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NOTICE OF ENTITLEMENT

We, TAMAGNI AG a Swiss firm

of Seefeldstrasse 25, CH-8008 Zürich, Switzerland

being the Applicant in respect of Application No: 63573/90, state the following:

The Inventor devised the invention in the course of normal employment with the nominated person and the nominated is entitled under the provisions of Sub-section 15(1)(c) of the Patents Act 1990 to the granted patent.

The Application is associated with a PCT Application the details of which are PCT Application No: PCT/CH90/00229 dated 27th September 1990 which is in turn based on Swiss Patent Application No: 3544/89-2 dated 30th September 1989 and the basic application was the first application made in a Convention country in respect of the invention the subject of the application.

Dated this 26th day of June 1991

TAMAGNI AG
By their Patent Attorneys
COLLISON & CO.


ALUN THOMAS

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KNEE-ORTHESIS APPLIANCE

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(57) Claim

1. A process for manufacturing a knee orthosis appliance for stabilising the ligamentous apparatus in the knee with two four bar chains, characterised in that a positive plaster cast is made of the leg, two basic shaping plates are used in the lateral and medial areas of the knee joint for which the four bar chains have been provided, a carbon-fibre composite layer is applied to the plaster cast and over the basic shaping plate and lower joint plates and upper joint plates of the four bar chains are positioned on the basic shaping plates, the carbon-fibre composite layer is then cast with a laminate and hardened, whereafter the contours of the knee joint are cut out of the knee orthosis appliance and the plaster cast is removed, whereby at least one basic shaping plate is removed.

12. A knee orthosis appliance for stabilising the ligamentous apparatus in the knee manufactured by the method of any one of Claims 1 to 11, having a lateral and a medial four bar chain located between an upper and a lower plastic skin, characterised in that the plastic skins are of a carbon-fibre composite layer construction, in which, on each of the lateral and medial positions corresponding to the lateral area of the knee joint against which the four bar chains (21) rest, a lower joint plate (5) and an upper joint plate (6) of the four bar chains (21) have been embedded in position in the carbon-fibre composite layer.

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(21) Internationales Aktenzeichen: PCT/CH90/00229 (22) Internationales Anmeldedatum: 27. September 1990 (27.09.90) (30) Prioritätsdaten: 3544/89-2 30. September 1989 (30.09.89) CH (71) Anmelder (für alle Bestimmungsstaaten ausser US): TAMAGNI AG [CH/CH]; Seefeldstr. 25, CH-8008 Zürich (CH). (72) Erfinder; und (75) Erfinder/Anmelder (nur für US) : TAMAGNI, Rudenz [CH/LI]; Schwefelstrasse 25, FL-9490 Vaduz (LI). (74) Anwalt: ABATRON-PATENTBÜRO; Altstetterstrasse 224, CH-8048 Zürich (CH).		(81) Bestimmungsstaaten: AU, CA, US. Veröffentlicht <i>Mit internationalem Recherchenbericht.</i> <i>Vor Ablauf der für Änderungen der Ansprüche zugelassenen Frist. Veröffentlichung wird wiederholt falls Änderungen eintreffen.</i>

631931

(54) Title: KNEE-ORTHESIS APPLIANCE

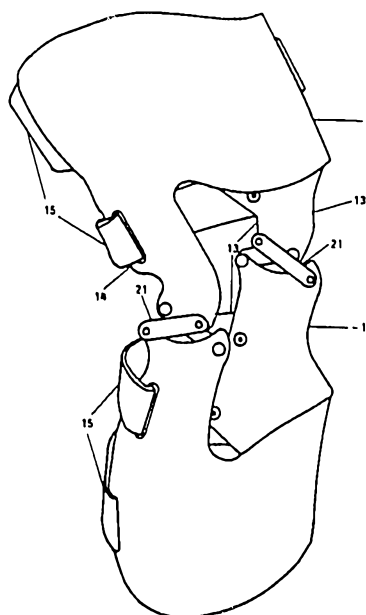
(54) Bezeichnung: KNIEORTHESE

(57) Abstract

The knee-orthesis appliance (7) of the invention is made of carbon-fibre composite material with an integral Menshik linkover four-bar chain (21) made of titanium. It provides the knee joint with secure, reliable support. Owing to its low weight, it is extremely comfortable to wear. The angle of bend (22) can be adjusted to suit the individual as prescribed by the doctor. The shells of the appliance are made from a positive plaster cast (1), using vacuum composite-production techniques. This simple process enables the appliance to be manufactured to a high standard of quality in orthopaedic workshops. The joint plates (5, 6) are inserted between the individual layers of the composite. Following filling and curing, the sidepieces (16, 17) only have to be riveted to the joint plates to complete the four-bar chains and hence the finished appliance.

(57) Zusammenfassung

Die neue Knieorthese (7) aus Karbonverbundschichtstoff mit integrierten überschlagenen Vieregelenkketten (21), nach Menshik aus Titan, entlastet das Kniegelenk auf sicherste Art und Weise. Dank ihrem geringen Gewicht bietet sie einen ausgezeichneten Tragkomfort. Der Beugewinkel (22) kann je nach Vorschrift des Arztes individuell begrenzt werden. Die Schalen der Knieorthese werden ab einem positiven Gipsabdruck (1) gefertigt. Dabei bedient man sich der Vakuumfertigungstechnik für Verbundschichtstoffe. Dieses einfache Verfahren erlaubt es, die neue Knieorthese in orthopädischen Werkstätten in hoher Qualität zu fertigen. Zwischen den einzelnen Lagen der Verbundschicht werden die Gelenkplatten (5, 6) gelegt. Nach dem Ausgießen und Aushärten müssen lediglich die Schenkel (16, 17) an den Gelenkplatten angenietet werden, um die fertigen Vieregelenkketten und somit gleichzeitig die fertige Knieorthese zu erhalten.



K N E E O R T H E S I S A P P L I A N C E

Problem:

Knee orthosis appliances are used to stabilise the ligamentous apparatus in the knee.

Where knee orthosis appliances were previously prescribed mainly pre-operatively as a measure to prevent further damage to torn or overstretched ligaments and post-operatively after ligament surgery as protection, nowadays sportsmen from the most varied of disciplines use these knee splints more or less at will to protect against knee or ligament injuries.

The simplest version of the knee orthosis device has a monocentric joint; but it cannot correctly imitate the anatomical movement of the knee joint. The movement or the interplay between all elements of the knee involved in anatomical movement (joint surfaces of the femur and the tibia, cruciate ligaments, patella) is much more complex. This means that knee orthosis appliances having monocentric joints cannot move in synchrony with the thigh and the tibia. The result is annoying frictions, which reduce comfort when wearing one. Since monocentric joints are something of a temporary solution, they are not suitable for sportsmen.

The rolling/sliding movement of the knee joints which actually occurs physiologically and the particular position of the cruciate ligaments was studied and described by Menshik. The result is a so-called "linkover four bar chain" which has been named after him (hereinafter simply referred to as a four bar chain), which imitates the rolling/sliding movement very well and therefore effectively relieves the knee. However this is still far from constructing a knee splint which combines a high level of worn comfort and good management of the ligaments, preconditions which are considered to be self-evident in high performance sport today.



State of the Art:

- 5 Today, ready-made splints are available for attaching to four bar chains which can be obtained separately. These knee splints are secured to the knee joint by ready to use bandages. These bandages have pockets into which the ready-made splints are inserted. However, the splints have a not
10 and forwards, which is why the knee is badly managed in conventional splints. The security required by the ligament is therefore not available under heavy or extreme loads.

- 15 To now achieve a more exactly fitting shape, the most modern production techniques are exploited: with CAD/CAM support, knee splits can be milled out of a massive single block of carbon fibre, after measurements of the knee joint and associated parts of the femur and tibia have been taken by a laser scanner and digitised. However, knee splints manufactured in this way do not have a four bar chain and have the positive disadvantage of being very
20 expensive due to the enormous technical expense (integrated CAD/CAM manufacturing station).

Solution to the problem:

- 25 This present invention proposes a process for manufacturing a knee orthosis appliance for stabilising the ligamentous apparatus in the knee with one or with two four bar chains, characterised in that a positive plaster cast is made of the leg, at least one basic shaping plate is used in the lateral and/or medial areas of the knee joint for which the four bar chain or
30 chains have been provided, a carbon-fibre composite layer is applied to the plaster cast and over the basic shaping plate or plates and lower joint plates and upper joint plates of the four bar chain or chains are positioned on the basic shaping plate or plates, the carbon-fibre composite layer is then cast with a laminate and hardened, whereafter the contours of the
35 knee joint are cut out of the knee orthosis appliance and the plaster cast is removed, whereby at least one basic shaping plate is removed.



The new carbon-fibre composition layer construction knee orthosis appliances are an extremely good fit and achieve their objective in an excellent manner thanks to the Menshik four bar chain.

Detailed Example:

The invention will now be discussed with reference to the preferred embodiment as illustrated in the accompanying drawing in which:

- Fig. 1 shows the overall view of the knee orthosis appliance according to one embodiment
- Fig. 2 shows the construction/manufacture of the knee orthosis appliance of Fig. 1
- Fig. 3 shows parts of the four bar chain of Fig. 1
- Fig. 4 shows the four bar chain assembled and the method of operation

Its low weight (approx 360 g) and simple manufacture based on a simple positive plaster cast (1) of the knee, are excellent additional characteristics of the carbon-fibre composite material knee orthosis appliance (7) (Fig 1). Because a simple plaster cast (1) serves as a base, this guarantees that the carbon-fibre composite construction knee orthosis appliance (7) can be manufactured at low prices and to consistently good quality in specially equipped orthopaedic workshops.

In detail, production is as follows: firstly a negative plaster cast is made of the leg which will wear the knee splint. The knee splint will involve three-quarters of the leg. After hardening, the negative plaster cast is cut laterally and removed from the leg. It is then put together again and bound with plaster bandages. This negative mould is then filed with liquid



plaster, which provides a positive plaster cast (1) (Fig. 2) and we therefore achieve an exact imitation of the patient's knee joint. Any possible irregularities can then be smoothed out by subsequent modelling.

Now two basic shaping plates are placed in the positive plaster cast (1) in the lateral and medial area of the knee joint, in which the four bar chains (21) (Fig. 4a) are located. To this end, two holes (3) in which the retaining pins (4) of the basic shaping plates (2) are screwed (Fig 2), are bored in the positive plaster cast. It is now decisive that in a procedure (described later), the crescent-shaped lower joint plate (5) (Fig. 3) and the upper trapezoidal joint plate (6) of the four bar chain can be pre-positioned and completely integrated into the carbon-fibre composite construction knee orthosis appliance (7) (Fig. (1) itself. The four bar chains (21) which finally result are absolutely free of play and exactly positioned, which guarantees a previously unheard-of level of security for the knee joint ligamentous apparatus. It is self-evident that the level of wearer comfort is considerably increased; a highly accurate fit allows the patient to forget the knee orthosis. It should be pointed out here that the basic shaping plates for positioning the joint plates (5,6) have positioning pins (8) (Fig. 2), whose position must match that of the boreholes (9) (Fig 3) in the joint plates. The additional significance of the basic shaping plate will be dealt with later. Additionally, the hollow space necessarily created between the plaster cast (1) and the inserted basic shaping plates (2), is filled with plasticine. A knitted cotton sock (not shown in Fig. 2) must be pulled on over the positive plaster cast before we begin manufacturing the carbon-fibre composite. The knitted cotton sock is removed at the end, and its sole function is to keep residual moisture in the plaster



cast (1) away from the PVA (polyvinyl acetate) foil. A carbon-fibre layer (11) now follows. This is a carbon-fibre mat netting with 200 strands per square centimetre. This mat is placed axially around the plaster cast and glued together at the rear (that is "at the back" of the leg). Now the tubular knitted glass fibre (12) which serves to provide mechanical strength, can be pulled on. The first half of the carbon-fibre composite layer is now ready. The joint plates (5,6) (Fig. 2) can now be fitted to the positioning pins in the basic shaping plate (1) as discussed above. This is very easy to do, because the positioning pins penetrate well through the thin PVA foil (10), the carbon-fibre layer (11) and the knitted glass fibre (12). It is now essential for the joint plates (5,6) be glued onto the knitted glass fibre lying below, in order that they do not subsequently move. Knitted glass fibre has the added advantage over glass fibre matting, that it does not break up into fibres when pulled. This directly increases the quality of the carbon-fibre composite since, viewed mechanically, the load-bearing mat shows no breaks, which would restrict the load-bearing capacity of the carbon-fibre composite layer.

Now the second, outer half of the carbon-fibre composite is layered, by applying a second layer of knitted glass fibre (12) (Fig. 2). In order to stiffen the area of the four bar chain mechanically (to achieve the stability required for joint splint areas), glass fibre matting (not shown in Fig. 2) is wound twice crossways around the area of the joint. This is followed by a further, all-covering layer of knitted glass fibre (12). A further layer of carbon-fibre netting is laid over this, upon which a covering layer of PVA foil is laid. In summary, we then have a "composite sandwich", whose inner layers have been laid between two PVA foils around the plaster cast.



Now, a liquid laminate (resin and hardener) is poured between these foils. The rough poured mould is then connected to a vacuum and the air evacuated. Doing this firstly presses the layered parcel firmly against the plaster cast and secondly, completely removes the air between the layers of material; the layers of material are evenly saturated by the flowing laminate. This process is best known as the vacuum procedure and is excellently suited, according to experience, to special designs on plaster moulds. It is now quite clear why, as discussed above, the hollow space between the basic shaping plates (2) and the positive plaster cast (1) are filled with plasticine. We have to prevent the inner PVA foil being torn by the evacuation of any residual air bubbles which, with the flowing laminate, would lead to the basic shaping plates also being poured in. Curing in the vacuum procedure takes place at room temperature and lasts for approximately one hour. The splint mould is now ready for final working.

Firstly, the contours of the knee joint (13) (Fig. 1) are cut out on the front and rear of the knee orthosis. This frees the parts of the knee which have to move. The knee orthosis can now be cut down to the final length. After this, the plaster cast is no longer required and is subsequently destroyed after the orthosis has been delivered. The (re-usable) basic shaping plates are removed. The cotton stocking and plasticine are likewise removed. The result is that we obtain the knee orthosis as a still rigid semi-finished product. The orthosis is sawn through between both joint plates (5,6), so that the upper and lower halves can be worked on independently. Now, for example, superfluous carbon-fibre composite material can be ground down, principally between the joint plates. Both halves are cut open along their length at the back, in order that the knee orthosis



appliance can be pulled on. Slots (14) are cut for the fastenings (15) and a tibia cushion (not shown) is put in to increase wearer comfort. Finally, the inner sidepiece (16) and the outer sidepiece (17) are riveted, with the integrated joint plates, to the finished four bar chain (21) (Fig. 4) and, at the same time, to the finished knee orthosis appliance (7) (Fig. 1). The fact that the sidepieces (16,17) and the joint plates (5,6) are made of titanium, which is well-known to combine the best tensile strengths with astoundingly low weight, contributes to the low weight of approx. 360 g. Use of carbon-fibre composite material for the knee orthosis appliance also results in the lowest weight with very high strength in relation to the necessary material thickness.

We have to look more closely at the basic shaping plates (2) and the function of the four bar chain (21) (Fig. 4a), to see the additional advantages of the new knee orthosis. As discussed, the joint plates (5,6) are positioned thanks to the basic shaping plate (2) (Fig. 2). The mutual position of the joint plates in manufacturing the knee orthosis depends on how greatly the patient's knee can be straightened. A straightened leg with a corresponding angle of bend of 0° , which is never obtained following surgery, would be ideal. (The angle of bend (22) (Fig. 4d) is the assumed angle between the axis of the upper femur and the assumed lengthening of the lower femur beyond the knee.) Basic shaping plates are therefore made for angles of bend of 20° , 30° , 40° and 45° at least. Basic shaping plates can, of course, be made for any angle desired. This guarantees that the joint plates (5,6) are positioned, at the time the knee splint is produced, at the present angle of bend which suits the patient for whom the plaster cast (1) was made.



Furthermore, the new knee orthosis appliance cannot be overstretched (negative angle of bend). Fig. 4 shows that with the leg fully extended (angle of bend 0'), the straight flank (18) of the crescent-shaped lower joint plate (5) (Fig. 3) serves as a point for the flank (18) to be attached to the upper joint plates (6). In addition, the joint plates of the individual four bar chains which are opposite each other respectively, must be positioned exactly parallel and identically, in order to prevent the knee orthosis appliance from so-called opening up when bending the knee. There will be positioning tolerances despite careful manufacture; these can be very easily evened out by subsequently grinding the stop flanks (18) (Fig. 3). Another decisive advantage of the new knee orthosis appliance is that the angle of bend (22) can be limited in a very easy manner. This is respectively required if the surgeon orders that the patient should only bend the knee in a range between 20' and 60'. The first method of limiting the angle consists of not removing all the residues when subsequently machining the composite material between the joint plates (5,6). This automatically produces limited freedom of movement in the joint plates and therefore a limited angle of bend. Once the patient is allowed to bend the knee more strongly after a certain period, we only have to grind the composite material further down. The second method consists of inserting a stop screw (20) (cylinder head or self-tapping screw) in the holes (19) provided for this in the upper joint plates and allowing its thread to stick out so far as to serve as a stop for the inner sidepiece (14) of the four bar chain. Of course, you must ensure that the screw is prevented from unscrewing and that it cannot injure the skin of the knee. It can now be seen that the straightening movement of the knee is limited if the upper joint plate (6) moves towards the lower



joint plate (5), a movement which is only possible to a certain extent due to the stop screw (20). Figure 4c shows how the upper edge of the inner sidepiece (16) rests on the stop screw (20) when the knee is straightened in direction (23), and limits the extension angle (25), which we again find between the flanks of both joint plates. To make this more clear, Fig. 4b shows the position of the joint plates (5,6) at a angle of bend of 0° (upper joint plate pulled out) and at a selected angle of bend (upper joint plate (6) is the dotted line). The extension angle (25) and the angle of bend (22) can be adapted individually, because we only have to select the position of the holes and determine the side on which the thread should protrude. In doing so, it is self-evident that one of the two four bar chains limits the angle of bend, while the other limits the extension angle.

Patients can be released from hospital care earlier thanks to the new composite layer design knee orthosis appliance. The healing process is markedly accelerated which allows the patient to return to work more quickly. In addition, expensive follow-up treatments can be omitted, thanks to the excellent stability which the knee is given. Joint arthroses will not occur very often, with the likelihood of a subsequent, very expensive artificial knee-joint implant falling to a minimum. This will more than compensate for the costs of such a knee orthosis appliance.

The new knee orthosis appliance can also be worn without difficulty under jeans, due to the low weight and the snug-fitting shape. These advantages are also appreciated by sportsmen in all disciplines. For example, the close fitting knee orthosis appliance fits into a skier's racing suit without difficulty. Ice hockey players, rowers, tennis players, weight lifters and footballers, to name but a few, will certainly use the knee

orthosis appliance as a preventive measure because it effectively protects the knee joint, fits completely and is comfortable to wear due to the low weight. The new knee orthosis appliance will replace all existing products of this nature, because it represents a truly progressive step in orthopaedic engineering due to the systematic use of the most modern materials.



REFERENCE NUMBER INDEX

1. Plaster Cast
2. Basic Shaping Plate
3. Hole
4. Retaining Pin
5. Lower Joint Plate
6. Upper Joint Plate
7. Knee Orthosis Appliance
8. Positioning Pin
9. Borehole
10. PVA foil
11. Carbon Fibre Matting Layer
12. Knitted Glass Fibre
13. Contour of Knee Orthosis Appliance
14. Slots
15. Fastening
16. Inner Sidepiece
17. Outer Sidepiece
18. Stop Flank
19. Borehole for the Stop Screw
20. Stop Screw
21. Four Bar Chain
22. Angle of Bend
23. Direction of Extension
24. Upper Edge of the Inner Sidepiece
25. Extension Angle

5 THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A process for manufacturing a knee orthosis appliance for stabilising the ligamentous apparatus in the knee with two four bar chains, characterised in that a positive plaster cast is made of the leg, two basic
10 shaping plates are used in the lateral and medial areas of the knee joint for which the four bar chains have been provided, a carbon-fibre composite layer is applied to the plaster cast and over the basic shaping plate and lower joint plates and upper joint plates of the four bar chains are
15 positioned on the basic shaping plates, the carbon-fibre composite layer is then cast with a laminate and hardened, whereafter the contours of the knee joint are cut out of the knee orthosis appliance and the plaster cast is removed, whereby at least one basic shaping plate is removed.

2. A process for manufacturing a knee orthosis appliance for stabilising
20 the ligamentous apparatus in the knee with a four bar chain, characterised in that a positive plaster cast is made of the leg, at least one basic shaping plate is used in the lateral area of the knee joint for which the four bar chain has been provided, a carbon-fibre composite layer is applied to the plaster cast and a lower joint plate and an upper joint plate of the four bar
25 chain are positioned in the basic shaping plate, the carbon-fibre composite layer is cast with a laminate and hardened, the contours of the knee joint are cut out of the knee orthosis appliance and the plaster cast is removed, whereby the basic shaping plate is removed, the rigid orthosis appliance is divided between the joint plates such that an upper and a lower half are
30 created and the inner and outer legs are connected to the four bar chain.

3. A process in accordance with one of the Claims 1 or 2, characterised in that the basic shaping plates are fixed in the positive plaster cast with retaining pins.
35

4. A process in accordance with one of the Claims 1 to 3, characterised in that the hollow space between the plaster cast and the basic shaping plate are filled with a plastic material, e.g. Plasticine.



5. A process in accordance with one of the Claims 1 to 4, characterised
5 in that an initial layer of carbon-fibre composite material is applied to the
plaster cast, the lower and the upper joint plate is fitted and a second
carbon-fibre composite layer is applied.

6. A process in accordance with Claim 5, characterised in that the
10 lower and the upper joint plates are located on positioning pins in the
basic shaping plate, which extend through the first carbon-fibre composite
layer.

7. A process in accordance with one of the Claims 1 to 6, characterised
15 in that a foil, e.g. a plastic film, is applied to the plaster cast and over the
basic shaping plate, after which the first carbon-fibre composite layer is
applied and then the joint plates are attached to the basic shaping plate,
whereafter the second carbon-fibre composite layer is applied, to which a
covering layer in the form of a plastic film is applied.

20 8. A process in accordance with one of the Claims 5 to 7, characterised
in that the first and second layers of the carbon-fibre composite layer are a
carbon-fibre fibre net matting.

25 9. A process in accordance with one of the Claims 5 to 8, characterised
in that the lower and upper joint plates are glued onto a layer of glass fibre,
e.g. knitted glass fibre, which is applied to the first carbon-fibre composite
layer prior to the joint plates being positioned.

30 10. A process in accordance with one of the Claims 7 to 9, characterised
in that the fluid laminate is poured into the carbon-fibre composite layers
between the plastic foil on the plaster cast and the covering layer.

35 11. A process in accordance with one of the Claims 1 to 10,
characterised in that at least one basic shaping plate is made for a knee
angle of bend of 0° to 60°.



12. A knee orthosis appliance for stabilising the ligamentous apparatus in the knee manufactured by the method of any one of Claims 1 to 11,
5 having a lateral and a medial four bar chain located between an upper and a lower plastic skin, characterised in that the plastic skins are of a carbon-fibre composite layer construction, in which, on each of the lateral and medial positions corresponding to the lateral area of the knee joint against which the four bar chains (21) rest, a lower joint plate (5) and an upper
10 joint plate (6) of the four bar chains (21) have been embedded in position in the carbon-fibre composite layer.

13. A knee orthosis appliance in accordance with Claim 12,
characterised in that the lower joint plate (6) is crescent-shaped.
15

14. A knee orthosis appliance in accordance with Claims 12 or 13,
characterised in that the upper joint plate (6) is trapezoidal.

15. A knee orthosis appliance in accordance with any one of Claims 12
20 to 14, characterised in that three-quarters of the leg is preferably involved in order to support the leg.

16. A knee orthosis appliance in accordance with any one of Claims 12
25 to 15, characterised in that the joint plates (5,6) have boreholes (9).

17. A knee orthosis appliance in accordance with any one of Claims 12
to 16, characterised in that two carbon-fibre composite layers are located
between the covering layers.

18. A knee orthosis appliance in accordance with any one of Claims 12
30 to 17, characterised in that the joint plates (5,6) correspond to an angle of bend of the knee.

19. A knee orthosis appliance in accordance with Claim 18,
35 characterised in that the angle of bend is between 0° and 60°.



20. A knee orthosis appliance in accordance with Claims 18 or 19,
characterised in that the angle of bend is limited.

5

21. A knee orthosis appliance in accordance with any one of Claims 18
to 20, characterised in that the angle of bend is limited by a stop screw
(20).

10 Dated this 21st day of May 1992

TAMAGNI AG
By their Patent Attorneys
COLLISON & CO

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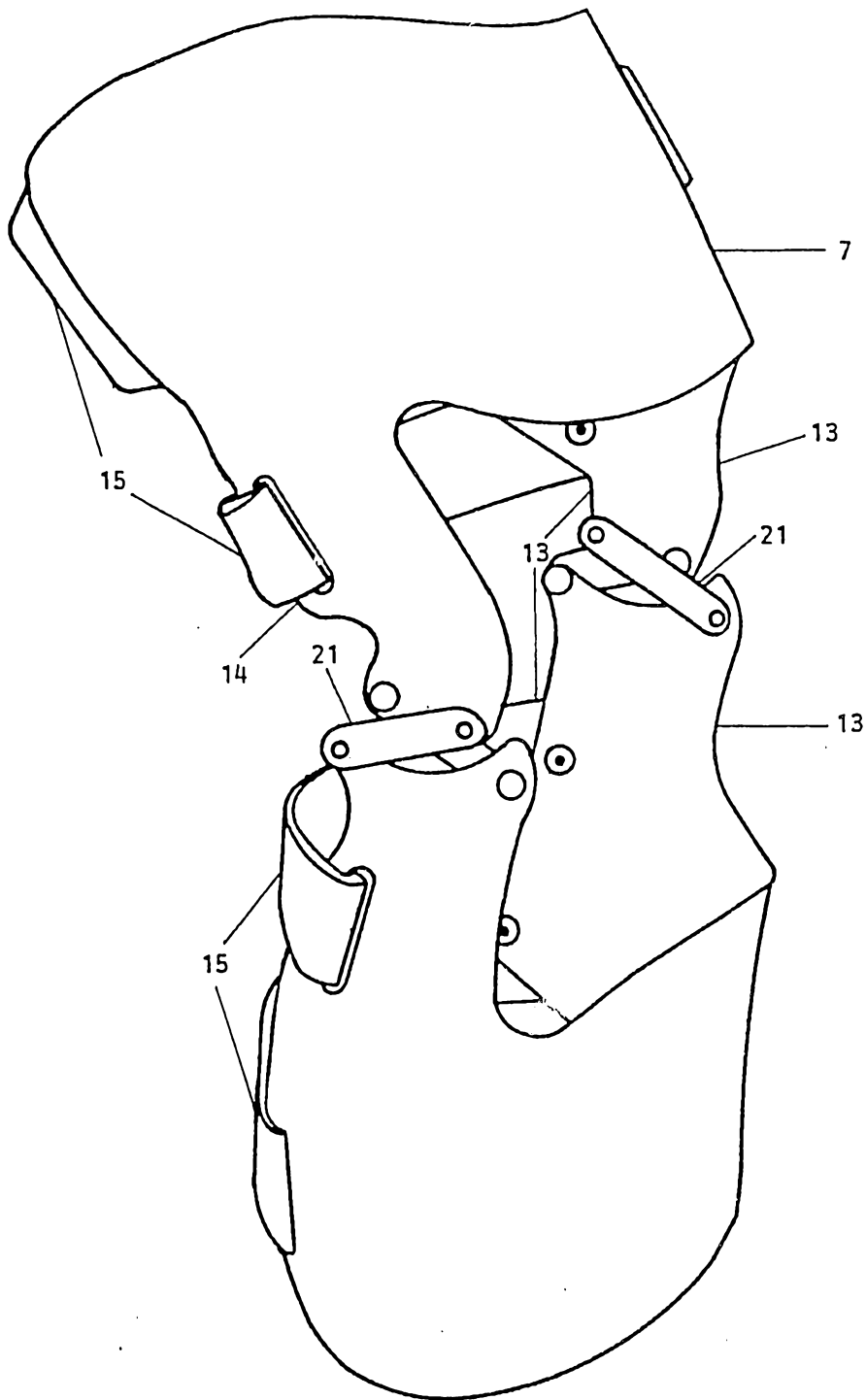


Fig. 1

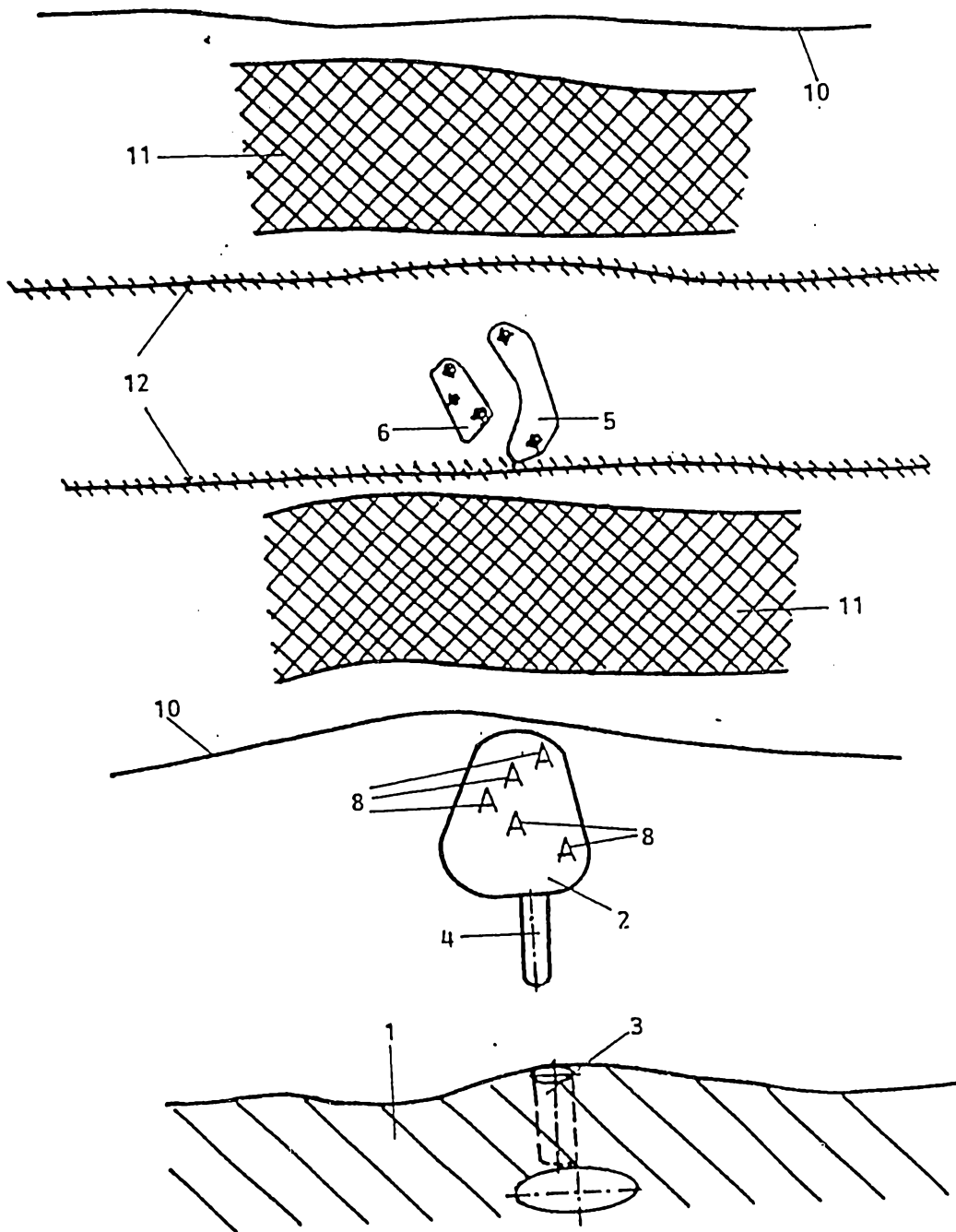


Fig. 2

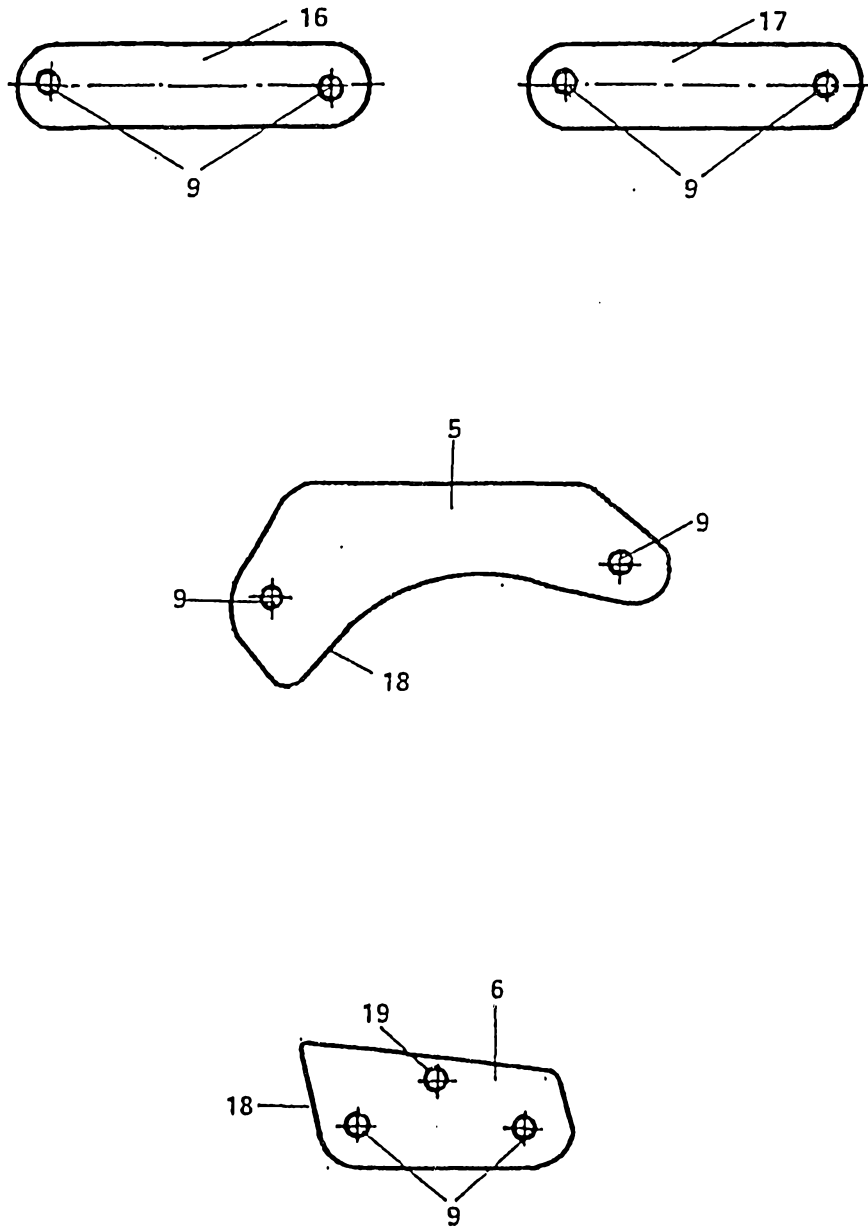


Fig. 3

Fig. 4a

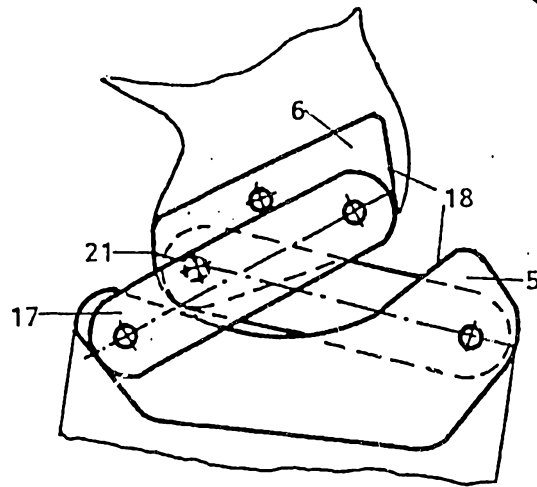


Fig. 4d

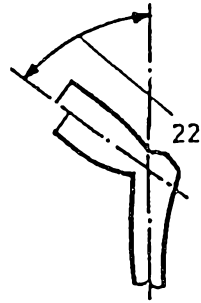


Fig. 4b

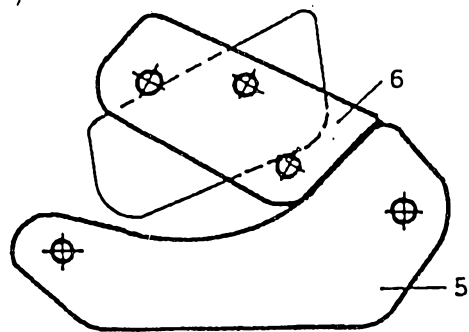
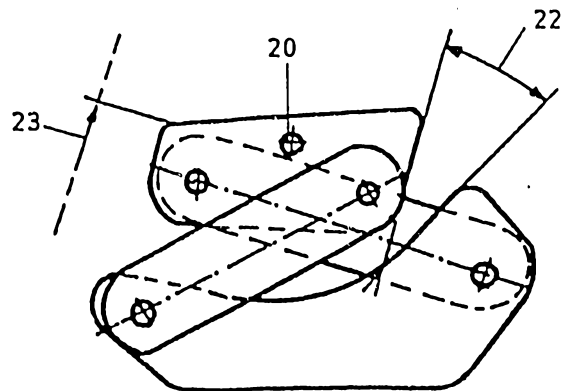


Fig. 4c



INTERNATIONAL SEARCH REPORT

International Application No PCT/CH 90/00229

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. ⁵	A61F 5/01	
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. ⁵	A61F, A61L	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched *		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	FR, A, 1236669 (Y.-L. VERTUT) 13 June 1960 see page 5. "Résumé" ; figures 9-13	1,4-5,7-10
A	--	11-12
Y	Medizinisch-Orthopädische Technik, vol. 108, No. 6, November/December 1988 Gentner publisher stuttgart, DE), J. Eichler: "Knieorthesen", pages 201-212, see page 206, paragraph 8. "Vierfach-Gelenke"; pages 208-209: "C.T.I. -knieorthese" figures 13.16	1,4-5,7-10
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A	AT, B, 384733 (H. SÖVEGJARTO) 28 December 1987 see the whole document	1,7-10
A	AT, B, 369978 (IPOS) 25 February 1983 see page 3, line 28 - page 4, line 12; page 4, lines 16-18; figure 2	1,6,11-12,16, 18-19,21
A	GB, A, 1348781 (SECRETARY OF STATE FOR SOCIAL SERVICES) 20 March 1974 see page 1, lines 66-87; page 2, lines 19-22, 32-33, 41-43, 60-92, 122-125	1,11-14
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Δ" document member of the same patent family</p> </div> </div>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
24 January 1991 (24.01.91)	11 February 1991 (11.02.91)	
International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 05/02/91
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A- 1236669		None	
AT-B- 384733	28-12-87	AT-A, B 384733	28-12-87
AT-B- 369978	25-02-83	AT-A, B 369978	25-02-83
GB-A- 1348781	20-03-74	None	

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen

PCT/CH 90/00229

I. KLASSEFIZIKATION DES ANMELDUNGSGEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben) ⁶ Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC Int.Cl. ⁵ A 61 F 5/01		
II. RECHERCHIERTE SACHGEBIETE Recherchierter Mindestprüfstoff ⁷		
Klassifikationssystem	Klassifikationssymbole	
Int.Cl. ⁵	A 61 F, A 61 L	
Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Sachgebiete fallen ⁸		
III. EINSCHLÄGIGE VERÖFFENTLICHUNGEN⁹		
Art*	Kennzeichnung der Veröffentlichung ¹¹ , soweit erforderlich unter Angabe der maßgeblichen Teile ¹²	Betr. Anspruch Nr. ¹³
Y	FR, A, 1236669 (Y.-L. VERTUT) 13. Juni 1960 siehe Seite 5, "Résumé"; Figuren 9-13	1, 4-5, 7-10
A	--	11-12
Y	Medizinisch-Orthopädische Technik, Band 108, Nr. 6, November/Dezember 1988, Gentner Verlag, (Stuttgart, DE), J. Eichler: "Knieorthesen", Seiten 201-212, siehe Seite 206, Abschnitt 8. "Vierfach- Gelenke"; Seiten 208-209: "C.T.I.-Knieor- these", Abbildungen 13, 16	1, 4-5, 7-10
A	--	11-12
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Besondere Kategorien von angegebenen Veröffentlichungen¹⁰:</p> <p>"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist</p> <p>"E" älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist</p> <p>"L" Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchenbericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgeführt)</p> <p>"O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht</p> <p>"P" Veröffentlichung, die vor dem internationalen Anmeldedatum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist</p> </div> <div style="width: 45%;"> <p>"T" Spätere Veröffentlichung, die nach dem internationalen Anmeldedatum oder dem Prioritätsdatum veröffentlicht worden ist und mit der Anmeldung nicht kollidiert, sondern nur zum Verständnis des der Erfindung zugrundeliegenden Prinzips oder der ihr zugrundeliegenden Theorie angegeben ist</p> <p>"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden</p> <p>"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist</p> <p>"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist</p> </div> </div>		
IV. BESCHEINIGUNG		
Datum des Abschlusses der internationalen Recherche		Absendedatum des internationalen Recherchenberichts
24. Januar 1991		11.02.91
Internationale Recherchenbehörde		Unterschrift des bevollmächtigten Bediensteten
Europäisches Patentamt		F.W. HECK

III.EINSCHLÄGIGE VERÖFFENTLICHUNGEN (Fortsetzung von Blatt 2)		
Art *	Kennzeichnung der Veröffentlichung, soweit erforderlich unter Angabe der maßgeblichen Teile	Betr. Anspruch Nr.
A	AT, B, 384733 (H. SÖVEGJARTO) 28. Dezember 1987 siehe das ganze Dokument --	1,7-10
A	AT, B, 369978 (IPOS) 25. Februar 1983 siehe Seite 3, Zeile 28 - Seite 4, Zeile 12; Seite 4, Zeilen 16-18; Figur 2 --	1,6,11-12, 16,18-19, 21
A	GB, A, 1348781 (SECRETARY OF STATE FOR SOCIAL SERVICES) 20. März 1974 siehe Seite 1, Zeilen 66-87; Seite 2, Zeilen 19-22,32-33,41-43,60-92,122-125 -----	1,11-14

**ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT
ÜBER DIE INTERNATIONALE PATENTANMELDUNG NR.**

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In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben.
Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am 05/02/91
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
FR-A- 1236669		Keine	
AT-B- 384733	28-12-87	AT-A,B 384733	28-12-87
AT-B- 369978	25-02-83	AT-A,B 369978	25-02-83
GE A- 1348781	20-03-74	Keine	