No 776,908. PATENTED DEC. 6, 1904.

S. J. HENRY.

ARTIFICIAL LIMB.

APPLICATION FILED AUG. 12, 1904.

NO MODEL. 3 SHEETS—SHEET 1.

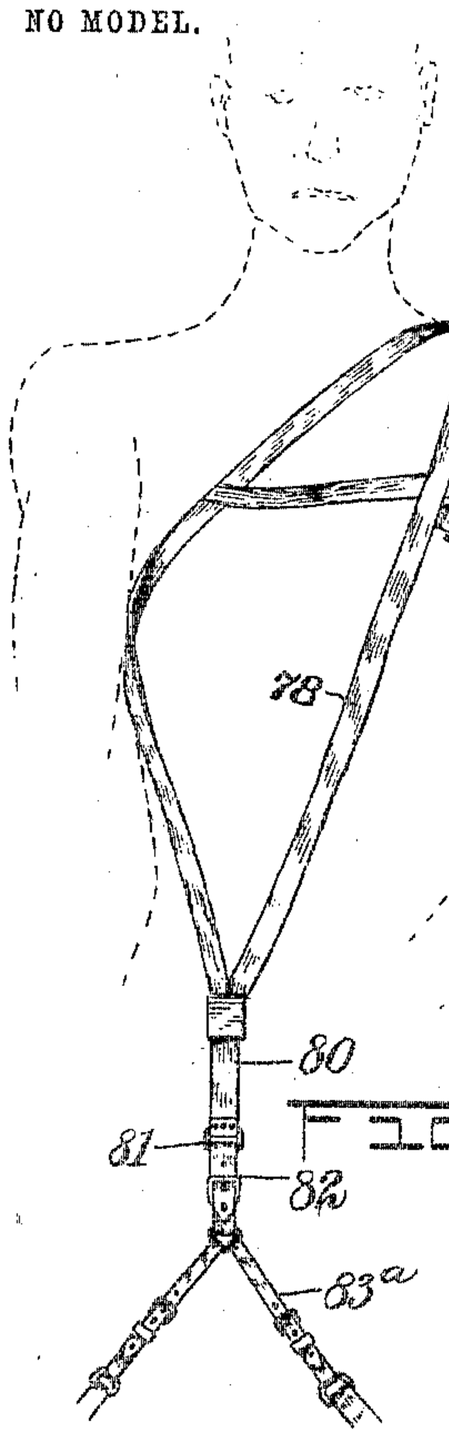

FIG. 10.

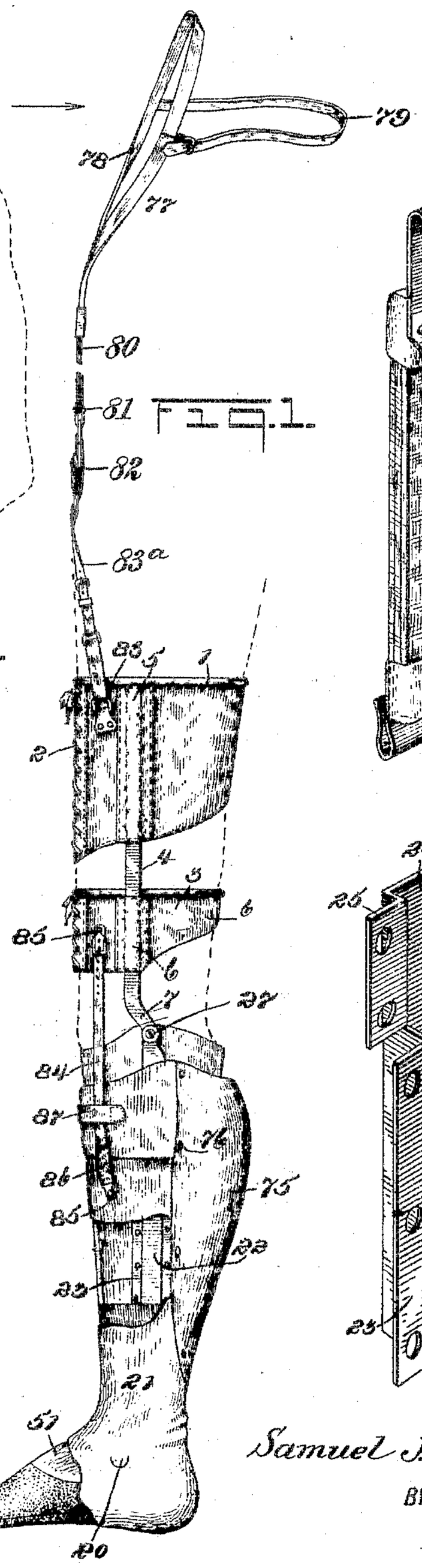

FIG. 1.

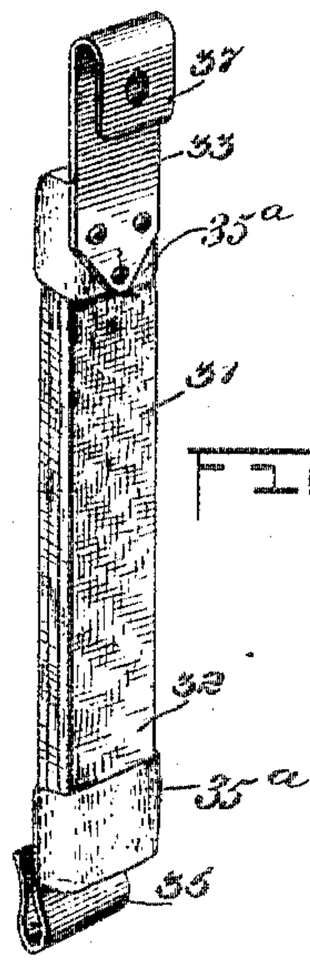

FIG. 7

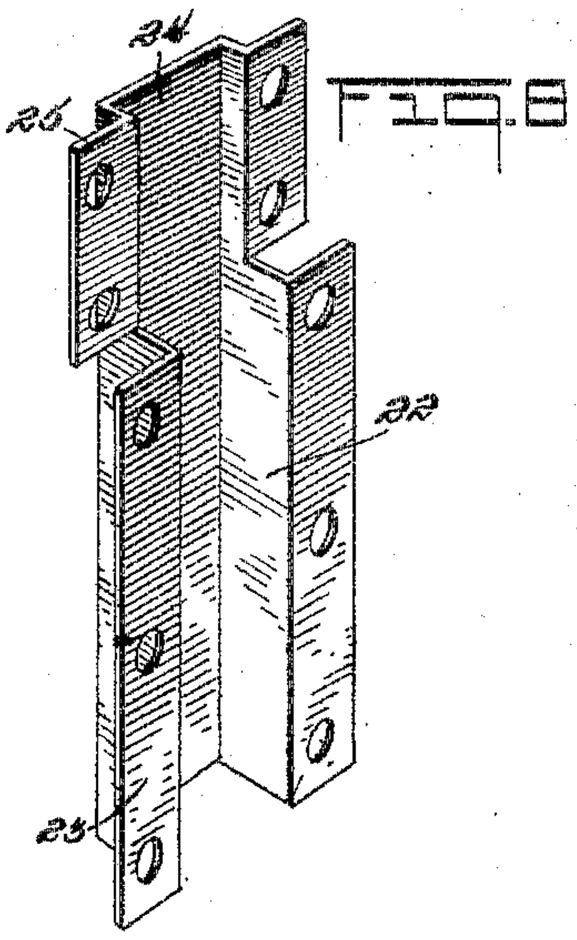

FIG. 8

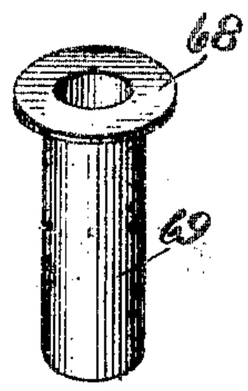

FIG. 9.

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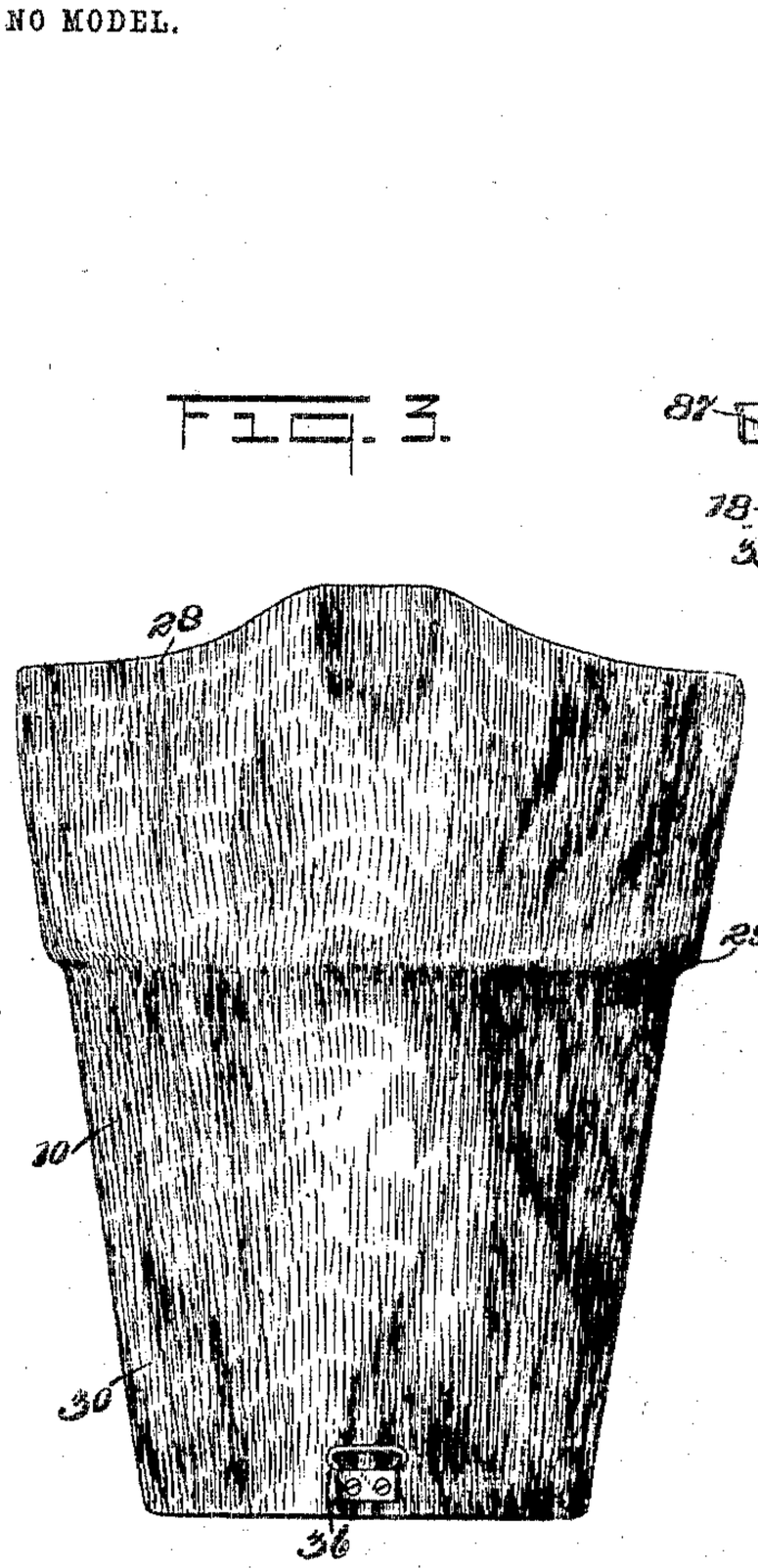
NO MODEL. 3 SHEETS—SHEET 2.

FIG. 3.



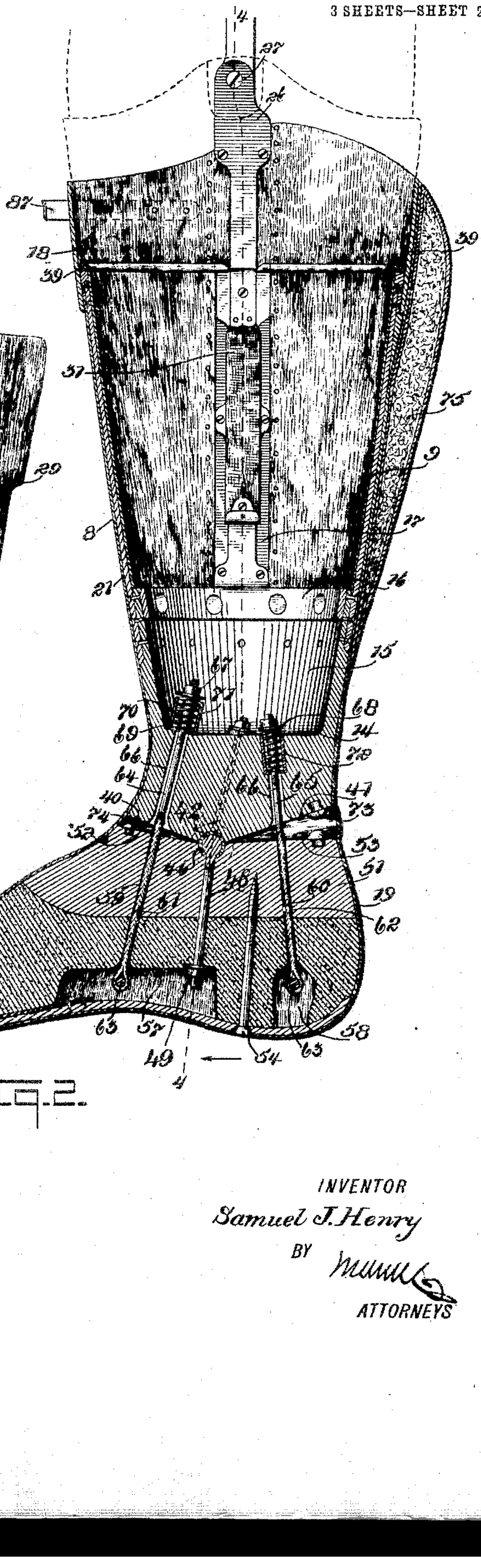


FIG. 2.

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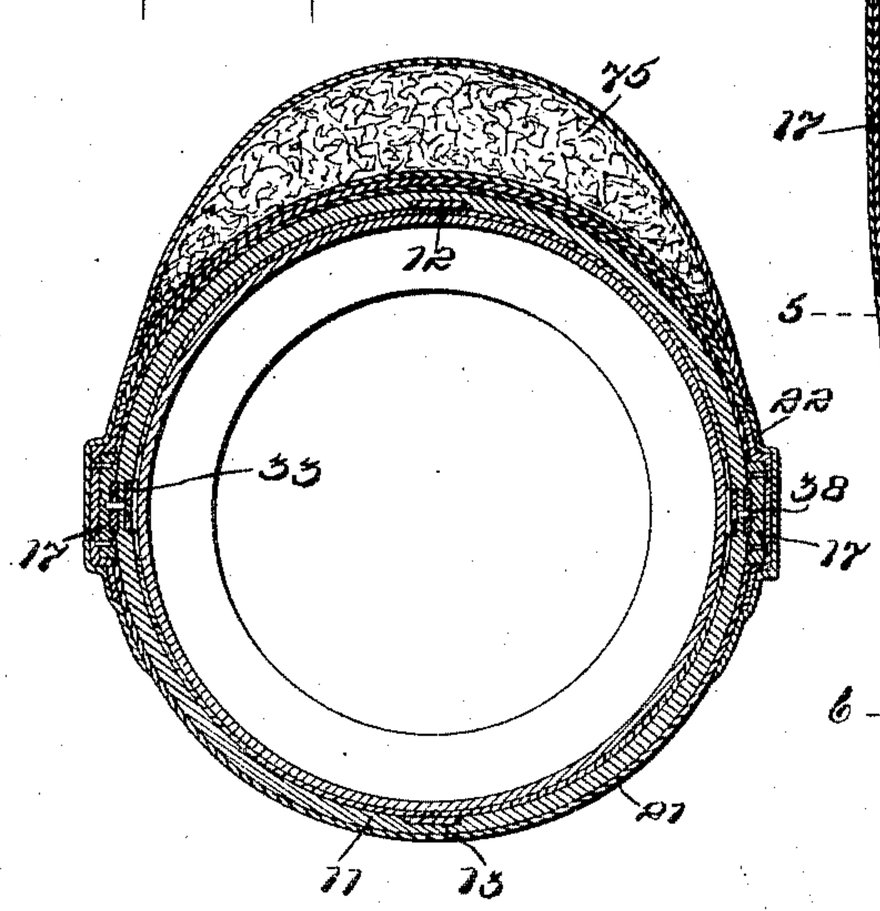
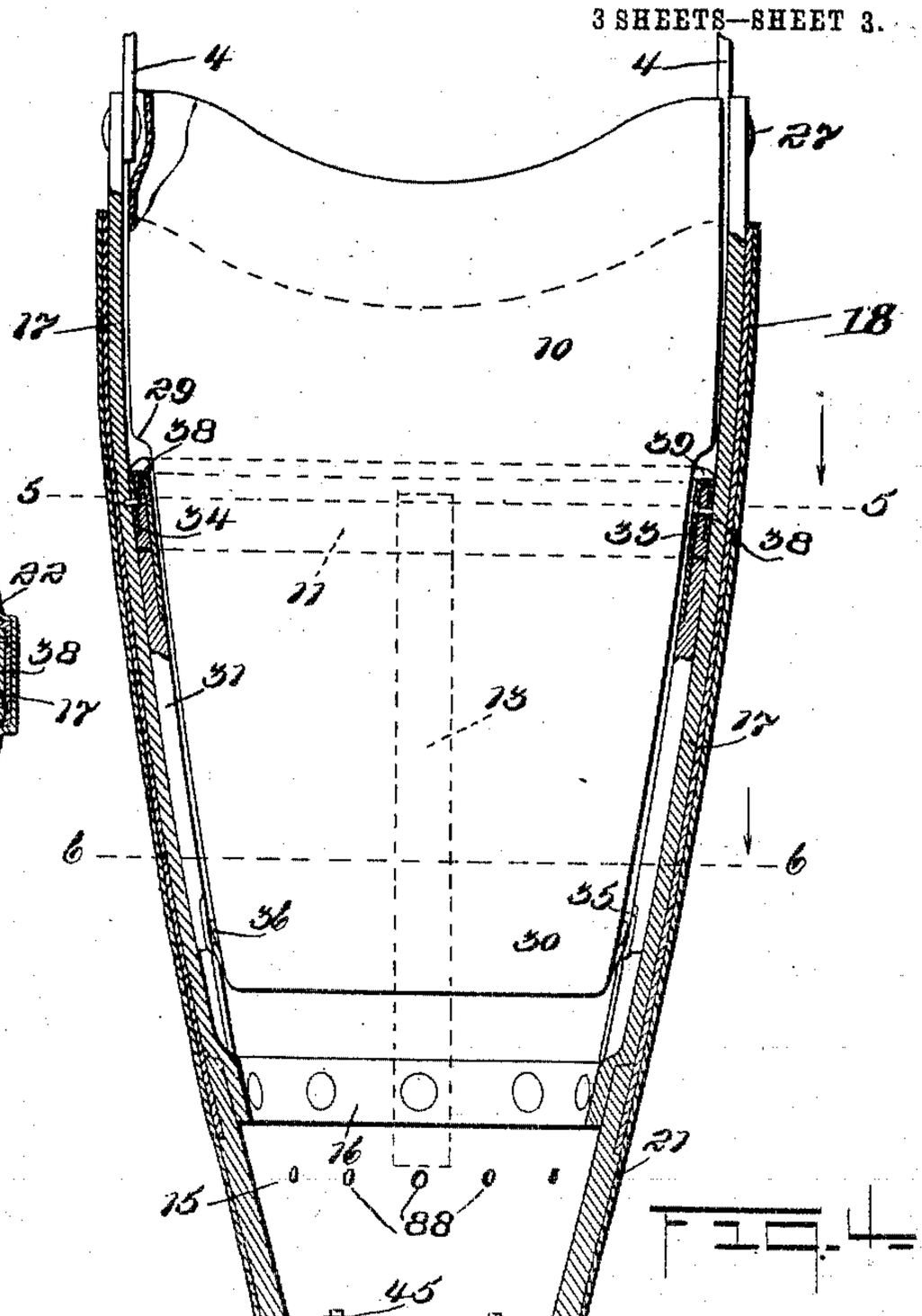
NO MODEL. 3 SHEETS—SHEET 3.

FIG. 5.





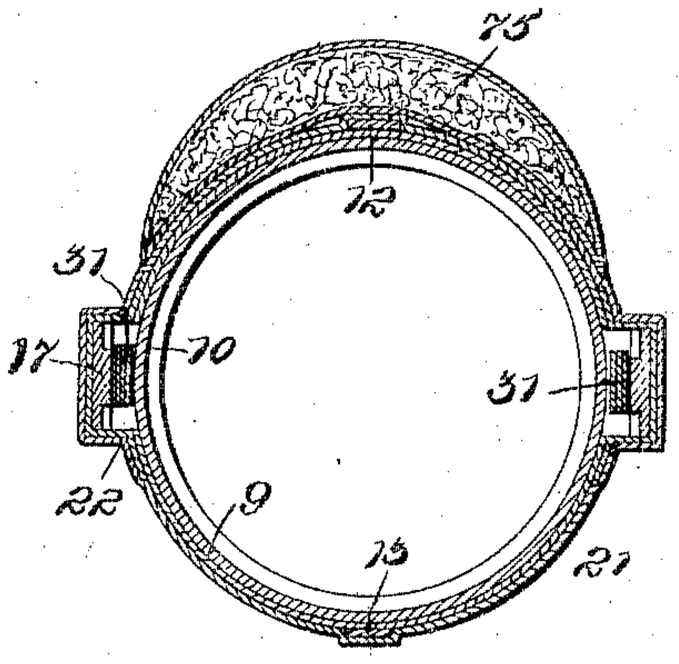


FIG. 6.

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No. 776,908. Patented December 6, 1904.

UNITED STATES PATENT OFFICE.

SAMUEL J. HENRY, OF PRINCETON, IOWA.

ARTIFICIAL LIMB.

SPECIFICATION forming part of Letters Patent No. 776,908, dated December 6, 1904.

Application filed August 12, 1904. Serial No. 220,500. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL J. HENRY, a citizen of the United States, and a resident of Princeton, in the county of Scott and State of Iowa, have invented new and useful Improvements in Artificial Limbs, of which the following is a full, clear, and exact description.

My invention relates to artificial limbs.

The object of the invention is to produce an artificial limb which may be worn with comfort and which in use gives a certain elasticity of movement, preventing shocks and jars to the amputated limb.

The invention consists in the construction and combination of parts to be more fully described hereinafter and definitely set forth in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is substantially a side elevation of the artificial limb complete, some parts being broken away and shown in section. Fig. 2 is a longitudinal section taken through the lower portion of the artificial limb. Fig. 3 is a side elevation of a member which constitutes an inner socket intended to receive the stump of the amputated limb. Fig. 4 is a vertical section taken substantially on the line 4 4 of Fig. 2. In this view the inner socket is shown substantially in elevation, but broken away at a certain point. Fig. 5 is a horizontal section taken substantially upon the line 5 5 of Fig. 4. Fig. 6 is a horizontal section taken substantially upon the line 6 6 of Fig. 4. Fig. 7 is a perspective view representing an elastic strap used in connection with the limb. Fig. 8 is a perspective view of a guide or channel used in the construction of the lower portion of the limb. Fig. 9 is a perspective view of a sleeve or thimble used in connection with the ankle-joint of the limb; and Fig. 10 is a perspective view of a suspender which assists in supporting the artificial limb, illustrating the manner of applying the suspender to one's body.

Before proceeding to a detail description of the artificial limb it should be stated at the outset that the limb to which the same is to be applied is supposed to have been amputated below the knee.

Referring more particularly to the parts, 1 represents a thigh-lacer, (shown most clearly in Fig. 1,) the same consisting of a wide band or cuff of stout leather adapted to encircle the thigh above the knee, the same being laced, preferably, at the front with a suitable cord or string 2. Below the thigh-lacer 1 a knee-cuff 3 is provided, the same being very similar in construction to the thigh-lacer 1, but of less width, as shown. This cuff is adapted to be applied to the limb just above the knee, as indicated. At the sides of the thigh-lacer and knee-cuff thigh-straps 4 are provided, the same being securely attached to the thigh-lacer and knee-cuff, as indicated at 5 and 6. This strap 4 preferably consists of a flat band of steel or similar material, and at its lower extremity it is formed with an offset extension 7 opposite the knee-joint.

Referring now more especially to Figs. 2 to 6, inclusive, the lower part 8 of the artificial limb comprises an outer socket 9 and an inner socket 10. In its construction the outer socket comprises a stout ring 11, disposed at the upper portion of the member, which ring is connected at its front and rear by means of shin-straps 12 and 13 with an ankle or ankle-piece 14, which is diposed at the lower portion of the limb, as shown. This ankle-piece 14 is preferably composed of wood and has substantially the form of a natural limb just above the ankle-joint. The upper portion of this piece is preferably provided with a cavity or large recess 15. At the upper extremity of the ankle within the recess 15 a ring 16 is attached, as shown, and at the sides side straps 17 connect this ring 16 with the aforesaid upper ring 11. On the outer side of the upper ring 11 a top leather 18 is attached which passes continuously around the outer side of the ring and projects above the same, as shown. To the lower portion of the ankle-piece 14 a foot 19 is attached by a joint 20, and this foot, together with the entire limb below the top leather 18, is covered by a suitable leather 21, as shown, the said

leather surrounding and incasing the straps 12, 13, and 17 and passing continuously around the ring 11.

At the sides of the limb channel members or guides 22 are provided, one of which is very clearly shown in Fig. 8. The bodies of these guide are substantially channel-shaped, as indicated, and provided with flanges 23, which attach to the leather covering 21 on the outer side thereof, as indicated. At their upper portions the bodies of the channels 22 are reduced, as at 24, and the flanges 25 at these points attach to the outer face of the cover 21 at the upper ring 11. The side straps 17, already referred to, are carried in the channels or guides 22 and extend upwardly beyond the same, as indicated. These straps enlarge above the outer socket to form heads 26, which make pivotal connections at 27 with the lower extremities of the thigh-straps 4.

The inner socket 10, referred to above, is shown most clearly in Fig. 3. It comprises an enlarged upper extremity or mouth 28, which tapers downwardly to form a shoulder 29, and below this shoulder a long tapering neck 30 is provided. This inner socket 10 is adapted to be received within the outer socket, as indicated most clearly in Fig. 4. From an inspection of this figure it should appear that the neck 30 is received in the outer socket below the ring 11, while the shoulder 29 is disposed a short distance above the ring, as incated. This inner socket 10 is normally maintained in the position in which it is shown in Fig. 4 by means of elastic hangers or tapes 31, which are disposed at each side of the limb, lying in the channels 22 over the face of the straps 17. One of these tapes is very clearly shown in Fig. 7. Each tape consists, preferably, of a number of layers or strips 32 of elastic material, and at the upper extremity of each tape a hook 33 is attached. These hooks are received in pockets or recesses 34, formed in the outer face of the upper ring 11 between the same and the straps 17, as indicated most clearly in Fig. 4. The lower extremities of these tapes 32 are also provided with hooks 35, and these hooks are adapted to be received by elongated eyes 36, attached to the lower portion of the neck 30 of the inner socket, as indicated most clearly in Figs. 3 and 4. The hangers 32 are permanently secured in place at their upper extremities by means of openings in the hooks 33, which openings receive screws 38 therethrough which attach the same to the upper ring 11, as indicated in Fig. 5. The ends of the tapes are incased in leathers 35[a].

Upon the upper face of the upper ring 11 an elastic ring or buffer 39 rests, the same consisting, preferably, of rubber. The purpose of this buffer will appear more fully hereinafter.

The joint 20, referred to above, will be located at substantially the same point as in a natural limb, and from this point inclined faces 40 and 41, formed at the under side of the ankle-piece 14, extend forwardly and rearwardly, as shown. At the joint 20 a tubular member or sleeve 42 is mounted in a horizontal position, as shown in Fig. 4, the said tube being recessed into the under side of the ankle-piece at the meeting-line of the faces 40 and 41. At intermediate points the said sleeve 42 is formed with integral flanges or collars 43, which serve as reinforcements to facilitate the attachment of bolts 44, which make a threaded engagement therewith and pass upwardly into the recess 15, at which point they are secured in position by suitable nuts 45. In this way the sleeve 42 is rigidly attached to the under side of the ankle-piece. At substantially its middle point the under side of the sleeve 42 is provided with a short circumferential slot 46, and within the sleeve behind this slot a loose plug or tumbler 47 is mounted. This tumbler is provided with a stem or stud 48, which extends downwardly through the slot and the foot 19. To the lower extremity of this stem a nut 49 is attached, which firmly connects the foot 19, as will be readily understood.

In its construction the foot 19 comprises a body 50, having substantially the form of the lower portion of the foot and preferably composed of Mexican felt or similar material. To the upper side of this body an upper or block 51 is attached, the same consisting, preferably, of wood and having inclined upper faces 52 and 53 lying substantially adjacent to the inclined faces 40 and 41, as shown most clearly in Fig. 2. At the junction of the inclined faces 52 and 53 substantially the lower half of the sleeve 42 is recessed into the upper side of the block 51, as indicated. The body 50 of the foot is preferably attached to the upper 51 by means of a suitable screw 54 passing upwardly near the heel, and this screw serves to attach a sole 55, as indicated, which sole is incased with the rest of the foot by the covering 21. It has been found that a tendency to turn up at the toes sometimes manifests itself in artificial limbs of this kind, and in order to overcome this defect I provide an insole 56, preferably of elastic material, which attaches to the upper side of the sole 55 near the shank thereof, as indicated in Fig. 2, and to the under side of the body 50 of the foot near the toe thereof. The under face of the body 50 of the foot is preferably provided at substantially the shank of the foot with a recess 57, into which recess the aforesaid stem 48 extends, facilitating the attachment of the nut 49 thereto. Rearwardly of the recess 57 a second recess 58 is provided at the heel of the foot. Openings 59 and 60 are provided, which pass through the foot 19 respectively from the faces 52 and 53, opening out into the recesses 57 and 58. These openings receive cords 61 and 62, which terminate below in

loops attaching to transversely-disposed pins 63, carried, respectively, in the recesses 57 and 58. These cords project above the faces 52 and 53, as indicated, and attach to stems 64 and 65. These stems lie in openings 66, which pass upwardly and communicate with the recess 15. Their upper extremities are threaded, as shown, for the attachment of nuts 67, seating upon the heads 68 of thimbles 69. Surrounding the bodies of the thimbles 69 springs 70 are placed, the same being received in sockets 71 and 72. These sockets are open above, as shown, and the socket 71 rests upon the bottom of the recess 15, while the socket 72 is preferably countersunk into the same, as shown. The openings 66 are in substantial alinement with the openings 59 and 60, and, as indicated, these openings are preferably inclined, so that the heel-stem 65 inclines forwardly above, while the toe-stem 64 inclines rearwardly above. The cords 59 and 60 are preferably formed of waxed Irish linen with a buckskin cover.

It should be understood that in walking with the artificial limb the foot 19 rocks upon the ankle-joint 20, and the springs 70 operate very beneficially to produce the desirable resiliency or elasticity in the step. In order to prevent any shock and to limit the movement of the foot, the faces 41 and 53 are preferably provided with buttons or buffers 73, of substantially mushroom form, having enlarged heads adapted to abut together, as will be readily understood. The forward-inclined face 52 is provided with a buffer 74 of similar form, the head of which is adapted to come against the under side of the ankle-piece to arrest the upward movement of the toe of the foot.

In order to give the lower portion of the artificial limb a shapely appearance, a pad 75 is provided of substantially the form shown, the same having clasps 76 around the edges thereof, as indicated in Fig. 1, making the pad removable, as will be readily understood.

A suspender 77 is provided for supporting the thigh-lacer 1, and this suspender comprises a main band 78, which passes over the shoulder of the invalid which is remote from the artificial limb, as indicated most clearly in Fig. 10, passing under the armpit of the adjacent shoulder. An adjusting-strap 79 is attached to this band 78 at the point shown, passing around the body for the purpose of securing the main band and adjusting the same, as will be readily understood. The main band 78 terminates in an elastic loop 80, supporting an eye 81, and to this eye an adjustable strap 82 attaches, the lower extremity whereof attaches to adjustable straps 83[a]. These lead to the sides of the thigh-lacer near the upper portion thereof and are connected to eyes 83, as shown. The forward portion of the knee-cuff 3 is connected with the upper portion of the lower limb 9 of the artificial limb by means of straps 84, which attach at 85, as shown. The lower extremities of these straps include elastic portions 86, and the straps pass under keepers or guide-loops 87, formed of leather, and attaching to the forward face of the top leather 18, as indicated, it being understood that with the movement of the lower limb upon the knee-joint the straps 84 would have perfect freedom of play forwardly and rearwardly under the keepers 87.

In applying the limb it should be understood that the stump of the lower limb would be received in the inner socket 10, the inner socket being received in the outer socket in the manner described above.

In walking as the weight is placed upon the artificial limb the inner socket operates to extend the hangers 32, which afford an elastic resistance as the socket seats itself upon the elastic cushion 39. In this manner a very elastic motion results, which prevents possibility of shocks being received by the stump of the limb. It should be stated that the character of the hangers 32 depends upon the weight of the person who uses the limb, an increased force being necessary to extend the hangers where the person wearing the limb is of large proportions. The manner of connecting the foot to the ankle-piece is considered highly advantageous by reason of the resulting resiliency and elasticity of tread, it being understood that the foot may rock freely upon the ankle-piece and tends to return always to a normal position by reason of the springs 70. The elastic insole 56 operates beneficially toward the same end, as also do the buffers or elastic buttons 73 and 74. The fact that the inner socket is normally free to rotate slightly upon its vertical axis is very beneficial in preventing torsional strains being imparted to the stump of the amputated limb.

In order to provide for a free circulation of air in the lower member, the wall of the recess 15 is provided with a plurality of openings 88, as shown.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A lower member for an artificial limb comprising, in combination, an inner socket having a shoulder thereabout and a reduced portion below said shoulder, an outer socket adapted to receive said inner socket and presenting a ring upon which said shoulder may descend, channels disposed on the inner face of said outer socket, below said ring, and elastic hangers supported from said ring, attached to said inner socket and disposed in said channels.

2. A lower member for an artificial limb, comprising in combination, a frame having an upper ring, a casing enveloping said frame, channels facing inwardly and having flanges attaching to said casing, an inner socket having a reduced lower neck, and presenting a

shoulder adapted to seat upon said ring, and elastic hangers attaching to said ring at their upper extremities and attaching at their lower extremities to said neck near the lower extremity thereof, said hangers lying in said channels.

3. A foot for an artificial limb composed of a body of compressible material, an outsole attaching to the lower side thereof, an insole consisting of a tongue of resilient material, fastening devices securing said insole to the under side of said body forwardly, and fastening devices securing said insole to said outsole rearwardly thereof.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SAMUEL J. HENRY

Witnesses:
A. S. CARROLL,
WILLIAM HENRY.