PROSTHETIC ELBOW JOINT

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The instant elbow joint is very strong and durable to withstand the repeated heavy loadings encountered by a wearer who works in an industrial, construction, farming or similar environment. The elbow joint of the present invention comprises a turntable, a frame, a forearm and a locking assembly. The frame generally includes a housing for the locking assembly and two protruding ears. The forearm includes an elongated beam having a cup-shaped cylindrical member at one end and a locking wheel having a plurality of holes along a circular arc on its other end with a central bore for pivotal attachment to the protruding ears of the frame. The locking assembly includes a collar having a central opening with a plurality of internal grooves, a plurality of internal cam members each having a chamfered surface at one end and a V-shaped slot at its other end; an elongated locking pin having a crown wheel with cam surfaces and locking lugs secured thereto; two coiled compression springs; and a flexible filament attached to one end of the elongated locking pin and extending from the locking assembly for extending and retracting the locking pin into the holes in the locking wheel to permit selective adjustment of the forearm relative to the frame. In use, the turntable is affixed to the upper arm part of the prosthesis (not shown) in the conventional manner and the cup-shaped cylindrical member on one end of the forearm is affixed to the forearm piece of the prosthesis (not shown) in the conventional manner. The elbow joint is easily adjusted and locked between maximum flex and extended positions.

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having a central opening 64 with a plurality of internal grooves 65 (FIGS. 5 and 7) therethrough, a plurality of internal cam members 61, each cam member 61 having a first chamfered surface 63 at one end and a second chamfered surface 67 at its other end with each second chamfered surface 67 including a generally V-shaped slot 73 (FIG. 5) therein, a round, elongated, locking pin 66 having a crown wheel 68, with a plurality of generally V-shaped cam surfaces 69 thereon, and a plurality of lugs 70 affixed thereto, each of the lugs 70 being adapted for sliding movement within one of said interlocking grooves 65 of opening 64 of collar 62 (FIG. 6) and the crown wheel 68 being adapted for sliding movement within opening 64 of collar 62 (FIG. 7), a flexible sheathing 71 (FIG. 1), a control wire 72 slidably mounted within sheathing 71 and having a first end 74 secured to locking pin 66 adjacent lugs 70 and a second end 76, a plug 78 having an external groove 80 and an internal curved passageway 82 (FIG. 3) for receiving the control wire 72 and allowing its second end 76 to protrude therefrom, a first compression coil spring 84 mounted within collar 62 for acting on lugs 70 and plug 78 to normally urge locking pin 66 to its extended, locking position as shown in FIG. 3, a second compression coiled spring 86 mounted partially over cam members 61 of collar 62 for acting on collar 62 and plug 78 to normally urge collar 62 into the bore 34 of housing 32 so that the inner edge of collar 62 seats against a shoulder formed on second ear 26 in an area surrounding the bore 27 in second ear 26 through which pin 66 penetrates before and after its entry into a selected hole 52 in locking wheel 50, and a C-shaped clip 88 for passing through the two diametrically opposed grooves 36 of housing 32 and groove 80 of plug 78 to secure the locking mechanism 60 to frame 20.

Frame 20, with locking assembly or mechanism 60 mounted and secured within housing 32, is secured to cup-shaped turntable 12 by passing threaded stud 38 through central opening 18 of turntable 12, applying washer 90 and threaded nut 92 over threaded stud 38, and tightening nut 92 on threaded stud 38. Forearm 40 is secured to frame 20 by passing pin 94 having circular groove 96 adjacent one end through bore 30 of first ear 24, bore 54 of locking wheel 50, and bore 30 of second ear 26 and applying a second C-shaped clip 98 in groove 96 of pin 94. A flesh colored elastic sleeve (not shown) can be placed over prosthetic elbow joint 10 to tightly engage the cylindrical wall 14 of turntable 12 and the outer wall of hollow, cup-shaped, cylindrical member 48 to cover the prosthetic elbow joint 10 to hide it and provide a more natural appearance.

FIGS. 4 and 5 show the prosthetic elbow joint 10 in its two extreme positions. FIG. 4 illustrates prosthetic elbow joint 10 in its maximum flex position and FIG. 5 illustrates prosthetic elbow joint 10 in its maximum extended position.

In operation, turntable 12 is affixed to the upper arm part of the prosthesis (not shown) in the conventional manner after first loosening and then tightening nut 92 to allow rotational alignment of elbow joint 10 to the upper arm prosthesis. The cup-shaped cylindrical member 46 of beam 42 is then attached to the forearm piece (not shown) of the prosthesis (not shown) in the usual manner. Assuming that, upon mounting of elbow joint 10 on the upper arm and forearm parts of the prosthesis, the elbow joint 10 is locked in its fully extended position as shown in FIG. 5 with the stop member 47 on beam 42 engaging stop member 37 of frame 20 and locking pin 66 being in engagement with the surface surrounding an end hole 52 in locking wheel 50, the wearer of elbow joint 10 will pull on control wire 72 thereby removing locking pin 66, against the force of compression spring 84, from the end hole 52 of locking wheel 50 and lugs 70 from the internal grooves 65 in central opening 64 of collar 62 to a position beyond second chamfered surfaces 67 of the cam members 61 at which time generally V-shaped cam surfaces 69 of crown wheel 68 engage first chamfered surfaces 63 of cam members 61 to cause collar 62 to rotate 45° revolution and upon the release of control wire 72 compression spring 84 urges lugs 70 into V-shaped slots 73 of second chamfered surfaces 67 of cam members 61 which hold locking pin 66 in its retracted, unlocked, position. The forearm 40 is then rotated about bore 84 to a desired flex position where locking pin 66 will be in alignment with another hole 52 in locking wheel 50 and the control wire 72 will then be pulled to cause the V-shaped cam surfaces 69 of crown wheel 68 to engage the first chamfered surfaces 63 of cam members 61 to again rotate collar 62 45° revolution and thus free lugs 70 of locking pin 66 from V-shaped slots 73 of second chamfered surfaces 67 of cam members 61 so that first compression coil spring 84 forces locking pin 66 into the hole 52 of locking wheel 50 in alignment therewith to thus lock forearm 40 in such position. When the control wire 72 is next pulled, the pin 66 will be removed from a hole 52 of locking wheel 50 and the lugs 70 will be in a position behind second chamfered surfaces 67 at which time the V-shaped cam surfaces 69 of crown wheel 68 engage the first chamfered surfaces 63 of collar 62 to rotate collar 62 45° revolution and upon the release of control wire 72, compression spring 84 urges lugs 70 into V-shaped slots 73 of second chamfered surfaces 67 of cam members 61 to again hold pin 66 in its retracted, unlocked, position. The forearm 40 is then rotated about bore 84 to a desired flex position where locking pin 66 will be in alignment with another hole in locking wheel 50 and the control wire 72 will again be pulled to free lugs 70 from V-shaped slot 73 to allow the lugs 70 to slide within internal grooves 65 of collar 62 and thereby allow locking pin 66 to be forced by compression spring 84 to enter a hole 52 to lock the joint 10 in the desired positions.

This procedure is continued each time that the wearer desires to place elbow joint 10 into a new position. In practice, each pull on control wire 72 will alternately extend or retract pin 66 from its locking and unlocking positions. With each adjustment of elbow joint 10 to a new position, the collar 62 is forced to move a short distance longitudinally, against the force of second coiled spring 86, by contact of first chamfered surfaces 63 with cam surfaces 69 of crown wheel 68, which force causes the V-shaped cam surfaces 69 of crown wheel 68 to slide along the chamfered surfaces 63 of cam members 61 thereby forcing each 45° revolution of collar 62.

While the above description constitutes a preferred embodiment of the present invention, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope and fair meaning of the accompanying claims.

1. A manually positionable elbow joint for attachment to and between an upper extremity, above-elbow, prosthetic and a forearm prosthetic, said elbow joint comprising:
a turntable for attachment to said upper extremity, above-elbow prosthetic;
a frame secured to said turntable, said frame having a base;
a forearm including an elongated beam having first and second ends, means on said second end of said beam for pivotal attachment to said frame including a generally round locking wheel having a central bore therein, at least one bore in said frame and means for passing through said bores for securing said forearm to said frame including a pin having first and second ends, an enlarged shoulder on said first end and a circular groove in said second end, and a C-clip for frictional engagement with the walls of said circular groove, and means on said first end of said beam for attachment to said forearm prosthetic; and
a housing secured to said frame; and
forearm locking means carried in said housing and including a member for reciprocal movement therein into and out of engagement with said means on said second end of said forearm for selectively locking said forearm in a plurality of positions between maximum extended and flexed conditions.

2. The manually positionable elbow joint of claim 1 wherein said means on said first end of said beam for attachment to said forearm prosthetic includes a hollow, cup-shaped member.

3. The manually positionable elbow joint of claim 2 wherein said means on said first end of said beam for attachment to said forearm prosthetic includes a plurality of lugs for holding said pin in its retracted, unlocking, positions.

4. The manually positionable elbow joint of claim 3 wherein said means for selectively locking said forearm in a plurality of positions comprises a collar having a central opening and a plurality of cam members at one end thereof, a pin slidably mounted within said central opening for movement between extended, locking, and retracted, unlocking, positions, a plurality of lugs mounted on said pin, and a compression spring for acting on said lugs for normally urging said pin into said locking position.

5. The manually positionable elbow joint of claim 4 wherein said forearm locking means further includes an end plug having a curved passageway therein and a flexible filament extending through and projecting from said passageway and being secured to said pin at one end thereof.

6. The manually positionable elbow joint of claim 5 wherein each of said cam members include first and second chamfered surfaces, each of said second chamfered surfaces including a slot therein for engaging said lugs for holding said pin in its retracted, unlocking, position.

7. A manually positionable elbow joint for attachment to and between an upper extremity, above-elbow, prosthetic and a forearm prosthetic, said elbow joint comprising:
a turntable for attachment to said upper extremity, above-elbow, prosthetic;
a frame having a base, a lower portion extending from said base, and a housing extending from said lower portion and having a bore therein, said lower portion and housing defining a recess therebetween;
a forearm including an elongated beam having first and second ends, means on said second end of said beam for pivotal attachment to said lower portion of said frame within said recess between said lower portion and said housing of said frame including a generally round locking wheel having a central bore therein, at least one bore in said lower portion of said frame and means for passing through said bores for securing said forearm to said frame including a pin having first and second ends, an enlarged shoulder on said first end and a circular groove in said second end, and a C-clip for frictional engagement with the walls of said circular groove, and means on said first end of said beam for attachment to said forearm prosthetic; and
means partially positioned within said bore of said housing of said frame for engaging said means on said second end of said forearm for selectively locking said forearm in a plurality of positions between maximum extended and flexed conditions.

8. The manually positionable elbow joint of claim 7 wherein said means on said first end of said beam for attachment to said forearm prosthetic includes a hollow, cup-shaped member.

9. The manually positionable elbow joint of claim 8 wherein said generally round locking wheel of said forearm includes a plurality of spaced holes therein along a circular arc on its outer perimeter.

10. The manually positionable elbow joint of claim 9 wherein said means partially positioned within said bore of said housing of said frame for selectively locking said forearm in a plurality of positions comprises a collar having a central opening and a plurality of cam members at one end thereof, a pin slidably mounted within said central opening for movement between extended, locking, and retracted, unlocking, positions, a plurality of lugs mounted on said pin, and a compression spring for acting on said lugs for normally urging said pin into said locking position.

11. The manually positionable elbow joint of claim 10 wherein said means for selectively locking said forearm in a plurality of positions further includes an end plug having a curved passageway therein and a flexible filament extending through and projecting from said passageway and being secured to said pin at one end thereof.

12. The manually positionable elbow joint of claim 11 wherein each of said cam members include first and second chamfered surfaces, each of said second chamfered surfaces including a slot therein for engaging said lugs for holding said pin in its retracted, unlocking, position.

13. An artificial manually positionable elbow joint for attachment to and between an upper extremity, above-elbow, prosthetic and a forearm prosthetic, said elbow joint comprising:
a turntable for attachment to said upper extremity, above-elbow, prosthetic;
a frame having a base, first and second ears extending from said base and defining a recess therebetween, a first bore in each of said first and second ears, a second bore in said first ear, and a stud extending from said base and being adjustable secured to said turntable;
a housing secured to said first ear of said frame, said housing including a central bore in alignment with said second bore of said first ear of said frame, said central bore in said housing being of greater diameter than said and second bore of said first ear;
a forearm including an elongated beam having first and second end portions, a generally round lock-
ing wheel fixed to said first end portion, said locking wheel including a central bore an outer perimeter and a plurality of spaced holes having walls along a circular arc adjacent said outer perimeter, said locking wheel being pivotally secured to said first and second ears of said frame within said recess, and means on said second end portion of said beam for attachment to said forearm prosthetic.

forearm locking means partially positioned within said central bore of said housing for engaging said walls of a selected said hole adjacent the outer perimeter of said locking wheel for selectively locking and unlocking said forearm in a plurality of positions between maximum extended and flexed conditions; and means for actuating said forearm locking means to cause said locking and unlocking of said forearm.

14. The artificial manually positionable elbow joint of claim 13 wherein said forearm locking means comprises a collar having a central opening and first and second ends, a plurality of longitudinal grooves within said central opening, and a plurality of cam members secured to said first end, each of said cam members having an inner end and an outer end, a chamfered surface on said inner end of each said cam member and a V-shaped slot in said outer end of each said cam member; and a pin including a plurality of radially extending lugs, a crown wheel having a plurality of cam surfaces thereon, said pin being slidably mounted within said central opening of said collar with each of said lugs being selectively engaged with the walls of a respective said groove of said collar; and a compression spring for acting on said lugs for normally urging said pin toward its said locking position, said cam surfaces on said crown wheel being adapted for engaging said chamfered surfaces of said cam members to cause rotation of said collar for causing said lugs to be engaged and disengaged in said V-shaped slot in said outer end of said cam members.