July 16, 1940. J. J. McCANN 2,208,275

ARTIFICIAL KNEE

Filed June 25, 1937 2 Sheets-Sheet 1

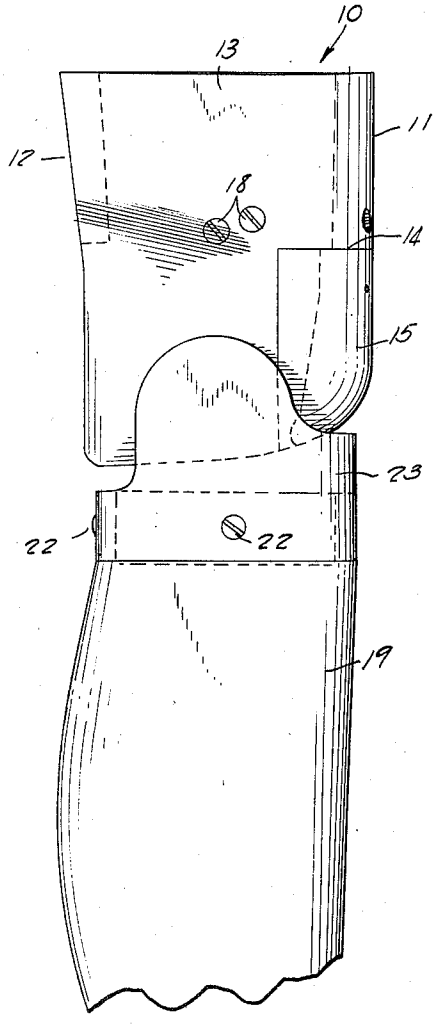


Fig. 1

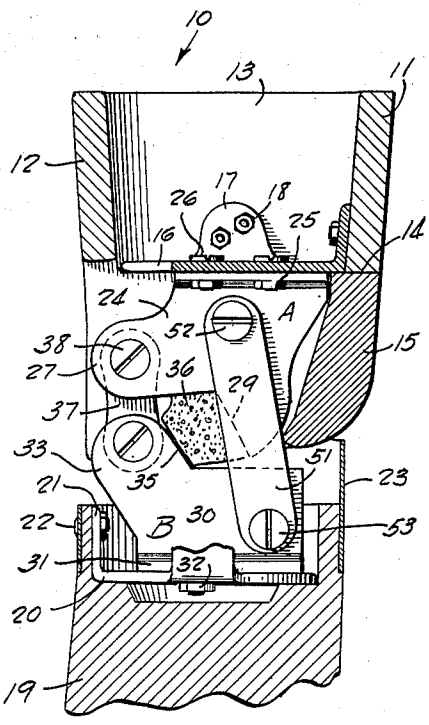


Fig. 2

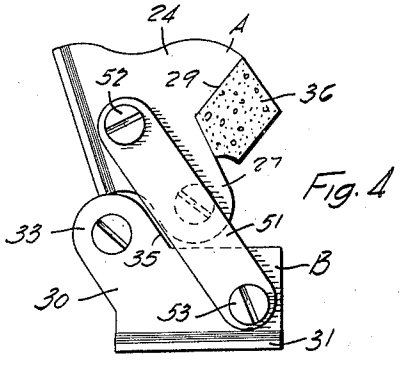


Fig. 4

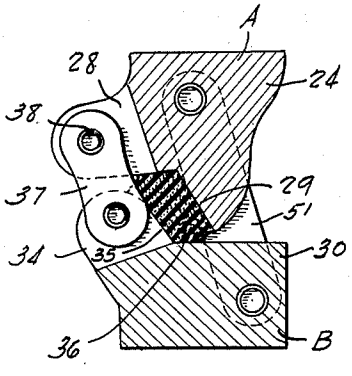


Fig. 3

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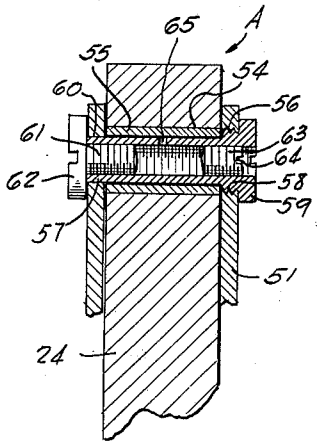


Fig. 5

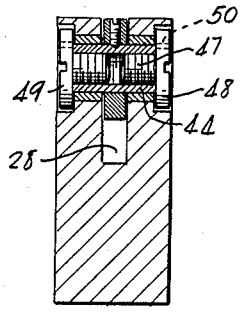


Fig. 7

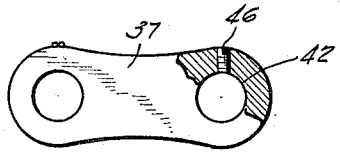


Fig. 10

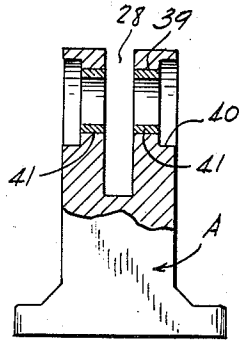


Fig. 9

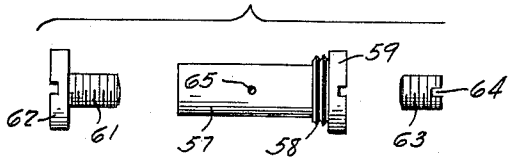


Fig. 6

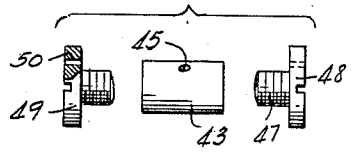


Fig. 8

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UNITED STATES PATENT OFFICE

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ARTIFICIAL KNEE

John J. McCann, Burlington, N. J.; J. Conner French, Mercer County, and John A. McCann, Burlington County, N. J., executors of John J. McCann, deceased

Application June 25, 1937, Serial No. 150,293

2 Claims. (Cl. 3—2)

This invention relates to artificial limbs and is concerned primarily with the knee joints of such artificial limbs.

At the present time there is available to the public an artificial limb including a knee joint, which is characterized as including a pair of links which are pivotally connected to the thigh piece and shin member of the leg respectively, and with which links are associated another pair of pivotally mounted links that are longer than the first mentioned links, and are also connected to the thigh and shin members respectively. In order that a knee joint of the type above identified be properly operable, it is necessary that the shorter of the pivotal links be movable between the longer pivotal links. In the now known joints of this type this movement is accommodated by making the longer links of an arched or offset formation whereby space through which the smaller pivotal links may move is provided. However, the use of the now known types of knee joints of the character above-noted is attended by certain disadvantages which are intended to be improved by the present invention.

With the foregoing in mind, this invention has in view as an important objective the provision of a knee joint for artificial limbs which comprises a pair of joint members, one for the thigh piece and one for the shin piece of the artificial limb. Each of these joint members is formed with a slot intermediate the faces thereof and which slotted portions are provided with pivotal pins whereby a link is adapted to be mounted in the slotted portions of the joint members. The longer pivotal links are pivotally mounted on the outer faces of the joint members, and thus movement of the shorter pivotal link member between the longer outer pivotal members is provided.

Important detailed features of the invention are associated with the provision of proper pivotal mountings for the above noted link members.

Another important phase of the present invention is the provision of a novel type of structure for positively and rigidly securing the joint members to the thigh and shin members respectively. In accordance with the present invention, the lower end of the thigh member and the upper end of the shin member are each provided with base plates, which are securely anchored to the respective members. The joint members of this invention are formed with flanges that are adapted to engage the base plates and be bolted thereto to securely affix the joint members to the respective base plates.

Other important details of the invention are associated in the particular manner in which the base plates are anchored to the thigh and shin pieces respectively.

Various other more detailed objects and advantages will in part become apparent and in part be hereinafter constituted as the description of the invention proceeds.

The invention, therefore, comprises an artificial limb including a thigh piece and a shin piece each of which is provided with a base plate at the extremity adjacent the knee joint of the limb. Each of these base plates is anchored to the respective thigh or shin piece by a rigid connection and securely affixed to each base plate is a joint member, the connection being established by a bolted flange arrangement. Each of the joint members is slotted intermediate its faces and a short link is pivotally mounted in said slotted portions. Pivotally mounted on the outer faces of said joint members are a pair of longer links and in such relationship to the shorter length as to have the latter pass therebetween under certain conditions of movement of the joint members. Each of the joint members is formed with a shoulder that extends substantially in the direction of the link members, and interposed between the shoulders of the two joint members is a resilient pad which is designed to be compressed incident to certain movement of the joint members. This same resilient pad also causes movement between the joint members in a manner that will be pointed out in detail hereinafter.

For a full and more complete understanding of the invention references may be had to the following description and accompanying drawings wherein:

Figure 1 is a side view of that portion of an artificial limb which embodies a knee joint in accordance with the precepts of this invention,

Figure 2 is a transverse section of the knee joint, bringing out the arrangement of the joint members with respect to the thigh and shin pieces respectively,

Figure 3 is a side view, partly in section and partly in elevation, of the joint members per se,

Figure 4 is a view somewhat similar to Figure 3, showing the joint members in different relative positions,

Figure 5 is a section through one of the joint members, bringing out the manner in which the outer links are pivotally carried thereby,

Figure 6 is an elevational showing of the parts constituting the pivotal mounting for the outer

links. This view shows these parts in an exploded relationship,

Figure 7 is a sectional view similar to Figure 5, developing the pivotal mounting for the inner shorter link,

Figure 8 is an exploded elevational showing similar to Figure 9 of the parts constituting the mounting for the inner pivotal link,

Figure 9 is a viw of one of the joint members with parts broken away and shown in section to develop the slotted construction that accommodates the inner link, and

Figure 10 is a side view partly in section and partly in elevation of the inner link member, per se.

Referring now to the drawings wherein like reference characters denote corresponding parts.

The thigh piece of an artificial limb is represented in Figures 1 and 2 by the reference character **10**. The thigh piece **10** is of a hollow construction that is defined by a front wall **11**, rear wall **12** and side walls **13**, the walls **11** and **13** being connected by rounded corners to simulate the appearance of a natural thigh. The front wall **11** is cut away as represented by the line at **14** and the cut away portion is replaced by a removable piece **15** that may be taken out to obtain access to the joint mechanism that is obtained between continuations of the side walls **13** and the rear wall **12**. A base plate identified at **16** is formed on each side edge with an ear **17**, and each of the ears **17** is anchored to the walls **11**, **12**, and **13** respectively by a nut and bolt arrangement referred to generally at **18**. Secured to the base plate **16** is one joint member which is referred to in its entirety by the reference character A, of which the detailed construction will be pointed out hereinafter.

The shin piece of an artificial leg is shown at **19**, and the upper portion of this shin piece is hollowed out to accommodate the base plate **20**. The base plate **20** is formed with a plurality of ears **21** on its side edges which are bolted to the walls of the shin member **19** that define the recess receiving the base plate **20**. Inasmuch as the wall surrounding this recess is thin, permanence and rigidity of the anchorage of the base plate is afforded by having the anchoring bolts shown at **22** pass through the outer metallic shield **23** that is also carried by the shin piece **19**. The connecting member referred to in its entirety by the reference character B is carried by this base plate **20** and within the shield **23**.

Referring now more particularly to Figure 1, the connecting member A is shown as comprising a main body member **24** that is formed with a flange **25** that engages the base plate **16** of the thigh piece **10** and is securely anchored thereto by the nut and bolt arrangement identified at **26**. Extending towards the rear wall **12** from the main body portion **24** of the joint member A is a nose portion **27** that is slotted as shown at **28** in Figure 3, and extending downward from the main body **24** is a shoulder **29** that is also clearly brought out in Figure 3.

The joint member B also comprises a main body portion **30** that is formed with flanges **31** that engage the base plate **20** and are connected thereto by bolted nuts identified at **32**. Extending rearwardly and upwardly from the main body **30** is a nose portion **33** that is also slotted as shown at **34**. This nose portion **33** defines a shoulder **35**.

At this point it is well to note that a pad of a resilient material such as sponge rubber is interposed between the shoulders **35** and **29** and is preferably secured to the shoulder **29** in any preferred manner as by an adhesive.

This resilient pad is identified at **36**. A short link member **37** has one end pivotally mounted in the slotted portion of the nose **27** of the joint member A, the pivotal member being referred to generally by the reference character **38**. The other end of the link **37** is pivotally mounted in the nose portion **33** of the joint member B, and the structure of the pivotal connection is identical with that at **38**.

The detailed construction of the pivotal connection at **38** is best described by referring to Figures 7, 8, 9, and 10. This connection is described in conjunction with the joint member A and it is to be understood it is to be repeated in the joint member B.

The nose portion **27** of the joint member A on each side of the slot **28** is formed with openings **39** that are enlarged as shown at **40**. Each of the openings **39** is lined with a bushing **41** which is preferably of bronze to constitute a good bearing element. The end of the link **37** which is received in the slot **28** is formed with a circular opening **42** and extending through this opening **42** and the bushings **41** is a cylindrical sleeve shaped member **43**, the inner surface of which is threaded as indicated at **44** in Figure 7. It is notable that the sleeve **43** is provided with a slight recess **45** and a set screw **46** has a pointed extremity which is adapted to be received in the recess **45**. This set screw **46** is threaded in that portion of the link member **37** surrounding the opening **42** and serves to establish a non-rotating relationship between the link member **37** and the sleeve **43**.

The screw **47** is threaded into one end of the sleeve **43** and has an enlarged flat head **48** that is received in the enlargement **40** of the opening **39** and this screw **47** is duplicated at the other end of the sleeve **43** as shown at **49**. The heads **48** of the screw members **47** and **49** may be provided with lubricating openings shown at **50**.

A pair of link members **51** are disposed on each face of the joint members A and B and anchored thereto by pivotal connections referred to generally at **52** and **53**. These pivotal connections **52** and **53** are of identical construction and only one of them needs here be described for this specification.

Referring now more particularly to Figures 5 and 6, the main body portion **24** of the joint member A is shown as formed with an opening extending transversely there across and identified at **54**. This opening **54** is lined by a bearing member **55** which may be of bronze or other suitable material. The link **51** at the right hand side of **55** is formed with a threaded opening shown at **56**. A bearing pin of cylindrical formation is identified at **57** and is shown as having an enlarged shoulder which is provided with threads which are complemental to the threaded opening **56**. This threaded shoulder is identified as **58**.

The bearing pin **57** terminates in a slotted head **59** that engages against the link **51** on its outer face. The link **51** on the opposite face of the body portion **24** of the joint member A is provided with an opening **60**, in which fits the free extremity of the bearing pin **57**. The bearing pin **57** is of a hollow formation and the bore thereof is threaded and receives the headed screw member **61**, the head **62** of which overlaps the link **51** to retain the latter in position on the bearing pin **57**. This bearing **57** is also threaded

at the other end and receives a screw plug 63, the head of which is slotted as shown at 64 to provide for the engagement of a screw driver therewith. The cylindrical wall of the bearing pin 57 is provided with a lubricating opening 65 and a suitable lubricant such as grease is contained in the bore of the bearing pin 57 between the members 61 and 63. It is evident that by screwing plug 63 inwardly, the lubricant will be extruded through the sleeve 55 to thoroughly lubricate the outer surface of the bearing pin with respect to the sleeve 55.

With the thigh piece 10 and the shin piece 19 of the artificial limb in substantial alignment the pivotal links assume substantially the same position which is brought out in Figure 2. If the weight of the wearer is applied to the limb, the resilient pad 36 will be compressed in the manner brought out in Figure 3. When the weight of the wearer is removed from the thigh piece 10 the resilient pad 36 will cause a flexing on the shin piece 19 with respect to the thigh piece 10 which action is comparable to natural walking movement. If the shin piece 19 is further moved to reduce the angle between this piece and the thigh piece 10, the pivotal mounting of the link 37 will be moved between the links 51 in the manner clearly brought out in Figure 4. It is evident with the arrangement illustrated in the drawings and described in the foregoing specification it is not necessary to provide any offset or bowed construction in the links 51 as the link 37 and pivotal mounting thereof is readily movable therebetween.

While a preferred specific embodiment of the invention is hereinbefore set forth, it is to be clearly understood that I am not to be limited to the exact constructions illustrated and described, because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claims.

I claim:

1. A knee joint for artificial limbs comprising a joint member being formed with a nose portion at one side thereof, and which nose portion is slotted, said joint member also being formed with a shoulder, a second joint member adapted to be connected to the shin piece of an artificial limb, said second joint member having an upwardly extending nose portion defining a shoulder spaced from the shoulder on the first mentioned joint member, said last mentioned nose being slotted, a link having each extremity disposed in the slots in the said joint members and pivotally mounted therein, a pair of links longer than the first mentioned link disposed on opposite faces of the joint members and pivotally connected there to their extremities, and a resilient pad of appreciable thickness which is carried by one of the shoulders, said pad being movable with the shoulder relative to the other shoulder and subject to compression by and between the shoulders as said shoulders approach a limit of movement toward one another, said compressed pad having a shape of materially reduced thickness whereby energy is stored in said pad to separate said shoulders when pressure on the joint is released.

2. A knee joint for artificial limbs comprising a joint member adapted to be connected to the thigh piece of an artificial limb and being formed with a nose portion at one side thereof, said joint member also being formed with a shoulder, a second joint member adapted to be connected to the shin piece of an artificial limb, said second joint member having an upwardly extending nose portion defining a shoulder spaced from the shoulder on the first mentioned joint member, linkage pivotally connected to each of said nose portions, a pair of links longer than the first mentioned linkage and disposed on opposite faces of the joint members and pivotally connected thereto at their extremities, and a resilient pad of appreciable thickness which is carried by one of the shoulders, said pad being movable with the shoulder relative to the other shoulder and subject to compression by and between the shoulders as said shoulders approach a limit of movement toward one another, said compressed pad having a shape of materially reduced thickness whereby energy is stored in said pad to separate said shoulders when pressure on said joint is released.

JOHN J. McCANN.