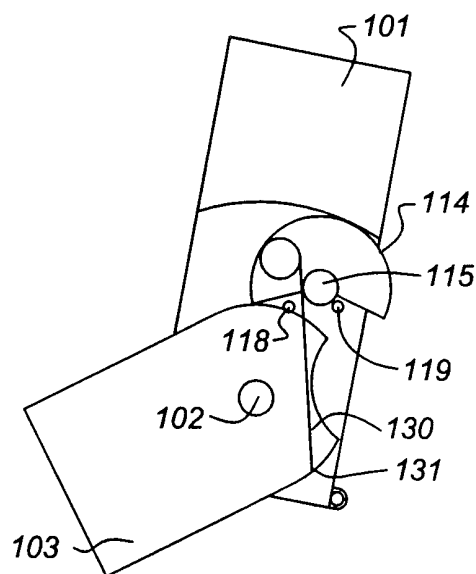
**Fig 20**



**Fig 21**

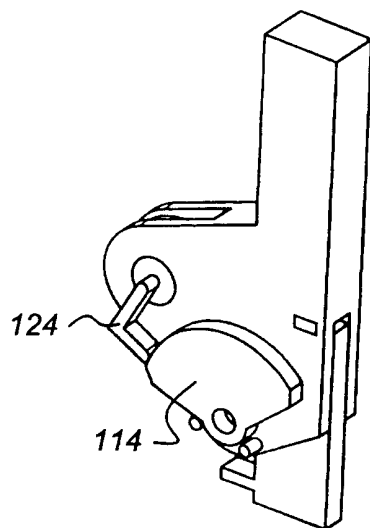


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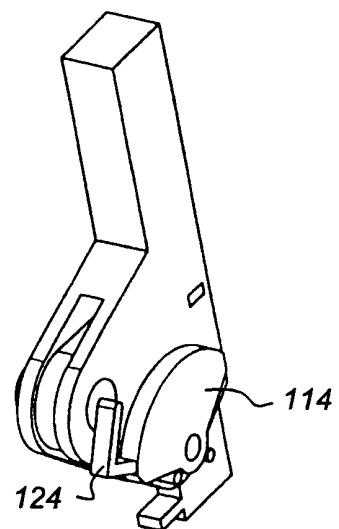
**Fig 22****Fig 23****Fig 24**

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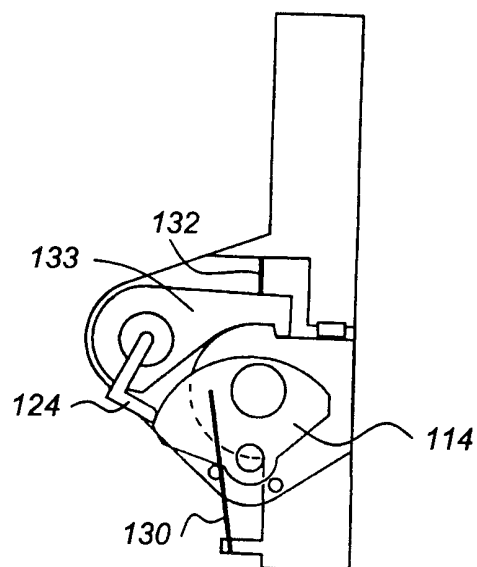
*Fig 25*



*Fig 26*



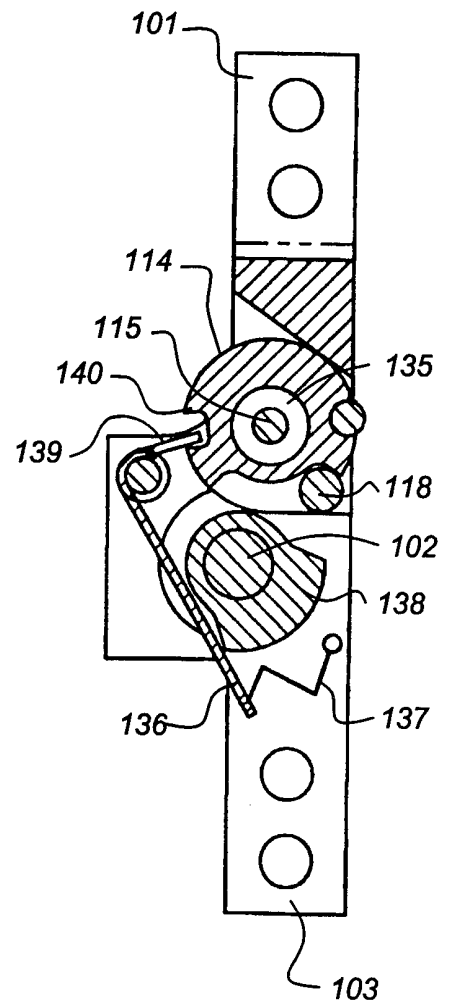
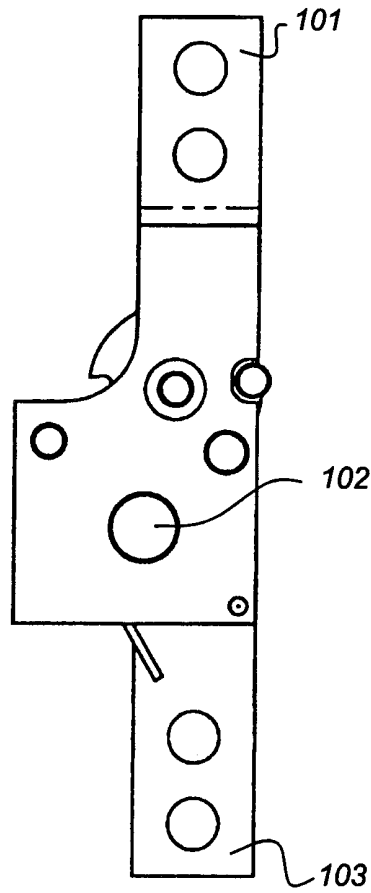
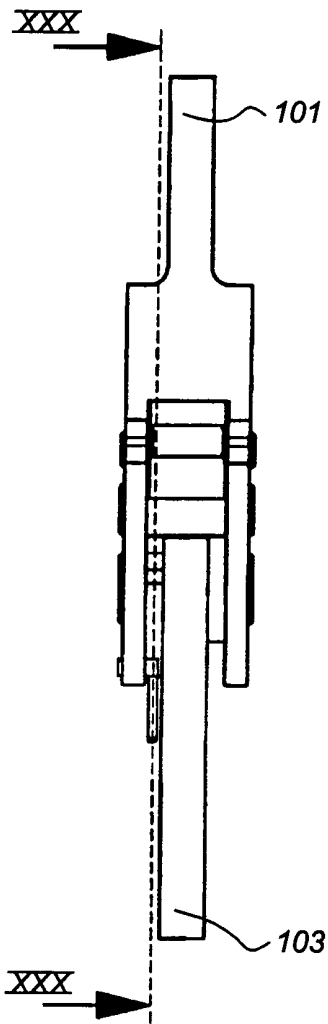
*Fig 27*



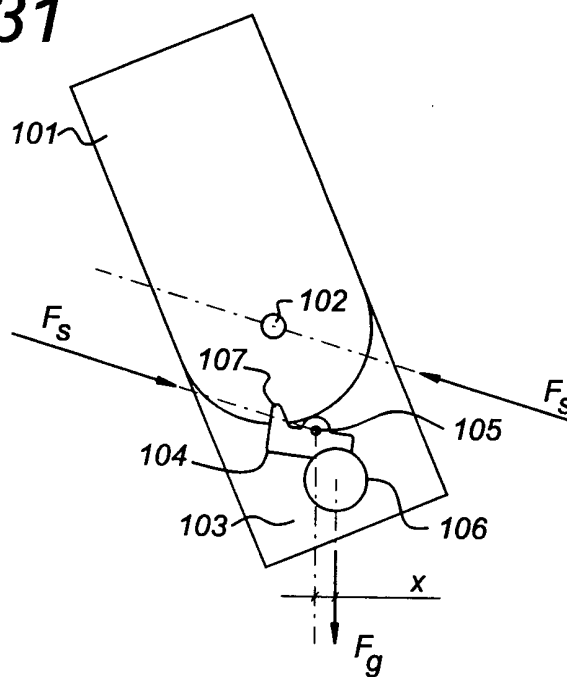
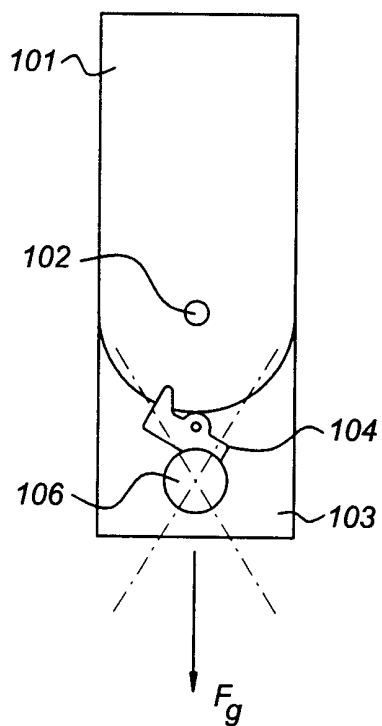
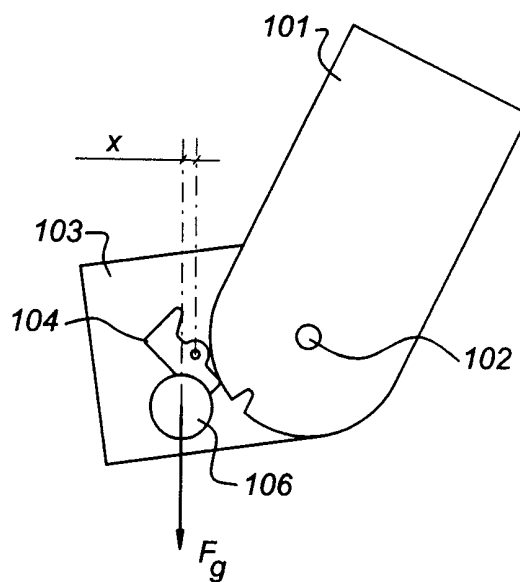
*Fig 28*

*Fig 29*

*Fig 30*



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**Fig 31****Fig 32****Fig 33**

## INTERNATIONAL SEARCH REPORT

Internat Application No

PCT/NL 01/00236

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61F5/01

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61F E05F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 425 700 A (AASERUDE GORDON V ET AL) 20 June 1995 (1995-06-20)	1-9, 11, 14, 16, 17
Y	the whole document	10, 15
X	DE 197 47 020 A (BLANKE JUERGEN ; SCHREIER SUSANNE (DE)) 29 April 1999 (1999-04-29) column 5, line 5 - line 57; figures 6, 10-14	1
X	US 5 369 843 A (YU JOHNSON C T) 6 December 1994 (1994-12-06) abstract; figures	1
X	US 5 315 722 A (DJIE ERIC J) 31 May 1994 (1994-05-31) abstract; figure 4	1
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Date of the actual completion of the international search

11 June 2001

Date of mailing of the international search report

19/06/2001

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European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

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International Application No

PCT/NL 01/00236

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 826 251 A (ROSS C) 30 July 1974 (1974-07-30) cited in the application abstract; figures ---	10,15
A	US 5 399 154 A (KIPNIS ALEXANDER ET AL) 21 March 1995 (1995-03-21) abstract ---	12,13
A	EP 0 872 224 A (NORD ORTHOPEDIE S A) 21 October 1998 (1998-10-21) cited in the application -----	

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I. Information on patent family members

International Application No

PCT/NL 01/00236

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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