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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
19/249,517	06/25/2025	Michael Stevens	97578-422936	1685
204887	7590	12/12/2025		
Figure AI Inc. 3960 N. First Street San Jose, CA 95134			EXAMINER WATKINS, NATHANIEL WILLIAM	
			ART UNIT	PAPER NUMBER
			3611	
			NOTIFICATION DATE	DELIVERY MODE
			12/12/2025	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ip@figure.ai

Office Action Summary

Application No.

19/249,517

Applicant(s)

Stevens et al.

Examiner

NATHANIEL W WATKINS

Art Unit

3611

AIA (First Inventor to File) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 10/29/2025.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2a) ☒ This action is **FINAL**.

2b) ☐ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☒ Claim(s) 1,3-7 and 9-33 is/are pending in the application.

5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) ☐ Claim(s) ____ is/are allowed.

7) ☒ Claim(s) 1,3-7,9-28 and 30-33 is/are rejected.

8) ☒ Claim(s) 29 is/are objected to.

9) ☐ Claim(s) ____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☒ The drawing(s) filed on 6/25/2025 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some** c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

3) ☐ Interview Summary (PTO-413)

Paper No(s)/Mail Date ____.

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)

4) ☐ Other: ____.

Paper No(s)/Mail Date ____.

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Response to Arguments

Applicant's arguments with respect to claims 1, 3-7, 9-12, 14-19, and 21 have been considered but are moot because the new ground of rejection does not rely on any reference applied in the prior rejection of record for any teaching or matter specifically challenged in the argument.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the fifth interior wall extent and the sixth interior wall extent of claims 11 and 25 must be shown or the features canceled from the claims. No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet"

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pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

(a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

Claim 11-15, 25, and 30-32 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claims contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for applications subject to pre-AIA 35 U.S.C. 112, the inventors, at the time the application was filed, had possession of the claimed invention.

Claims 11 and 25 recite the limitations “a fifth interior wall extent” and “a sixth interior wall extent positioned a third distance from the fifth interior wall extent”. The specification contains no mention of a fifth or sixth interior wall extent and the structure is not shown in the drawings.

Applicant may:

- (a) Amend the written description of the specification such that it expressly recites what structure, material, or acts perform the entire claimed function, without introducing any new matter (35 U.S.C. 132(a)); or
- (b) Amend the written description of the specification such that it clearly links the structure, material, or acts disclosed therein to the function recited in the claim, without introducing any new matter (35 U.S.C. 132(a)).

If applicant is of the opinion that the written description of the specification already implicitly or inherently discloses the corresponding structure, material, or acts and clearly links them to the function so that one of ordinary skill in the art would recognize what structure, material, or acts perform the claimed function, applicant should clarify the record by either:

- (a) Amending the written description of the specification such that it expressly recites the corresponding structure, material, or acts for performing the claimed function and clearly links or associates the structure, material, or acts to the claimed function, without introducing any new matter (35 U.S.C. 132(a)); or
- (b) Stating on the record what the corresponding structure, material, or acts, which are implicitly or inherently set forth in the written description of the specification, perform the claimed function. For more information, see 37 CFR 1.75(d) and MPEP §§ 608.01(o) and 2181.

The specification cites conflicting subject matter for how claims 11 and 25 are to be interpreted. Paragraph [00241] of the instant application teaches the interior wall extents as shown in Fig. 35 of the instant application with the three distances being designated as DP1, DP2, and DP3 respectively; however, specification paragraphs [00187]-[00188] of the instant

application point to an interpretation of the first and second distances being perpendicular distances measured from wall extents 310.2.2, 310.2.4, 310.2.6, and 310.2.8 respectively.

Claims 12-15 and 30-32 are also rejected under 35 U.S.C. 112(a) as depending from a rejected parent claim.

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

Claims 11 and 25 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention.

Claims 11 and 25 recite the limitations “a fifth interior wall extent” and “a sixth interior wall extent positioned a third distance from the fifth interior wall extent”. The specification does not offer clear guidance of what the scope of the claims is. See related discussion under 35 USC 112a, above.

Claims 12-15 and 30-32 are also rejected under 35 U.S.C. 112(b) as depending from a rejected parent claim.

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a

new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-6, 9-10, and 26-28 are rejected under 35 U.S.C. 103 as being unpatentable over Walters (US 4834761) in view of Ihrke (US 20110071673; henceforth Ihrke-673) and Ihrke (US 20110071671; henceforth Ihrke-671).

- Regarding claim 1, Walters teaches a forearm assembly, and a wrist assembly (See annotated Fig. 19-1 below), and wherein the forearm assembly includes:

a forearm frame 65 that includes: (i) a forearm axis that is substantially centered within an extent of the forearm frame, (ii) both a first plane that extends through said forearm axis and a second plane that extends through the forearm axis, wherein said first plane is oriented perpendicular to the second plane to define four distinct quadrants (Col. 4, lines 34-35, Fig. 19 of Walters; the forearm can be divided into four quadrants along its center axis), (iii) a proximal mounting portion (See annotated Fig. 19-1 below), (iv) a distal mounting portion including a distal end coupled to an extent of the wrist assembly (See annotated Fig 4 below),

a first plurality of actuators 42a, 43a coupled to the proximal mounting portion and arranged radially around the forearm axis, wherein a portion of at least one actuator of the first plurality of actuators is positioned within each of the four quadrants of said forearm frame (Col. 3, lines 58-63, Figs. 5 and 19), and wherein a first actuator 42a

contained in the first plurality of actuators (a) is in contact with a first tendon, (b) is positioned in a first quadrant of the four quadrants, and (c) includes a first tendon departure region (Abstract, Figs. 5 and 19),

a second plurality of actuators 42c, 43c coupled to the distal mounting portion and arranged radially around the forearm axis, wherein a portion of at least one actuator of the second plurality of actuators is positioned within each of the four quadrants of said forearm frame (Col. 3, lines 48-50, Figs. 5 and 19), and wherein a second actuator contained in the second plurality of actuators_(a) is in contact with a second tendon, (b) is positioned in a second quadrant of the four quadrants, and wherein the second quadrant is diagonally opposed to the first quadrant, and (c) includes a second tendon departure region (Figs. 19-20), and

wherein the first tendon departure region is at a first distance from the wrist assembly and the second tendon departure region is at a second distance from the wrist assembly, and wherein the first distance is not equal to the second distance (Figs. 19-20; any proximally-mounted tendon which is located in the opposite quadrant from the first actuator will be located at an unequal, second distance from the wrist assembly).

Walters does not teach a humanoid robot with lower, central, and upper regions. However, Ihrke-673 teaches a humanoid robot 10 ([0022], Fig. 1 of Ihrke-673), comprising:

an upper region including at least: a head 12, a torso 14, an arm 16 ([0022], Fig. 1) having: an elbow assembly B ([0024], Fig. 2), a lower region spaced apart from the upper region and including a pair of legs ([0022] of Ihrke-673); and, a central region 15 interconnecting the upper region and the lower region ([0022] of Ihrke-673).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the robotic hand, wrist, and forearm of Walters to be attached to the humanoid robot with elbow assembly of Ihrke-673 in order to advantageously provide a robotic device which can provide mobility, dexterity, and work task-related functionality ([0003] of Ihrke-673).

While Walters does not teach the proximal end coupled to the elbow assembly, the question is what would result from the combined teachings of the references. See *in re Keller*, 642 F.2d 413, 425 (CCPA 1981). Here, that result would be the proximal end of the forearm of Walters being coupled to an extent of the elbow assembly of Ihrke-673.

Walters as modified teaches a wrist assembly which supports up-down motion and back and forth motion (Col. 4, lines 33-61), but does not expressly teach a wrist pivot axis and a wrist yaw axis.

However, Ihrke-671 teaches a humanoid robotic hand with a wrist connected so as to have a wrist pivot axis C1 and a wrist yaw axis C2 ([0026], Fig. 3 of Ihrke-671).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the wrist of Walters to connect to the forearm assembly by the connections of Ihrke-673 in order to advantageously provide a large range of motion to the hand assembly ([0026] of Ihrke-671).

- Regarding claim 3, Walters as modified teaches wherein the forearm frame further includes a medial mounting portion that is positioned between the proximal mounting portion and the distal mounting portion (See annotated Fig. 19-1 below), and wherein said forearm assembly further includes a third plurality of actuators 42b, 43b coupled to the medial mounting portion and arranged radially around the forearm axis thereby

causing a portion of at least one actuator of the third plurality of actuators to be positioned within each of the four quadrants of the said forearm frame (Col. 3, lines 42-50, Figs. 5 and 19).

- Regarding claim 4, Walters teaches the humanoid robot further comprising an end effector with a finger with an metacarpophalangeal (MCP) joint 5, and wherein a third actuator contained in the third plurality of actuators is in contact with a third tendon that is configured to control linear movement of the finger about the MCP joint 5 (Col. 3, lines 42-50; Figs. 8a-8d).
- Regarding claim 6, Walters as modified teaches the first tendon having a total curvature in an uncurled state that is greater than the curvature of the second tendon (Fig. 8a).

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to rearrange the mounting locations of the actuators so that the actuator which drives the first tendon is mounted at the distal end of the forearm assembly and the actuator which drives the second tendon is mounted at the proximal end of the forearm assembly, thereby making the second tendon have the greater total curvature in an uncurled state. See *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950) (Claims to a hydraulic power press which read on the prior art except with regard to the position of the starting switch were held unpatentable because shifting the position of the starting switch would not have modified the operation of the device.); *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975) (the particular placement of a contact in a conductivity measuring device was held to be an obvious matter of design choice).

- Regarding claim 9, Walters as modified teaches the humanoid robot further comprising an end effector with more than 20 actuated degrees of freedom (Col. 7, lines 12-18, Col. 5, lines 54-68, Fig. 19).
- Regarding claim 10, Walters as modified does not expressly teach a biasing member coupled to the tendon.

However, Ihrke-671 teaches a humanoid robot further comprising a biasing member coupled to a first tendon ([0021]; in the configuration that lacks a return tendon, springs [multiple biasing members] are used to bias each tendon towards a neutral position).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified tendons and actuators of Walters to include a biasing member as Ihrke-671 teaches in order to advantageously provide a return motion for returning the hand and tendons to a neutral position ([0021] of Ihrke-671).

- Regarding claim 26, Walters as modified teaches the humanoid robot further comprising a finger assembly with a knuckle assembly 101 (See annotated Fig. 19-1 below) having an enclosure (Col. 5, lines 5-9, Figs. 15-16; each guide slot is an enclosure), and wherein said enclosure includes a guide slot 101, 102, 103, and 104: (i) formed in a top member of said enclosure, and (ii) configured to receive a portion of the second tendon (Col. 5, lines 5-9).
- Regarding claim 27, Walters as modified teaches the humanoid robot wherein the finger assembly further includes a member 7: (i) positioned near a distal end of the finger assembly, and (ii) having a top guide slot 136 formed in said member 7, and said top

guide slot 136 is configured to receive a portion of the second tendon (Col. 6, lines 3-6, Figs. 19 and 21-22).

- Regarding claim 28, Walters as modified teaches the humanoid robot further comprising a finger assembly having a member, and wherein the first tendon includes a distal end that is directly coupled to the member (Col. 6, lines 3-6, Figs. 19 and 21-22; any of the final hinge joints in the finger assemblies are directly coupled to their corresponding tendons by having the tendons routed through cable guides 136, 137).

Claim 5 is rejected under 35 U.S.C. 103 as being unpatentable over Walters in view of Ihrke-673 and Ihrke-671, and further in view of Ren (US 20220287853).

- Regarding claim 5, Walters as modified is silent on the output torques of the actuators.

However, Ren teaches a humanoid robotic hand with multiple actuators wherein the first actuator 70 has a first peak torque value and the second actuator 71 has a second peak torque value that is greater than the first peak torque value ([0291] of Ren).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the actuators of the modified robotic hand of Walters/et.al. to have different peak output torques in order to advantageously provide a dexterous robot hand which can complex operations due to having improved adaptability ([0014] of Ren).

Claim 24 is rejected under 35 U.S.C. 103 as being unpatentable over Walters in view of Ihrke-673 and Ihrke-671, and further in view of Gazeau (US 20230033779).

- Regarding claim 24, Walters as modified teaches the humanoid robot further comprising an end effector (See annotated Fig. 19-1 below), but is silent on the use of a glove.

However, Gazeau teaches a robotic hand assembly comprising an end effector and a glove 102 that substantially encases the end effector, and at least a portion of the wrist assembly 103 ([0130], Figs. 15-16 of Gazeau).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand of Walters/et.al. to wear a glove as Gazeau teaches in order to advantageously increase the adhesion between the tips of the fingers and objects which they grasp ([0036] of Gazeau).

Claims 7 and 25 are rejected under 35 U.S.C. 103 as being unpatentable over Walters in view of Ihrke-673 and Ihrke-671, and further in view of Blackwell (US 20070035143 A1).

- Regarding claim 7, Walters as modified teaches the humanoid robot further comprising: an end effector (See annotated Fig. 19-1 below) and a finger assembly, and a carpal tunnel-like structure 120 positioned forward of at least one of the wrist pivot axis or the wrist yaw axis and configured to guide the first and second tendons from the forearm assembly, through the wrist assembly, and to a base of the end effector (Col. 5, lines 47-49, Fig. 19).

Walters as modified does not expressly teach a housing for the end effector.

However, Blackwell teaches a humanoid robotic hand having a housing (Figs. 21, 27, 30, 31, and 34; the robotic hand has an outer shell which functions as the housing).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand of Walters/et.al. to have an outer housing as Blackwell teaches in order to advantageously provide structure to the robotic joints of Walters.

While Walters does not teach the carpal tunnel-like structure configured to guide the tendons to a base of the housing, the question is what would result from the combined teachings of the references. See *in re Keller*, 642 F.2d 413, 425 (CCPA 1981). Here, that result would be the tendons of Walter/et.al. being guided to a base of the end effector, where the modified housing of Blackwell is located.

- Regarding claim 25, Walters as modified teaches the humanoid robot further comprising:
an end effector coupled to the wrist assembly (See annotated Fig. 19-1 below).

Walters does not expressly teach an outer housing.

However, Blackwell teaches a robotic hand 1 having a housing (Figs. 21, 27, 30, 31, and 34; the robotic hand has an outer shell which functions as the housing), and wherein said housing includes:

a first interior wall extent,

a second interior wall extent positioned a first distance from the first interior wall extent, and wherein the first distance resides within a first plane that is configured to be substantially parallel with the wrist pitch axis (Fig. 29 of Blackwell),

a third interior wall extent,

a fourth interior wall extent positioned a second distance from the third interior wall extent, and wherein: (i) the second distance resides with a second plane that is substantially parallel with the first plane, a fifth interior wall extent,

a sixth interior wall extent positioned a third distance from the fifth interior wall extent, and wherein: (i) the third distance resides with a third plane that is substantially parallel with the first plane, and

wherein: (i) the third distance is both: (a) less than the first distance, and (b) greater than the second distance, and (ii) the second distance is positioned between the first and third distances (See annotated Fig. 30 below).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand of Walters/et.al. to have the outer housing of Blackwell in order to advantageously provide structure to the robotic joints of Walters.

Claims 11 and 30 are rejected under 35 U.S.C. 103 as being unpatentable over Ihrke-671 in view of Blackwell and Ihrke-673.

- Regarding claim 11, Ihrke-671 teaches a humanoid robot 10 ([0018]), comprising:
 - an upper region including: (i) a head 12, (ii) a torso 14, (iii) an arm 16 coupled to the torso 14 and including: (a) a forearm assembly 24, (b) a wrist assembly C coupled to the forearm assembly ([0019], Fig. 3) and having a wrist pitch axis C1 ([0026], Fig. 3), and (c) an end effector 18 coupled to the wrist assembly C (Fig. 3), and wherein said end effector includes:
 - an index finger 19 assembly having a metacarpophalangeal (MCP) joint F ([0020], Fig. 1),
 - a middle finger assembly 19 positioned proximate to the index finger assembly ([0019], Fig. 3),

a ring finger assembly 19 positioned proximate to the middle finger assembly ([0019], Fig. 3),

a little finger assembly 19 positioned proximate to the ring finger assembly ([0019], Fig. 3),

a thumb assembly 21 ([0019], Fig. 3),

a housing coupled to the index finger, middle finger, ring finger, little finger, and thumb assemblies 19, 21 (Figs. 3-4; the hand is the end effector and contains an outer housing), and

wherein said housing includes:

a first interior wall extent (See annotated Fig. 4 below),

a second interior wall extent positioned a first distance from the first interior wall extent (See annotated Fig. 4 below), and wherein the first distance resides within a first plane that is configured to be substantially parallel with the wrist pitch axis C1 (Fig. 3),

a third interior wall extent (See annotated Fig. 4 below),

a fourth interior wall extent positioned a second distance from the third interior wall extent (See annotated Fig. 4 below), and wherein (i) the second distance resides with a second plane that is substantially parallel with the first plane (Fig. 3),

a fifth interior wall extent (See annotated Fig. 4 below),

a sixth interior wall extent positioned a third distance from the fifth interior wall extent (See annotated Fig. 4 below), and wherein: (i) the third distance resides with a third plane that is substantially parallel with the first plane (Fig. 3), and

wherein: the third distance is both: (a) less than the first distance, and (b) greater than the second distance, and (ii) the second distance is positioned between the first and

third distances (See annotated Fig. 4 below; the second distance extends across the end effector between the endpoints of the first and third distances; the third distance has an extent which is shorter than the first distance, and an extent which is longer than the second distance);

a first plurality of tendons 34 coupled to at least the index finger assembly and a second plurality of tendons 34 coupled to the middle finger assembly ([0021], each finger assembly is connected to tendons which may be routed to a driving and a return actuator), and wherein the first and second plurality of tendons 34 are positioned between: (i) the first and second interior wall extents, (ii) the third and fourth interior wall extents, and (iii) the fifth and sixth interior wall extents ([0021] and [0025], Fig. 4; the plurality of tendons are shown entering the hand assembly between the interior wall extents).

Ihrke-671 does not teach the index finger assembly being configured for lateral movement.

However, Blackwell teaches a robotic hand and arm apparatus wherein an index finger assembly 4 is configured to experience lateral movement about an MCP joint 30 ([0035] and [0069], Fig. 11 of Blackwell).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the finger assembly of Ihrke-671 to have the MCP joint, push and pull cable, drum and motor of Blackwell in order to advantageously increase the versatility of the grip by providing a range of sideways movement to the finger assembly ([0069] of Blackwell).

Ihrke-671 as modified teaches a central region 15 ([0019]), but does not teach a lower region.

However, Ihrke-673 teaches a robot assembly with a lower region spaced apart from the upper region and including a pair of legs ([0022] of Ihrke-673); and a central region interconnecting the upper region and the lower region ([0022], Fig. 1 of Ihrke-673; the legs will be mounted to the robot by the waist portion 15).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the robotic hand assembly of Ihrke-671 to have a lower region of Ihrke-673 in order to advantageously provide a task-suitable fixture for moving the robot assembly across terrain ([0022]).

- Regarding claim 30, Ihrke-671 as modified teaches wherein the index finger assembly 19 and the middle finger assembly 19 are substantially the same and are both mounted on the palm of a robotic hand ([0020], Fig. 3).

While Ihrke-671 does not expressly teach that the finger assemblies are interchangeable. It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the middle and index finger assemblies to be interchangeable duplicates of each other in order to advantageously simplify manufacturing costs. See *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960) (Claims at issue were directed to a water-tight masonry structure wherein a water seal of flexible material fills the joints which form between adjacent pours of concrete. The claimed water seal has a "web" which lies in the joint, and a plurality of "ribs" projecting outwardly from each side of the web into one of the adjacent concrete slabs. The prior art disclosed a flexible water stop for preventing passage of water between masses of concrete in the shape of a plus sign (+). Although the reference did not disclose

a plurality of ribs, the court held that mere duplication of parts has no patentable significance unless a new and unexpected result is produced.).

Claims 12-13 are rejected under 35 U.S.C. 103 as being unpatentable over Ihrke-671 in view of Blackwell and Ihrke-673, and further in view of Engler (US 5447403).

- Regarding claim 12, Ihrke-671 as modified teaches wherein the wrist assembly C comprises:

a housing coupling component (See annotated Fig. 4 below; the bar connected between the left and right base member is the housing coupling component);

a pitch component coupled to the housing coupling component and the housing of the end effector and configured to provide up-and-down movement of the end effector (See annotated Fig; 4 below; the left and right base member function as the pitch component, allowing for up-and-down rotation about axis C1), and wherein the pitch component only extends across a partial width of the housing of the end effector (Fig. 4); and

a yaw component 76 coupled to the housing coupling component (Fig. 4)

Irhke-671 as modified does not teach the yaw component coupled to a base structure that is configured to be coupled to the forearm assembly.

However, Engler teaches a robotic hand wherein a wrist assembly comprises:

a housing coupling component 14 (Col. 5, line 57-Col. 6, line 2, See annotated Fig. 2 of Engler below);

a pitch component coupled to the housing coupling component and the housing of the end effector and configured to provide up-and-down movement of the end effector

(Col. 5, line 57-Col. 6, line 2, See annotated Fig. 2 of Engler below), and wherein the pitch component only extends across a partial width of the housing of the end effector (Fig. 2); and

a yaw component coupled to the housing coupling component and a base structure that is configured to be coupled to the forearm assembly (Col. 5, line 57-Col. 6, line 2, Figs. 1a and 2 of Engler).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand of Ihrke-671/et.al. to have the wrist assembly of Engler in order to advantageously provide a robotic hand with enhanced control and gripper dexterity (Col. 2, lines 11-16 of Engler).

- Regarding claim 13, Ihrke-671 as modified teaches wherein the pitch component includes a cable guide configured to route at least one tendon of the first or second plurality of tendons around a portion of the pitch component.

While Ihrke-671 does not teach the claimed pitch component, the question is what would result from the combined teachings of the references. See *in re Keller*, 642 F.2d 413, 425 (CCPA 1981). Here, that result would be the modified pitch component and corresponding wrist assembly of Engler being substituted for the modified wrist assembly of Ihrke-671/et.al. so that the tendons of Ihrke-671 are routed around a cable guide on the pitch component in the same manner as Engler teaches (Figs. 1a-1b of Engler; cables are

shown being routed from actuators, around the pitch component, and into the end effector).

Claim 14 is rejected under 35 U.S.C. 103 as being unpatentable over Ihrke-671 in view of Blackwell and Ihrke-673, and further in view of Rosheim (US 4804220).

- Regarding claim 14, Ihrke-671 as modified teaches the humanoid robot further comprising a carpal tunnel-like structure 76 configured to guide the first or second plurality of tendons 34 from the forearm assembly to the housing of the end effector ([0034], Fig. 4; the palm link acts as a carpal tunnel-like structure by positioning the tendons within the end effector in an opening within the hand which it surrounds), wherein the carpal tunnel-like structure is positioned between the first interior wall extent and the second interior wall extent (Fig. 4).

Ihrke-671 as modified does not teach a sheath surrounding a plurality of tendons.

However, Rosheim teaches a carpal tunnel-like structure 40'' which secures an extent of a sheath 32' that surround a first or second plurality of tendons (Col. 8, lines 46-55, Fig. 11B of Rosheim).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand of Ihrke-671/et.al. to have the sheath surrounding the tendons coupled to the carpal tunnel-like structure as is taught by Rosheim in order to advantageously accommodate a large number of tendons into the hand assembly (Col. 8, lines 46-49 of Rosheim).

Claim 15 is rejected under 35 U.S.C. 103 as being unpatentable over Ihrke-671 in view of Blackwell and Ihrke-673, and further in view of Ren.

- Regarding claim 15, Ihrke-671 as modified does not expressly teach the actuators having peak torque values.

However, Ren teaches a humanoid robotic hand further comprising a first plurality of actuators 70 positioned in the forearm assembly and having a first peak torque ([0291], Fig. 11 of Ren), and a second plurality of actuators 71 that are positioned forward of the first plurality of actuators and have a second peak torque that is greater than the first peak torque ([0291], Fig. 11 of Ren). .

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the actuators of the modified robotic hand of Walters/et.al. to have different peak output torques in order to advantageously provide a dexterous robot hand which can complex operations due to having improved adaptability ([0014] of Ren).

Regarding the limitation of “a second plurality of actuators that are positioned rearward of the first plurality of actuators”. It would have been obvious to one of ordinary skill in the art to switch the mounting locations of the first and second pluralities of actuators since it has been held that the rearrangement of parts requires only routine skill in the art. See *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950) (Claims to a hydraulic power press which read on the prior art except with regard to the position of the starting switch were held unpatentable because shifting the position of the starting switch would not have modified the operation of the device.); *In re Kuhle*, 526 F.2d 553, 188

USPQ 7 (CCPA 1975) (the particular placement of a contact in a conductivity measuring device was held to be an obvious matter of design choice).

Claim 31 is rejected under 35 U.S.C. 103 as being unpatentable over Ihrke-671 in view of Blackwell and Ihrke-673, and further in view of Gazeau.

- Regarding claim 31, Ihrke-671 as modified does not teach a glove.

However, teaches the humanoid robot further comprising a glove 102 that substantially encases the end effector, the wrist assembly 103, and a portion of the forearm assembly 101 ([0130], Figs. 15-16 of Gazeau).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand of Walters/et.al. to wear a glove as Gazeau teaches in order to advantageously increase the adhesion between the tips of the fingers and objects which they grasp ([0036] of Gazeau).

Claim 32 is rejected under 35 U.S.C. 103 as being unpatentable over Ihrke-671 in view of Blackwell and Ihrke-673, and further in view of Ihrke (US 20110068595; henceforth Ihrke-595).

- Regarding claim 32, Ihrke-671 as modified is silent on the routing of the tendons.

However, Ihrke-595 teaches a humanoid robot 10 ([0029] of Ihrke-595) wherein the index finger assembly 19A includes a curvilinear outer surface 110 formed within a slot that is in contact with a first tendon 46B contained in the first plurality of tendons and is configured to change the direction of said first tendon ([0040] and [0052], Fig. 15 of Ihrke-595).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand assembly of Ihrke-671/et.al. to have the curvilinear outer surface of Ihrke-595 in order to advantageously selectively replaceable tendon-routing structures ([0052] of Ihrke-595).

Claims 16 and 18 are rejected under 35 U.S.C. 103 as being unpatentable over Ihrke-671 in view of Ihrke-673.

- Regarding claim 16, Ihrke-671 teaches a humanoid robot 10 ([0018], Fig. 1), comprising:
 - an upper region including: (i) a head 12, (ii) a torso 14, (iii) an arm 16 coupled to the torso 14, the arm 16 ([0019], Fig. 1) including: (a) a forearm assembly 24 ([0022], Fig. 3) having an actuator 26 and a first tendon 34 ([0021], Fig. 3), (b) a wrist assembly C coupled to the forearm assembly (Fig. 3), and (c) an end effector coupled to the wrist assembly C (Fig. 3; the hand portion is the end effector), and wherein the wrist assembly includes:
 - a left base member (See annotated Fig. 4 below),
 - a right base member (See annotated Fig. 4 below),
 - a rotational axis C1 that extends between the left and right base members ([0026], Figs. 3-4),
 - a carpal tunnel-like structure 76 directly coupled to the end effector and having an opening formed therein configured to receive an extent of the first tendon 34 ([0034], Fig. 4; the palm link acts as a carpal tunnel-like structure by positioning the tendons within the end effector in an opening within the hand which it surrounds), and wherein a centroid of the opening formed in the carpal tunnel-like structure does not reside on the

rotational axis (Fig. 4; the opening is the entryway within the end effector where the tendons are routed to, and the centroid of the carpal tunnel-like structure is perpendicular to the rotational axis).

Ihrke-671 teaches a central region 15 ([0019]), but does not teach a lower region.

However, Ihrke-673 teaches a robot assembly with a lower region spaced apart from the upper region and including a pair of legs ([0022] of Ihrke-673); and a central region interconnecting the upper region and the lower region ([0022], Fig. 1 of Ihrke-673; the legs will be mounted to the robot by the waist portion 15).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the robotic hand assembly of Ihrke-671 to have a lower region of Ihrke-673 in order to advantageously provide a task-suitable fixture for moving the robot assembly across terrain ([0022]).

- Regarding claim 18, Ihrke-671 as modified teaches the humanoid robot further comprising a biasing member coupled to the first tendon 34 ([0021]).

Claim 21 is rejected under 35 U.S.C. 103 as being unpatentable over Ihrke-671 in view of Ihrke-673, and further in view of Gazeau.

- Regarding claim 21, Ihrke-671 as modified does not expressly teach a glove.

However, Gazeau teaches the humanoid robot further comprising a glove 102 that substantially encases the end effector ([0130], Figs. 15-16 of Gazeau).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand of

Walters/et.al. to wear a glove as Gazeau teaches in order to advantageously increase the adhesion between the tips of the fingers and objects which they grasp ([0036] of Gazeau).

Claims 17, 19-20, and 33 are rejected under 35 U.S.C. 103 as being unpatentable over Ihrke-671 in view of and Ihrke-673, and further in view of Ihrke-595.

- Regarding claim 17, Ihrke-671 as modified teaches fingers driven by tendons ([0021]) but does not expressly teach a curvilinear outer surface.

However, Ihrke-595 teaches a humanoid robot 10 ([0029] of Ihrke-595) further comprising a structure that includes a curvilinear outer surface 110 that is in contact with a first tendon 46B and is configured to change the direction of said first tendon 46B ([0040] and [0052], Fig. 15 of Ihrke-595).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand assembly of Ihrke-671/et.al. to have the curvilinear outer surface of Ihrke-595 in order to advantageously selectively replaceable tendon-routing structures ([0052] of Ihrke-595).

- Regarding claim 19, Ihrke-671 as modified teaches the humanoid robot further comprising a second tendon 34 that extends through the carpal tunnel-like structure (Fig. 4).

Ihrke-671 as modified is silent on the curvatures of the tendons.

However, Ihrke-595 teaches a robotic hand assembly with multiple tendons, wherein the second tendon 46A has a second total curvature that is less than a first total curvature of the first tendon 46C in the uncurled state ([0050], Fig. 9 of Ihrke-595).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand assembly of Ihrke-671/et.al. to have the fingers and tendon routing of Ihrke-595 in order to advantageously provide a robotic hand assembly which can selectively rotate each phalange ([0005] of Ihrke-595).

- Regarding claim 20, Ihrke-671 as modified teaches the structural limitations of a first and second tendon.

Regarding the limitation of “wherein an application of force or a frequency of use that is associated with the second tendon is greater than an application of force or a frequency of use associated with the first tendon” is functional language. “[Apparatus claims cover what a device is, not what a device does.” *Hewlett-Packard Co.v.Bausch & Lomb Inc.*, 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990) (emphasis in original). A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987.). Ihrke-671 as modified discloses the structural limitation of the claim. wherein an application of force or a frequency of use that is associated with the second tendon is greater than an application of force or a frequency of use associated with the first tendon.

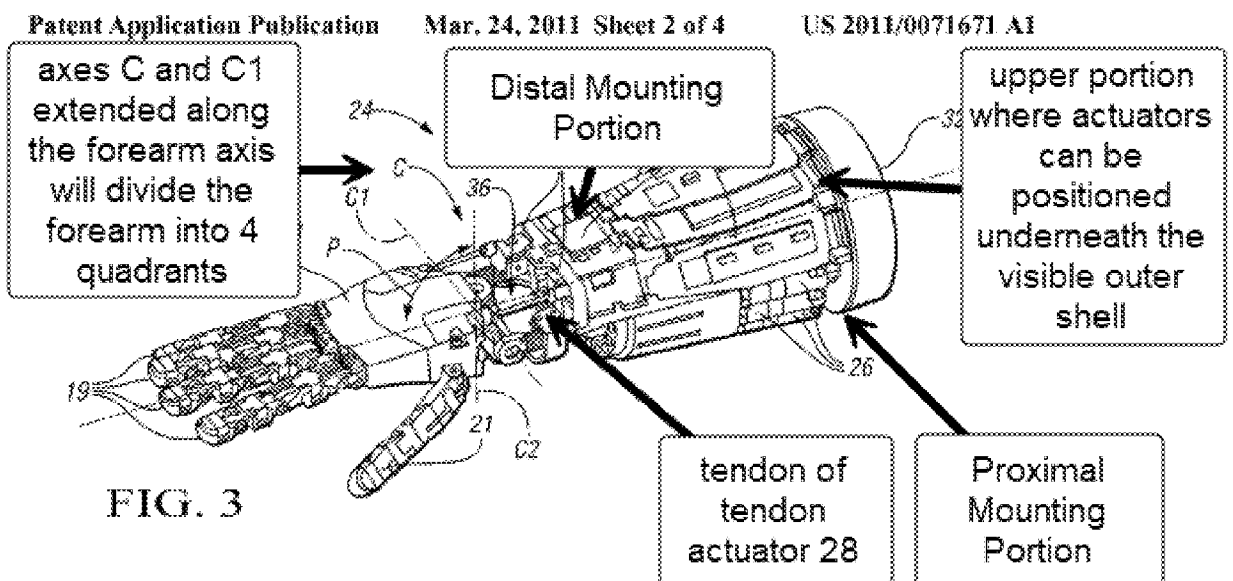
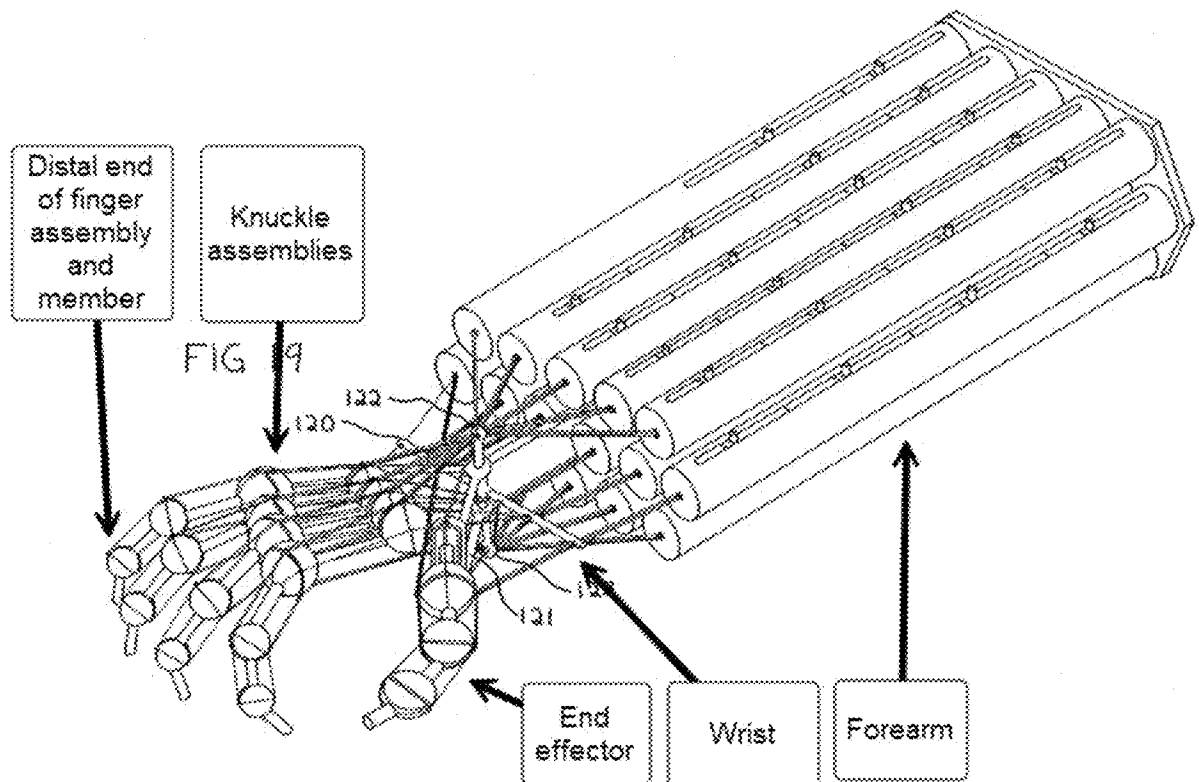
- Regarding claim 33, Ihrke-671 as modified does not expressly teach the tendon being directly coupled to a member within the finger assembly.

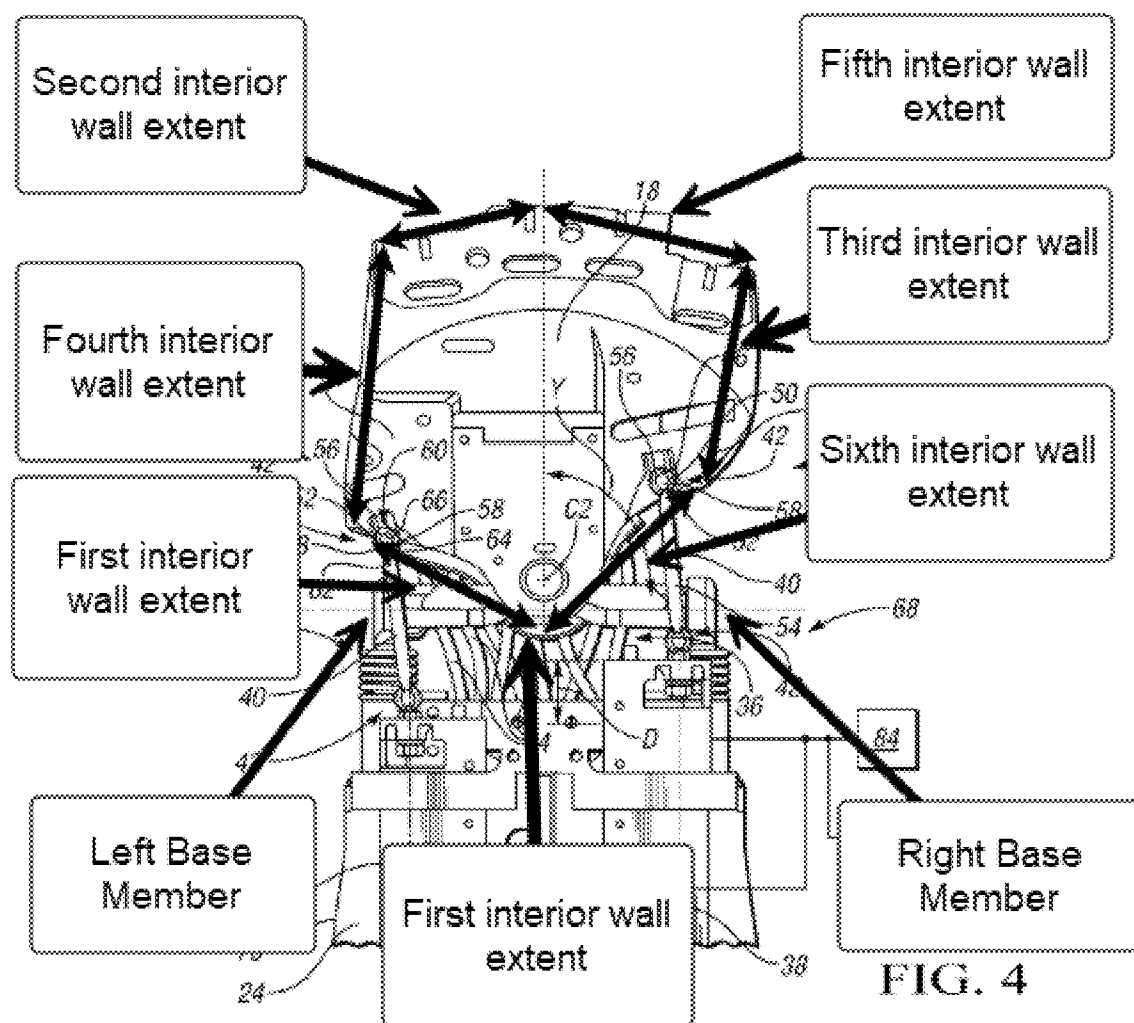
However, Ihrke-595 teaches a robotic hand assembly wherein the end effector 18 includes a finger assembly 19 having a member 110C, and wherein the first tendon

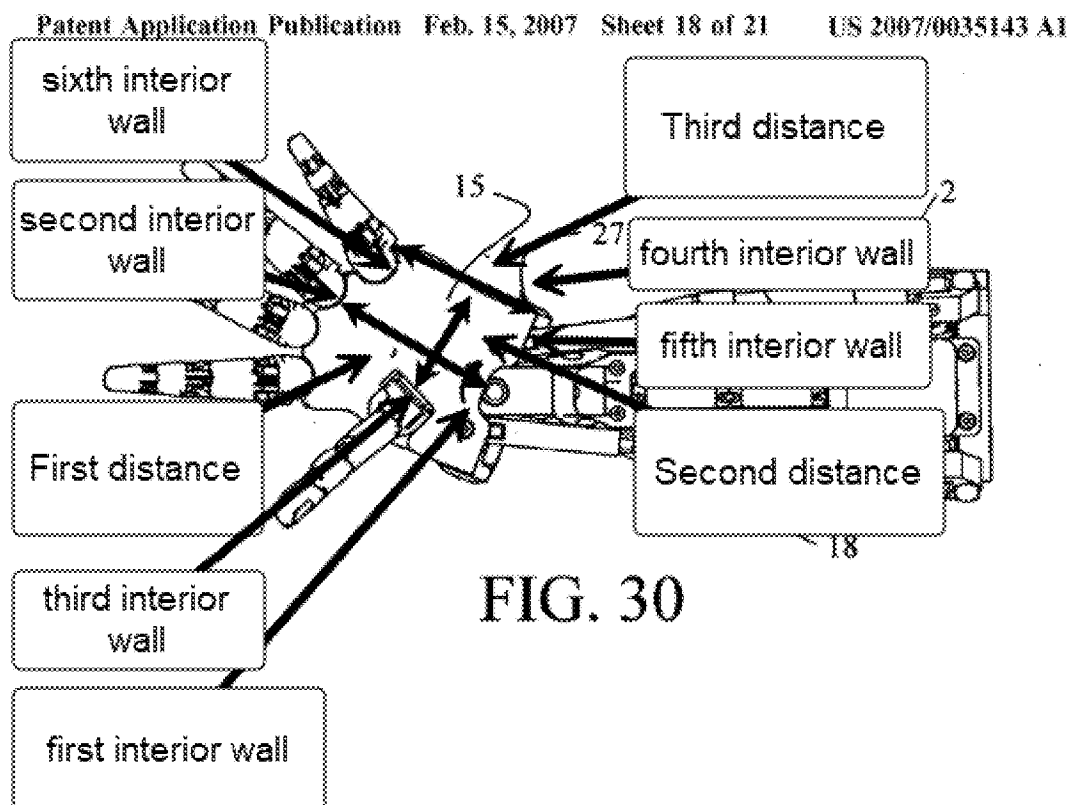
includes a distal end that is directly coupled to the member ([0052] and [0054], Figs. 4 and 15 of Ihrke-595).

Therefore, it would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the modified robotic hand assembly of Ihrke-671/et.al. to have the fingers and tendon routing of Ihrke-595 in order to advantageously provide a robotic hand assembly which can selectively rotate each phalange ([0005] of Ihrke-595).

U.S. Patent May 30, 1989 Sheet 15 of 15 4,834,761 Annotated Fig. 19-1





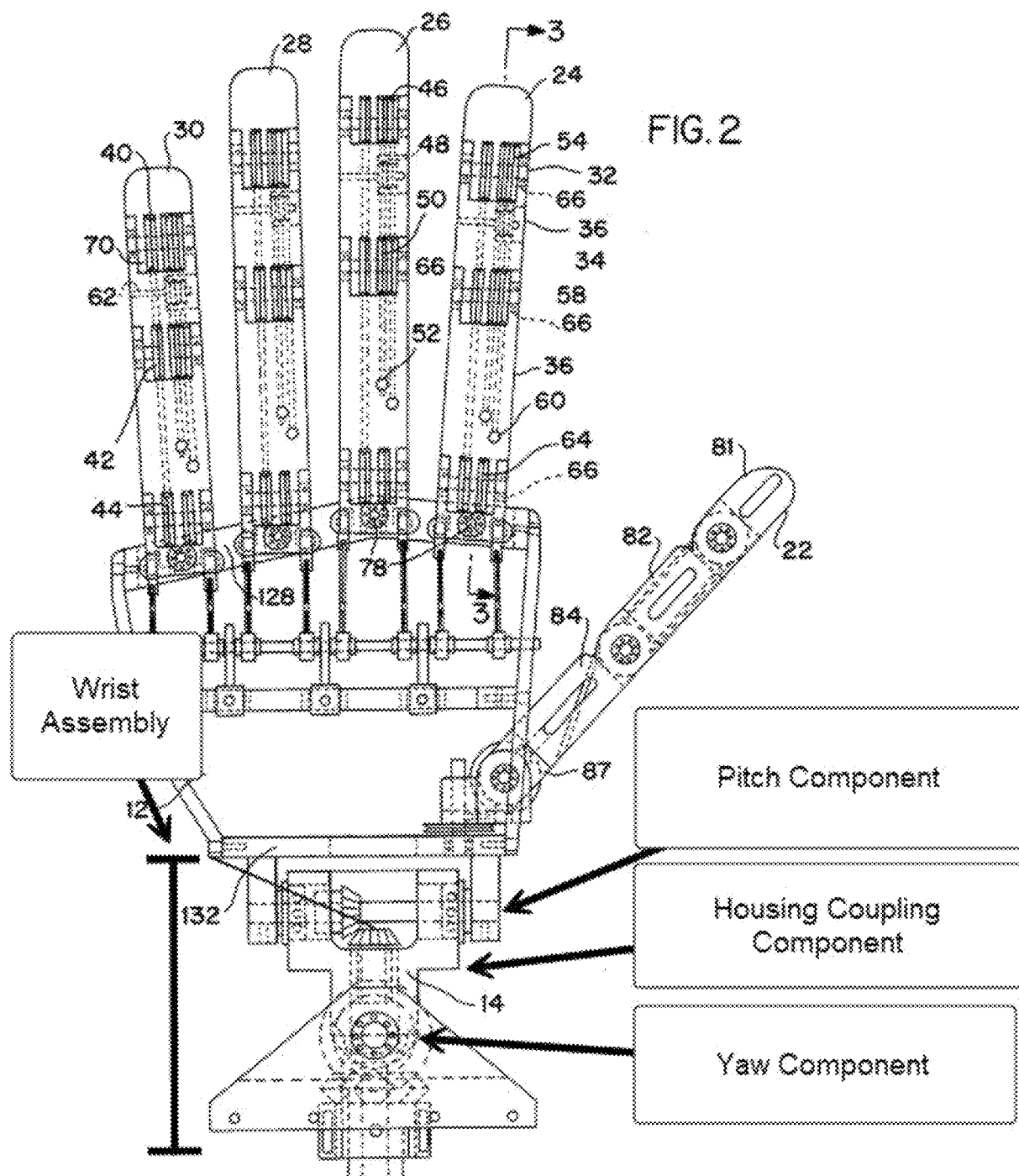


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Allowable Subject Matter

- Claim 29 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Regarding claim 29, Walters as modified teaches the humanoid robot further comprising a third tendon that is routed: (i) below an extent of a knuckle assembly, and in line with the proximal and medial assemblies. It would not have been obvious to one of ordinary skill in the art to modify the tendon routing of Walters to extend both above the proximal assembly and below the medial assembly without resorting to impermissible hindsight.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any nonprovisional extension fee (37 CFR 1.17(a)) pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NATHANIEL WILLIAM WATKINS whose telephone number is (703)756-4744. The examiner can normally be reached Monday-Thursday, 8:30 am -6:00 pm EST; Friday 8:30 am - 2:00 pm EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Valentin Neacsu can be reached at (571)272-6265. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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