

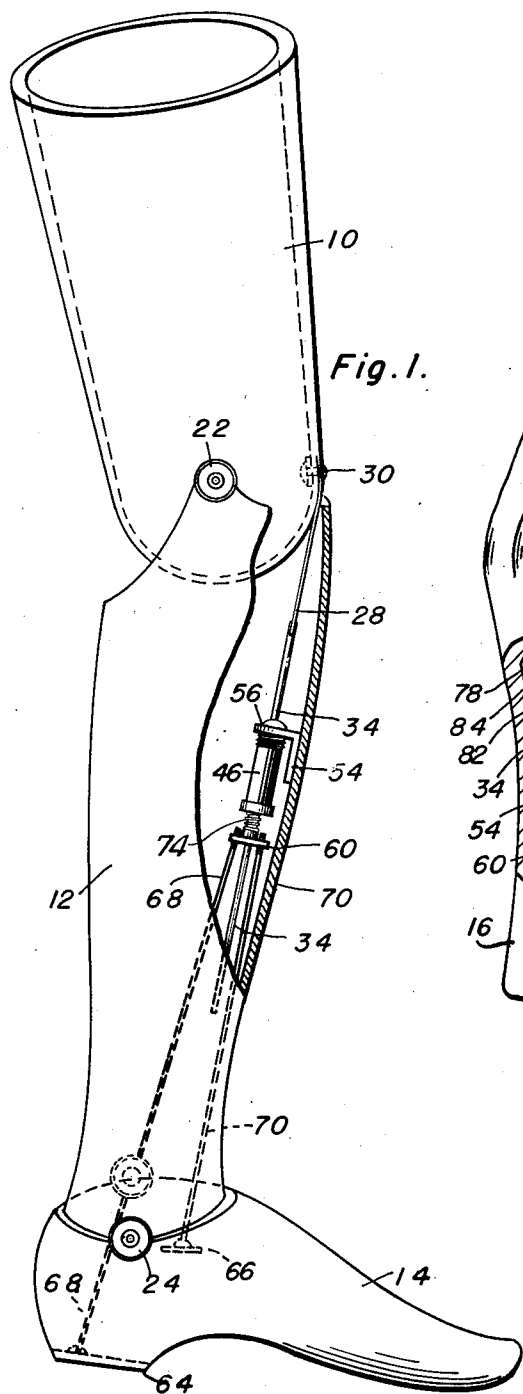
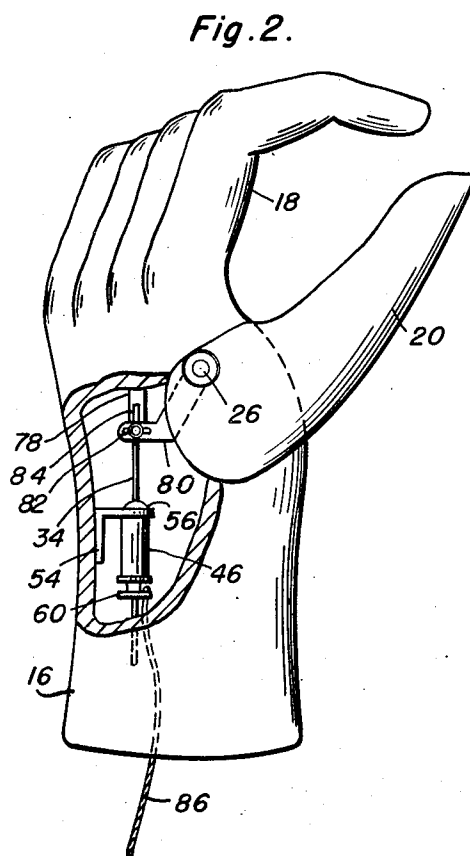
July 3, 1951

H. G. HANSON
ARTIFICIAL LIMB

2,559,017

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2 Sheets-Sheet 1



Inventor

Henry G. Hanson

By

Clarence A. O'Brien
and Harvey B. Jacobson
Attorneys

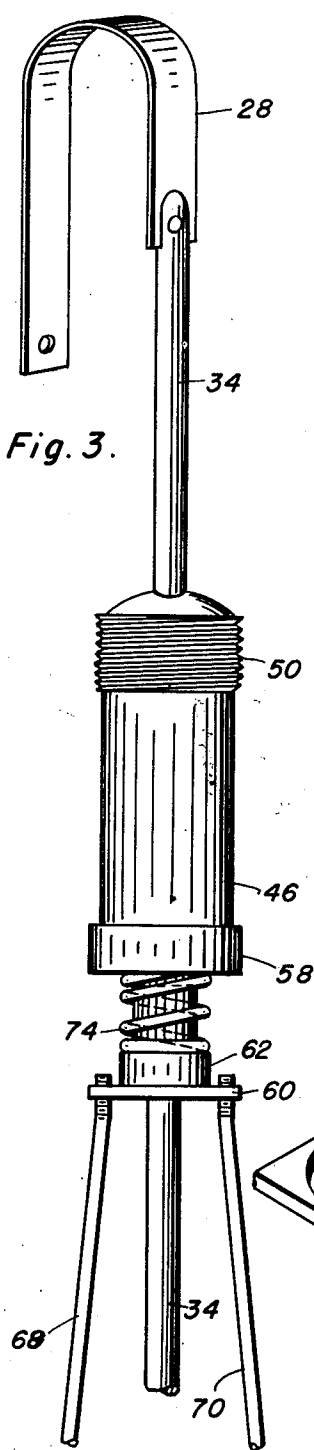
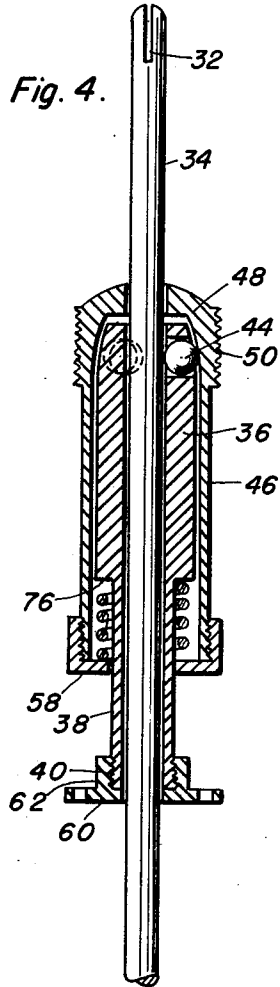
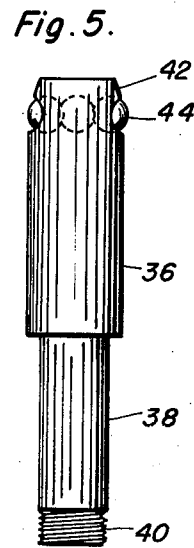
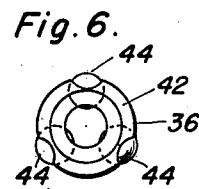
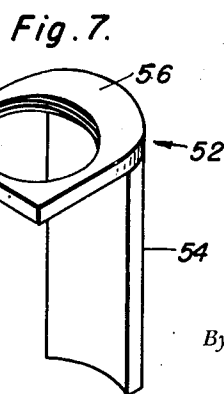
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Inventor

Henry G. Hanson

By

Alvanice A. O'Brien
and Harvey B. Jacobson
Attorneys

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ARTIFICIAL LIMB

Henry G. Hanson, Minneapolis, Minn.

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3 Claims. (Cl. 3—2)

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This invention relates generally to artificial limbs, and more particularly to a joint lock for cable and rod actuating members in an artificial limb.

A primary object of this invention is to provide a slide joint or cable and rod actuating members which will automatically lock or fasten together different units of an artificial limb when the limb itself, one or more of said actuating members or some other member is moved.

Another object of this invention is to provide locking means of this character which will lock certain members against relative movement when one of these members is moved very slightly, this extreme sensitivity of the lock being reflected in smooth and natural operation of the limb.

Still another object of this invention is to provide a lock which is absolutely dependable and which will tighten upon greater pressure or tension being applied thereto.

Still another object of this invention is to provide a lock which may be used in two very different combinations, the adaptation to the second use being accomplished by merely moving the spring from one location to another within the device.

Still another object of this invention is to provide means of this character which may be incorporated with many different types of joints in artificial limbs.

A very important object of this invention is to provide a device of this character which permits the limb to straighten freely, since one of the actuating members, that is, one of the cables or rods connected to the device, is always free to move in one direction, even when the device is in locked position, and this feature is particularly valuable when the device is applied to an artificial leg.

And a last object to be specifically mentioned is to provide a device of this character which is relatively inexpensive and practicable to manufacture, absolutely reliable and simple in operation, and which will give generally efficient and durable service.

With these objects definitely in view, this invention resides in certain novel features of construction, combination and arrangement of parts and portions as will be hereinafter described in the specification and particularly pointed out in the claims, one embodiment of this invention being illustrated in the accompanying drawings which form a material part of this application, and in which:

Figure 1 is a side elevational view of an artificial limb with this invention incorporated thereon, portions of the figure being broken away and the underlying portions shown in elevation and in section, to facilitate the illustration of this invention and the manner in which the same is used;

Figure 2 is a view of an artificial hand with this invention operatively connected thereon, the figure including the representation of means of cable character used to release the lock;

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Figure 3 is an enlarged elevational view of the chief elements of this invention operatively associated as represented in Figure 1;

Figure 4 is a vertical center sectional view of the device with the compression spring inserted within the cylinder, as when this device is used in such combinations as that illustrated in Figure 2;

Figure 5 is an external view of the piston;

Figure 6 is a top plan view, or end view of the piston, the view being taken from the top of Figure 5; and,

Figure 7 is a perspective view of the bracket used to secure the cylinder to an artificial limb.

Similar characters of reference designate similar or identical parts and portions throughout the specification and throughout the several views of the drawings.

Referring now to these drawings in detail, it will be noted that the environment wherewith this invention is adapted to be used includes artificial limbs exemplified in the drawings by an artificial leg having an upper leg portion 10, a lower leg portion 12 and a foot 14, as well as an artificial hand having a wrist portion 16, fingers 18 and a thumb 20. Other units in which no invention is claimed, include the knee joint 22, the ankle joint 24 and the thumb joint 26.

A cable 28 will be terminally secured, as at 30 to the upper leg 10 when this device is applied to an artificial leg, the lower end of the cable being secured in any suitable manner, as by insertion of the end of the cable into a slot 32 in the upper end of the shaft 34, it being understood that ordinarily this cable will comprise a spring steel strap, as illustrated in Figure 3. The shaft 34 extends through an axial bore in the piston 36 which has a reduced diameter portion 38 terminating in a threaded portion 40. The other end of this piston is tapered as at 42 and is radially bored to receive locking members 44. In the drawings, these locking members are of ball character and three similar and small radial bores are provided to receive three of these ball members 44, the diameter of these ball members being such that when the same are inserted in the bores with the shaft 34 positioned in the axial bore of the piston, these balls when contacting said shaft will extend outwardly beyond the curved profile 42 on one end of the piston.

A cylinder 46 of an internal diameter slightly greater than the external diameter of the larger portion of the piston 36 and of a length slightly greater than the length of this larger portion, fits over this piston, as best illustrated in Figure 4. The closed end 48 of this cylinder is tapered to correspond generally with the taper on the end 42 of the piston, and this end 48 of the cylinder is bored to receive the shaft 34, and is also provided with an externally screw-threaded portion 50. A bracket, generally indicated by the numeral 52, is provided with an attachment strap 54 and a right-angularly disposed portion 56 which is internally screw-threaded for attachment to the screw-threaded portion 50 of the cylinder. The

lower end of the cylinder is also screw-threaded to receive a cap member 58 which is centrally apertured to receive the reduced portion 38 of the piston. An outwardly flanged member 60 of an annular plate character is provided with an up-
standing boss 62 which is hollow and internally threaded to engage the threaded portion 40 at one end of the piston, and this member is axially apertured to receive the shaft 34.

The foot portion 14 of the artificial limb is provided with a heel plate 64 and with another plate 66 disposed in said foot forwardly of the ankle pivot 24, and a pair of rods 68 and 70 are terminally secured to these plates and to the member 60, in any suitable manner, as by welding the lower ends of the rods to said plates and by screw-threading the upper ends of the rods for engagement in threaded apertures 72 in the member 60.

When the device is used in conjunction with a leg as described above, a spring 74 of helical character is compressed between the boss 62 and the outer surface of the cap member 58, and when the device is used, as illustrated in Figure 2, this spring 74 is inserted between the inner surface of this cap member 58 and the shoulder 76 between the larger portion 36 and the reduced portion 38 of the piston.

Referring to Figure 2, it will be noted that a fixed bracket 78 is secured to the artificial hand and that a lever 80 is secured to the thumb portion 20 and pivots about the pivotal connection 26 of this thumb portion. A pin 82 is secured to the upper end of the shaft 34 and this pin is adapted to move within slots 84 in the bracket 78 and the lever 80. The attaching bracket 52 is secured to the hand by means of the strap 54 and the shaft 34 is disposed to extend through the cylinder 46 and into the wrist portion 16 of the hand. Although not shown in the drawings, it will be understood that the steel spring band, above referred to as the cable 28, is attached to the inner side of the lower end of the upper arm, and the actuation of the lower arm is similar to that of the lower leg portion 12. The piston must be released by means of a cord or by means of hydraulic controls, in the majority of artificial hand constructions using this device, such control being represented by the cable 86 which is shown secured to the member 60.

The operation of this invention will be clearly understood from the foregoing description of the mechanical details thereof, taken in connection with the above recitation of the objects sought to be achieved by this invention, but it may be added in recapitulation that when the leg is bent at the knee the cable 28 is pulled upwardly and the shaft 34 is free to move upwardly unless locked. The locking of this shaft 34 within the piston 36 is effected immediately when the heel or ball of the foot 14 is pressed on the ground or some other object. This pressure will act on one or the other of the rods 68 and 70 to force the piston 36 upwardly and to cause the locking members 44 to simultaneously engage the shaft 34 and the tapered portion 48 of the cylinder. As before mentioned, an important feature of this invention resides in the fact that when such locking action has taken place, the shaft 34 is still free to move downwardly through the piston 36. The result of this feature is that the leg is always free to straighten. In the light of the foregoing description it will now be clear that this construction prevents "jack-knifing" of the limb when weight is placed thereon when the artificial

limb is not straight or fully extended, this feature permitting the use of such limbs for traversing rough ground, climbing ramps and stairways, and when applied to a hand this allows gripping action independent of the angular position of the upper arm and forearm. That is, the thumb may be always made to grip an object, usually by means of springs, and the lock described herein will hold the thumb in tight gripping position until released by the means represented at 86 in Figure 2. Finally, another important advantage of this construction is that it allows use of an artificial leg in exerting pressure in directions other than that used in walking, the device being particularly suitable for the use of those persons desiring to operate the foot pedals of a motor car.

Though there has been shown a particular embodiment of this invention, this application is not limited to this particular embodiment, but it is desired to include in the scope of this invention, the construction, combination and arrangement of parts and portions substantially as set forth in the appended claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. An artificial limb having a pair of limb portions, a joint connecting said limb portions allowing relative movement in one plane only, a pair of inflexible rods having one end of each connected to one limb portion on opposite sides of said joint, a shaft adapted for connection to an operating member, a clutch connection between said shaft and both of said rods, said clutch connection allowing movement of the shaft in one direction relative to said rods in all positions of said one limb portion, and preventing relative movement in the opposite direction when said one limb portion is tilted in either of the two possible directions from a normal position.

2. An artificial limb according to claim 1 and wherein said one limb portion is a foot, said joint being an ankle joint, said operating member is an upper leg portion, and said clutch connection is secured to a lower leg portion between said foot and said upper leg portion, whereby jack-knifing of the limb is prevented, the clutch connection being locked when weight is placed on either the toe or heel portion of the foot.

3. An artificial limb according to claim 2 and wherein said clutch connection comprises a hollow cylinder having an internally tapered portion, a bored piston in said cylinder and having a coating tapered portion, said shaft being axially slidable in said piston, and locking members carried by said tapered portion of the piston and shiftable to wedge between said tapered portion of the cylinder and said shaft when said shaft is moved in said opposite direction.

HENRY G. HANSON.

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