No. 648,345. Patented Apr. 24, 1900.

J. A. PEER.

ARTIFICIAL LEG.

(Application filed June 15, 1899.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1

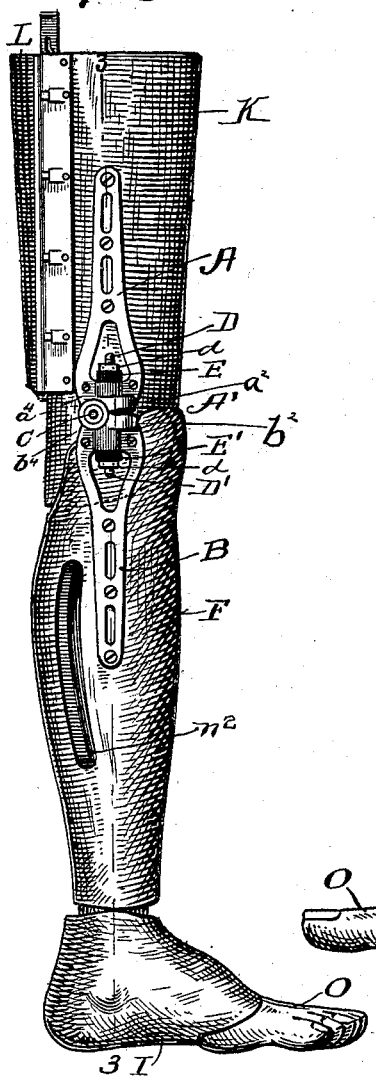


Fig. 2.

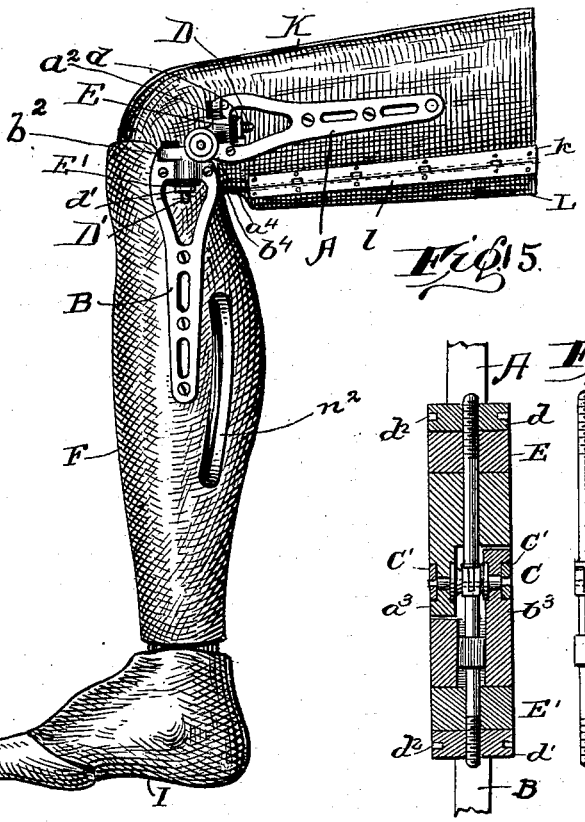
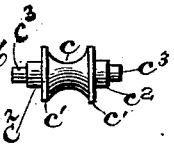


Fig. 15.

Fig. 17.

Fig. 16.



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(No Model.) 4 Sheets—Sheet 2.

Fig. 3.

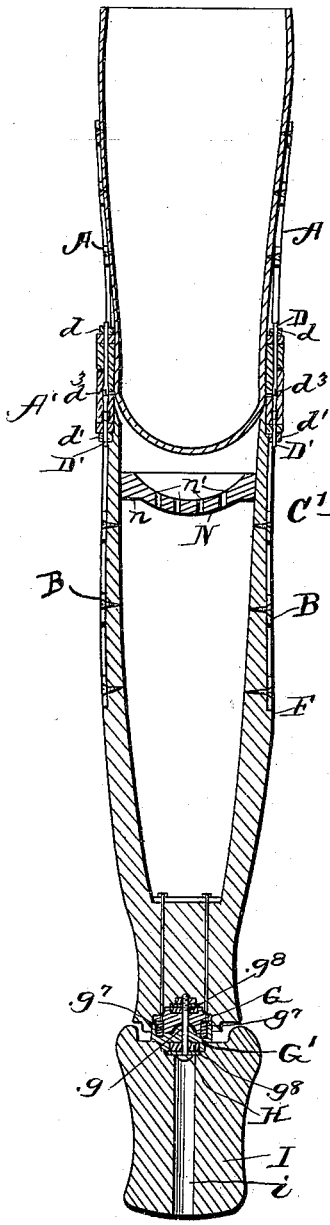


Fig. 9.

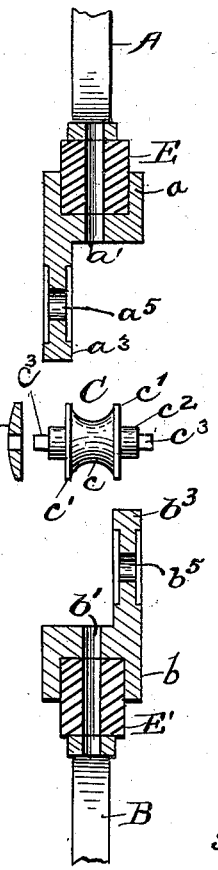


Fig. 10.

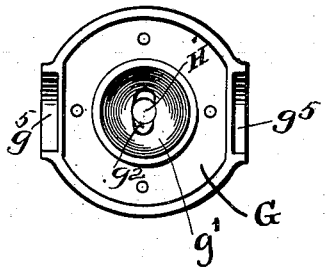


Fig. 11.

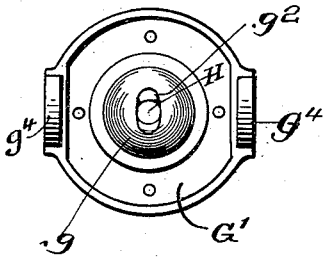
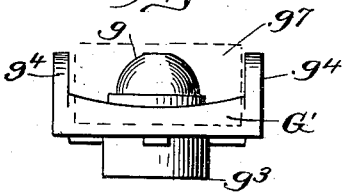


Fig. 12.



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ARTIFICIAL LEG.

(Application filed June 15, 1899.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 4.

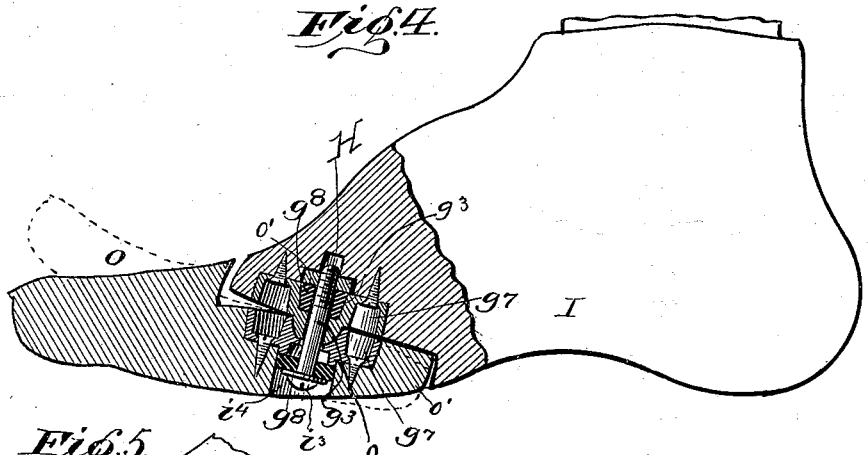


Fig. 5.

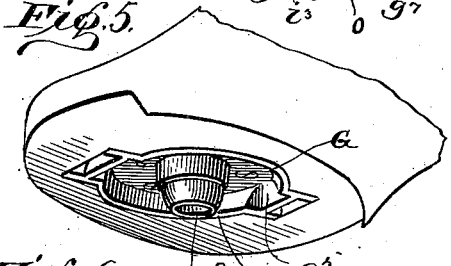


Fig. 6

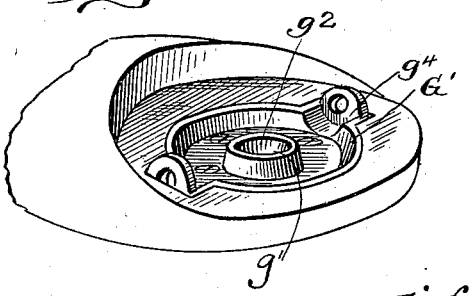


Fig. 7.

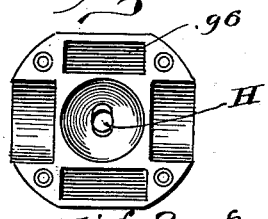


Fig. 8

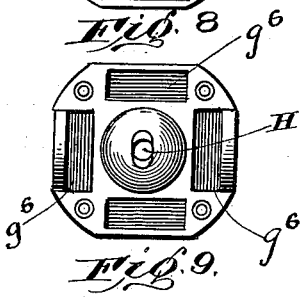
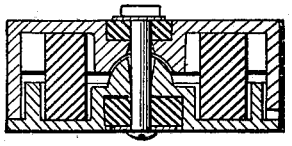


Fig. 9.

Fig. 10.



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No. 648,345. Patented Apr. 24, 1900.

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ARTIFICIAL LEG.

(Application filed June 15, 1899.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 13.

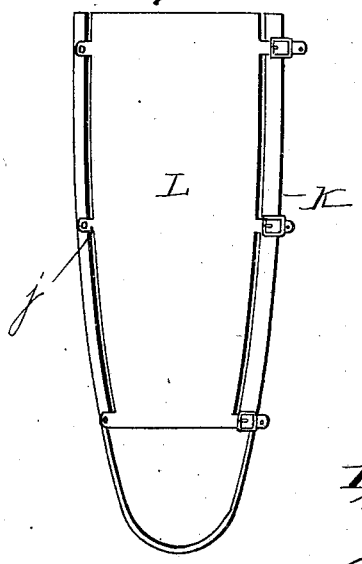


Fig. 13a

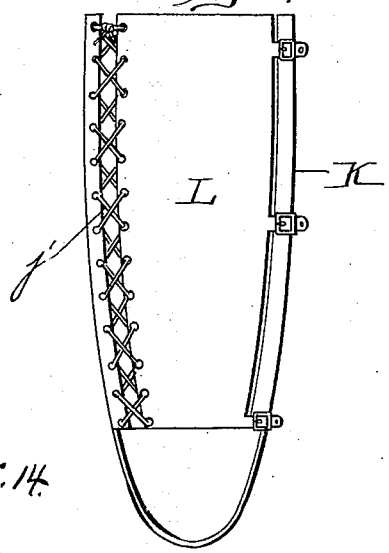
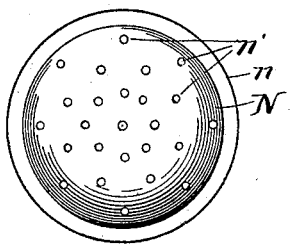


Fig. 14.



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UNITED STATES PATENT OFFICE.

JOHN A. PEER, OF NEW ORLEANS, LOUISIANA.

ARTIFICIAL LEG.

SPECIFICATION forming part of Letters Patent No. 648,345, dated April 24, 1900.

Application filed June 15, 1899. Serial No. 720,614. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. PEER, a citizen of the United States, residing at New Orleans, Orleans parish, Louisiana, have invented certain new and useful Improvements in Artificial Legs; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in artificial legs.

One object of my invention is to provide an artificial leg whose movements will more nearly resemble those of the natural leg than any artificial leg heretofore known to me.

A further object of my invention is to avoid the dangers of breakage at the joints, which have been common in artificial legs heretofore constructed, to provide for the ready adjustment of the joints, and to take up automatically all lost motion in such joints.

With these main objects in view and some others which will be obvious to the skilled in the art my invention consists in the features, details of construction, and combinations of parts, which will first be described in connection with the accompanying drawings and then particularly pointed out in the claims.

In the drawings, Figure 1 is a side elevation of an artificial leg embodying my improvements; Fig. 2, a similar view taken from the opposite side, showing the knee-socket swung over; Fig. 3, a transverse sectional view of the entire leg on the line 3 3, Fig. 1; Fig. 4, a longitudinal section of the foot; Figs. 5 and 6, detail perspective views illustrating the two parts of a toe-joint; Figs. 7, 8, and 9, detail elevations of one form of ankle-joint employed by me; Figs. 10, 11, and 12, similar views of another form of toe-joint employed by me; Figs. 13 and 13^a, detail elevations of two forms of knee-socket-fastening devices which may be employed in connection with my invention; Fig. 14, a plan view of the ventilated stump-plate; Figs. 15 and 16, a detail section and side elevation, respectively, of a knee-joint and knee-joint bolt; Fig. 17, an elevation of the mechanical sinew; Fig. 18, a sectional view illustrating a modified form of ankle-joint-fastening device embodying my invention. Fig. 19 is an enlarged detail sectional view of the knee-joint bolt and stay-plates separated from each other, the latter being partly broken away.

For the sake of perspicuity I will describe my various improvements in artificial legs under the following heads:

I. The knee-joint.
II. The ankle-joint.
III. The toe-piece and the toe-joint.
IV. The thigh-socket.
V. The artificial calf and its ventilated stump-plate.

I. *The knee-joint.*—Each knee-joint comprises two sets of joint mechanism, one set for each side of the leg, each set, furthermore, comprising an upper and a lower stay-plate, a joint-bolt, a mechanism which I will term the "mechanical sinew," and suitable cushioning devices.

I will now describe in detail one set of joint mechanism, it being understood that the corresponding sets of joint mechanism forming a knee-joint differ from each other only in being "rights" and "lefts," terms which will be fully understood by those skilled in the art.

Referring to the drawings, A is an upper stay-plate, provided at a with an upward-extending socket having an opening in its bottom, as shown at a' in Fig. 19. In front of and below the said socket a is arranged a downward-extending socket a^2 to carry a cushion. The upper stay-plate A is also provided with a downward-extending lug or ear a^3, Fig. 19, which is offset laterally, in the present case toward the inside of the leg.

The lower stay-plate B, which coacts with the upper stay-plate, has a downward-extending socket b, provided with an opening b' above it, as shown in Fig. 19, and with a second socket b^2, Figs. 1 and 2, which extends upward and which is in front of the socket b, being also arranged to come opposite the downward-extending socket a^2 of the upper stay-plate. The said lower stay-plate B also has a lug or ear b^3 projecting upward, which lug or ear is offset laterally, in the present instance away from the leg.

Each lug or ear $a^3 b^3$ is provided with a bolt-hole, a^5 and b^5, as shown, the inner and outer faces of the lugs a^3 and b^3 being countersunk around the respective bolt-holes, as will be seen in Fig. 19. The lugs are arranged to come op-

posite each other in such a position that their respective bolt-holes will register with each other.

The lugs a^3 b^3 of each pair of stay-plates A B are movably connected in proper operative relation by means of a knee pivot-bolt C, Fig. 19, which has a central portion comprising a groove substantially semicircular, as indicated at c, and a flange c' at each side of said groove. The bolt projects at each end beyond the flanges c', as shown at c^2, the extreme ends being reduced somewhat in diameter, as shown at c^3. Each reduced end is arranged to receive a washer C', as will be explained hereinafter.

In assembling the two stay-plates one projecting end c^2 of the bolt is inserted in the opening in the lug of one of the stay-plates—for example, the opening in the lug a^3 of the upper stay-plate A. (See Fig. 15.) Thereupon the corresponding washer C' is slipped upon the respective reduced end c^3, which projects slightly beyond the stay-plate lug. The washer is arranged to enter the countersunk portion of the lug, whereupon the end of the pivot-bolt may be riveted to hold the said washer in place. The other stay-plate is now secured to the opposite end of the pivot-bolt in a similar manner. At this stage of the construction we will have an upper and a lower stay-plate A and B, respectively, each pivotally connected to the pivot-bolt C by means of their lugs, which will be separated from each other by the two flanges c' and the groove c, while the axes of the sockets a b a^2 b^2 will all be in one vertical plane.

In the sockets a^2 b^2 rubber plugs are inserted, which of course will come into contact with each other when the two stay-plates move in one direction, thereby yieldingly limiting the movement of the stay-plates about their common axis in the said direction. The movement in the opposite direction of the stay-plates about their common axis is limited by the contact of the sides of the stay-plates. The points of contact are indicated at a^4 b^4, respectively, Figs. 1 and 2.

I will now proceed to describe what I term the "mechanical sinew." This consists of a pair of bolts D D', Fig. 17, threaded at the outer ends, upon which are screwed adjusting-nuts d d', Fig. 15, provided with pin-holes d^2 to receive the end of an ordinary adjusting-pin, spanner, or the like. The inner ends of the bolts D D' are connected by a knuckle-joint of the usual kind, as shown at d^3, Fig. 17. One of the said bolts is also provided with a square portion d^4, which is of such a width as to be nearly equal to the distance between the flanges c' of the pivot-bolt C, for a purpose hereinafter described. Before the two stay-plates A and B are pivoted together, as above described, the mechanical sinew is put in place by inserting the respective ends of the bolts D D' through the openings a' b', Fig. 19, in the bottoms of their respective sockets a b, after which elastic washers E E' are slipped over the ends of said bolts D D' and allowed to enter the said sockets, the adjusting-nuts being then screwed upon the threaded ends of the bolts, care being taken that in assembling all the parts of a joint mechanism the swivel-joint d^3 connecting the bolts D D' is arranged to permit the movement of the stay-plates about their axes, while the squared portion d^4 remains between the two flanges c' of the pivot-bolt C or in the space between the lugs a^3 b^3, thereby preventing the turning of the bolts D D', and hence retaining them in their proper operative relation.

It is to be noted that in my construction the swivel-joint d^3 of the two bolts D D' is normally in close contact with the pivot-bolt. Hence as the two stay-plates A B are swung from their normal position to a position where their longitudinal axes are at right angles to each other the mechanical sinew will compress the elastic cushions through which it passes, and the two bolts D D' forming said mechanical sinew will also lie with their axes at an angle to each other, turning on their swivel-joint d^3.

In my improved knee-joint, which comprises two mechanisms such as just described, (with the difference that one is a right and the other a left,) the lower stay-plates are screwed or otherwise fastened to the lower leg portion F, as shown, while the upper stay-plate carries the knee-socket, being bolted, riveted, screwed, or otherwise fastened to said knee-socket.

In the ordinary use of an artificial leg embodying my improved knee-joint the normal position of the knee-joint device will be with the two lower cushions in contact with each other. Hence these cushions and the pivot-bolts C will transmit the weight upon the knee-socket to the ground in an elastic manner and without jarring the stump of the limb which is secured to the artificial leg. In walking the mechanical sinews will compress their cushions as the lower leg portion F is bent backward at the knee-joint at the time when the other leg has moved one step forward. Therefore when the artificial leg is raised from the ground for the next step the mechanical sinew, owing to the elasticity of its cushions, will pull the lower leg portion into line with the knee-socket, thereby causing the lower leg portion to swing forward, whereby it comes into position for the next step. At the same time the cushions of the mechanical sinew take up all lost motion which might arise in the knee-joint from wear, this lost motion being taken up automatically, owing to the fact that the said cushions of the mechanical sinew maintain a pressure on the joint, and thus keep the parts from rattling.

It is to be particularly noted that in my improved knee-joint when the wearer sits down, and thereby brings the knee-socket at an angle to the lower leg portion, the mechanical sinew is bent on its swivel-joint, so that the cushions of the said mechanical sinew

pull at an angle to each other, the strain of each cushion tending to draw the corresponding opposite bolt into close contact with the pivot-bolt C. Hence as the wearer sits down there is but little or no tendency on the part of the mechanical sinew to draw on the lower leg portion. This is a great advantage, since it allows the leg to be bent at the knee without great effort on the part of the wearer.

II. *The ankle-joint.*—My improved ankle-joint comprises an upper part G and a lower part G′, one of which is provided with a ball g and the other with a corresponding socket g', arranged to coact with the ball in the usual manner. Both the ball and socket are provided with central openings g^2, preferably flared, as shown. At the outer side of the parts G G′ are formed sockets, as indicated at g^3. One of the parts—as, for example, the part G′—is provided with a pair of projecting semicircular ears g^4, arranged to enter corresponding bearings g^5 in the opposite part G, the said ears g^4 and their bearings g^5 together forming a swivel-joint, this being possible for the reason that the faces of the two parts G G′ slope at an obtuse angle away from the axis of the joint, so that when the ball and socket are in contact and the ears g^4 resting in their bearings g^5 there will be a space between the two faces of the parts G G′ at the outer edges away from the axis of the joint. The said parts G G′ are provided with corresponding registering recesses arranged to receive rubber or other elastic cushions. In Fig. 8 four of these cushions g^6 are shown, while in Fig. 3 I have shown a single circular cushion g^7, surrounding the ball and socket. In order to hold the two parts G G′ together, a central bolt H is passed through the opening in the ball and socket, respectively, and also through elastic cushions g^8, which are located in the sockets g^3, the bolt H having a slotted head or screw-head at the lower end and a nut or the like at the upper end.

In uniting the foot to the lower leg portion by means of my improved ankle-joint I form the usual sort of socket in the upper or ankle portion of the footpiece I and screw one of the parts, as G′, to the footpiece I, and bolt the other part G to the lower end of the leg portion proper by suitable bolts passing through a plate, as shown. The bolt H is then put in place to unite the two parts G G′, thus uniting the foot portion of the artificial leg to the lower leg portion, the said bolt H being inserted into place through a hole i in the bottom of the foot portion. Through the hole i the said screw-headed bolt may be reached with a screw-driver in order to adjust the tension of the joint.

III. *The toe-piece and its swivel-joint.*—One of the most important features of my invention consists of the formation of the toepiece and the relative location of the axis of the joint of said toepiece, as will be more fully understood from the description hereinafter.

Referring to Fig. 4 of the drawings, O is the toepiece, arranged to be connected to the foot by a suitable joint device, such as the one hereinafter described. The axis o of the joint is located above the bottom surface of the toepiece, and the said toepiece extends rearward of the vertical plane passing through said axis, said toepiece thereby partaking of the nature of a lever of the first order fulcrumed at the axis o. The toepiece has a movement about its axis from a position where the bottom surface of the toepiece may rest firmly on the ground, as shown by the full lines in Fig. 4, to a position where the front portion of the toepiece is inclined upward and forward, as shown by the dotted lines in Fig. 4. The latter position I will call the "normal" one, and the toepiece is retained yieldingly in said normal position by suitable elastic or yielding means, preferably, however, by the toe-joint, which will be described hereinafter. Hence when the front portion of the toepiece is in its normal position the portion back of the vertical plane through the axis of the toe-joint will extend downward below the surface of the bottom of the foot portion I, as will appear from Fig. 4. Consequently when the artificial leg is swung forward in taking a step the heel comes into contact with the ground first, and then as the weight of the wearer is brought forward, and the calf of the leg assumes a more nearly upright position the rear portion o' of the toepiece is brought into contact with the ground, thereby forcing said rear portion upward, while the front portion of the said toe-piece is thereby forced downward until finally the bottom of the toepiece is brought into close contact with the ground, thus giving a full and solid bearing of the entire bottom surface of the foot on the ground at the moment when the whole weight of the wearer is brought upon the artificial leg, and when the other leg is about to make a step. While this is being done the heel of the artificial leg is raised from the ground, while the bottom surface of the forward part of the foot portion proper and the whole of the bottom surface of the toepiece sustain the weight of the wearer, the heel and the foot portion proper of the artificial leg swinging upward with the axis o as a center of motion. Then as the next step of the artificial leg is commenced by lifting the latter from the ground the front part of the toepiece will be inclined with relation to the foot portion proper—that is to say, will be in its normal position as it leaves the ground, in which position it is held by the elastic or yielding means in the toe-joint mechanism, so that as the artificial leg is swung forward in making its advancing step the toepiece will have no tendency to drag along the ground. By this means a natural action of the toepiece is effected and there is no danger of the wearer "stumping his toe" (as it is commonly called) and falling as a result thereof. At the same time by my construction when the weight of the

wearer is brought upon the artificial foot the toepiece is capable of sustaining and does sustain its full share of the weight of the wearer, and there is no tendency of it to yield or spring away from the ground. Thus, as will be seen, the said toepiece becomes an important aid in walking, just as the toes of the natural foot do. Another advantage of this combination is that tension of the elastic or yielding mechanism of the toe-joint need not be much, since the action of the wearer in walking serves to bring the toepiece into its normal position, and it is only required of the said elastic or yielding mechanism that it maintain the toepiece in said normal position, the said elastic or yielding mechanism having but little function in moving the toepiece to its normal position.

In view of the fact that in my construction I cause the toepiece to assist materially in maintaining the balance of the wearer, and hence in supporting some of the weight of said wearer, it becomes important to have the toepiece connected to the foot portion proper by a joint which will not be broken under the load to which it is subjected. I therefore employ a joint device which is substantially the same in general principles of construction as either the ankle-joint shown in Fig. 3 or that shown in Fig. 7, which have been heretofore described, the only difference being that the toe-joint device is usually and preferably somewhat smaller than the joint device employed as an ankle-joint, and, furthermore, said toe-joint is located so that the plane of division between its two parts is inclined upward and forward, as shown in Fig. 4, whereby it results that the connecting-bolt (which unites the two portions of the said toe-joint device) projects forward and downward and has its screw-head i^3 located in a recess at the bottom of the toepiece, said recess being shown at i^4 in Fig. 4. By this arrangement the adjustment of the tension of the elastic cushions of the joint device may be done readily and without requiring the dismantling of any part of the artificial leg, it being only necessary to apply a screw-driver to the said screw-head i^3 and turn the same in either direction, according as it is desirous to increase or decrease the tension of the elastic cushions or to take up wear in the ball-and-socket connection.

IV. *The thigh-socket.*—In general, this comprises the front piece K, made of any suitable material, such as sole-leather, and preferably smooth in front, the said front piece being connected to the upper stay-plates A, as hereinbefore described. The back piece L of the thigh-socket is made so that it may be opened in order to allow the insertion of the stump of the wearer. In my preferred form of construction, as shown in Fig. 1, I unite the back piece, which is preferably of sole-leather, by means of a hinge l, to one edge k of the front piece K. The other edge of said back piece L may be detachably secured to the corresponding edge of the front piece by any suitable fastening or locking device. In Fig. 13 I have shown buckles and straps employed for this purpose, said figure also illustrating an ordinary riveted connnection j instead of the hinge, while in Fig. 13ª I have shown a lacing j' in place of such hinge.

V. *The artificial calf or lower leg portion and its ventilated stump-plate.*—This part of my invention relates to the means for ventilating the stump and for permitting the fitting of the leg to wearers having different lengths of stumps which end below the knee. For this purpose my invention consists in making the interior of the lower leg portion slightly conical and providing a stump-plate N, Fig. 14, having a thick rim n and a plurality of ventilating-holes, as shown at n'. The leg is also provided toward the rear with longitudinal slots or openings n^2 for the entrance of the air to the interior of the leg and to the stump of the wearer. When the leg embodying my improvements is to be fitted to a wearer having a stump ending between the knee and ankle, the knee-socket is left open at the bottom in order that the stump may project through into the interior of the lower leg portion. The ventilated stump-plate N is then turned off until it is of such diameter that it will drop down into the interior of the lower leg portion until it is stopped at the proper point for the reception of the stump of the wearer. It is to be understood that a pad of open-work material is to be placed on top of the stump-plate to receive the end of the stump.

In conclusion it is to be understood that whenever in the above specification I have referred to "cushions" or similar elastic devices these may be of india-rubber or made of metallic springs, as desired, although I prefer the rubber devices.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an artificial leg, a knee-joint comprising a pair of upper stay-plates, a pair of lower stay-plates, pivot-bolts uniting said stay-plates and swiveled bolts bearing against the pivot-bolts and yieldingly connected to the stay-plates.

2. In an artificial leg, the combination with an upper stay-plate having a socket and a lug, of a lower stay-plate having a corresponding socket and a lug, a pivot-bolt on which each lug is pivoted, a pair of bolts connected by a swiveled joint, bearing against the pivot-bolt and having their ends extending through the sockets, nuts on the projecting ends of said bolts and elastic cushioning devices in the sockets and beneath the nuts.

3. In an artificial leg, the combination with an upper and a lower stay-plate, each having a lug offset laterally in correspondingly-opposite directions, a pivot-bolt provided with flanges and connecting the said lugs, washers on the ends of the pivot-bolts and coun-

tersunk into the lugs, and a pair of bolts connected by a swivel joint and bearing against the pivot-bolt, one of said bolts being provided with an enlargement intermediate the flanges of the pivot-bolt whereby rotation of said bolts is prevented, means for yieldingly connecting the ends of said bolts to the upper and lower stay-plates, and cushioned stop devices for limiting the angular movement of the stay-plates.

4. In an artificial leg, the combination with a footpiece, of a toepiece having a rearward-extending portion normally projecting below the bottom surface of the toepiece, pivoted means for connecting the toepiece to the footpiece, the axis of said pivotal means being forward of the said rearward-extending portion, and yielding means for holding the toepiece in the normal position.

5. In an artificial leg, a joint device comprising two parts, one provided with a ball and the other with a socket, one part also having projecting ears with rounded ends, the other having corresponding recesses to receive said ends a yielding cushion arranged between both of said parts, a bolt passing through the ball and socket, and yielding means surrounding the ends of the bolts for keeping the parts tight.

6. In an artificial leg, a joint comprising two parts having coacting faces receding from their actual line of contact, one part having a ball and the other a socket, one part having a pair of ears with rounded ends and the other a pair of corresponding recesses to receive said rounded ends, a cushion device located between the two parts and acting on each, and means for holding the parts together in a yielding manner.

7. In an artificial leg, a footpiece, a toepiece having a hole, a joint connecting the toepiece to the footpiece and comprising two parts, one secured to the footpiece and the other to the toepiece, the plane of division of the two pieces being inclined upward and forward, and a bolt device sloping forward and downward, said bolt device connecting the two parts of the joint and having its head opposite the hole in the toepiece, whereby the joint may be adjusted from the bottom of the toepiece.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN A. PEER.

Witnesses:
EDWARD HOWARD,
JOHN W. THOMAS.