United States Patent

[11] **3,599,245**

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[33] **Great Britain**
[31] **30454/68**

[54] **ARTIFICIAL LEG HAVING A PRESET AUTOMATIC FRICTION BAND TENSION CONTROL**
4 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **3/28,** 3/29,3/1.2
[51] **Int. Cl.** **A61f 1/04,** A61f 1/08
[50] **Field of Search** ..... 3/1.2, 2, 22—29

[56] **References Cited**

FOREIGN PATENTS

233,950	5/1925	Great Britain	3/27
779,087	7/1957	Great Britain	3/23

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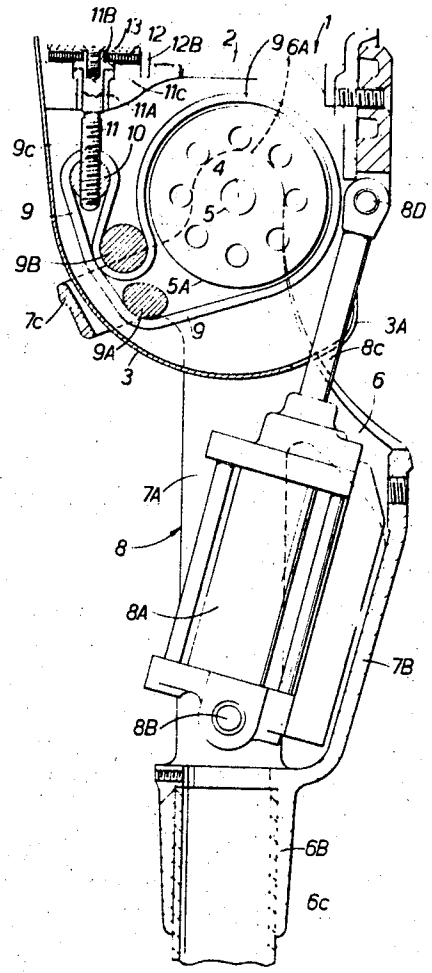
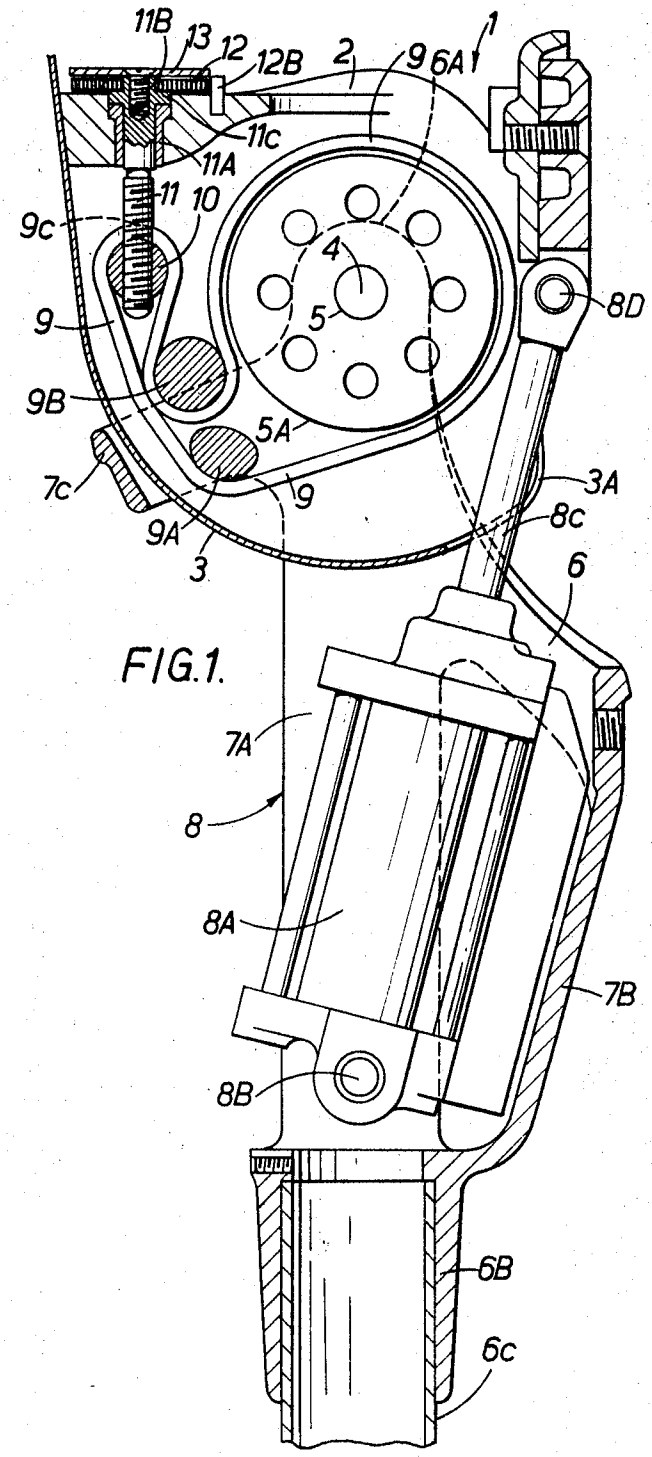
Assistant Examiner—Ronald L. Frinks
Attorney—Finnegan, Henderson & Farabow

ABSTRACT: An artificial leg in which flexion about the knee axis is controlled in known manner by knee control mechanism of the kind having a friction band looped around a drum, the drum being connected to the shin of the leg and the friction band to the thigh. Wear in the knee control mechanism, and "bedding down" of its component parts, is compensated by a preset clock-type coil spring, which automatically adjusts tension applied to the friction band.




11B
13
12
12B
2
9
6A
1
11c
11A
11
10
9c
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5
8D
9
9B
5A
7c
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9A
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7A
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FIG. 1.

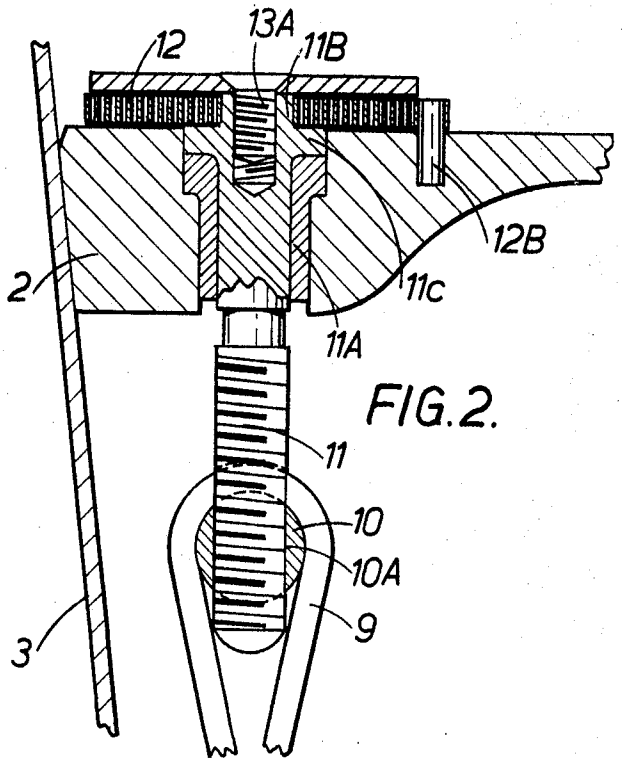

FIG. 2.

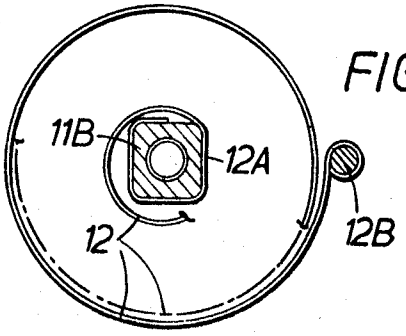

FIG. 3.

ARTIFICIAL LEG HAVING A PRESET AUTOMATIC FRICTION BAND TENSION CONTROL

BACKGROUND OF THE INVENTION

This invention relates to an artificial leg.

British Pat. No. 779,087 discloses a knee control mechanism which has proved successful in use for a number of years; this control mechanism gives a mechanical control of knee flexion and in particular prevents flexion, or prevents further flexion from an already flexed state, when an increased load is applied to the artificial leg. This prevents collapse of the knee caused by uncontrolled flexion, while permitting a desirable degree of flexion during normal use.

British Pat. No. 982,527 discloses a pneumatic swing phase control mechanism which in known manner controls knee flexion, but does not, and is not intended to, prevent collapse of the knee.

It is known to use both the above-described mechanism in the same artificial leg.

In the knee control mechanism referred to above, control of flexion is by a constant friction control which can be varied by the patient by manually adjusting for example a knurled wheel. This constant friction control provides for damping of the flexion. When the pneumatic swing phase control unit referred to above is also incorporated in the leg, this control unit takes over the damping function, and it has been found that manual adjustability of the constant friction control is unnecessary.

Nevertheless, in an artificial leg having both the knee control mechanism and the pneumatic swing phase control, when the feature of manual adjustability is omitted from the said control mechanism, it is found that some loss of operating efficiency occurs in the knee control mechanism. This is caused by wear in the knee control mechanism, and also by the "bedding down" or "settingling" of its parts.

It is an object of this invention to avoid as far as possible this loss of operating efficiency.

SUMMARY OF THE INVENTION

According to this invention there is provided an artificial leg in which flexion of upper and lower parts of the leg about a knee axis is controlled by knee mechanism, the knee mechanism including a drum connected to and movable with the said lower part and a friction band around the drum and connected to and movable with the said upper part, wherein a predetermined tension in the band is maintained by preset automatic compensating means.

The friction band may be looped around an adjustably movable member having a threaded bore in which is mounted a threaded rod which is rotatable by a preset clock-type spring coiled around the axis of the threaded rod. A clock-type coil spring occupies little space, and can be readily pretensioned during assembly of the knee mechanism. Also, although pretensioned the friction produced by it is very small.

Preferably the end of the threaded rod remote from the adjustably movable member is of square cross section, in which case the inner coil of the clock-type spring is also square and fits closely about the said end of the threaded rod. This provides a simple manner of connecting the spring operatively to the threaded rod.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a central vertical cross section of an artificial leg in accordance with the invention, with some parts shown in side elevation;

FIG. 2 is an enlarged central vertical cross section of part of FIG. 1; and

FIG. 3 is a schematic detail, partly in top plan and partly in horizontal cross section.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, it should be understood that the invention is applicable to various well-known constructions of artificial leg and that accordingly only those parts strictly relevant to an understanding of the invention have been illustrated. Persons skilled in the art will readily understand how the parts described below can be embodied in an artificial leg.

A knee mechanism, indicated generally by **1**, includes a frame **2** by means of which the knee mechanism **1** is fitted to the lower end of a thigh (not shown). A conventional knee enclosing "cup" is indicated at **3** and has a slot **3A**. The knee axis, about which relative flexion between the thigh and shin occurs, is indicated at **4**. A knee shaft **5** is fixed at its ends to the upper ends (one of which is seen at **6A**) of a cradle or framework **6**, the lower end of which is formed as a socket **6B**. In the socket **6B** is fixed the upper end of a well-known shin tube **6C**. The framework **6** also includes side members (one of which is seen at **7A**), a rear member **7B**, and a transverse or front member **7C**.

Known pneumatic swing phase control mechanism is indicated generally at **8**. It has a body part **8A** pivotally connected at **8B** to the framework **6**. It has a piston rod **8C** extending through the slot **3A** and pivotally connected at **8D** to the knee mechanism frame **2**. In known manner, as previously mentioned, the mechanism **8** controls knee flexion, that is, it controls relative movement of the shin and thigh about the knee axis **4**. British Pat. No. 982527 discloses a suitable swing phase control mechanism.

Integral with the knee shaft **5** is a drum **5A** around which extends a friction band **9** in known manner. The band **9** also passes around members **9A**, **9B** and finally round a member **10** which is adjustably movable for varying the tension in the band **9**.

Referring to FIG. **2**, the member **10** has a threaded bore **10A** in which is received a rotatable threaded rod **11**. The band **9** has an aperture **9C** through which the rod **11** passes. The rod **11** is rotatably mounted in a bushing **11A** in the frame **2**. When the rod **11** is rotated, the member **10** is adjusted up or down, to adjust the tension in the band **9**. The upper end **11B** of the rod **11** (i.e. the end remote from the member **10**) is of generally square cross section, see also FIG. **3**. The rod **11** has a flange **11C** which rests on the bushing **11A**.

Coiled around the rod **11** is a clock-type spring **12**, whose innermost coil **12A** is generally square (see FIG. **3**) and fits closely about the square upper end **11B** of the rod **11**. The outer end of the spring **12** is anchored to a pin **12B** fixed in the frame **2**. During assembly, the innermost coil **12A** is fitted over the end **11B**. Then the spring is preset (or pretensioned) by rotating its outer end say two or three times. Then the outer end is hooked over the pin **12B**. In this condition it will be understood that the spring always exerts torque on the rod **11** and the arrangement is such that the spring always tends to turn the rod **11** in that direction which will cause the member **10** to be moved upwardly on the rod **11**. In this way, any slackness or stretching which may gradually occur in the friction band **9** during use, is automatically compensated.

When the spring **12** has been fitted and pretensioned a cover plate **13** is fitted over it, the cover plate **13** being retained by a screw **13A**.

The clock-type spring **12** is desirably of comparatively low rate so that the torsion exerted by it remains reasonably constant over a wide range of rotation of the rod **11**. Friction in the spring is very small. By way of example, the spring can be of steel, have **18** working coils, and require three turns of its outer end to produce a torque of 0.15 pounds per inch.

I claim:

1. An artificial leg having an upper part, a lower part, and knee mechanism controlling flexion of the upper and lower parts about a knee axis, the knee mechanism including a drum connected to and movable with the lower part, and a friction band around the drum and connected to and movable with the

upper part, characterized in that a predetermined substantially constant tension in the band is maintained by preset automatic compensating means responsive to slackening or stretching in the friction band.

2. An artificial leg according to claim 1 in which the friction band is looped around an adjustably movable member having a threaded bore, said compensating means comprising a rotatable, threaded rod mounted in the threaded bore and rotatable by a preset clock-type spring coiled around the axis of the threaded rod.

3. An artificial leg according to claim 2 characterized in that the end of the threaded rod remote from the adjustably movable member is of square cross section, the innermost coil of the spring being also square and fitting closely about the said end.

4. The artificial leg of claim 1, where the preset automatic compensating means is operatively connected to the friction band and includes biasing means for maintaining the tension in the friction band.