

## **Specification of Richard Archibald Brooman : artificial limbs.**

### **Contributors**

Brooman, Richard Archibald.

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A.D. 1849 . . . . . N<sup>o</sup> 12,444.

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S P E C I F I C A T I O N

OF

RICHARD ARCHIBALD BROOMAN.

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ARTIFICIAL LIMBS.  
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A.D. 1849 . . . . . N° 12,444.

**Artificial Limbs.**

**BROOMAN'S SPECIFICATION.**

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, RICHARD ARCHIBALD BROOMAN, of the Patent Office, 166, Fleet Street, in the City of London, Patent Agent, send greeting.

WHEREAS Her present most Excellent Majesty Queen Victoria, by Her  
5 Royal Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the Twenty-seventh day of January, One thousand eight hundred and forty-nine, in the twelfth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Richard Archibald Brooman, my eñors, adñors, and assigns,  
10 Her especial licence, full power, sole privilege and authority, that I, the said Richard Archibald Brooman, my eñors, adñors, and assigns, and such others as I, the said Richard Archibald Brooman, my eñors, adñors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully  
15 might make, use, exercise, and vend, within England, Wales, and the Town of Berwick-upon-Tweed, and in the Islands of Guernsey, Jersey, Alderney, Sark, and Man, and in all Her said Majesty's Colonies and Plantations abroad, the Invention of "CERTAIN IMPROVEMENTS IN THE MANUFACTURE OF ARTIFICIAL LIMBS," being a communication from a certain Foreigner  
20 residing abroad; in which said Letters Patent is contained a proviso that I, the said Richard Archibald Brooman, should cause a particular description of the nature of the said Invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, to be inrolled in Her said Majesty's High Court of Chancery within six calendar months



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*Brooman's Improvements in the Manufacture of Artificial Limbs.*

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next and immediately after the date of the said in part recited Letters Patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

**NOW KNOW YE**, that in compliance with the said proviso, I, the said Richard Archibald Brooman, hereby declare that the nature of the said 5 Invention, as communicated to me, and the manner in which the same is to be performed, are fully described and ascertained in and by this present Specification thereof, reference being had to the Drawings hereunto annexed, that is to say:—

The nature of the Invention consists in an improved method of constructing 10 artificial limbs, having for its object the shaping and attaching of the various joints, springs, ligatures, &c. composing the limb so as to cause them to imitate closely the movements and uses of the natural limb.

Figure 1 is a section of a leg embodying my improvements. Figure 2 is a view of the shape of the thigh at its lower extremity. Figure 3 is a view of 15 the ancle joint. Figure 4 is a view of the foot shewing the shape of the toe joint, and also the shape it has at the place where it is joined to the ancle. Figure 5 is a view of the method of forming the hinge for securing the toe upon the foot. Figure 6 is a view of the leg as it appears externally.

In making my legs or other limbs I use any material which can be suitably 20 worked, but I prefer the wood of the willow tree for the stalks. Having selected a suitable piece for the thigh, I shape it externally to represent that portion of the human limb as seen at *a*. The top part is hollowed to receive the stump of the amputated limb after the usual fashion. The lower part I make spherical, so that it shall be truly circular, having its axis at *b* and 25 radius *c*, *b*. There is also a suitable cavity cut to insert the spring *w* and other parts immediately connected therewith. The second joint *e* represents the calf, shin, and ancle of the leg. The upper part, as seen at *f*, *c*, Figure 6, is cut and hollowed out so as to encircle the lower part of the thigh, the inside being chamfered off so as to bring a very thin edge up against the thigh piece. 30 The back part is deeply cut away as represented at *g*, *f*, in order to allow the knee joint to work, the thigh piece in bending filling up this space. When the leg is straight this forms the only gap in any joint about the leg, but this gap may be easily covered by a piece of flexible material *b*, *f*, *g*, such as buck-sin or cloth, a countersink being cut to receive it, so that it shall be flush with 35 the leg.

The foot and ancle are next to be attached, which the Inventor accomplishes by a novel and peculiar joint in the following manner:—Having found a proper centre for the joint, as *h*, I cut the front to represent a part of the instep *i*, *k*,



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which is of hemispherical form;  $h$  is the axis. The back  $l$  is hollowed out to receive the heel of the foot and chamfered to a fine edge so as to play upon the heel without leaving any ridge or opening. The foot is made to adapt itself to this joint, so that when the centres  $h$  and  $h^1$ , Figure 3, are pinned  
 5 together it can vibrate upon it as in the natural foot. The top of the foot is, however, cut out so as to receive the hemisphere ( $i, k$ ) within it, the instep of the foot overlapping it as far as the centre ( $h$ ), where the heel of the foot is narrowed so as to play within the angle, as seen at ( $m$ ), Figure 1. The heel is likewise cut convex at  $m, n, h$ , being the centre whereby it operates  
 10 in the manner described for the knee and instep. The letters  $o, o$ , show the toe joint. The toes are secured to the foot by means of the bent wire seen in Figure 5. This has always been a very troublesome part of an artificial leg to keep together, as it is liable to receive severe knocks.

By the following method the Inventor is enabled to keep the toes always in  
 15 place, and render it almost impossible to remove them:—The joint  $o, o$ , on the foot and the concave in the toes are cut to match, after which the hole  $o^1$  is bored through the side of the foot and becomes the centre of the radius  $o, o$ . Through this hole the Inventor pushes a piece of wire  $p$  of the proper length, and having bent the two ends, as seen at  $p$ , Figure 5, he slips the toes (which  
 20 have two holes bored through them) on the projecting ends of this wire, and afterwards turns the ends around two pins, which hold them securely, and lays them in a groove cut in the under side, as seen at  $p^1$ . The cavity in the toes is afterwards filled up so as to keep the external appearance smooth, and conceal the wire. The foot is jointed to the ankle by means of the pin  $h$ , which  
 25 passes through the foot, and the eyes are made in two plates of metal, which are fastened on each side of the second joint  $e$  and shown by the dotted lines. The thigh is fastened to the second joint in like manner by two plates and a bolt at  $b$ . These bolts do not move within the metallic plates, but the foot and knee revolve upon the bolts when the leg is in use.

30 The several ligatures and springs for giving motion to the various joints fall next to be described. The foot and toes are actuated by a wire spring, as seen at  $r$ . This consists of a wire coiled round a pin  $r^1$ , which is passed through the foot. From the forward end of the spring  $r$  a cord  $s$  extends to the bottom of the toe piece, and keeps it down  
 35 on a line with the bottom of the foot. The opposite end of the spring  $r$  is connected to the ankle by a similar cord  $s^1$ , and this lifts the foot up as far as it is permitted to go by the ligature connected with the heel. There is likewise a pin  $x$  driven in the second joint  $e$  just forward of the ligature  $t$ , and as far above the foot as it is to be allowed to play. As the



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leg is advanced in walking the heel strikes the ground first, and this pin guages the extent of motion it should have, preventing all strain upon the ancle and foot spring, but not touching the heel in ordinary walking. There is no liability in this spring to break from working, as its action is extremely slight. Within the leg there are two ligatures, or, as they may be 5 called, tendons. The tendo-achilles *t*, is attached by its lower end to the foot near the heel, while its upper end is fastened in the leg in some convenient position below the knee. The second tendon *u* is attached to the thigh at the back parts of the leg at one end, and extends down into the foot, where it is fastened immediately forward of the ankle bolt *h*, or it may be 10 attached to the front of the leg, as seen in the dotted lines *u*<sup>1</sup>. Both these tendons are composed of "gut," but other cords may be used. At the knee joint a spiral spring is attached for the purpose of throwing the second joint and foot forward as the leg is advanced. To cause this to operate properly and without noise it is connected as follows:—The thigh-bolt *b* is so fastened 15 as to revolve with the second joint *e*; to this bolt, midway through the thigh, there is attached a metallic arm *v*, which extends horizontally forward, terminating near the front of the leg; the front edge of this arm is rounded off and grooved to receive the cord. A spiral or other spring *w* is next attached by the cord, as represented, the top of the spring being fastened to the thigh, 20 while the cord depending from its lower end passes round in the grooved end of the arm (*v*), passing underneath and then secured to the bolt *b*. This spring, therefore, by pulling on the arm (*v*) and that acting on the bolt *b*, throws the joints *e* and foot forward, until it is checked and held by the tendon *u*. It will be seen that there is a short space between the lower end 25 of the spring *w* and arm *v*, which is occupied by the cord. This space must always be equal to the length of the arm *v*, as otherwise the spring would interfere with it in some positions. As, for instance, in sitting down, the wearer brings the knee joint at right angles, and then the cord would lie along the top of the arm from *v* to *b*, the arm *v* not changing its position with 30 respect to the second joint *e*. The spring and lever do not act upon the knee when the leg is at right angles with the thigh, as is usual in sitting, but act powerfully in all the various walking positions.

The Drawings represent a leg to be applied when amputation has taken place above the knee, and is attached to the stump in any known mode. When 35 amputation has been below the knee, then the leg (*e*) is hollowed out to receive the stump as far as about the lower edge of the natural patella. The foot and all the parts connected remain the same, with the exception that the long tendon (*u*) is dispensed with, and usually also all the metallic parts about



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the knee. In some cases the short tendon (*t*) may become the long tendon, and the tendon (*u*) the short one; that is, by extending the tendon (*t*) up to the thigh, and fastening it along with the tendon (*u*), and then removing the lower termination of the tendon (*u*<sup>1</sup>) and (*t*<sup>1</sup>) to the front part of the second  
5 joint, as represented in the dotted lines. In operation, the thigh in being advanced to take the step causes the second joint (*e*) to follow, by the throw of the spring (*w*), which is so tempered in strength as to perform its office with sprightliness; the second joint coming forward until it is a little in advance of a right line, when it is checked by the tendon (*u*). The toes and  
10 foot meanwhile are kept up in their natural position by the spring *r*. The heel now striking brings the foot flat upon the ground, and in doing so it slightly strains the tendon (*u*), which prevents it from slapping violently down. The leg now passes under the body, sustaining its weight, the body advancing over *h* as its axis. The instep (*i*, *k*,) sinks in the foot, while the  
15 back of the ankle (*l*) plays upon the heel (*n*, *m*). As soon as the body has advanced the proper distance the tendo-achilles (*t*) becomes tightened and lifts the heel a very little from the ground, the body now bears upon and actuates the toe-joint (*o*, *o*). The leg is then raised and advanced, as before, as in continuous walking. By this peculiar arrangement of the joints, tendons, and  
20 springs, I get a limb much stronger, lighter, and more elastic than those hitherto in use. All noise and vibrations are besides obviated, and certainty of step and safety are secured. For the spring *w*, the Inventor uses a bent or coiled wire or gum elastic, and he does not confine himself to any particular material for the coils and tendons. The spring *w* he sometimes places inside  
25 the leg, which is in that case hollowed out for the purpose. At other times he excavates a cavity on each side of the leg sufficiently to admit the spring, placing one on each side of the leg or not as may be necessary. In the same way also as he excavates the inside of the leg *e*, through which space the tendons are passed; or he excavates or cuts grooves on the outside through which the  
30 cords pass to the foot. When the parts are all together and in their places he covers such external excavation with any convenient flexible material, by glueing it on smoothly. He then paints the leg throughout with some pigment, and polishes the whole smooth, after which he gives it one or more coats of flesh-coloured paint, and polishes again so as to give it, as near as possible,  
35 the colour of the natural leg, and make it smooth and pleasant to the wearer.

And having now described the nature of the said Invention, and in what manner the same is to be performed, I declare that what I claim, is the artificial leg, before described, in the general arrangement, combination, and



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adaptation of parts of which the same consists, that is to say, in so far as regards,—

First, giving the thigh at its lower part a spherical shape, so that the second joint (*e*), when adapted thereto, shall play over the said sphere when the joint is put in motion, without causing any seam or opening to be made between 5 them.

Second, the combination of the arm (*v*) and spring (*w*), with the thigh and second joint, as described.

Third, the shaping of the foot and ankle, so that they shall produce, when put together, the peculiar joint described. 10

Fourth, the method of attaching the toe piece to the foot, by means of the hinge, seen in Figure 5.

Fifth, the spring (*r* and *s*) for actuating the toe piece and foot, as described.

Sixth, the tendon (*u*), in the position represented, or in the position repre- 15 sented in the dotted line, or in any similar position in which it is made to operate, as herein set forth.

Seventh, the foot arrangements, independent of the thigh piece, when such are to be applied where amputations are made below the knee. And,

Eighth, the metallic plates and bolts combining the thigh, leg, and foot, at 20 the articulations of the knee and ankle joints.

In witness whereof, I, the said Richard Archibald Brooman, have here- unto set my hand and seal, this Twenty-seventh day of July, in the year of our Lord One thousand eight hundred and forty-nine.

R. A. (L.S.) BROOMAN. 25

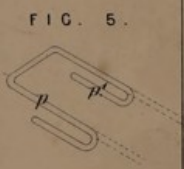
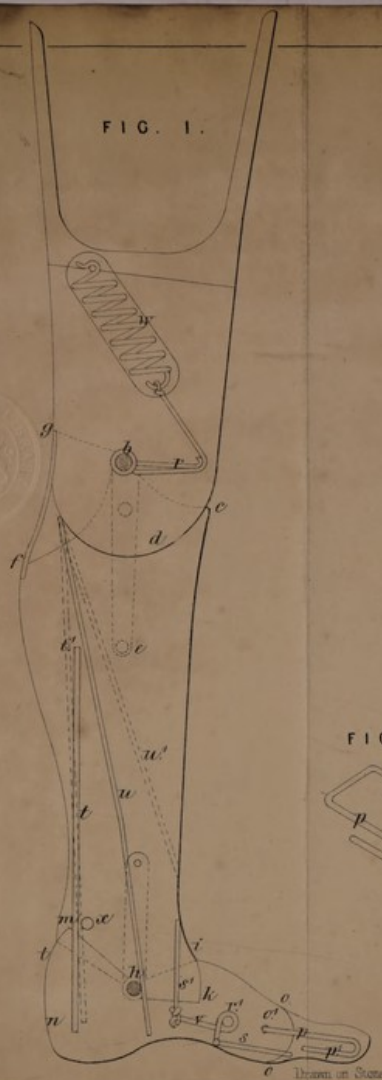
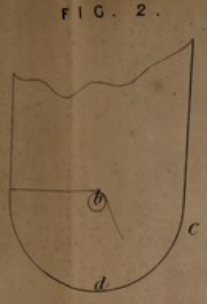
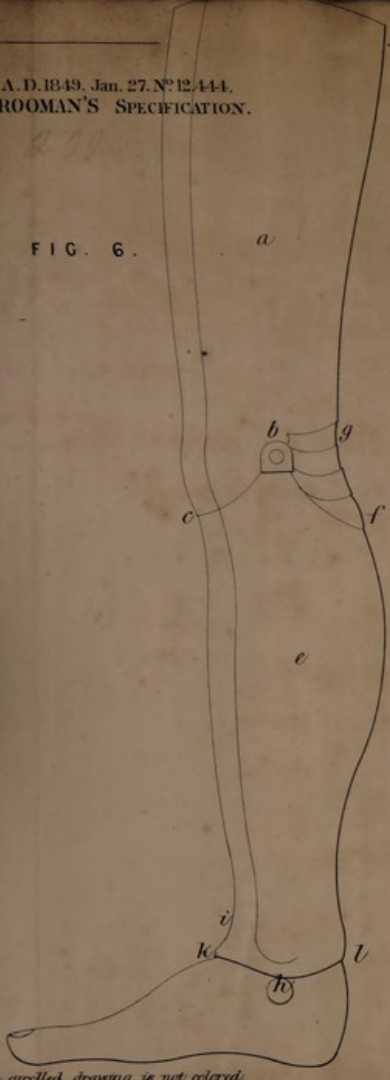
**AND BE IT REMEMBERED**, that on the Twenty-seventh day of July, in the year of our Lord One thousand eight hundred and forty-nine, the aforesaid Richard Archibald Brooman came before our said Lady the Queen in Her Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also 30 the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Enrolled the Twenty-seventh day of July, in the year of our Lord One thousand eight hundred and forty-nine.

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The overled drawing is not colored.

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