Preliminary Report:

Patent Landscape Data Overview of Motorized, Motion-Actuated Prosthetic Hands

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ITTI
International Technology Transfer Institute
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BRIEF OVERVIEW OF THE TECHNOLOGY/ DISCLOSURE PROVIDED: (PROVIDED TO ITTI BY CLDP)

The final Product form and its advantages

With our research and experience, we have finally been able to develop a fully functional below elbow prosthetic limb which is a hybrid between body powered and externally powered prosthetic upper limbs. Details of the developed product follow:

a. Technical Advantages

Our prototype uses the physical design of conventional body powered limb, with a motorized gripper and a small electronic circuit, to provide the patient an easy to use and cheap upper prosthesis solution. We have not only mitigated the force required to actuate the limb but our prototype also allows the user to pick objects with voluntarily controlled gripping force just like the brain controlled limb. During the project, we have been in continual contact with doctors at Armed Forces Institute of Rehabilitation Medicine (AFIRM) and have their positive feedback about our work. The doctors believe that our prosthetic upper limb provides all the requisite functionality and is ready for production. Apart from certain electronic components, most of the project items can be acquired from the local market. This is one of the major factors which can help ease the process of bringing this project as a product in the market. We have tested our prototype on patients from AFIRM and have found very good response.

b. Economic Advantages

The overall estimated cost of our prototype is Rs. 47000 which when compared to any externally powered prosthetic upper limb manufactured by different companies around the world is smaller manifold. The actual cost of a myo–electric arm from Otto Bock, an international company, is around USD 80, 000 or PKRs 4,800,000. Yet they have a definite impact upon the lives of the disabled people. We believe that our product will find customers in local as well as international market.

c. Design Advantages

Around the world, the two major concepts seen in the making of prosthetic limbs is that either they are myo-electric (brain controlled) or body powered. However, we have used a novel concept in our design which has made it easier to reduce cost as well as make the training of the amputee easier. Our prototype requires the patient to use his healthy shoulder for actuation of the gripper, just like the body powered limb, but with enormously reduced actuation force. This helps us bypass the complex and costly interface of the embedded electronic system with the brain and give the patient a comfortable source for actuation. On the other end, the embedded electronic system appropriately drives the motor enabling the gripper to open or close with enough gripping force to hold various commonly used items such as a glass of water. The patient can grip objects of various sizes and also control the magnitude of gripping force through his shoulder movement.

SEARCH METHODOLOGY

The scope of the project was defined as conducting a patent landscape analysis of technologies pertaining to a fully functional below elbow prosthetic limb, which is a hybrid between body powered and externally powered prosthetic upper limbs. In particular, the prosthetic requires the patient to use his healthy shoulder for actuation of the gripper wherein the actuation force is enormously reduced by the use of a motor.

The team began by reviewing few literatures relating to prosthetic arm to better understand the technology. Relevant literature and the provided disclosure was used to determine a list of keywords. These keywords were then used to do preliminary searches on Thomson Innovation, Delphion, Patent Storm and the USPTO websites. The initial keywords used in the two main categories in the search rounds were:

Prosthetic	**Arm**
Robotic	Wrist
Artificial	Limb
Mechanical	hand
Biomimetic	appendage
Bionic	Upper extremity
Bioelectric	
Electronic	
Myoelectric	

The keywords were then derived to generate useful search strings. The following search string was utilized to retrieve core patent documents from Thomson Innovation using the search field of "Title, Abstract and Claims:"

(Prosthe* or robot* or artificial or mechani* or biomimetic or bionic or bioelectric* or electric* or electronic or sensor* or myoelectric*) adj (arm or wrist* or limb* or hand* or appendage* or (upper adj extremit*)))

The identified core patent documents are as follows:

Publication Number	Title	US Class - Main	Application Year
US5480454A	Control system for prosthetic devices	623024	1994
US2259911A	Mechanism for operating artificial limbs	623026	1937
US4094016A	Artificial hand and forearm	623024	1976
US2445711A	Mechanical movement	623058	1946
US2580987A	Electrically operated artificial arm for above-the-elbow amputees	623024	1948

Once the core patent documents were discovered, the team used these documents to identify the relevant United State Patent Classifications and International Patent Classifications. Since the team was not familiar with the technology, the combination of keywords and classifications in search strings was useful for parsing through the technology, which in-turn facilitated in identifying additional relevant patent documents. Based on the early results, the team used an iterative, redundant search strategy: combination of keywords, classification and forward citation search and analysis to further refine the data set.

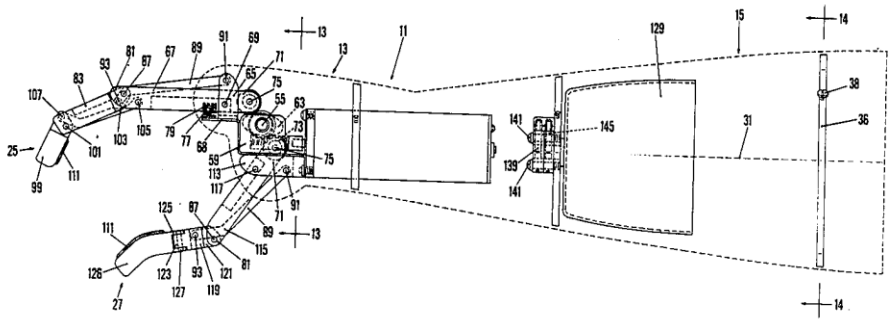
As an example, a patent issued in 1978 appears to embody several key features of the prosthetic technology under analysis:

1. Motorized Prosthetic
2. Mechanically actuated
3. Gripping functionality

US4094016A

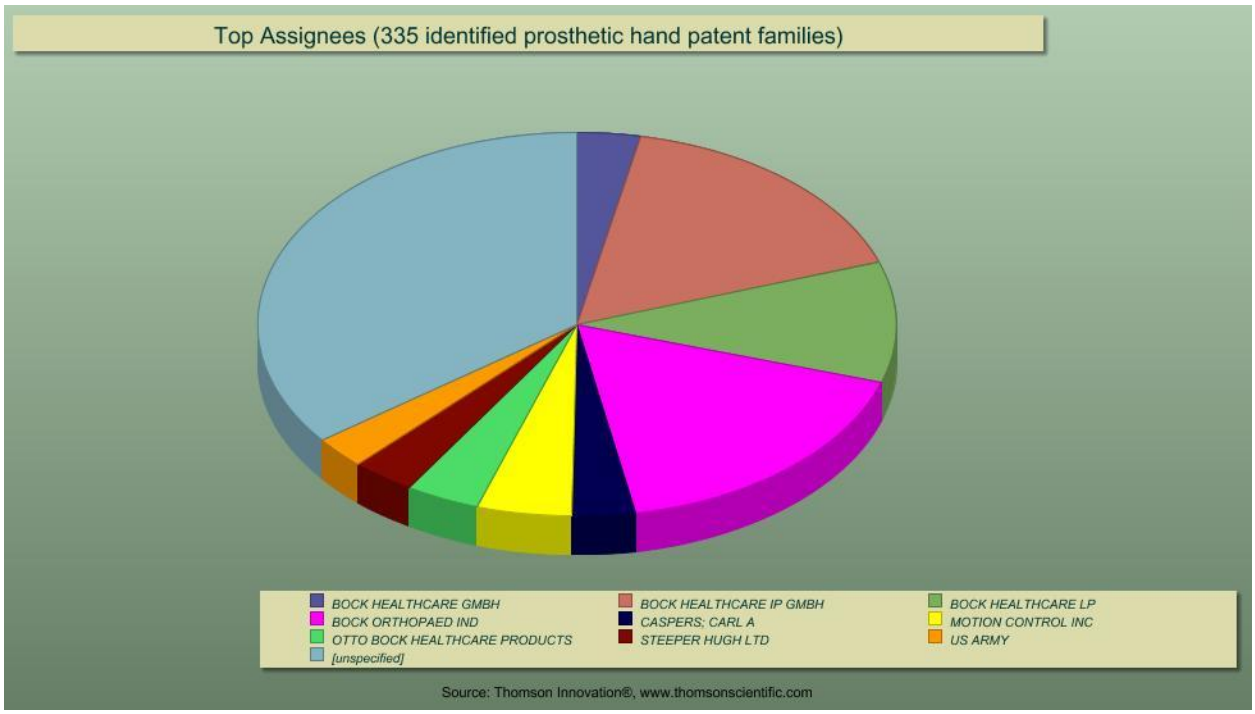
Title- Artificial hand and forearm

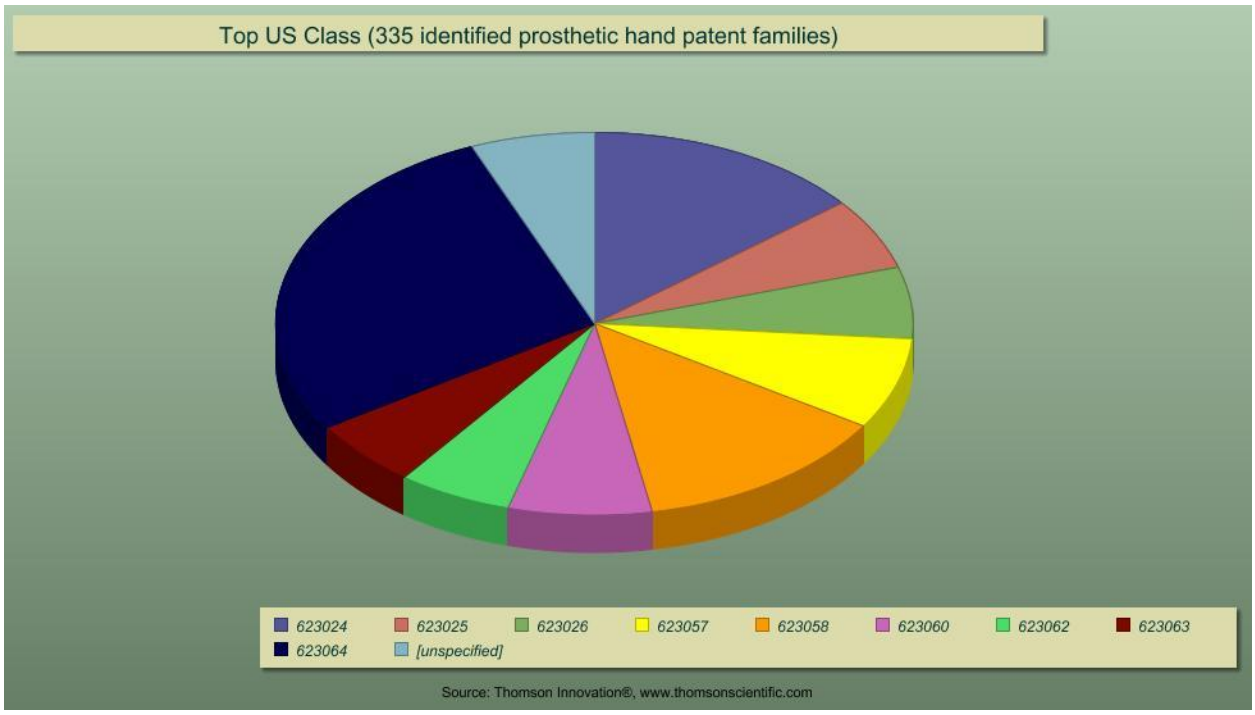
Abstract- An artificial hand and forearm comprises an elongated housing open at its rear end adapted to receive the stub of a human forearm and adjacent upper arm, adapted for securing thereto. A plate within the housing pivotally mounts a series of finger assemblies within the housing, with said finger assemblies projecting from the housing. A thumb assembly is spaced from said finger assemblies and pivotally mounted upon said plate, with the thumb assembly projecting from the housing and opposed to the forefinger assembly. A cam shaft is journalled upon said plate and mounts a series of spaced cams respectively registering with the inner ends of the finger assemblies. One cam includes a pair of opposed cam surfaces for simultaneous registry with the forefinger and thumb assemblies. A spring biases said finger assemblies into an open position against said cams. A reversible electric motor within the housing has an output shaft geared to the cam shaft. A power source, a switch and an electrical circuit within the housing connects said motor. The switch under the control of an arm stub may be activated in one direction, said cams rotating in one direction moving said finger and thumb assemblies inwardly to grip an object, deactivating said switch stopping said fingers. Successively activating said switch in the opposite direction reversing said motor, said cams rotating in the opposite direction pivoting said thumb and finger assemblies to move outwardly releasing said object.

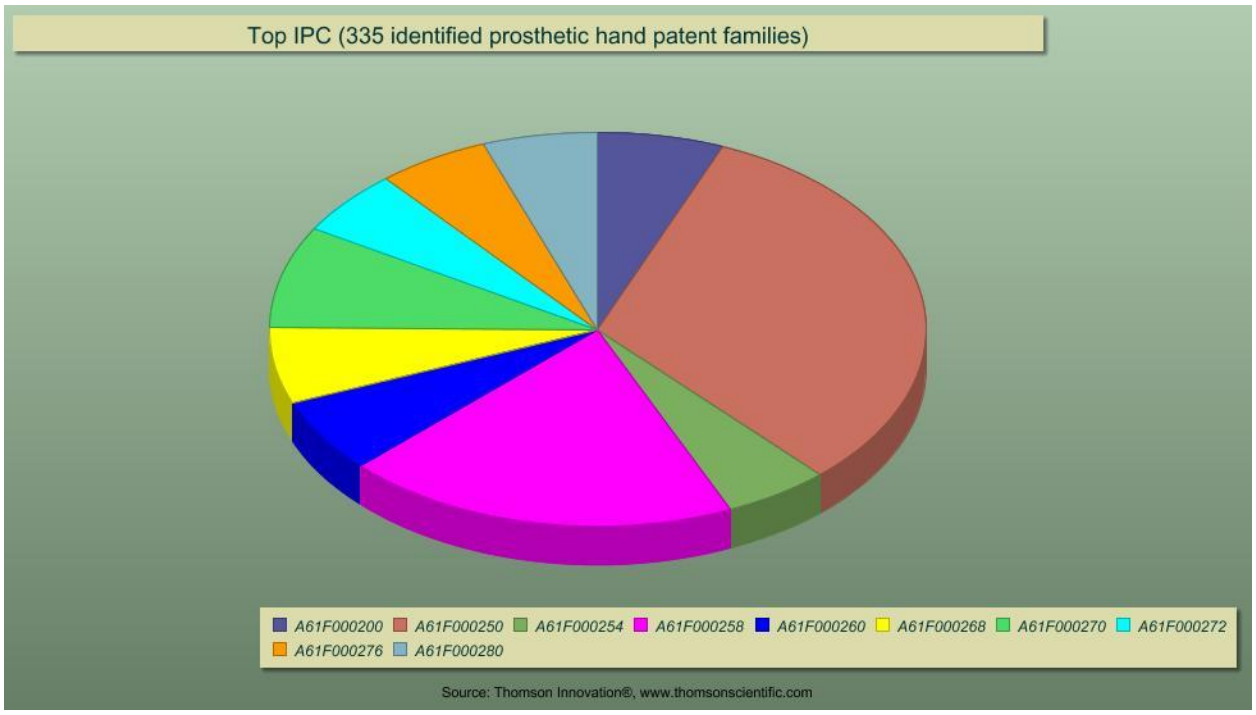


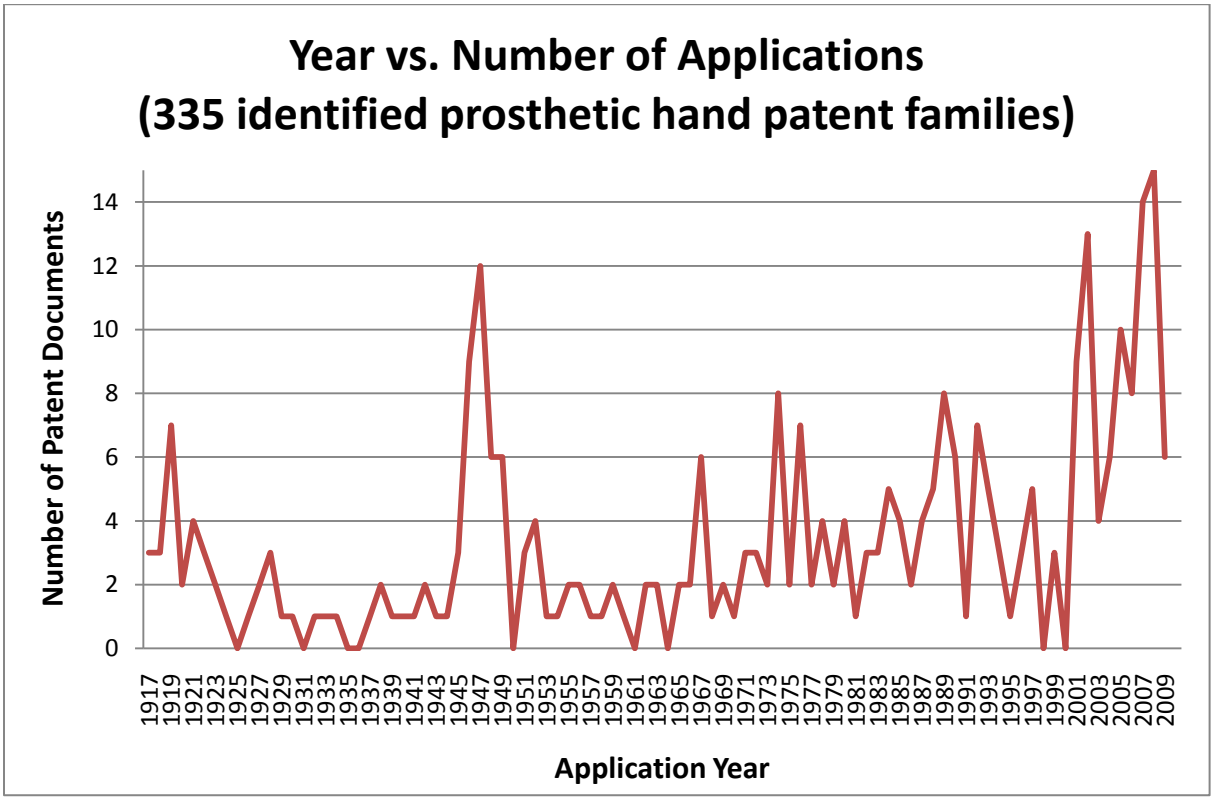
RESULTS

Initial findings identified 335 patent families which appear to describe prosthetic technologies potentially related to the technology under analysis. What follows is a summary of this information in the form of analytic charts and comprehensive patent tables. In addition, we also include tables that describe the principal US and International Classifications relevant to the technology under analysis.


Top Assignees (335 identified prosthetic hand patent families)
BOCK HEALTHCARE GMBH
BOCK HEALTHCARE IP GMBH
BOCK HEALTHCARE LP
BOCK ORTHOPAED IND
CASPERS; CARL A
MOTION CONTROL INC
OTTO BOCK HEALTHCARE PRODUCTS
STEEPER HUGH LTD
US ARMY
[unspecified]
Source: Thomson Innovation®, www.thomsonscientific.com


Top US Class (335 identified prosthetic hand patent families)
623024
623025
623026
623057
623058
623060
623062
623063
623064
[unspecified]
Source: Thomson Innovation®, www.thomsonscientific.com





TOP 10 US CLASSIFICATIONS

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US Class	Definition
623	PROSTHESIS (I.E., ARTIFICIAL BODY MEMBERS), PARTS THEREOF, OR AIDS AND ACCESSORIES THEREFOR
623/024	CLASS 623, PROSTHESIS (I.E., ARTIFICIAL BODY MEMBERS), PARTS THEREOF, OR AIDS AND ACCESSORIES THEREFOR 24 HAVING ELECTRICAL ACTUATOR
623/025	CLASS 623, PROSTHESIS (I.E., ARTIFICIAL BODY MEMBERS), PARTS THEREOF, OR AIDS AND ACCESSORIES THEREFOR 24 HAVING ELECTRICAL ACTUATOR 25 . Bioelectrical (e.g., myoelectric, etc.):
623/026	CLASS 623, PROSTHESIS (I.E., ARTIFICIAL BODY MEMBERS), PARTS THEREOF, OR AIDS AND ACCESSORIES THEREFOR 26 HAVING FLUID ACTUATOR
623/058	CLASS 623, PROSTHESIS (I.E., ARTIFICIAL BODY MEMBERS), PARTS THEREOF, OR AIDS AND ACCESSORIES THEREFOR 57ARM OR COMPONENT (E.G., ELBOW, WRIST, HAND, FINGER, ETC.), AND ACTUATOR OR CONNECTOR THEREFOR: This subclass is indented under the class definition. Subject matter manufactured or adapted to replace or assist an upper limb, or part thereof, of a human body, i.e., an arm, a elbow, hand or finger or the connecting joints, and actuating means or attaching devices for any of the same. 58. Torso supported and actuated: This subclass is indented under subclass 57. Subject matter in which an artificial arm member is provided with a device attaching the member to the trunk of a human body and is provided with means able to actuate the member by the trunk of the human body.

623/060	CLASS 623, PROSTHESIS (I.E., ARTIFICIAL BODY MEMBERS), PARTS THEREOF, OR AIDS AND ACCESSORIES THEREFOR 57 ARM OR COMPONENT (E.G., ELBOW, WRIST, HAND, FINGER, ETC.), AND ACTUATOR OR CONNECTOR THEREFOR: 59 . Elbow: 60 .. With forearm actuation:
623/062	CLASS 623, PROSTHESIS (I.E., ARTIFICIAL BODY MEMBERS), PARTS THEREOF, OR AIDS AND ACCESSORIES THEREFOR 57 ARM OR COMPONENT (E.G., ELBOW, WRIST, HAND, FINGER, ETC.), AND ACTUATOR OR CONNECTOR THEREFOR: 61 . Wrist: 62 .. With wrist actuation:
623/063	CLASS 623, PROSTHESIS (I.E., ARTIFICIAL BODY MEMBERS), PARTS THEREOF, OR AIDS AND ACCESSORIES THEREFOR 57ARM OR COMPONENT (E.G., ELBOW, WRIST, HAND, FINGER, ETC.), AND ACTUATOR OR CONNECTOR THEREFOR: This subclass is indented under the class definition. Subject matter manufactured or adapted to replace or assist an upper limb, or part thereof, of a human body, i.e., an arm, a elbow, hand or finger or the connecting joints, and actuating means or attaching devices for any of the same. 63. Arm or torso initiated finger actuation: This subclass is indented under subclass 57. Subject matter in which an artificial digit of a human hand is provided with means able to actuate the digit wherein such means is supported by an upper limb of a human body, i.e., an arm or the trunk of a human body, i.e., a torso.
623/064	CLASS 623, PROSTHESIS (I.E., ARTIFICIAL BODY MEMBERS), PARTS THEREOF, OR AIDS AND ACCESSORIES THEREFOR 57 ARM OR COMPONENT (E.G., ELBOW, WRIST, HAND, FINGER, ETC.), AND ACTUATOR OR CONNECTOR THEREFOR: 64 . Finger actuator embodied in simulated hand:

TOP 10 INTERNATIONAL PATENT CLASSIFICATIONS

IPC Class	Definition
A61F 0/00	FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS (dental prosthetics
A61F 2/50	A SECTION A — HUMAN NECESSITIES HEALTH; LIFE-SAVING; AMUSEMENT A61 MEDICAL OR VETERINARY SCIENCE; HYGIENE A61F FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS A61F 2/00 Filters implantable into blood vessels; Prostheses, i.e. artificial substitutes or replacements for parts of the body; Appliances for connecting them with the body; Devices providing patency to, or preventing collapsing of, tubular structures of the body, e.g. stents (as cosmetic articles, see the relevant subclasses, e.g. wigs, hair pieces, A61F 2/01 · Filters implantable into blood vessels [6] A61F 2/02 · Prostheses implantable into the body [4] A61F 2/50 · Prostheses not implantable in the body
A61F 2/54	A SECTION A — HUMAN NECESSITIES HEALTH; LIFE-SAVING; AMUSEMENT A61 MEDICAL OR VETERINARY SCIENCE; HYGIENE

	A61F FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS (dental prosthetics Fulltext... A61F 2/00 Filters implantable into blood vessels; Prostheses, i.e. artificial substitutes or replacements for parts of the body; Appliances for connecting them with the body; Devices providing patency to, or preventing collapsing of, tubular structures of the body, e.g. stents (as cosmetic articles, see the relevant subclasses, e.g. wigs, hair pieces, A61F 2/50 · Prostheses not implantable in the body [4] A61F 2/52 · · Mammary prostheses (brassières Fulltext... A61F 2/54 · · Artificial arms or hands or parts thereof
A61F 2/58	A SECTION A — HUMAN NECESSITIES HEALTH; LIFE-SAVING; AMUSEMENT A61 MEDICAL OR VETERINARY SCIENCE; HYGIENE A61F FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS A61F 2/00 Filters implantable into blood vessels; Prostheses, i.e. artificial substitutes or replacements for parts of the body; Appliances for connecting them with the body; Devices providing patency to, or preventing collapsing of, tubular structures of the body, e.g. stents (as cosmetic articles, see the relevant subclasses, e.g. wigs, hair pieces, A61F 2/50 · Prostheses not implantable in the body [4] A61F 2/54 · · Artificial arms or hands or parts thereof [4] A61F 2/56 · · · adjustable [4] A61F 2/58 · · · Elbows; Wrists

A61F 2/60	A SECTION A — HUMAN NECESSITIES HEALTH; LIFE-SAVING; AMUSEMENT A61 MEDICAL OR VETERINARY SCIENCE; HYGIENE A61F FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS A61F 2/00 Filters implantable into blood vessels; Prostheses, i.e. artificial substitutes or replacements for parts of the body; Appliances for connecting them with the body; Devices providing patency to, or preventing collapsing of, tubular structures of the body, e.g. stents (as cosmetic articles, see the relevant subclasses, e.g. wigs, hair pieces, Fulltext... A61F 2/50 · Prostheses not implantable in the body [4] A61F 2/52 · · Mammary prostheses (brassières Fulltext... A61F 2/54 · · Artificial arms or hands or parts thereof [4] A61F 2/60 · · Artificial legs or feet or parts thereof

A61F 2/68	A SECTION A — HUMAN NECESSITIES HEALTH; LIFE-SAVING; AMUSEMENT A61 MEDICAL OR VETERINARY SCIENCE; HYGIENE A61F FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS A61F 2/00 Filters implantable into blood vessels; Prostheses, i.e. artificial substitutes or replacements for parts of the body; Appliances for connecting them with the body; Devices providing patency to, or preventing collapsing of, tubular structures of the body, e.g. stents (as cosmetic articles, see the relevant subclasses, e.g. wigs, hair pieces, A61F 2/50 · Prostheses not implantable in the body [4] A61F 2/52 · · Mammary prostheses (brassières Fulltext... A61F 2/54 · · Artificial arms or hands or parts thereof [4] A61F 2/60 · · Artificial legs or feet or parts thereof [4] A61F 2/68 · · Operating or control means
A61F 2/70	A SECTION A — HUMAN NECESSITIES HEALTH; LIFE-SAVING; AMUSEMENT A61 MEDICAL OR VETERINARY SCIENCE; HYGIENE A61F FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS

	A61F 2/00 Filters implantable into blood vessels; Prostheses, i.e. artificial substitutes or replacements for parts of the body; Appliances for connecting them with the body; Devices providing patency to, or preventing collapsing of, tubular structures of the body, e.g. stents (as cosmetic articles, see the relevant subclasses, e.g. wigs, hair pieces, A61F 2/50 · Prostheses not implantable in the body [4] A61F 2/68 · · Operating or control means [4] A61F 2/70 · · · electrical
A61F 2/72	A SECTION A — HUMAN NECESSITIES HEALTH; LIFE-SAVING; AMUSEMENT A61 MEDICAL OR VETERINARY SCIENCE; HYGIENE A61F FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS A61F 2/00 Filters implantable into blood vessels; Prostheses, i.e. artificial substitutes or replacements for parts of the body; Appliances for connecting them with the body; Devices providing patency to, or preventing collapsing of, tubular structures of the body, e.g. stents (as cosmetic articles, see the relevant subclasses, e.g. wigs, hair pieces, Fulltext... A61F 2/50 · Prostheses not implantable in the body [4] A61F 2/68 · · Operating or control means [4] A61F 2/70 · · · electrical [4] A61F 2/72 · · · · Bioelectric control, e.g. myoelectric
A61F 2/76	A SECTION A — HUMAN NECESSITIES HEALTH; LIFE-SAVING; AMUSEMENT A61 MEDICAL OR VETERINARY SCIENCE; HYGIENE

	A61F FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS A61F 2/00 Filters implantable into blood vessels; Prostheses, i.e. artificial substitutes or replacements for parts of the body; Appliances for connecting them with the body; Devices providing patency to, or preventing collapsing of, tubular structures of the body, e.g. stents (as cosmetic articles, see the relevant subclasses, e.g. wigs, hair pieces, Fulltext... A61F 2/50 · Prostheses not implantable in the body [4] A61F 2/52 · · Mammary prostheses (brassières Fulltext... A61F 2/54 · · Artificial arms or hands or parts thereof [4] A61F 2/60 · · Artificial legs or feet or parts thereof [4] A61F 2/68 · · Operating or control means [4] A61F 2/76 · · Means for assembling, fitting, or testing prostheses, e.g. for measuring or balancing
A61F 2/80	A SECTION A — HUMAN NECESSITIES HEALTH; LIFE-SAVING; AMUSEMENT A61 MEDICAL OR VETERINARY SCIENCE; HYGIENE A61F FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS A61F 2/00 Filters implantable into blood vessels; Prostheses, i.e. artificial substitutes or replacements for parts of the body; Appliances for connecting them with the body; Devices providing patency to, or preventing collapsing of, tubular structures of the body, e.g. stents (as cosmetic articles, see the relevant subclasses, e.g. wigs, hair pieces, Fulltext... A61F 2/50 · Prostheses not implantable in the body [4]

	A61F 2/78 · · Means for protecting prostheses or for attaching them to the body, e.g. bandages, harnesses, straps, or stockings for the limb stump [4] A61F 2/80 · · · Sockets, e.g. of suction type

PROSTHETIC HAND POTENTIALLY RELEVANT PATENT FAMILIES
(1 representative document presented for each patent family**)**

Publication Number	Title (English)	Assignee - Standardized	Priority Country	Application Year
US20100070051A1	PROSTHESIS SHAFT WITH ACTIVE AIR RELEASE	OTTO BOCK HELATHCARE GMBH,,,,,	DE | US	2009
US20100010636A1	Method and Apparatus for Wrist Arthroplasty	BIOMET MFG CORP,,,,,	US	2009
US20090308526A1	PROCESS FOR FORMING COVERINGS	TOUCH EMAS LTD,,,,,	GB | US	2009
WO2009115835A1	PROSTHESIS COVERING	TOUCH EMAS LTD,,,,, | GILL HUGH,,,,,	GB	2009
US20090326677A1	Joint Prosthetic Device	FOURIER DESIGNS LLC,,,,,	US	2009
US20090292371A1	Correlated Magnetic Prosthetic Device and Method for Using the Correlated Magnetic Prosthetic Device	CEDAR RIDGE RES LLC,,,,,	US	2009
US20080255670A1	PROSTHETIC OR ORTHOTIC JOINT	BOCK HEALTHCARE IP GMBH,,,,,	DE | US	2008
US20080269910A1	Medical prosthetic devices having improved biocompatibility		DK | US	2008
US20080304935A1	Robotic exoskeleton for limb movement		US	2008
IN200802358P2				2008
US20090030530A1	ELECTRONICALLY CONTROLLED PROSTHETIC SYSTEM		US	2008

US20080312753A1	Clutch Module For Prosthesis	BOCK HEALTHCARE IP GMBH,,,,,	DE | US	2008
WO2008116646A1	GEAR ARRANGEMENT	OTTO BOCK HEALTHCARE PRODUCTS,,,,, | PUCHHAMMER GREGOR,,,,,	DE | EP	2008
US20080269907A1	Articulated Hand Prosthesis	OTTO BOCK HEALTHCARE GMBH & CO,,,,,	DE | US	2008
IN200802545P2				2008
DE102008015388A1	System particularly for use with embedded energy storage for prosthesis systems of upper extremities, has orthopedic device, particularly prosthesis, which has storage device for electrical energy	OTTO BOCK HEALTHCARE PRODUCTS,,,,,	DE	2008
US20080243265A1	METHOD AND APPARATUS FOR CONTROL OF A PROSTHETIC	DEKA PRODUCTS LP,,,,,	US	2008
KR20091251210A	PROSTHESIS WITH CHARGEABLE ELECTRIC ENERGY ACCUMULATOR	OTTO BOCK HEALTHCARE PRODUCTS,,,,,	DE | KR	2008
US20080276725A1	Sensor Assembly for Measuring Forces and/or Torques and Use of Said Assembly	BOCK HEALTHCARE IP GMBH,,,,,	DE | US	2008

WO2009015751A1	PROSTHETIC GRIP UNIT	OTTO BOCK HEALTHCARE PRODUCTS,,,,, | PUCHHAMMER GREGOR,,,,,	DE | EP	2008
US20080288088A1	ARM PROSTHETIC DEVICE	DEKA PRODUCTS LP,,,,,	US	2008
US20070191965A1	PROSTHETIC DEVICE UTILIZING ELECTRIC VACUUM PUMP	OHIO WILLOW WOOD CO,,,,,	US	2007
WO2008040291A1	PROSTHESIS COMPRISING A SHAFT FOR ACCOMMODATING AN AMPUTATION STUMP	BOCK HEALTHCARE IP GMBH,,,,, | SCHMIDT ARNO,,,,, | REINELT STEFAN,,,,,	DE	2007
US20080200994A1	Detector and Stimulator for Feedback in a Prosthesis		US	2007
CN101069659A	Prosthesis inner shaft system	OTTO BOCK HEALTHCARE PRODUCTS,,,,,	DE | CN	2007
WO2008088204A1	FUNCTIONAL HAND PROSTHESIS MECHANISM	BRAVO CASTILLO LUIS ARMANDO,,,,,	MX	2007
EP2066268A1	PROSTHESIS COMPRISING A SHANK FOR ACCOMMODATING AN AMPUTATION STUMP	BOCK HEALTHCARE GMBH,,,,,	DE | EP	2007
CN101095632A	Method for determining the insertion height of a prosthesis	BOCK HEALTHCARE IP GMBH,,,,,	DE | CN	2007

US20070255424A1	PROSTHETIC SENSING SYSTEMS AND METHODS		US	2007
US20070260328A1	PROSTHETIC JOINT	BOCK HEALTHCARE IP GMBH,,,,,	DE | US	2007
US20070144299A1	Joint driving device		JP | EP | US	2007
EP2061633A2	ROTARY ACTUATOR ARRANGEMENT	ELUMOTION LTD,,,,,	GB | EP	2007
US20080312747A1	SYSTEMS AND METHODS FOR THE INSPECTION OF CYLINDERS		US	2007
US20070213842A1	PROSTHETIC ARM		US	2007
US20080045374A1	Gear bearing drive	NASA GODDARD SPACE FLIGHT CT,,,,,	US	2007
US20070173955A1	WRIST DEVICE FOR USE WITH A PROSTHETIC LIMB	MOTION CONTROL INC,,,,,	US	2006
DE202006007461U1		OTTO BOCK HEALTHCARE PRODUCTS,,,,,	DE	2006
US7717962B2	Proprioception enhancement device	WILSON MICHAEL T,,,,,	US	2006
WO2006101445A1	SYSTEM AND METHOD FOR CONSCIOUS SENSORY FEEDBACK	LUNDBORG GOERAN,,,,,	SE	2006
CN101180014A	System consisting of a liner and a myoelectronic electrode unit	OTTO BOCK HEALTHCARE PRODUCTS,,,,,	DE | CN	2006
US20070162152A1	Artificial joints using agonist-antagonist actuators	MASSACHUSETTS INST TECHNOLOGY,,,,,	US	2006

US20100106259A1	Conducting polymer nanowire brain-machine interface systems and methods	UNIV NEW YORK,,,,, | MASSACHUSETTS INST TECHNOLOGY,,,,,	US	2006
CN101212929A	Technical orthopaedic auxiliary agent, in particular prosthesis for an extremity	BOCK HEALTHCARE IP GMBH,,,,,	DE | CN	2006
US20050228515A1	Cognitive control signals for neural prosthetics	CALIFORNIA INST OF TECHN,,,,,	US	2005
US7296835B2	Robotic hand and arm apparatus	ANYBOTS INC,,,,,	US	2005
US20060155386A1	Electromyographic sensor		US	2005
US7361197B2	Prosthetic hand having a conformal, compliant grip and opposable, functional thumb	WINFREY REX CLAYTON,,,,,	US	2005
US7087092B1	Artificial hand for grasping an object	LANDSBERGER SAMUEL L,,,,,	US	2005
US20050131549A1	Osmotic membrane and vacuum system for artificial limb	BOCK HEALTHCARE LP,,,,,	US	2005
JP2005334675A	METHOD FOR CONTROLLING ARTIFICIAL LIMB WITH MUSCLE ELECTRICITY	BOCK HEALTHCARE GMBH,,,,,	DE | JP	2005
US20050234564A1	Enhanced-functionality prosthetic limb		US	2005
US7655051B2	Artificial hand	STARK MARK,,,,,	US	2005
DE602005008575D1		OTTO BOCK HEALTHCARE LP,,,,,	US | DE	2005
US7438724B2	System and method for force feedback	MOTION CONTROL INC,,,,,	US	2004

US20050021155A1	Device at a hand prosthesis		SE | US	2004
US20050267597A1	Neural interface system with embedded id		US	2004
US7442212B2	Decoding algorithm for neuronal responses	US HEALTH,,,,,	US	2004
US7474939B2	Object taking-out apparatus	FANUC LTD,,,,,	JP | US	2004
US6942703B2	Prosthesis	LUISA CERANO GMBH,,,,,	DE | EP | US	2004
US7713217B2	Torque imparting system	HONDA MOTOR CO LTD,,,,,	US | JP	2003
US7118601B2	Parallel linkage and artificial joint device using the same	HONDA MOTOR CO LTD,,,,,	JP | US	2003
US7150762B2	Pressure/temperature monitoring device for prosthetics	BOCK HEALTHCARE LP,,,,,	US	2003
DE10357579B4		BOCK HEALTHCARE GMBH,,,,,	DE	2003
US20030018388A1	Pneumatic muscle analogs for exoskeletal robotic limbs and associated control mechanisms		US	2002
US6846331B2	Gripper device	STEEPER HUGH LTD,,,,,	GB | US	2002
US6817641B1	Robotic arm and hand	SINGLETON JR LAWRENCE J,,,,,	US	2002
US6732015B2	Robot system	TOSHIBA KK,,,,,	US	2002
US7164967B2	Biomorphic rhythmic movement controller	IGUANA ROBOTICS INC,,,,,	US	2002
US6773327B1	Apparatus for actuating a toy	HASBRO INC,,,,,	US	2002

US6896704B1	Movable finger for prostheses, upper extremity prostheses using this movable finger, and movable finger controller	TETSUYA HIGUCHI C O NAT INST O,,,,,	JP | US	2002
US7041141B2	Safety clutch for a prosthetic grip	MOTION CONTROL INC,,,,,	US	2002
US6660043B2	Artificial hand	NAT INST OF ADVANCED IND SCIEN,,,,,	JP | US	2002
WO2003017878A1	MECHANICAL HAND WITH THE GRIPPING ABILITY OF THE HUMAN HAND	BERGOMED AB,,,,, | BRIMALM STELLAN,,,,,	SE	2002
US6645252B2	Drive unit for prosthetic limb	HONDA MOTOR CO LTD,,,,,	JP | US	2002
US6952687B2	Cognitive state machine for prosthetic systems	CALIFORNIA INST OF TECHN,,,,,	US	2002
US7302296B1	Electrical stimulation system and methods for treating phantom limb pain and for providing sensory feedback to an amputee from a prosthetic limb	NEUROSTREAM TECHNOLOGIES INC,,,,,	US | CA	2002
US6660042B1	Methods of biomimetic finger control by filtering of distributed forelimib pressures	UNIV RUTGERS,,,,,	US	2001
US6679920B2	Device and method for remote maintenance of an electronically controllable prosthesis	BIEDERMANN MOTECH GMBH,,,,,	DE | EP | US	2001

US6443993B1	Self-adjusting prosthetic ankle apparatus	KONIUK WAYNE,,,,,	US	2001
US7192445B2	Medical prosthetic devices and implants having improved biocompatibility	ASTRA TECH AB,,,,,	DK | US	2001
US6695885B2	Method and apparatus for coupling an implantable stimulator/sensor to a prosthetic device	MANN ALFRED E FOUND SCIENT RES,,,,,	US	2001
US6589287B2	Artificial sensibility	LUNDBORG GOERAN,,,,,	SE | US	2001
US20020065580A1	Method and system for determining native neurological dominant hemisphere functionality and use of such information for therapeutics and for control of prostheses and robotics		US	2001
US7209788B2	Closed loop brain machine interface	UNIV DUKE,,,,,	US	2001
US6761743B1	Alignment device for a prosthetic limb	JOHNSON TIMOTHY,,,,,	US	2001
US6344062B1	Biomimetic controller for a multi-finger prosthesis	STATE UNIVERSITY RUTGERS,,,,, | NIAN CRAE INC,,,,,	US	1999
US6109852A	Soft actuators and artificial muscles	UNIV NEW MEXICO,,,,,	US	1999
US6379393B1	Prosthetic, orthotic, and other rehabilitative robotic assistive devices actuated by smart materials	UNIV RUTGERS,,,,,	US	1999

US5888213A	Method and apparatus for controlling an externally powered prosthesis	MOTION CONTROL INC,,,,,	US	1997
US5888235A	Body-powered prosthetic arm	SARCOS INC,,,,,	US	1997
US5893891A	Prosthesis control system	BLATCHFORD & SONS LTD,,,,,	GB | US	1997
US5941914A	Articulated, stacked-plate artificial body part	SARCOS L C,,,,,	US	1997
US5904722A	Hypobarically-controlled, double-socket artificial limb with mechanical interlock	CASPERS; CARL A,,,,,	US	1997
CN1121194C	Braking type joint of artificial limb	OTTO BOCK HEALTH NURSING AG,,,,,	DE | CN	1996
US5888246A	Motor drive system and linkage for hand prosthesis	ROYAL INFIRMARY OF EDINBURGH N,,,,,	GB | US	1996
US6500210B1	System and method for providing a sense of feel in a prosthetic or sensory impaired limb	SEATTLE SYSTEMS INC,,,,,	US	1996
US5571211A	Tubular adapter for a prosthetic limb	BOCK ORTHOPAED IND,,,,,	DE | US	1995
US5443525A	Conductive patch for control of prosthetic limbs	LAGHI; ALDO A,,,,,	US	1994
US5599151A	Surgical manipulator	DAUM GMBH,,,,,	DE | US	1994
US5480454A	Control system for prosthetic devices	US ARMY,,,,,	US	1994
US5378033A	Multi-function mechanical hand with shape adaptation	UNIV KENTUCKY RES FOUND,,,,,	US	1993

JP7000436A	ARTIFICIAL LIMB FOR ORTHOPEDICS AND JOINT OF ORTHESIS	BOCK ORTHOPAED IND,,,,,	DE | JP	1993
US5376132A	Prosthetic liner and method of making the liner with a prosthesis socket	CASPERS; CARL A,,,,,	US | AU | EP	1993
US5443530A	Elbow fitting part	BOCK ORTHOPAED IND,,,,,	DE | US	1993
US5447403A	Dexterous programmable robot and control system	ENGLER JR; CHARLES D,,,,,	US	1993
US5246463A	Sensate and spacially responsive prosthesis	GIAMPAPA VINCENT C,,,,,	US	1992
US5336269A	Method and apparatus for switching degrees of freedom in a prosthetic limb	LIBERTY MUTUAL INSURANCE CO,,,,,	US	1992
US5326369A	Flexible actuating screw	SCHECTMAN LEONARD A,,,,,	US	1992
US5326351A	Prosthesis fitting device	SARAZIN MAURICE,,,,,	FR | US	1992
US5413611A	Computerized electronic prosthesis apparatus and method	MCP SERVICES INC,,,,,	US	1992
US5252102A	Electronic range of motion apparatus, for orthosis, prosthesis, and CPM machine	ELECTROBIONICS CORP,,,,,	US	1992
US5219366A	Artificial hand	SCRIBNER ALBERT W,,,,,	US	1992

US5127420A	APPARATUS AND METHOD FOR FITTING A PROSTHESIS SOCKET	BOCK ORTHOPAED IND,,,,,	AT | US	1991
US5020388A	Wire guide apparatus for wire-driven mechanism	AGENCY IND SCIENCE TECHN,,,,, | MITI MINI INT TRADE & IND,,,,,	JP | US	1990
US5080682A	Artificial robotic hand	SCHECTMAN LEONARD A,,,,,	US	1990
US5200679A	Artificial hand and digit therefor	GRAHAM DOUGLAS F,,,,,	US	1990
US5108140A	Reconfigurable end effector	ODETICS INC,,,,,	US	1990
US5080681A	Hand with conformable grasp	CALSPAN CORP,,,,,	US	1990
US5052736A	Modular dexterous hand	UNIV MARYLAND,,,,,	US	1990
JP2080044A	ARTIFICIAL HAND DRIVING DEVICE	BOCK ORTHOPAED IND,,,,,	AT | JP	1989
US5092646A	Double capstan winch drive	SMALLRIDGE BRUCE B,,,,,	US	1989
US4986723A	Anthropomorphic robot arm	AGENCY IND SCIENCE TECHN,,,,, | MITI MINI INT TRADE & IND,,,,,	JP | US	1989
US5013326A	Artificial hand	BOCK ORTHOPAED IND,,,,,	AU | US	1989
EP352252A1	Epicyclic friction gear.	BOCK ORTHOPAED IND,,,,,	AT | EP	1989
US5062673A	Articulated hand	TOYODA CHUO KENKYUSHO KK,,,,,	JP | US	1989
US4955918A	Artificial dexterous hand	UNIV SOUTHERN CALIFORNIA,,,,,	US	1989

EP352251B1	ARTIFICIAL HAND	OTTO BOCK ORTHOPAEDISCHE INDUSTRIE BESITZ- UND VERWALTUNGS-KOMMANDITGESELLSCHAFT,,,,,	AT | EP	1989
US4944755A	Motorized joint	AIR MUSCLE LTD,,,,,	GB | US	1988
US4846843A	Inner hand	BOCK ORTHOPAED IND,,,,,	DE | US	1988
US4958705A	Hydraulic controller, especially for the movement of a prosthetic joint	BOCK ORTHOPAED IND,,,,,	AT | US	1988
US5062855A	Artifical limb with movement controlled by reversing electromagnet polarity	RINCOE RICHARD G,,,,,	US	1988
US4865613A	Laterally operative cosmetic hand	RIZZO MARY B,,,,,	US	1988
US4808187A	Tactile stimulus receptor for a hand prosthesis	UNIV IOWA STATE RES FOUND INC,,,,,	US	1987
US4834443A	Robotic gripping device having linkage actuated finger sections	SECR DEFENCE BRIT,,,,,	GB | US	1987
US4834761A	Robotic multiple-jointed digit control system	WALTERS DAVID A,,,,,	US	1987
US4770662A	Sensate vibratory prosthesis	GIAMPAPA VINCENT C,,,,,	US	1987
US4792338A	Artificial hand	CENTRI GUMMIFABRIK AB,,,,,	SE | US	1986
US4643473A	Robotic mechanical hand	GEN MOTORS CORP,,,,,	US	1986
US4636221A	Elbow lock mechanism	STEEPER HUGH LTD,,,,,	GB | US	1985
US4685928A	Artificial arm and hand assembly	YAEGER IVAN,,,,,	US	1985

US4650492A	Artificial hands	HANGER & CO LTD J E,,,,,	GB | US	1985
US4685929A	Total hand prostheses	PARTICIPATIONS S A COMP GEN DE,,,,,	FR | US	1985
US4685925A	Voluntary opening prehension device	UNIV NORTHWESTERN,,,,,	US	1984
US4613331A	Articulated prosthetic wrist	UNIV UTAH,,,,,	US	1984
US4921293A	Multi-fingered robotic hand	NASA,,,,,	US	1984
US4895574A	Piezoelectric motivator for prosthetic devices	ROSENBERG LARRY,,,,,	US	1984
US4604098A	Prosthetic elbow with a motor-driven release mechanism	UNIV JOHNS HOPKINS,,,,,	US	1984
US4521924A	Electrically driven artificial arm	UNIV UTAH,,,,,	US	1983
US4529332A	Tubular joint for receiving and fastening tubular skeleton elements of artificial limbs	BOCK ORTHOPAED IND,,,,,	DE | US	1983
US4547912A	Amputation apparatus	SHERVA PARKER CAROLE J,,,,,	US	1983
DE3222885C2		OTTO BOCK ORTHOPAEDISCHE INDUSTRIE BESITZ- UND VERWALTUNGS-KOMMANDITGESELLSCHAFT 3408 DUDERSTADT DE,,,,,	DE	1982
DE3215990A1		BOCK OTTO SCANDINAVIA AB,,,,,	SE | DE	1982
US4393728A	Flexible arm, particularly a robot arm	ROBOTGRUPPEN HB,,,,,	SE | US	1982
US4377305A	Artificial hand	BOCK ORTHOPAED IND,,,,,	AT | US	1981

US4387472A	Torque absorber with biofeedback	MEDICAL CENTER PROSTHETICS INC,,,,,	US	1980
US4332038A	Artificial hand	FREELAND JOHN L,,,,,	US	1980
US4364593A	Object grasping system	AGENCY IND SCIENCE TECHN,,,,,	JP | US	1980
US4315650A	Mechanical hand amusement device	TOMY CORP,,,,,	US	1980
US4258441A	Dual operated lateral thumb hand prosthesis	HAND REHABILITATION FOUNDATION,,,,,	US	1979
US4246661A	Digitally-controlled artificial hand	BOEING CO,,,,,	US	1979
US4225983A	Prosthetic terminal device	RADOCY ROBERT,,,,, | DICK RONALD E,,,,,	US	1978
DE2801299C2		OTTO BOCK ORTHOPAEDISCHE INDUSTRIE KG 3428 DUDERSTADT DE,,,,,	DE	1978
DE2801300A1		BOCK ORTHOPAED IND,,,,,	DE	1978
US4167044A	Means for actuating artificial or disabled arm members	UNIV IOWA STATE RES FOUND INC,,,,,	US	1978
US4149278A	Compact artificial hand	NASA,,,,, | WIKER GORDON A,,,,, | MANN WOLFGANG A,,,,,	US	1977
US4114464A	Artificial hand and drive apparatus for such hand	MESSERSCHMITT BOELKOW BLOHM,,,,,	DE | US	1977
US4067070A	Prosthetic joint lock and cable mechanism	US ADMINISTRATOR OF VETERANS &,,,,,	US	1976
US4094016A	Artificial hand and forearm	EROYAN GARY,,,,,	US	1976
US4180870A	Universal-orthese	TEUFEL WILH JUL FA,,,,,	YU | US	1976
US4087730A	Electric control circuit	VIENNATONE GMBH,,,,,	AT | US	1976

US4030141A	Multi-function control system for an artificial upper-extremity prosthesis for above-elbow amputees	US VETERANS ADMINISTRATION,,,,,	US	1976
US4074367A	Prosthetic load-lift hook locking mechanism	US ADMINISTRATOR OF VETERANS &,,,,,	US	1976
US4016607A	Artificial hand	PIHLAJA EINO,,,,,	US	1976
US4078670A	Cable-operated power manipulator	COMMISSARIAT ENERGIE ATOMIQUE,,,,,	FR | US	1975
US3967321A	Electrically driven hand orthosis device for providing finger prehension	INDIANA UNIVERSITY FOUNDATION,,,,,	US	1975
US3866966A	MULTIPLE PREHENSION MANIPULATOR	SKINNER II FRANK R,,,,,	US	1974
US3900900A	Device for detachably connecting an implement to a shaft of an arm prosthesis and joint comprising said device	BOCK ORTHOPAED IND,,,,,	AT | US	1974
US3987498A	Electric elbow	SAMOLE SIDNEY,,,,,	US	1974
US3940803A	Method and system for control of a powered prosthetic device	BATTELLE MEMORIAL INSTITUTE,,,,,	US	1974
US3864983A	ROTARY-TO-LINEAR AND LINEAR-TO-ROTARY MOTION CONVERTERS	JACOBSEN STEPHEN C,,,,,	US	1974
US3927424A	Mechanical hand	AGENCY IND SCIENCE TECHN,,,,,	JP | US	1974

US3922727A	Apparatus to assist fastening of an artificial limb	BIANCO FRANK,,,,,	US	1974
US4010495A	Artificial wrist and arm prosthesis	OTTO BOCH ORTHOPADISCHE IND KG,,,,,	AT | US	1974
US3883900A	Bioelectrically controlled prosthetic member	LIBERTY MUTUAL INSURANCE COMPA,,,,,	US	1973
US3801990A	ARTIFICIAL LIMB WITH A JOINT THAT SIMULATES A BICONDYLAR JOINT MOVEMENT	HELFET A,,,,,	GB | US	1973
US3820168A	SYSTEM FOR OPERATING A PROSTHETIC LIMB	BOCK O ORTHOPAEDISCHE IND FA K,,,,,	US | DE	1972
US3751733A	TACTILE SENSING MEANS FOR PROSTHETIC LIMBS	FLETCHER J,,,,, | SCOTT W,,,,,	US	1972
US3735426A	AUXILIARY DEVICE FOR HAND PROSTHESIS	BOCK ORTHOPAED IND,,,,,	DE | US	1972
US3822418A	ELECTRICALLY DRIVEN ARTIFICIAL HAND FOR UPPER EXTREMITY PROSTHESIS	YAKOBSON Y,,,,, | POPOV LLIIN B,,,,, | IGNATOVICH V,,,,, | LEONOV V,,,,, | SYSIN A,,,,, | VOSKOBOINIKOVA L,,,,, | MELNIKOV J,,,,, | KOVANOV N,,,,, | BIR M,,,,, | DEGTYAREV G,,,,, | FORICHEY S,,,,, | SKUDINA N,,,,, | SKACHKOV A,,,,,	SU | US	1971

US3722005A	PERCUTANEOUS MYO-ELECTRODE SYSTEM	PLESSEY HANDEL INVESTMENT AG,,,,,	GB | US	1971
US3683423A	GRAVITY ACTIVATED PROSTHETIC DEVICE	RUSSELL S CRAPANZANO,,,,,	US	1971
US3694021A	MECHANICAL HAND	JAMES F MULLEN,,,,,	US | DE	1970
US3604017A	SPRING-ACTUATED PROSTHETIC HAND WITH A FRICTIONAL LATCHING CLUTCH MEANS	D W DORRANCE CO INC,,,,,	US	1969
US3609769A	CONTROL SYSTEM FOR ELECTRICALLY POWERED ARTIFICIAL LIMBS	OMRON TATEISI ELECTRONICS CO,,,,,	JP | US	1969
US3548419A	ELECTRICALLY DRIVEN PROSTHETIC ELBOW	US ARMY,,,,,	US	1968
US3474466A	GAS OPERATED ARM PROSTHESIS	STEEPER HUGH LTD,,,,,	GB | US	1967
US3501776A	ELECTROPNEUMATIC CONVERTER FOR OPERATING AN ARTIFICIAL LIMB	TNO,,,,,	NL | US	1967

US3491378A	ARTIFICIAL ARM HAVING BIOELECTRICALLY CONTROLLED FINGER MOVEMENT AND HAND ROTATION RESPONSIVE TO SHOULDER MUSCLE IMPULSES	DAVID MOISEEVICH IOFFE,,,,, | VITALY MOISEEVICH BERNSHTEIN,,,,, | SERGEI VASILIEVICH BOLKHOVITIN,,,,, | LIDIA MIKHAILOVNA VOSKOBOINIKO,,,,, | MIKHAIL DMITRIEVICH EZHOV,,,,, | EFIM PINKHASOVICH POLYAN,,,,, | ANTONINA MIKHAILOVNA SEMENOVA,,,,, | NINA GRIGORIEVNA SEMENOVA,,,,, | EKATERINA ALEXEEVNA SHIROKOVA,,,,,	US	1967
US3521303A	ARTIFICIAL HAND FOR PROSTHESES WITH BIOELECTRICAL CONTROL	YAKOV SAVELIEVICH YAKOBSON,,,,, | VITALY MOISEEVICH BERNSHTEIN,,,,, | EFIM PINKHASOVICH POLYAN,,,,,	US	1967
US3466937A	LINEAR TO ROTATIONAL MOVEMENT CONVERTER	GILBERT M MOTIS,,,,,	US	1967
US3526007A	PROSTHETIC ARM HAVING HUMERAL ROTATION	IVKO JOSEPH J,,,,, | RENETTE M IVKO,,,,,	US	1967

US3423765A	PROSTHETIC DEVICE WITH ELECTRONIC PROPORTIONAL CONTROL GRASP	US ARMY,,,,,	US	1966
US3418662A	Prosthetic hand with improved control system for activation by electromyogram signals	NAT RES DEV,,,,,	GB | US	1966
US3509583A	ELECTRO-MECHANICAL HAND HAVING TACTILE SENSING MEANS	BENDIX CORP,,,,,	US	1965
US3413658A	Artificial hand having a body constructed from separate molded plastic parts for easier replacement of damaged parts	DANIEL B BECKER,,,,,	US	1965
US3345647A	Mechanical hand having computer-type drive mechanisms for producing numerous hand articulations similar to a human hand	GENTILUOMO JOSEPH A,,,,,	US	1963
US3258784A	Prosthetic hand with overload release means and means for adjusting relative finger and thumb positions	BROWN NOEL J,,,,,	US	1963

US3188655A	Harness for control of upper extremity prosthesis	MARTIN COOPER CARL,,,,, | SULMONETTI WILLIAM B,,,,, | RENFRO CLARENCE A,,,,,	US	1962
US3173151A	Positive grip prosthetic hand having automatic locking means	OTTO BOCK ORTHOPADISCHE IND K,,,,,	DE | US	1962
US3090049A	Artificial hand	LYVIN LANTEIGNE,,,,,	US	1960
US3026534A	Prosthetic hands	BROWN NOEL J,,,,,	US	1959
US3074075A	Artificial hand for amputees	GERD KUHN GOTZ,,,,,	DE | US	1959
US2861701A	Remote controlled handling unit	GEN MILLS INC,,,,,	US	1958
US3007176A	Artificial limbs for amputees	OTTO HAFNER,,,,,	US	1957
US2893016A	Prosthetic devices	LIONEL CORP,,,,,	US	1956
US2859450A	Artificial fingers and hand mechanism	BECKER DANIEL B,,,,,	US	1955
US2902696A	Prosthetic apparatus	NORTH AMERICAN AVIATION INC,,,,,	US	1955
US2757383A	Artificial arms	COHAN HARRIS K,,,,,	US	1954
US2706296A	Prosthetic appliance	FLETCHER MAURICE J,,,,, | MCKEE JR JOHN M,,,,, | RIBLETT VICTOR T,,,,, | BROWN JOHN S,,,,,	US	1953
US2696010A	Pneumatically operated artificial hand	ROBINSON GEORGE B,,,,,	US	1952
US2641769A	Mechanical hand	ROBINSON GEORGE B,,,,,	US	1952
US2686319A	Harness for operating prosthetic devices	WEIR ALDERSON SAMUEL,,,,,	US	1952
US2679649A	Push button means for operating power-driven	WEIR ALDERSON SAMUEL,,,,,	US	1952

	artificial hands			
US2629107A	Artificial hand locking mechanism	BECKER DANIEL B,,,,,	US	1951
US2659896A	Universally mounted artificial pneumatic hand	ANGELO BIASI,,,,,	US	1951
US2640994A	Switch for operating artificial limbs	ALDERSON SAMUEL W,,,,,	US	1951
US2545947A	Artificial pneumatic hand	JEANNE FELIP,,,,, | ANGELO BIASI,,,,,	US	1949
US2557792A	Artificial arm	MAGUTH MICHAEL J,,,,,	US	1949
US2568297A	Artificial limb	STEEPER HUGH LTD,,,,,	GB | US	1949
US2556524A	Artificial hand	DRENNON WILLIAM M,,,,,	US	1949
US2568299A	Artificial hand	STEEPER HUGH LTD,,,,,	GB | US	1949
US2568298A	Artificial hand	STEEPER HUGH LTD,,,,,	GB | US	1949
US2598593A	Polycentric articulated finger for artificial hands	IBM,,,,,	US	1948
US2500614A	Artificial hand	CARL LOHMANN,,,,,	US	1948
US2553827A	Artificial hand with articulated fingers and passively positioned thumb	NORTHROP AIRCRAFT INC,,,,,	US	1948
US2582234A	Prosthetic hand	CONZELMAN JR JOHN E,,,,, | ELLIS HERBERT B,,,,, | O'BRIEN CLAYTON W,,,,,	US	1948
US2549074A	Artificial hand with worm and gear drive to thumb	NORTHROP AIRCRAFT INC,,,,,	US	1948

US2540375A	Artificial arm hook or hand with force multiplier and lock	NORTHROP AIRCRAFT INC,,,,,	US	1948
US2619652A	Artificial limb	A J HOSMER CORP,,,,,	US	1947
US2494734A	Artificial arm	WILKINSON ROBERT W,,,,,	US	1947
US2561383A	Cosmetic prosthetic hand	LARKINS EDWARD T,,,,, | THOMAS BERNARD S,,,,, | FETTERS DAVID R,,,,,	US	1947
US2535489A	Artificial arm	EDWARDS HAROLD T,,,,,	US	1947
US2537338A	Artificial arm	NORTHROP AIRCRAFT INC,,,,,	US	1947
US2549792A	Control device for prosthetic hands	FLETCHER MAURICE J,,,,,	US	1947
US2559017A	Artificial limb	HANSON HENRY G,,,,,	US	1947
US2528464A	Hydraulic artificial arm	IBM,,,,,	US	1947
US2528322A	Artificial hand	SYVERUD ANNAR F,,,,, | PETERSON BERTIL G,,,,,	US	1947
US2536868A	Artificial arm	BENDER CHARLES F,,,,,	US	1947
US2549716A	Mechanical artifical hand	HAROLD SIMPSON JOHN,,,,,	GB | US	1947
US2433301A	Mechanically operated thumb for artificial hands	SIMPSON FRANCIS P,,,,,	US	1947
US2425154A	Artificial hand and control mechanism	HIBBARD FRANK K,,,,,	US	1946
US2457305A	Artificial hand	DALE FRANK L,,,,,	US	1946
US2497493A	Artificial arm	THEODORE EDWARDS HAROLD,,,,,	US	1946
US2445711A	Mechanical movement	FITCH AND SONS INC,,,,,	US	1946
US2429001A	Artificial hand	STONE AXEL H,,,,,	US	1946

US2478721A	Artificial limb	STEWART JOHN H F,,,,,	US	1946
US2493776A	Artificial limb	ALBERTO PECORELLA,,,,, | PECORELLA BENEDICT G,,,,,	US	1946
US2429866A	Mechanical finger	ALFRED BROSTE,,,,,	US	1946
US2494460A	Artificial hand	TRAUTMAN RAYMOND B,,,,,	US	1946
US2435614A	Artificial hand	TUREMAN JR GARNET R,,,,,	US	1945
US2415145A	Artificial hand-hook type	FRANKLIN I SAEMANN,,,,,	US	1945
US2409884A	Artificial arm and hand	FRANKLIN I SAEMANN,,,,,	US	1945
US2400140A	Hydraulic artificial hand	JOHN SARGESON,,,,,	US	1944
US2408880A	Artificial hand	REBERS PAUL A,,,,,	US	1943
US2350339A	Orthopedic arm	QUIRNO COSTA JOSE ANTONIO,,,,,	AR | US	1942
US2364313A	Artificial hand	PECORELLA BENEDICT G,,,,,	US	1942
US2301009A	Artificial hand	BECKER DANIEL B,,,,,	US	1941
US2287781A	Articficial arm and hand	CARNES WILLIAM T,,,,,	US	1940
US2230378A	Artificial hand and wrist assembly	EBERLE FRANK V,,,,,	US	1939
US2285885A	Mechanical hand	BECKER DANIEL B,,,,,	US	1938
US2157747A	Artificial arm	WILLIAM A HENDRY,,,,,	US	1938
US2259911A	Mechanism for operating artificial limbs	TANCRED WILLIAM L,,,,, | WILLIAM HENDERSON,,,,,	US	1937
US2033150A	Artificial arm	RADTKE PAUL W,,,,,	US	1934
US1989960A	Artificial arm	WHEELER FRANK E,,,,, | EMBERTON WILLIAM H,,,,,	US	1933
US1981698A	Artificial hand	CHARLES HENNING FREDERICK,,,,,	US	1932

US1929541A	Artificial hand	TRAUTMAN RAYMOND B,,,,,	US	1930
US1861678A	Artificial hand	WILHELM BAEHR JUSTUS,,,,,	US	1929
US1774715A	Artificial limb	LIVINGSTON ARTIFICIAL LIMB CO,,,,,	US	1928
US1718095A	Harness for artificial arms	VRADENBURG WILBUR C,,,,,	US	1928
US1929926A	Artificial hand	DANIEL B BECKER,,,,,	US	1928
US1742269A	Artificial hand	MCELROY WILLIAM A,,,,,	US	1927
US1792183A	Artificial limb	ALBERTO PECORELLA,,,,,	US	1927
US1695952A	Artificial hand	DORRANCE DAVID W,,,,,	US	1926
US1507682A	Artificial limb	LIVINGSTON ARTIFICIAL LIMB COM,,,,,	US	1924
US1557703A	Artificial arm	KENNEY FRANK A,,,,,	US	1923
US1576487A	Artificial arm	HODGSON HARRIETTE E,,,,,	US	1923
US1422468A	Artificial arm	PETER NICOLA,,,,,	US	1922
US1458923A	Artificial arm	MACKENZIE ANDERSON DUNCAN,,,,,	US	1922
US1472177A	Artificial arm	KENNEY FRANK A,,,,,	US	1922
US1409415A	Mechanical hand	WILHELM SCHIMMEL,,,,,	US	1921
US1466163A	Artificial limb	JENNIE B WICKIZER,,,,, | C F HOLLAND,,,,, | TILLA BELCHNER,,,,, | MAUDE F GALIGHER,,,,, | WILHELMINE C GRIFFIN,,,,,	US	1921
US1402476A	Artificial-hand mechanism	CARNES ARTIFICIAL LIMB COMPANY,,,,,	US	1921

US1422714A	Jointed artificial hand	ALFRED INGOLD PAUL,,,,,	US	1921
US1375809A	Artificial hand	FRANCIS ARMSTRONG ROBERT,,,,,	US	1920
US1409513A	Artificial hand	FREDERICK W POLLMAN JR,,,,,	US	1920
US1368851A	Artificial limb	WILLIAM SMITH JOHN,,,,,	US	1919
US1334689A	Artificial hand	FRANCIS ARMSTRONG ROBERT,,,,,	US	1919
US1366453A	Artificial arm	MIRACLE ARTIFICIAL ARM CO,,,,,	US	1919
US1385669A	Artificial limb	GRAND DILWORTH OTTO LE,,,,,	US	1919
US1346092A	Artificial-limb lock	POMEROY COMPANY,,,,,	US	1919
US1362156A	Artificial hand	RAY TRAUTMAN,,,,,	US	1919
US1351955A	Artificial limb	LOWRY FRANK J,,,,,	US	1919
US1365646A	Artificial limb	CHARLES ADAMS ALFRED,,,,,	US	1918
US1334834A	Artificial limb	DUNCAN BLATCHFORD CHARLES,,,,,	US	1918
US1402709A	Artificial limb	ALBERT BLATCHFORD CHARLES,,,,,	US	1918
US1504121A	Artificial limb	NATURAL FUNCTION LIMBS COMPANY,,,,,	US	1917
US1385817A	Artificial arm and hand	GRAND DILWORTH OTTO LE,,,,,	US	1917
US1369016A	Artificial limb	EVERSON JOHN J,,,,,	US	1917
US1278106A	ARTIFICIAL HAND AND ARM			
US1324564A	ARTIFICIAL HAND			
US1225415A	ARTIFICIAL ARM AND HAND			

US569593A	ARTIFICIAL HAND			
US1046967A	ARTIFICIAL ARM			
US1272006A	ARTIFICIAL HAND AND ARM			
US423840A	ARTIFICIAL ARM			
US396061A	ARTIFICIAL ARM AND HAND			
US1301575A	ARTIFICIAL ARM			
US1161344A	ARTIFICIAL HAND			
US1173219A	ARTIFICIAL HAND			
US48659A	IMPROVEMENT IN ARTIFICIAL ARMS			
US1056499A	SUPPORTING HARNESS FOR ARTIFICIAL ARMS			
US1075861A	SUSPENDR FOR ARTIFICIAL ARMS			
US56427A	IMPROVEMENT IN ARTIFICIAL HANDS			
US44638A	IMPROVEMENT IN ARTIFICIAL ARMS			
US1229053A	ARTIFICIAL HAND			
US1304099A	ARTIFICIAL HAND			
US46696A	IMPROVEMENT IN ARTIFICIAL ARMS			
US2847678A	System for controlled actuation of an artificial hand	THEODORE OPUSZENSKI,,,,,	US	
US941197A	ARTIFICIAL HAND			

US46159A	IMPROVEMENT IN ARTIFICIAL ARMS AND HANDS			
US48002A	IMPROVEMENT IN ARTIFICIAL ARMS			
US1285617A	ARTIFICIAL HAND			
US1293885A	ARTIFICIAL LIMB			
US450476A	ARTIFICIAL ARM			
US1046966A	ARTIFICIAL ARM			

DISCLAIMER:

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As the team members are not experts in the field of prosthetic upper limb, it is also highly possible that the categorization of the patents found and coded are incomplete. Thus, the team cannot guarantee that the patents discovered were evaluated at the level of expert scientific sophistication. Due to the limited time frame, limited/terse disclosure and the number of patents evaluated, in combination with the significantly constrained schedule, additional patents may have been available for evaluation but without the necessary time within which to consider them, they may not have been identified and/or considered.