United States Patent [19]

Weber

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[54] **RESILIENT PIVOT JOINT FOR AN ARTIFICIAL LEG**

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[52] **U.S. Cl.** **3/2,** 3/21, 403/111, 403/165

[51] **Int. Cl.** **A61f 1/08,** A61f 1/04

[58] **Field of Search** ..... 3/2, 21, 6–7, 3/30–35; 287/85 R, 86, 91; 403/111, 165

[56] **References Cited**

UNITED STATES PATENTS

1,281,165	10/1918	Ingold	3/21 X
2,264,570	12/1941	Holden	128/83.5
2,475,372	7/1949	Catranis	3/6.1 X
2,981,970	5/1961	Nayes et al.	287/85 R X
2,988,388	6/1961	Newell	287/85 R
3,706,465	12/1972	Olowinski	287/85 R

OTHER PUBLICATIONS

"Human Limbs & Their Substitutes" by Klopsteg and Wilson et al. McGraw–Hill Book Co., Inc., N.Y., Toronto, London, 1954, page 449–501 relied upon.

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[57] **ABSTRACT**

A pivot joint for an artificial leg and the like has a thrust bearing and a pair of joint segments arranged spaced from one another and abutting the thrust bearing. A bolt may be arranged in apertures provided in the joint segments and retained by a nut for pivotally connecting the joint segments together. The joint segments are attached to respective sections of an artificial leg, with the cut preferably made in the lower leg area between the ankle and knee. A resilient sleeve is arranged about the joint segments for restoring same to a normal or predetermined relationship with respect to one another following the application of a torsional force to the joint.

7 Claims, 6 Drawing Figures

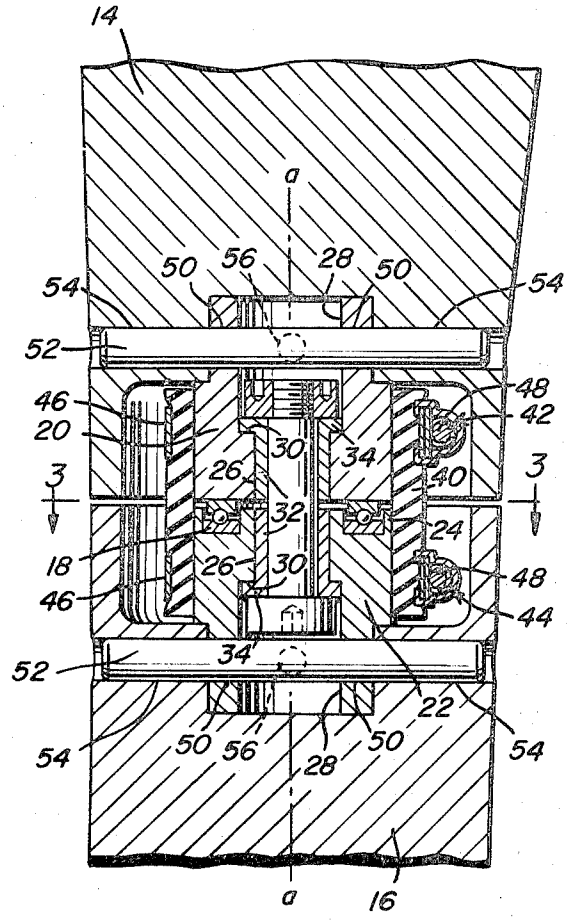


Fig. 1

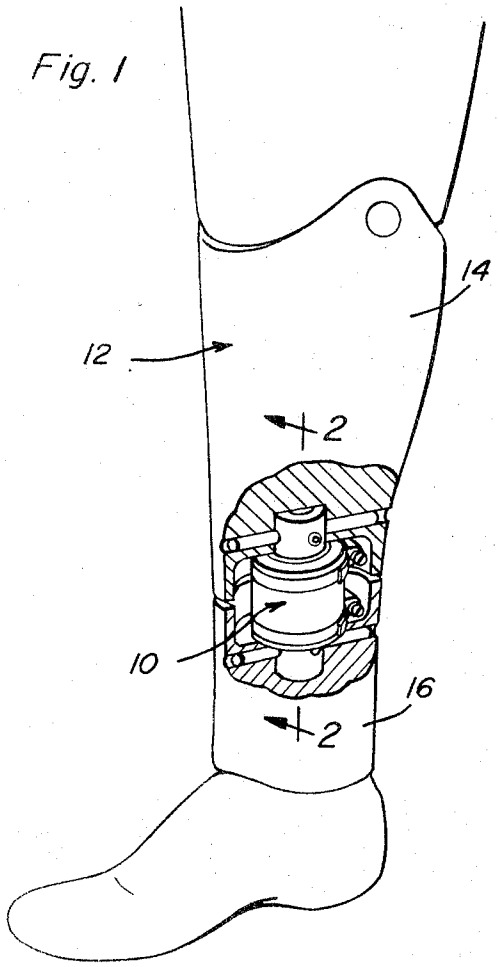


Fig. 2

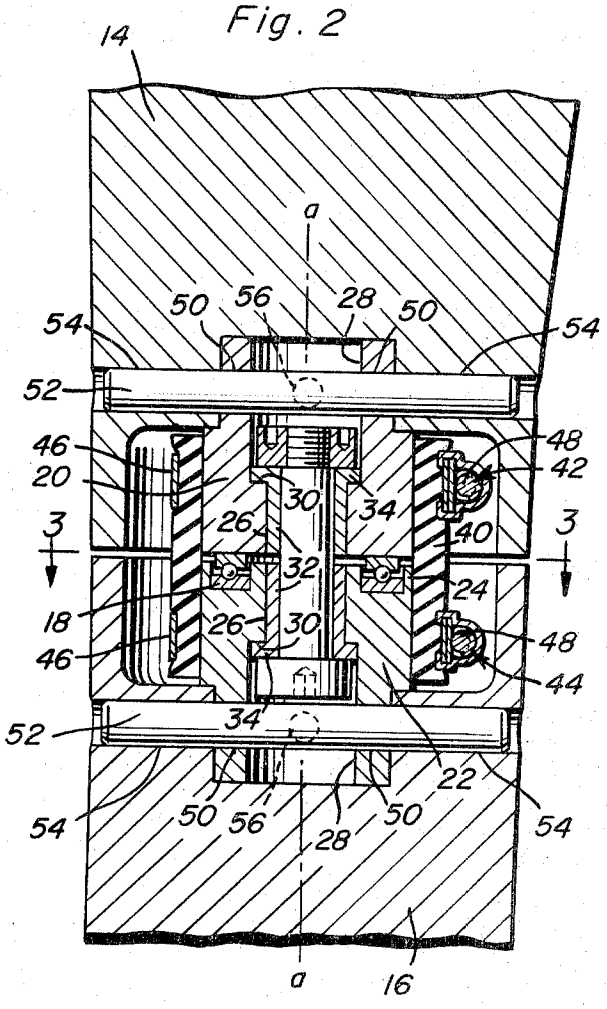


Fig. 3

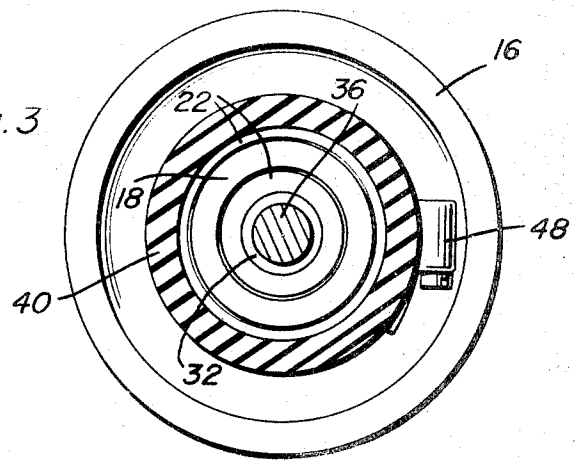


Fig. 4

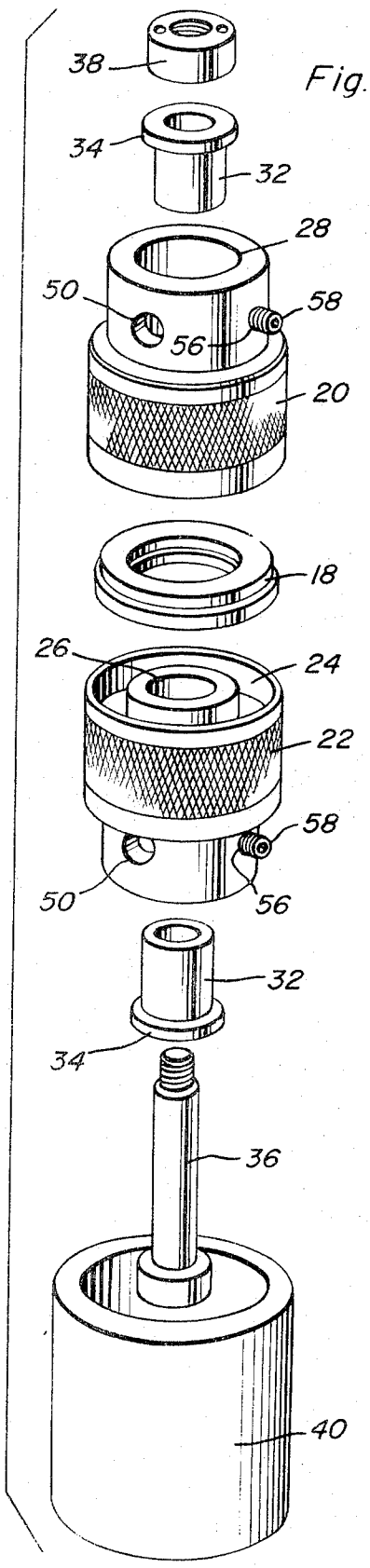
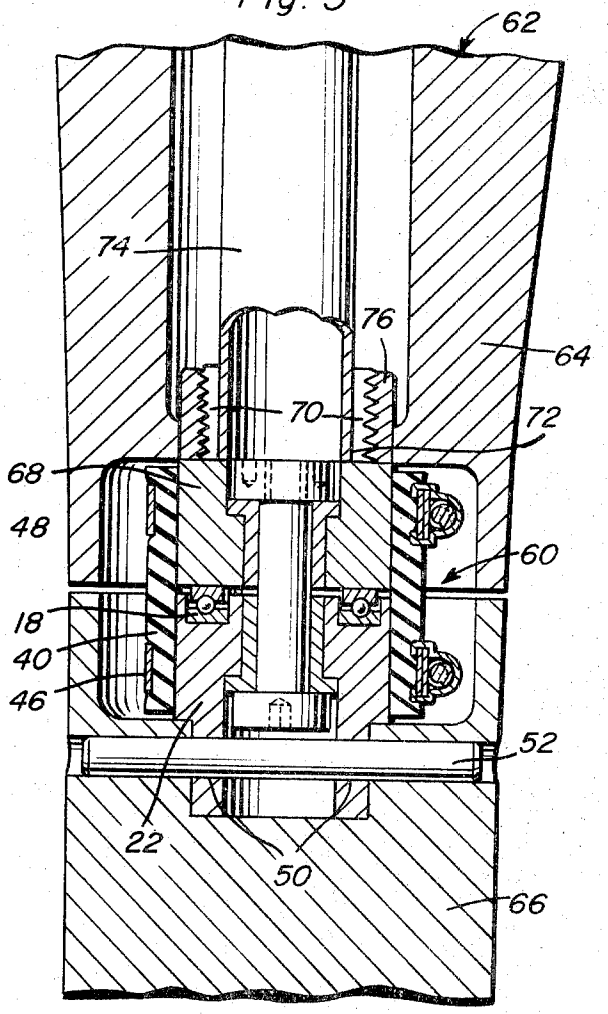


Fig. 5



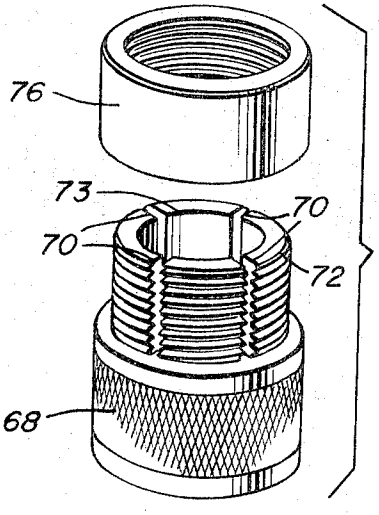


Fig. 6

RESILIENT PIVOT JOINT FOR AN ARTIFICIAL LEG

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to prosthetic devices, and in particular to a pivot joint for artificial limbs.

2. Description of the Prior Art

A problem commonly encountered by amputees and the like having been provided with a suitable prosthetic device such as an artificial limb is that the stump becomes strained and irritated by bodily movements performed while the prosthetic device remains stationary. The resulting discomfort is particularly severe for persons with leg amputations — both above and below the knee. A twisting, for example, either to the right or left by the wearer while the artificial leg remains stationary can subject the stump to strain and cause a slight movement of the stump relative to the socket of the artificial leg. As a result, the amputee suffers from vesications and the like which may become so severe as to prevent use of the prosthetic device. Further, the rigidity of conventional artificial limbs, particularly legs, discourages the wearer from climbing stairs, ramps, hills, and the like, and may subconsciously cause body movements to become, for example, strained and unnatural.

Arrangements have been proposed which insert a cushioning device in an artificial leg. However, these arrangements are primarily intended to improve foot fall by means of a limited horizontal movement and cushion the stump from shock, and do not reduce strain and irritation to a stump from various body movements. Further, these cushioning devices may reduce the stability of the prosthetic device.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide for use with an artificial limb and the like a pivot joint which will give an amputee and the like relief from vesication and the like, more comfort, improved mobility, and increased stability.

It is another object of the present invention to provide a pivot joint which may be simply and inexpensively installed on existing prosthetic limbs.

These and other objects are according to the present invention by providing a pivot joint having a bearing member, and a pair of joint segments arranged abutting the bearing member and spaced from one another. The joint segments may be connected together for movement relative to one another and connected to respective sections of a member, such as an artificial leg, in a suitable manner. A resilient element is arranged about the joint segments for restoring same to a predetermined relationship following the application of a torsional force to the pivot joint.

In a preferred embodiment of the present invention, the support member is a thrust bearing, and the resilient element is a sleeve constructed from pure gum rubber and the like.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, perspective view, partly cut away and in section, showing a pivot joint according to the present invention installed on an artificial leg.

FIG. 2 is a fragmentary, sectional view, taken generally along the line 2—2 of FIG. 1.

FIG. 3 is a sectional view, taken generally along the line 3—3 of FIG. 2.

FIG. 4 is an exploded, perspective view of the pivot joint of FIGS. 1 to 3.

FIG. 5 is a fragmentary, sectional view, similar to FIG. 2, showing a modified embodiment of a pivot joint according to the present invention.

FIG. 6 is an exploded, perspective view of a portion of the pivot joint of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 of the drawings shows a pivot joint **10** according to the present invention arranged in an artificial leg **12.** As illustrated, leg **12** is cut into sections **14** and **16** at a point located approximately, for example, eight inches from the bottom of its associated foot. Although the stump socket (not shown) is indicated as being arranged for an above-the-knee amputation, it is to be understood that a pivot joint **10** may be used with below-the-knee amputations as well.

Referring now to FIGS. 2 to 4 of the drawings, pivot joint **10** includes a bearing member such as a conventional thrust bearing **18.** A pair of joint segments **20, 22** are arranged spaced from one another and abutting bearing **18.** Segments **20, 22** are connectable to respective sections **14, 16** of leg **12** so as to pivotally connect these sections together. One of segments **20, 22** — segment **22** being illustrated — is provided with a, for example, annular pocket or recess **24** for receiving bearing **18.** Recess **24** is dimensioned such that bearing **18** protrudes slightly above the adjacent surface of joint segment **22** for spacing segments **20, 22** from one another. Aligned apertures are provided in segments **20, 22.** Each aperture has a section **26** arranged in a portion of its respective segments **20, 22** so as to be closer to the other segments **22, 20** when joint **10** is assembled than the other aperture section **28** forming the aperture. Aperture section **26** has a smaller area than aperture section **28.** A shoulder **30** is formed at the junction of aperture sections **26** and **28.** Hollow sleeves **32** - preferably constructed from a, for example, hardened and ground, suitable metal to reduce wear in joint **10** — are arranged in aperture section **26** with a flange **34** thereof abutting shoulder **30.** A, for example, spanner head bolt **36** is arranged in the apertures and threadingly engages a, for example, spanner nut **38** for being retained therein. In this manner, segments **20, 22** are connected together for movement relative to one another about bolt **36** and axis *a—a* (FIG. 2).

A sleeve **40** is arranged about segments **20, 22** and is constructed from a resilient material such as, for example, pure gum rubber and the like for restoring segments **20, 22** to a normal or predetermined relationship with respect to one another following the application of a torsion force to joint **10** causing at least one segment **20, 22** to be displaced about axis *a—a.* Clamps **42** and **44** are arranged about sleeve **40** for clamping same to segments **20** and **22,** respectively. The torque exerted by sleeve **40** may be decreased by moving clamps **42,**

44 further apart, and increased by arranging them closer together. This adjustment can be useful for providing a different degree of torque for persons of, for example, different weights. Each clamp **42, 44** is formed from a band **46** and a conventional, cam operated gripping device **48**.

Each segment **20, 22** may be provided with a hole **50** arranged in a plane which is transverse through axis a-a. This hole **50** permits the associated segment **20, 22** to be attached to a respective leg section **14, 16** as by a pin **52** arranged in hole **50** and matching holes **54** in the respective section **14, 16.** Segments **20, 22** are received in cut-out portions of leg sections **14, 16.** The portions of joint segments **20, 22** in which aperture sections **28** are arranged have reduced diameters so as to form a shoulder which limits movement of the joint segments **20, 22** into these cut-out portions of leg sections **14, 16.** Additional holes **56** may be arranged at, for example, 90° with respect to holes **50** and provided with screw threads for receiving, for example, set screws **58** which engage matching holes (not shown) in sections **14, 16** and furnish added support to the arrangement.

FIGS. **5** and **6** show a pivot joint **60** according to the present invention adapted to be used with the newer type cosmetic prosthetic legs constructed with, for example, aluminum tubing. A leg **62** is divided into sections **64** and **66.** Although only section **64** is illustrated as having the tubing, it is to be understood that section **66** may be similarly constructed.

A joint portion **68** has a plurality of slots **70,** four being shown, provided in a wall **72** and communicating with an aperture section **73** formed by wall **72.** Section **73** is dimensioned to receive an end of a section of tubing **74,** and, for example, tapered screw threads are formed on wall **72** for receiving a, for example, jam nut **76** and clamping tubing **74** in aperture section **73.** Alternatively, a clamp such as **42, 44** may be employed in place of nut **76.** Wall **72** and slot **70** form a split collar for gripping the tubing **74.**

As can be readily understood from the above description, a pivot joint **10, 60** according to the present invention enables an amputee to twist right or left while his foot remains stationary without placing a strain and rubbing or producing irritation on the amputee's stump. Further, a pivot joint **10, 60** according to the present invention gives an amputee greater freedom of, for example, hip movement.

A pivot joint **10, 60** according to the present invention may be made in various sizes so that amputees of all sizes and ages may be fitted.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A pivot joint for an artificial limb, comprising, in combination:

a. first and second joint segments;

b. means connecting the first and second joint segments together for pivotal movement relative to one another about a pivot axis;

c. a bearing member;

d. a recess provided in one of the first and second joint segments and arranged for receiving the bearing member, the bearing member being arranged in the recess;

e. resilient means including a sleeve arranged around the first and second joint segments for restoring same to a predetermined relationship with respect to one another following the application of a torsional force to the segments;

f. means for attaching the first and second joint segments to respective sections of a member to be pivotally joined together;

g. first and second clamping elements arranged for clamping the resilient means to the first and second joint segments, respectively; and

h. the first and second joint segments being provided with aligned apertures, the connecting means having a bolt arranged in these apertures and a nut threadingly engaging the bolt for retaining same, one of the joint segments having at least one slot provided in a wall thereof and communicating with an aperture provided in the joint segment, the aperture being dimensioned to receive an end of a length of tubing, and means arranged about the wall adjacent the slot for clamping the tubing in the aperture, the apertures provided in the joint segments each having two sections, the aperture section arranged closest to the other joint segment having a smaller area than the other aperture section of the same joint segment, and a shoulder being formed at the junction of the sections, and further including a hollow element provided with a flange and arranged in the smaller diameter aperture section with the flange abutting the shoulder.

2. A structure as defined in claim **1,** wherein the member is an artificial leg, and the pivot joint is arranged between the knee and ankle.

3. The structure as defined in claim **1,** wherein the bearing member is a thrust bearing.

4. A pivot joint for an artificial limb, comprising, in combination:

a. first and second joint segments;

b. means connecting the first and second joint segments together for pivotal movement relative to one another about a pivot axis, the first and second joint segments being provided with aligned apertures, and the connecting means having a bolt arranged in these apertures and a nut threadingly engaging the bolt for retaining same, the apertures provided in the joint segments each having two sections, the aperture section arranged closest to the other joint segment having a smaller area than the other aperture section of the same joint segment, and a shoulder being formed at the junction of the sections, and further including a hollow element provided with a flange and arranged in the smaller diameter aperture section with the flange abutting the shoulder;

c. a bearing member;

d. a recess provided in one of the first and second joint segments and arranged for receiving the bearing member, the bearing member being arranged in the recess; and

e. resilient means including a sleeve arranged around the first and second joint segments for restoring same to a predetermined relationship with respect

to one another following the application of a torsional force to the segments.

5. A structure as defined in claim 4, further including means for attaching the first and second joint segments to respective sections of a member to be pivotally jointed together.

6. A structure as defined in claim 4, further including first and second clamping elements arranged for clamping the resilient means to the first and second joint segments, respectively.

7. A structure as defined in claim 4, wherein the bearing member is a thrust bearing.

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