

April 7, 1936.

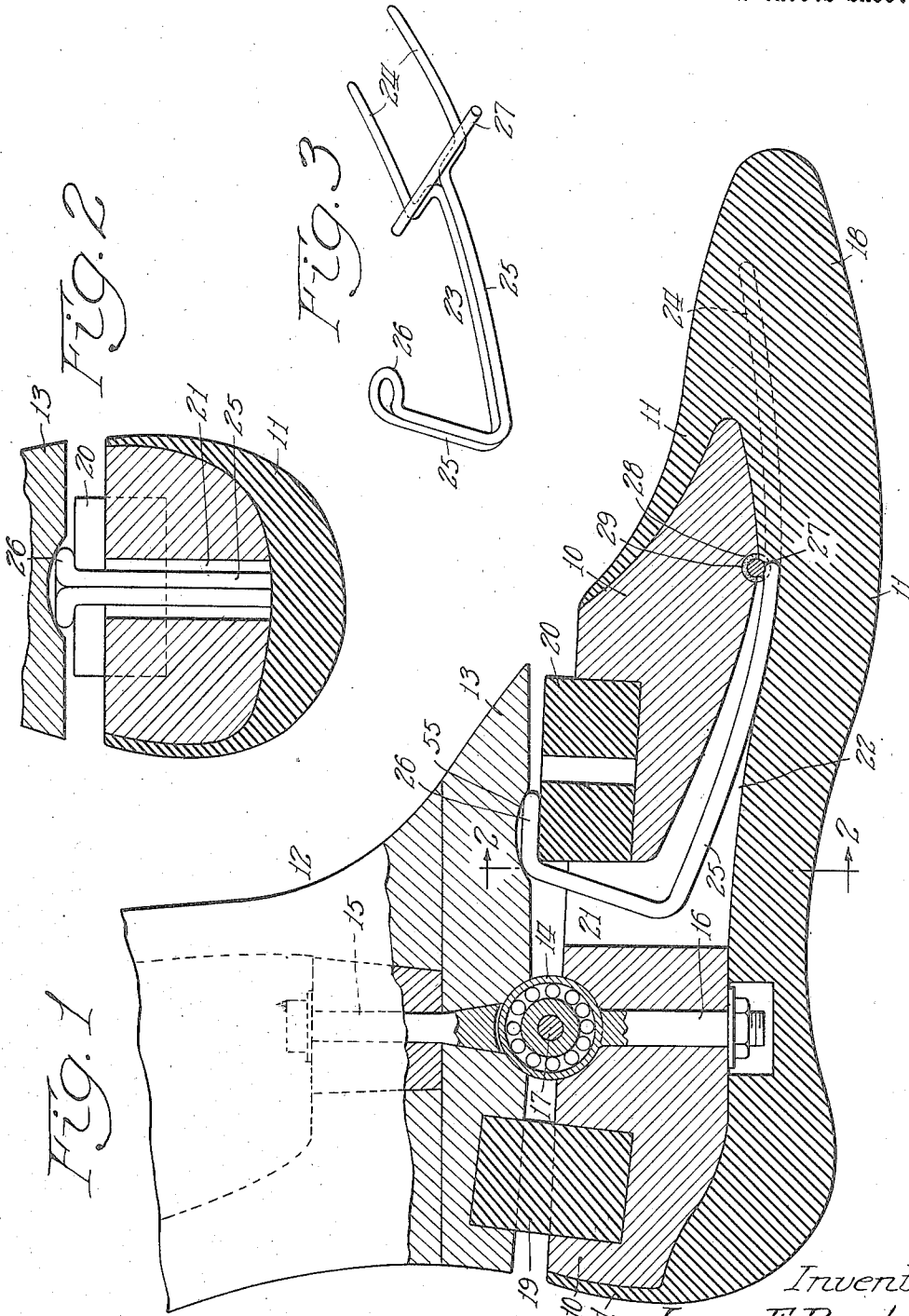
J. F. ROWLEY

2,036,830

ARTIFICIAL FOOT

Filed Aug. 13, 1934

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 5

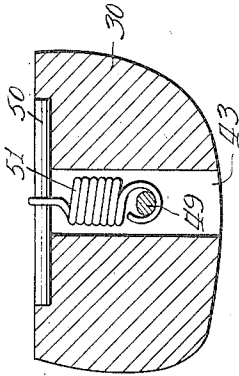


FIG. 6

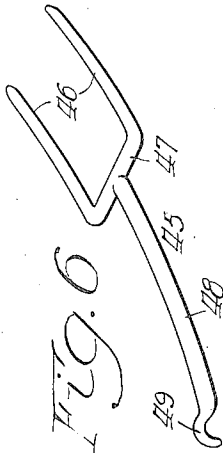
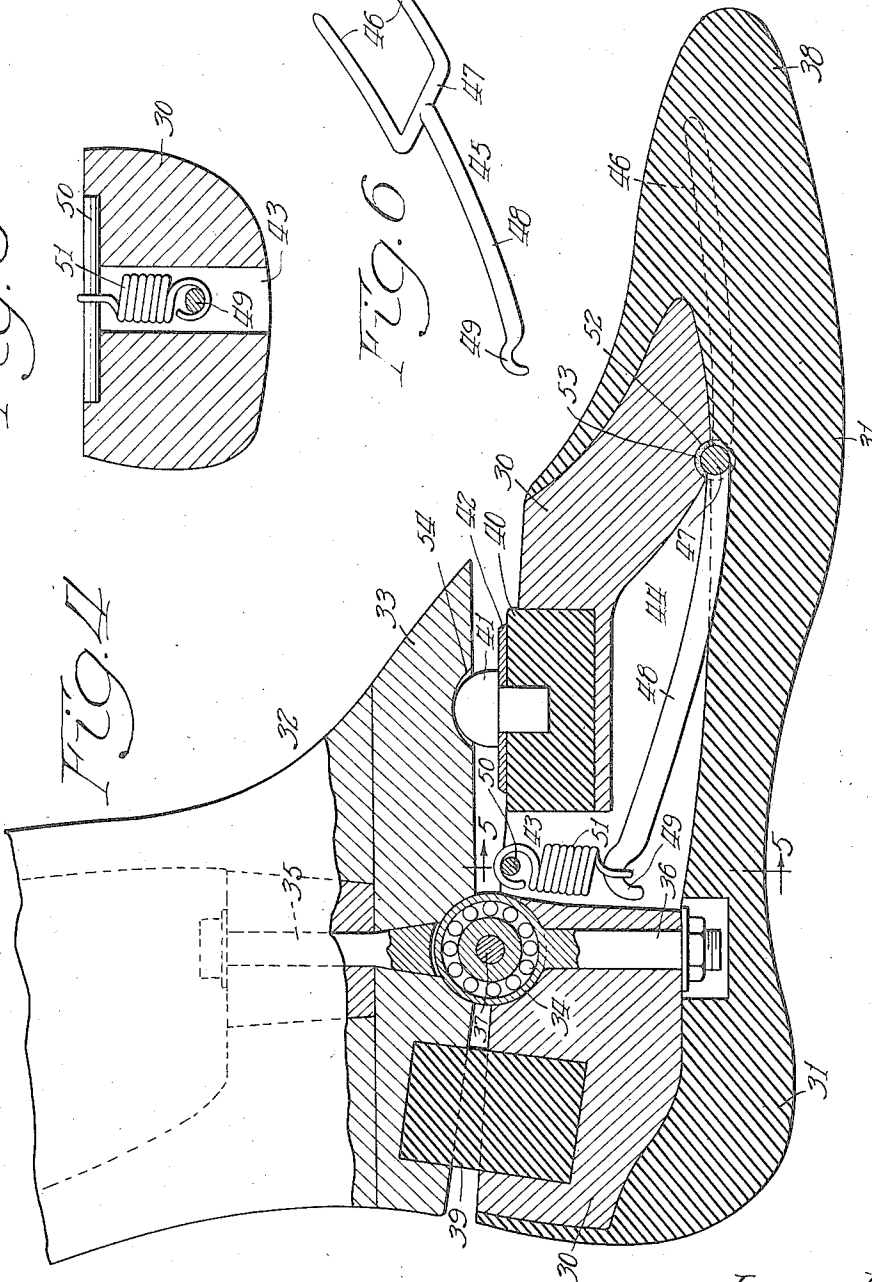


FIG. 7



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UNITED STATES PATENT OFFICE

2,036,830

ARTIFICIAL FOOT

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7 Claims. (Cl. 3—5)

My invention relates to artificial feet and more particularly it relates to improvements especially adapted for use with artificial feet comprising an outer flexible foot form and a core of hard material embedded therein.

It is an object of the invention to provide improved means operatively connecting the core with the flexible front or toe portion of the foot in such a manner that the toe portion is thereby automatically maintained in natural position relative to the body of the foot and upward flexure and return movement of the toe portion is permitted in accordance with the movement of the human foot while walking.

It is another object of the invention to provide an artificial foot having a flexible front portion and means adapted to yieldingly hold the front portion in its natural position and to permit it to be bent upwardly under the pressure exerted thereon in walking, the toe portion being returned to its natural position by the action of said means as soon as the pressure is released.

Still another object of the invention is to provide an artificial foot having a front or toe portion adapted to be flexed vertically in combination with means operable automatically for controlling the position of the toe relative to the body portion of the foot in accordance with the natural movement of the foot in walking.

It is a further object of the invention to provide an artificial foot having its component parts operatively connected in a manner such that the toe portion may be flexed by the normal pressure applied to the foot in walking and be automatically returned to its normal position upon release of the applied pressure.

Many other objects and advantages of the construction herein shown and described will be obvious to those skilled in the art from the disclosures herein given. To this end my invention consists in the novel construction, arrangement and combination of parts herein shown and described and more particularly pointed out in the claims.

In the drawings wherein like reference characters indicate like or corresponding parts:

Fig. 1 is a longitudinal vertical sectional view of one form of a foot embodying the principles of the invention;

Fig. 2 is a view along the line 2—2 of Fig. 1;

Fig. 3 is a perspective view of a rigid member operatively connecting the main body and toe portions of the foot;

Fig. 4 is a longitudinal vertical sectional view of an artificial foot showing an alternative form

of construction in which the principles of the invention are embodied;

Fig. 5 is a view along the line 5—5 of Fig. 4; and

Fig. 6 is a perspective view of a rigid member operatively connecting the flexible toe portion of the foot with a rigid core positioned in the main body of the foot.

Referring now more particularly to the drawings, the numeral 10 designates a core member of rigid material such as wood embedded in a foot form envelope 11 preferably constructed of sponge rubber. A shin section 12, including a transversely extending bottom member 13, is connected with the core member 10 by means of a bearing hinge 14 including a bolt 15 fastened to the shin section, a bolt 16 fastened to the core member, and a pivot 17 journaled in ball bearings. The shin member 13 is spaced away from the core member 10 to permit normal movement of the foot relative to the shin member.

The core member 10 terminates slightly in advance of the ball of the foot, the front or toe portion 18 of the envelope 11 being free to be flexed upwardly about the ball of the foot except as restricted in a manner hereinafter more particularly described.

A spring rubber block 19, having its ends respectively mounted in apertures provided for that purpose in the rear portion of the shin member 13 and the core member 10, yieldingly holds the core and shin members in normal position. A spring rubber buffer 20, mounted in an aperture provided for that purpose in the forward end of the core member 10, is operatively connected with the flexible toe portion 18 of the foot form by means of a rigid member 25. The member 25 is shown in perspective in Fig. 3 as having a pair of spaced-apart prongs 24 connected by a rod 27 and is shown in position in Fig. 1 with the prongs projecting forwardly in the toe portion 18.

The core member 10 is provided with a vertically extending opening 21 terminating in a forwardly extending longitudinal groove 22 in the bottom of the member. The member 25 is positioned in the groove 22 and has its rear end projecting upwardly through the opening 21 with its upper extremity turned forwardly to provide a flange 26 seated upon the block 20. The member 25 is positioned with the rod 27 providing a pivot at the ball of the foot. The rod 27 is positioned in a groove 28, provided for that purpose in the bottom of the core member 10, and is surrounded by suitable lubricant material 29.

The mounting and construction of the member 25 is such that the buffer block 20 normally holds the rigid member 25 in the unflexed position of the toe portion 18, the block yielding under pressure exerted thereon by the rigid member as the toe portion of the foot is flexed upwardly in walking. Upon release of the external pressure applied to the toe portion, the block 20 expands to its normal position thereby returning the rigid member to its normal position and carrying along with it the toe portion 18 to its original unflexed position.

The described arrangement and construction of the rigid member 25 is such that the toe portion 18 may be flexed upwardly and be returned to its normal position in a manner corresponding to the natural movement of the human foot in walking and the foot is manipulated in the same automatic manner as the human foot.

An alternative embodiment of the invention is shown in Fig. 4 as comprising a core member 30 embedded in an envelope 31 of resilient material such as sponge rubber or the like. A shin section 32 including a transverse bottom member 33 is operatively connected with the core member 30 by a ball bearing hinge 34 so arranged that the member 33 is normally spaced apart from the core member. The hinge 34 is fastened to the shin section by a bolt 35 and to the core member by a bolt 36, the bolts being connected in the usual manner by a pivot 37 journalled in ball bearings.

The rear portions of the core member 30 and shin member 33 are yieldingly held in normal spaced-apart relation by a sponge rubber block 39 having its opposite ends positioned in apertures respectively provided in the members for that purpose. The front portions of the members 30 and 33 are yieldingly held in normal spaced-apart relation by a buffer member 30 constructed of sponge rubber and surmounted by a solid bearing member 41 having its upper end positioned in a recess 54 in the member 33.

A washer 42 separates the head of the member 41 from the buffer 40 and serves to distribute the load coming from the shin member over the upper end of the buffer.

The core member 30 terminates slightly in advance of the ball of the foot and the front portion 38 of the foot, consisting entirely of resilient material such as sponge rubber or the like, is adapted to be flexed about the ball of the foot as a pivot. In order that the resilient front portion 38 may function in walking in a manner similar to that of the human foot, I have provided a rigid member 45 operatively connecting the front or toe portion 38 with the core member 30. The rigid member 45 is shown in perspective in Fig. 6 as comprising a lever 48 terminating in a pair of front prongs 46 which are embedded in the toe portion 38 as shown in Fig. 4. The member 45 is provided with a transversely extending pivot member 47 rotatably mounted in a groove 52 in the bottom of the member 30 adjacent the ball of the foot, the groove being filled with lubricant 53.

The core member 30 is provided with a vertically extending opening 43 terminating in a forwardly extending longitudinal groove 44 in the bottom of the member. The lever portion 48 of the member 46 is positioned in the groove 44 with its rear end providing a hook 49 operatively engaged by the lower end of an extensible spring 51 positioned in the opening 43. The upper end of the spring 51 is fastened to a sup-

porting rod 50 so arranged that the rigid member 45 normally occupies a position corresponding to the unflexed position of the toe portion 38. Upward bending of the toe portion 38 by external pressure, such as that exerted in walking, rotates the rigid member 45 about the pivot 47 and extends the spring 51. The spring 51 contracts and returns the member 45 and toe portion 38 to their normal positions upon the release of such pressure. In walking the toe portion 38 is flexed upwardly about the ball of the foot and is returned to its normal position by the action of the member 45 upon release of pressure on the toe portion.

Thus it will be seen that I have provided novel improvements in artificial foot construction which are adapted to permit movement of the toe portion relative to the main body of the foot in a manner corresponding to the natural movement of the corresponding parts of the human foot in walking and which operates to automatically return the toe portion of the foot to its normal position when no external pressure is applied thereto.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of my invention; hence I do not wish to be understood as limiting myself to the exact form, construction, arrangement and combination of parts herein shown and described or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. In an artificial foot, a rigid core member, an envelope of resilient material closely fitting the core member and providing a foot form, the core member having its forward end terminating adjacent the ball portion of the foot and providing a vertical opening rearwardly of said ball portion, a rigid member carried by the core member and extending longitudinally along the bottom thereof, means providing a mounting for and adapting the rigid member to be tilted about a transverse horizontal axis adjacent the ball of the foot, the front end of said rigid member being embedded in the toe portion of the form and having its rear portion extending through said opening and projecting forwardly over the top of the core member, a resilient member mounted on the top of the core member and providing a cushion seat for the forwardly projecting portion of the rigid member, said cushion seat being adapted to normally maintain the rigid member in a position corresponding to the unflexed position of the toe portion and to yield under external pressure applied to the bottom of the toe portion to permit upward movement thereof.

2. In an artificial limb, a rigid shin member, a rigid core member, means forming a rocker connection between said shin and core members, an envelope of resilient material closely fitting the core member and providing a foot form, the core member having its front portion terminating adjacent the ball portion of the foot, a rigid member pivotally mounted intermediate its ends on the core member with one movable end operatively related to the toe portion, and a resilient member mounted on the core member in operative relation to the other movable end of said rigid member in a manner to normally maintain said rigid member in a position corresponding to the unflexed position of the toe portion, said resilient member yieldable to permit movement of the toe portion relative to the core member, said shin

member being operable by tilting movement to move said rigid member against the resistance of said resilient member.

3. In an artificial limb, a rigid core member, an envelope of resilient material closely fitting the core member and providing a foot form, a rigid shin member, means providing a rocker connection between said core and shin members, the core member terminating adjacent the ball portion of the foot and providing an upwardly extending opening, a rigid member embedded in said toe portion and extending through said opening with its upper end projecting over the top of said core member, means providing a mounting for and adapting the rigid member to be tilted about a transverse axis adjacent the ball of the foot, a resilient member mounted on the top of the core member in advance of said rocker connection providing a cushion seat for said projecting end of the rigid member, said cushion seat normally maintaining the rigid member in a position corresponding to the natural relative positions of the toe portion, the shin member, and the core member, and resilient means adapted to maintain the forward end of the shin member in engagement with said projecting end of the rigid member, said cushion seat being yieldable under pressure exerted thereon to permit relative tilting movement of the forward portions of the shin and core members the one towards the other to actuate said rigid member to move the toe portion upwardly from its unflexed position.

4. In an artificial limb, a rigid core member, an envelope of resilient material closely fitting the core member and providing a foot form, a rigid shin member, means providing a rocker connection between said core and shin members, the core member terminating adjacent the ball portion of the foot and providing an upwardly extending opening, a rigid member embedded in said toe portion and extending through said opening with its upper end projecting over the top of said core member, means providing a mounting for and adapting the rigid member to be tilted about a transverse axis adjacent the ball of the foot, a resilient member mounted on the top of the core member in advance of said rocker connection providing a cushion seat for said projecting end of the rigid member, said cushion seat normally maintaining the rigid member in a position corresponding to the natural relative positions of said toe portion, shin and core members, and resilient means adapted to maintain the forward end of the shin member in engagement with said projecting end of the rigid member, said cushion seat being yieldable under pressure exerted thereon by actuation of the rigid member resulting from force applied to and resulting in movement of the toe portion upwardly relative to the core member.

5. In an artificial limb, a rigid core member, an envelope of resilient material closely fitting the core member and providing a foot form, a rigid

shin member, means providing a rocker connection between said core and shin members, the core member terminating adjacent the ball portion of the foot and providing an upwardly extending opening, a rigid member embedded in said toe portion and extending through said opening with its upper end projecting over the top of said core member, means providing a mounting for and adapting the rigid member to be tilted about a transverse axis adjacent the ball of the foot, a resilient member mounted on the top of the core member in advance of said rocker connection providing a cushion seat for said projecting end of the rigid member, said cushion seat normally maintaining the rigid member in a position corresponding to the respective relative natural positions of the toe portion, the shin member and the core member, and resilient means adapted to maintain the forward end of the shin member in engagement with said projecting end of the rigid member, said cushion seat being adapted to yield under pressure exerted thereon by said rigid member resulting from relative movement of the shin and core members the one towards the other and to yield also under the pressure resulting from movement of the rigid member resulting from upward movement of the toe portion by the application of external force to said toe portion.

6. In an artificial foot, a rigid core member having a vertical opening rearwardly of the ball of the foot, resilient material providing a foot form enveloping said core member, a rigid member extending forwardly from said opening along the bottom of the core member with its front end embedded in the toe portion of the form, means providing a pivotal mounting for said rigid member on said core member about a transverse axis adjacent the ball of the foot, the rear portion of said rigid member extending through said opening with its end overlying the top of the core member, and a cushion member providing a seat for said overlying end of the rigid member.

7. In an artificial foot, a rigid core member having a vertical opening rearwardly of the ball of the foot, resilient material providing a foot form enveloping said core member, a rigid member extending forwardly from said opening along the bottom of the core member with its front end providing a fork embedded in the toe portion of the form, means providing a pivotal mounting for said rigid member on said core member about a transverse axis adjacent the ball of the foot, the rear portion of said rigid member extending through said opening with its end overlying the top of the core member, and a cushion member providing a seat for said overlying end of the rigid member, said cushion member normally maintaining the rigid member in a position corresponding to the unflexed position of the toe portion of the said form and yieldable to permit upward bending of said toe portion.

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