W. G. KELLY.

ARTIFICIAL LIMB.

APPLICATION FILED APR. 7, 1910.

989,526. Patented Apr. 11, 1911.

Fig. 1.

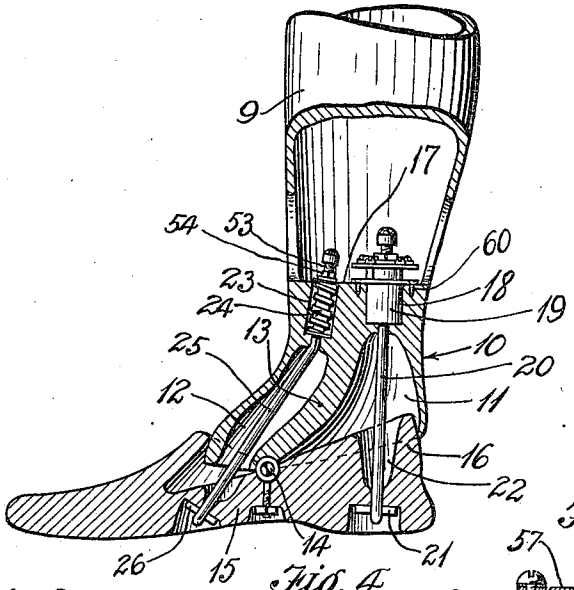


Fig. 3.

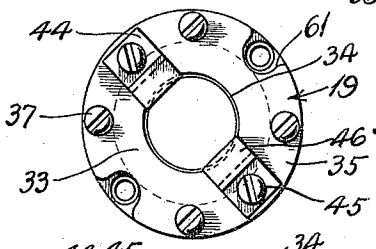


Fig. 4.

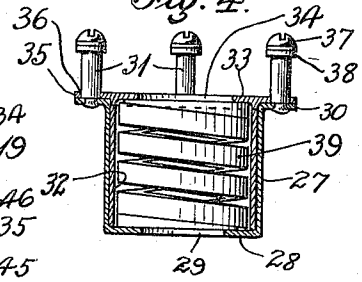


Fig. 6.

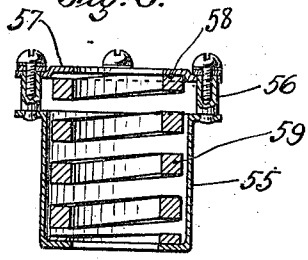


Fig. 2.

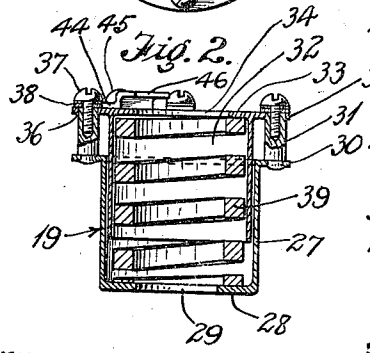


Fig. 5.

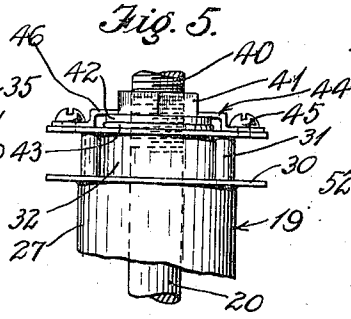


Fig. 7.

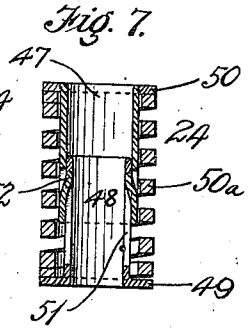
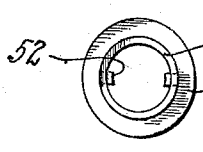


Fig. 8.



Witnesses.

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UNITED STATES PATENT OFFICE.

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ARTIFICIAL LIMB.

989,526. Specification of Letters Patent. Patented Apr. 11, 1911.

Application filed April 7, 1910. Serial No. 553,906.

To all whom it may concern:

Be it known that I, WILLIAM G. KELLY, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Artificial Limbs, of which the following is a specification.

This invention relates to springs, and the object of the invention is to provide a spring having improved means for mounting the same so that the spring is constantly maintained in a constrained or compressed condition, and so that when the distorting force is applied to the spring, the force will not begin to distort the spring until it reaches a predetermined strength. In other words, the spring is not normally in a state of relaxation.

In the following specification I have described the spring as applied to an artificial limb, to illustrate the manner in which the spring may be used in various arts or manufacture.

In the annexed drawings forming a part of the specification, Figure 1 is a side elevation and partial section through the lower part of the leg and the foot which is attached to the leg. Fig. 2 is a vertical section taken through the spring barrel when constructed in the form shown in Fig. 1, certain parts being shown in elevation and broken away. Fig. 3 is a plan of the parts shown in Fig. 2. Fig. 4 is a vertical section showing the spring barrel in its compressed or collapsed position, and indicating the means by which I prevent the coils of the spring from coming into contact with each other. Fig. 5 is a side elevation of the upper part of the spring barrel shown in Figs. 2 and 4, and particularly illustrating the means for preventing the adjustment of the flexible cord from changing. Fig. 6 is a view similar to Fig. 2, but showing a modified form of the invention. Fig. 7 is a vertical section through the toe spring of the device. Fig. 8 is an end view of one of the sleeves upon which the spring is mounted as shown in Fig. 7.

Referring more particularly to the parts, 9 represents the leg of the limb, the lower portion of which is formed into an ankle 10 having a heel chamber 11, and a toe chamber 12 separated by a dividing wall 13 which is integral with the leg as indicated. At the lower end of the dividing wall 13, a horizontal rocking pin 14 is provided, which secures the foot 15 pivotally to the ankle at a point above the arch or shank of the foot. The rear portion of the foot is formed into a heel 16 which is adapted to move up into the chamber 11 in walking. The lower portion of the leg 9 above the ankle is hollow, and is formed with a horizontal face or seat 17, in the rear part of which a socket 18 is formed to receive a spring barrel 19, and from this spring barrel 19 a flexible cord extends downwardly and is anchored by a suitable anchor pin 21 to the under side of the foot at the heel. This flexible cord 20, it should be understood, is non-elastic. It extends down through the heel chamber 11 and the upper portion of the heel is formed with a bore or recess 22 to make clearance for the cord when the foot rocks on the rocking pin 14 in walking. In the forward part of the face 17 a socket 23 is formed, in which a spring barrel 24 is mounted, and from this spring barrel 24 a flexible cord 25 extends downwardly into the toe chamber 12, and the lower end of this cord is anchored by an anchor pin to the under side of the foot just forward of the rocking pin 14.

Figs. 2, 4 and 5 show the spring barrel 19 in detail. This barrel comprises a cylindrical case or outer sleeve 27 which has a bottom head 28 for a central opening 29 in the bottom head as indicated. The upper end of the case is formed with a flange 30, and to this flange a plurality of vertically extending guide studs are attached. In the case 27 an inner sleeve 32 is received, said sleeve being of cylindrical form, and open at its lower end. The upper end of the sleeve 32 is formed with a head 33, having a central opening 34 and this head presents an outwardly projecting flange 35 having guide openings 36, through which the studs pass as indicated. The flange 35 is kept from passing off of the studs 31 by means of screws 37 which are applied in the ends of the studs so that the heads of the screws project out over the flange as indicated in Fig. 2. Under the heads of the screws 37 elastic washers 38 are provided, which act as cushions to absorb the shock when the sleeve returns under the extending action of the spring. Between the heads 28 and 33 a coil spring 39 is provided, and this spring is always in a state of compression even

when the inner sleeve is extended upwardly to the limit of its upward movement.

As indicated in Fig. 5, the heel cord 20 is connected at its upper end to a threaded metallic stem 40, and this stem 40 extends upwardly through the opening 34. Upon the stem 40 a nut 41 is received, and this nut has an enlarged collar 42 at its base. This collar is adapted to rest upon the upper face of the head 33, but a resilient or elastic washer 43 is placed under the collar 42 to cushion the action of the spring. By rotating the nut 41, the length of the flexible cord 20 can be very nicely adjusted. In order to hold the nut in position and prevent its rotation when the cord 20 is in a relaxed condition, I provide clips 44 which are attached at diametrically opposite points on the upper head 33 as indicated in Fig. 3. These clips 44 consist simply of plates attached by suitable screws 45, and having their inner faces offset upwardly so that they present flanges 46, the edges of which are adapted to engage the side faces of the nut 41. This will prevent the nut from rotating as shown in Fig. 5. These flanges rest upon the outer face of the collar 42, so that they hold the collar seated on the head 33. In Fig. 5, I show the spring barrel in a compressed or collapsed condition which it may have in walking. In this connection, attention is called to the fact that in the extreme downward movement of the inner sleeve, the flange 35 of the head 33 may come against the flange 30, but even if this should occur, the coils of the spring 39 will not come in contact with each other. This arrangement prevents the elastic limit of the spring from being reached, and prevents the spring from being broken.

The forward spring barrel 24 is shown in detail in Fig. 7. It comprises a coil spring 50^a, which is disposed about two telescoping tubular sleeves 47 and 48, the lower sleeve 48 having an outwardly projecting flange 49 at its lower end which forms a seat for the lower end of the spring as indicated. The upper sleeve 47 is threaded at its upper end so as to receive a removable collar 50 which can be detached when the spring is to be replaced. This collar 50 forms the seat for the upper end of the spring as indicated. The sleeves 47 and 48 are interlocked with each other, so that they cannot be detached by ordinary means. In order to form this interlocking connection, the sleeve 48 is formed with diametrically opposite, longitudinally disposed slots 51, and near the lower end of the sleeve 47 the material of the sleeve is offset inwardly to form resilient tongues 52 which project inwardly and upwardly. If the sleeves are telescoped together with the tongues 52 in alinement with the slots, the tongues will be forced inwardly so as to permit the inner end of the sleeve 48 to pass, and as soon as the slots 51 come opposite the tongues, the tongues will then snap into the slots and prevent the sleeve 48 from being withdrawn. This spring barrel is placed in the socket 23 as indicated, and the flexible cord passes up through the sleeves 47 and 48 as shown. The upper end of the flexible cord 25 is attached to a threaded stem 53, which is similar to the threaded stem 40, and this stem receives a nut 54 which is similar to the nut 41 described above. This nut seats on the collar 50 on the upper end of the sleeve 47.

Special attention is called to the fact that the spring barrels hold the springs constantly in a state of compression, and this arrangement greatly increases the life of the spring as the spring does not move between such wide limits. While I have applied my invention to a compression spring, it will be evident that the invention can be applied also to a tension spring, that is, the invention may be considered as consisting in maintaining a spring in a constrained state, so that the distorting force which acts on the spring does not move the spring from the condition of rest or zero tension but it must overcome the greater force of the spring before it produces any distortion whatever.

In the form of the invention shown in Fig. 6 a cylindrical case 55 is provided, which is similar to the case 27, and similarly provided with studs 56. In this instance I do not employ an inner sleeve, but simply provide an annular head 57, the middle portion of which is upset or offset to form a seat 58 on its under side for the upper end of the spring 59. In other respects the construction is identical with the form shown in Fig. 2.

In order to attach the spring barrel 19 in its socket 18, I provide screws 60 which are applied from above, and in order to enable the heads of these screws to be reached, the flange 35 is cut away or formed with gaps or recesses 61 on opposite sides as indicated in Fig. 3.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. In combination with an artificial limb, a spring barrel having a cylindrical case with a flange at one end thereof, a spring received in said case, studs secured to said flange, and a head guided on said studs forming a seat for said spring and maintaining said spring in a state of compression.

2. In combination with an artificial limb, a spring barrel consisting of two tubular sleeves, telescoping and interlocking together, means carried by said sleeves for limiting the spreading movement of said

sleeves, and a spring received on both of said sleeves and contained thereby.

3. In combination, with an artificial limb a spring consisting of two tubular sleeves telescoping together, one of said sleeves having a longitudinally disposed slot, the other of said sleeves having a resilient tongue projecting into said slot and locking said sleeves against detaching from each other, said sleeves having heads on the ends thereof, and a spring seated on said heads and disposed about the bodies of said sleeves.

4. In combination with an artificial limb having a foot mounted to rock thereupon, springs connecting said foot with said limb, and resiliently resisting the rocking movement of said foot, said springs being maintained in a state of compression in every possible position of said foot.

5. In combination with an artificial limb, of two members relatively movable with respect to each other, a spring held therebetween, means for limiting the outward movement of said members to maintain said spring in a constrained condition, and means for limiting the inward movement of said members to prevent the coils of said spring coming in contact with each other.

In witness that I claim the foregoing I have hereunto subscribed my name this 1st day of April, 1910.

WILLIAM GRANT KELLY.

Witnesses:

F. D. AMMEN,

EDMUND A. STRAUSE.