**INEXPENSIVE TRANSRADIAL PROSTHETIC DEVICE**

**[We can limit this to the fingers if you prefer.]**

**ABSTRACT**

An inexpensive transradial prosthetic for an amputation below the elbow but above the wrist that can be manufactured using 3D printed solutions, which can provide people with lower incomes eased access to effective prosthetics, and in which each finger utilizes a series of pulleys along with a moment arm to keep the transmission ratio as low as possible.

**DESCRIPTION**

TECHNICAL FIELD:

[0001] This invention relates to prosthetics and, more specifically, 3D printed prosthetic systems using pulleys and a moment arm.

BACKGROUND:

[0004] A transradial amputation is an amputation below the elbow but above the wrist. There are currently 41,000 individuals in America living with upper limb amputations, including a transradial amputation. International statistics for such amputations are largely unknown, however the number of transradial amputees in developing countries is expected to be much higher, mainly as a consequence of violence, unregulated industry, or lack of modern medicine.

[0005] A transradial amputation can greatly inhibit an individual's ability to complete every day activities. Being that this type of amputation usually results from accidents in the workplace, a transradial amputation can particularly debilitate ones access to economic opportunity. Such an amputation may also take a toll on one's personal life by affecting their ability to carry out basic tasks, hygiene habits, social encounters, etc. The even bigger problem is that most functional prosthetics are between $15,000 - $60,000. A large majority of the prosthetics in that range are also unusable as they are very primitive such as hooks or simple claw devices. Because of this, for hundreds of thousands of patients across the globe, affording any prosthetic at all, let alone a fully functioning one, is simply not an option.

[0006] Most types of transradial prosthetics are either body powered or battery powered.

[0004] One major problem of prosthesis, as stated before, is the cost. Functional transradial prosthetics can cost upwards to $60,000, unaffordable to the average American. Even still, many amputees in developing countries, victims of war, dangerous working conditions and the lack of developed medicine, are unable to purchase such ailments that can provide great help towards their daily lives. Reducing the cost of prosthetics is essential to providing better prosthesis care for millions across the world.

BRIEF DESCRIPTION OF DRAWINGS:

[0007]

Figs. 1A-1C are front, side and perspective views of a finger or digit manufactured in accordance with the present invention

Figs. 2A-2B show the individual components of the finger or digit in perspective and front views manufactured in accordance with the present invention.

Figs. 3A-3C are the front, side and perspective views of the arm portion of the prosthetic device that houses the motors, battery and the gear portion of the pulley system that moves the fingers.

Figs. 4A-4C are the front, side and perspective views of the palm portion of the prosthetic device.

Figs. 4D-4E are the expanded views of the palm portion.

Figs. 5A-5C are a front, side and back view of the distal and middle phalanx portion of the finger.

Figs. 5D-5E are an expanded view of the distal and middle portion of the finger.

Figs. 6A-6C are front, side and perspective views of the entire arm manufactured in accordance with the present invention.

DETAILED DESCRIPTION:

As best shown in Figs. 6A-6C, the prosthetic in accordance with the present invention is in the form of a hand having three digits 1, and a thumb 35 connected to a palm 24, which in turn is connected to appliance 10 which is secured to the limb of the user when in use.

The digits are shown in detail in Figs. 1 and 2. Each digit is comprised of a distal, middle and proximal section 2, 4, 6.  Each digit is also provided with a connector 8 for connection to the palm. The distal and middle sections 2 and 4, and connector 8 are provided with pulleys 2a, 4a and 8a, respectively, which are adapted to provide rotational movement of the distal section 2 relative to the middle section 4, rotational movement of the middle section 4 relative to the proximal section 6, and rotational movement of the proximal section 6 relative to the connector 8. Middle section 4 provides an additional moment arm, which allows for additional leverage.

To allow for rotation,

The fingers are attached to the palm of the prosthetic device through screws that go through the hole in 8 and into 34. This allows for the digits to be secured onto the prosthetic device while keeping its dexterity and modularity.

The digits move with close to a one-to-one transmission ratio, meaning that there is minimal power lost in its transfer from the motor to the finger. This allows for the most efficient power transfer, so the digits can open and close without added power from the motors, making the design extremely battery efficient while requiring only low cost materials.

The thumb design in Figs 5A-5E is variant from the other digit designs in Figs. 1 and 2. The thumb only has distal and proximal phalanges 36 and 40. To allow security between the thumb and the palm of the prosthetic, a connection is established between 42 and 32 with a screw to allow for rotation of the entire thumb design. The pulley thread is guided through the extension in 38 and in 32. This allows for the thread to be controlled so it does not interfere with any other moving parts of the prosthetic device.

On the other hand, the other three digits in Figs 1 and 2 have pulleys that allow the thread to be located inside of the finger. The thread is guided through 2a, 4a and 8a, allowing for the thread to not interfere with any other part of the digit.

To maintain finger stiffness, springs X are attached to another thread that goes through the back side of pulleys 4a and 8a and is tied to the top of 2a. This allows for the fingers to be erect when the fingers are not being actuated. The spring system also allows for the fingers to be extended once they are no longer being actuated. This removes the need for another extension actuation system, since the springs extend the fingers instead.