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A. ANDERSEN  
ARTIFICIAL LIMBS  
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2,808,593

FIG. 1.

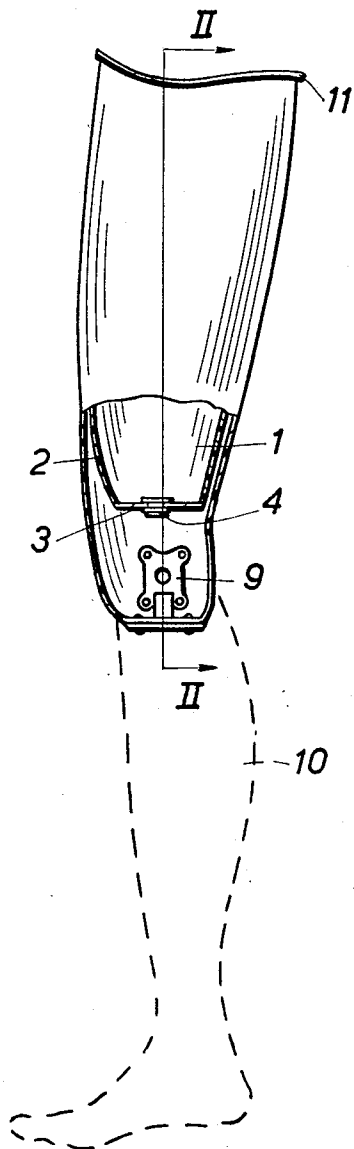
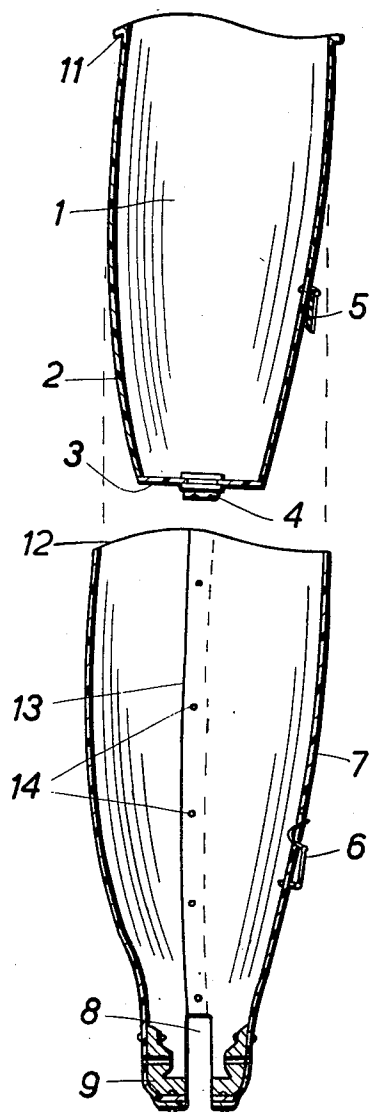


FIG. 2.



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## ARTIFICIAL LIMBS

Algot Andersen, Bergen, Norway

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1 Claim. (Cl. 3—17)

This invention relates to artificial limbs of the kind wherein the artificial limb is secured to the limb stump of the wearer by the use of suction, the stump being received in a hollow space within the artificial limb, whereupon the lower end of said hollow space is evacuated by vacuum creating means associated with the artificial limb.

It is an object of the present invention to obtain an artificial limb which may be secured to and adapted to the stump of the wearer in a much easier and more comfortable way than artificial limbs hitherto known in the art.

A further object of the invention is to obtain an artificial limb having lighter weight than present artificial limbs, and assuring greater comfort to the wearer than prior known artificial limbs of the stated kind.

A still further object of the invention is to obtain an artificial limb wherein the adaptation, and more specifically the shaping of outer contours of the artificial limb is not necessarily custom-made in each individual case; in other words, within certain limits a great part of the artificial limb according to the present invention may be built up from prefabricated elements needing only few adjustments to insure an excellent fit.

An aspect of the present invention is that remodelling of the individual artificial limb may be accomplished without the necessity that the wearer must desist from his old artificial limb during the period of readaptation. At present, such remodelling operations take long time and necessitate prolonged hospitalization.

According to the present invention, the artificial limb comprises an outer artificial limb casing, a limb-stump socket shaped to conform in the shape and size of the limb stump and adapted to be removably received within said outer artificial limb casing, an air chamber defined within said limb-stump socket by the walls of said socket and the limb stump, means for creating a vacuum within said air chamber so as to secure said limb-stump socket to the stump by the use of suction, said vacuum creating means being arranged in the walls of said limb stump socket and spaced from said limb casing, and means for releasably locking together said limb-stump socket and said outer limb casing, whereby said outer limb casing may be removed from said limb-stump socket while maintaining the latter secured to the stump by the use of suction.

Further objects and features of the invention are hereinafter referred to and claimed in the appended claim.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawing which illustrate, by way of example, one form of limb suitable for a person having a leg amputation considerably above the knee joint, and in which:

Fig. 1 is a side view of the artificial limb according to the invention, with parts of the limb-stump socket and the outer casing broken away.

Fig. 2 shows the parts of Figure 1 in a section taken along the line II—II of Figure 1.

The artificial limb according to the invention com-

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prises a limb-stump socket 1 having walls 2 and a bottom 3. The walls 2 are modelled exactly to conform with the individual shape of the limb stump of the wearer, a close fitting being necessary at least in the lower part of said socket, although a comfortable fit is preferred in the upper part of said socket, too. In the bottom 3 a suction valve means 4 is arranged for creating a vacuum in the interior of said socket after insertion of the stump, said suction valve means 4 being of a construction well known in the art, which need not be discussed to any greater detail in the present connection.

The wearer may secure said limb-stump socket to his stump by inserting the stump into the hollow interior of said socket, whereupon the wearer manipulates the vacuum creating valve means 4 to create a partial vacuum in the space defined by the bottom 3, the lower part of the walls 2, and the lower part of the stump. Hereby, the socket is firmly secured to the stump by the vacuum created within said space. It is not at all necessary that the outer shape of said socket conforms with the outer shape of the limb to be substituted by the artificial limb; moreover, it is preferred to arrange said socket to afford maximum comfort, light weight and excellent fit being paramount to this end.

Thus, it is intended that the wearer shall be able to leave said socket secured to his limb stump also during periods of rest, i. e. when there is no need for wearing an artificial limb, without any discomfort.

It is preferred to arrange the suction valve means 4 in the bottom 3 of the socket, although said valve means may also be arranged in the lower part of the walls. Usually, such suction creating valve means is manipulated by pressing a central button inwardly and then releasing said pressure; a combination of a rubber disc and a return spring creates an evacuating action during the return stroke of said button. Because only small amounts of air can be evacuated in each stroke, the wearer has to press said button inwardly and release said pressure repeatedly. By said valve means being arranged in the bottom of the socket, the finger pressure against the button also ensures that the socket receives the stump centrally. In prior known artificial limbs, the suction valve means were arranged excentrically with respect to the stump, whereby the finger pressure on the button tended to press the artificial limb out of its correct position with respect to the stump.

To the outer face of said socket a locking means part 5 is secured. Said part 5 co-operates with a counterpart 6 mounted on an artificial limb casing 7 having an outer shape and size to conform with the limb to be substituted by the artificial limb in question. The casing 7 is hollow and adapted to receive the limb-stump socket 1 in its hollow interior. The locking means part 5 and its counterpart 6 co-operate to form means for locking together the socket and the casing in a firm grip. Said locking means should be chosen to be easily fastened together and easily released; in the present embodiment the part 5 is indicated to be a hook, and its counterpart 6 is a swingable eyelet, but any type of snap fastening devices known in the art to be able to lock together two telescopically combined parts in a firm, releasable grip, may be employed as locking means 5, 6.

It is preferred to use two diametrically opposed parts 5 and two similarly located counterparts 6, in order to ensure a firm grip.

At its lower end, the casing has a slot 8 and a bearing 9 for receiving a leg part 10 (see dotted lines in Fig. 1), as conventional in artificial legs. Because these portions of the artificial limb according to the invention are conventional, their construction need not be discussed to any further details.

As mentioned, the casing has an exterior shape and out-

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line corresponding to the amputated limb to be substituted by the artificial limb, as exactly as possible in the manufacture of such artificial limbs. The interior walls of said casing corresponds substantially to the outer shape of the socket, but only to such extent as to prevent any play between the socket and the casing after locking said parts together. Such play is best prevented by arranging a flange 11 at the upper end of the socket, towards which the upper edge 12 of the casing bears in a close engagement. Eventually, mutually engaging parts (not shown) may be arranged on either the outer face of the socket or the inner face of the casing in order to ensure, in co-operation with the interengaging flange 11 and edge 12, that the socket and the casing are locked together without play by the locking means 5, 6.

In the manufacture of the artificial limb according to the present invention, the socket 1 is preferably first modelled to its final shape by heating and shaping a sheet of thermoplastic material. Thereupon, the casing is shaped to enclose said socket and to correspond in shape and outline to the artificial limb to be manufactured.

In Figure 2, it is indicated that the socket 1 is shaped to its final shape, while the casing 7 has been shaped to an intermediate stage by bringing the edges of a sheet of thermoplastic material to overlap each other at 13. These overlapping edges are secured to each other by means of intermediate joints, such as nails 14. After having finished the shaping of said casing, the edges are cut to form abutting edges, preferably under an obtuse angle, whereupon these edges are secured together by welding or by a suitable adhesive. A finishing shaping operation may comprise cementing thin sheets of the thermoplastic material to areas to be thickened.

The socket 1 is preferably shaped initially in this way by first overlapping the edges and then cementing or welding the edges together, but in this case it should be ensured that the joint is airtight.

While the socket 1 must be built entirely different in each case, the casing 7 may be prefabricated to the intermediate stage indicated in Figure 2, whereupon a final adjustment follows. Thus, it is only necessary during such final adjustment to have the socket 1 at hand.

In use, the wearer first secures the socket 1 to the stump by the use of suction. During periods of rest, said

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socket may be kept secured to his stump, and the wearer may also secure said socket to his stump while sitting in his bed. Thereupon, the casing 7 is locked to the socket by means of the co-operating locking means parts 5, 6.

A readjustment of the length of the artificial limb may easily be brought about by readjusting the mutual positions of said parts, 5, 6.

The casing 7 is finally coloured in a suitable skin color, whereas it is preferred to produce the socket from a suitable transparent plastic material, in order to enable control of the position of the stump within said socket when securing same to the stump.

In readjusting operations, it is easy to substitute the socket 1 by another having a better fit.

15 What I claim is:

An artificial limb, comprising an outer artificial limb casing, a limb-stump socket shaped to conform in the shape and size of the limb-stump and adapted to be removably received within said outer artificial limb casing, an air chamber defined within said limb-stump socket by the walls of said socket and the limb-stump, means for creating a vacuum within said air chamber so as to secure said limb-stump socket to the stump by the use of suction, said vacuum creating means being arranged in the walls of said limb-stump socket and spaced from said limb casing, a first locking means part arranged on the thigh face of said outer limb casing and a locking means counterpart arranged on the exterior face of said limb-stump socket, said first part and said counterpart forming together a snap fastening device for releasably locking together said outer casing and said limb-stump socket in a firm grip substantially without play, whereby said outer limb casing may be removed from said limb-stump socket while maintaining the latter secured to the stump by the use of suction.

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