

AMENDMENTS TO THE CLAIMS

Please amend the claims as indicated below.

1. (Currently Amended) An end effector for a humanoid robot, the end effector comprising:
 - a frame;
 - a finger assembly removably connected to the frame, the finger assembly comprising:
 - a worm drive link;
 - a proximal drive link pivotably coupled to the worm drive link;
 - a proximal link defining a proximal link recess, ~~configured to selectively receive wherein~~ at least a portion of the worm drive link and at least a portion of the ~~main~~ proximal drive link are configured to move into the proximal link recess during movement of the finger assembly from an uncurled position to a curled position therein;
 - a main medial link pivotably connected to both the proximal link and the proximal drive link ~~and including a medial link recess configured to receive an extent of the medial drive link~~; and
 - a medial drive link pivotably connected to the medial link by: (i) at least one first pivotable coupling located on a first side of a sagittal plane extending through the finger assembly and near a proximal end of the main medial link, and (ii) at least one second pivotable coupling located on a second side of the sagittal plane and near the proximal end of the main medial link.
2. (Original) The end effector of claim 1, wherein the finger assembly lacks a mechanical cable configured to actuate any component of the finger assembly.
3. (Currently Amended) The end effector of claim 1, wherein the finger assembly further comprises:
 - a motor including a motor shaft;
 - a worm drive gear coupled to the motor shaft;

a worm wheel in geared engagement with the worm drive gear and fixedly connected to the worm drive link; and

~~[[a]]the proximal drive link~~ pivotably connected to the worm drive link and configured to move in response to rotation of the worm drive link.

4. (Currently Amended) The end effector of claim 1, the finger assembly further comprising:

a medial housing assembly having an internal cavity;

a distal housing assembly including: (i) a rear external surface with a first end positioned adjacent the medial housing assembly when the finger assembly is in an open position, and (ii) a tongue that extends towards the proximal link ~~assembly~~ and has an upper surface that is offset inwardly from the rear external surface;

wherein, when the finger assembly is in the open position, a substantial ~~majority extent~~ of the tongue is positioned within the internal cavity of the medial housing assembly.

5. (Currently Amended) The end effector of claim 1, further comprising a glove that surrounds an extent of the end effector. ~~wherein the finger assembly lacks both a pressure sensor and a force sensor, but includes a textile covering.~~

6. (Currently Amended) The end effector of claim 1, wherein the finger assembly further comprises a single electric motor, a worm drive, and a worm wheel ~~configured to actuate the worm drive link.~~

7. (Currently Amended) The end effector of claim 1, wherein the finger assembly further comprises a biasing member having a first extent connected to the proximal link and a second extent connected to the proximal drive link, and wherein the ~~single~~ biasing member is configured to bias the proximal drive link toward an uncurled position.

8. (Currently Amended) The end effector of claim 1, wherein the finger assembly further includes:

a knuckle ~~assembly positioned adjacent to the proximal assembly;~~

a proximal assembly positioned adjacent to the knuckle assembly and that includes the worm drive link, the proximal drive link, and the proximal link;

- a medial assembly that includes the medial drive link and main medial link;
 - a distal assembly positioned adjacent to the medial assembly;
 - a metacarpophalangeal joint formed between the knuckle assembly and the proximal assembly;
 - a proximal finger interphalangeal joint formed between the proximal assembly and the medial assembly; and
 - a distal finger interphalangeal joint formed between the medial assembly and the distal assembly.
9. (Currently Amended) The end effector of claim 8, further comprising:
- a first finger encoder positioned proximate to the metacarpophalangeal joint and configured to collect data related to rotation of the metacarpophalangeal joint; and
 - a second finger encoder positioned proximate to the proximal finger interphalangeal joint and configured to collect data related to rotation of the proximal finger interphalangeal joint.
10. (Currently Amended) An end effector for a humanoid robot, the end effector comprising:
- a frame;
 - four finger assemblies, wherein each finger assembly of the four finger assemblies are substantially identical to every other finger assembly of the four finger assemblies, and wherein each finger assembly of the four finger assemblies is removably connected to the frame at ~~[[a]]~~respective ~~point~~points;
 - wherein all of the finger assemblies of the four finger assemblies are located substantially in a single plane;
 - wherein a respective sagittal plane of each finger assembly of the four finger assemblies is angularly offset within the single plane with respect to a respective sagittal plane of each ~~every~~ other finger assembly of the four finger assemblies;

wherein the each respective point of connection for each finger assembly of the four finger assemblies is not colinear with the corresponding respective points of connection for all the other finger assembly of the four finger assemblies ~~respective points of connection of the four fingers assemblies to the frame are not co-linear~~; and

wherein each finger assembly of the four finger assemblies lacks a mechanical cable configured to actuate any component of the finger assembly.

11. (Currently Amended) The end effector of claim 10, wherein each finger assembly of the four finger assemblies comprises:

a worm drive link;

a proximal drive link pivotably coupled to the worm drive link;

a proximal link defining a proximal link recess configured to selectively receive at least a portion of the worm drive link and at least a portion of the main proximal drive link therein;

a medial drive link pivotably connected to a main medial link by: (i) at least one first pivotable coupling located on a first side of a sagittal plane extending through the finger assembly and near a proximal end of the main medial link, and (ii) at least one second pivotable coupling located on a second side of the sagittal plane and near the proximal end of the main medial link; ~~and~~

~~a medial link pivotably connected to both the proximal link and the proximal drive link and including a medial link recess configured to receive an extent of the medial drive link.~~

12. (Cancelled)

13. (Cancelled)

14. (Currently Amended) The end effector of claim 10, wherein each finger assembly of the four finger assemblies only have a single electric motor ~~and include a textile covering~~.

15. (Currently Amended) The end effector of claim 10, wherein each finger assembly of the four finger assemblies is configured to operable independently of every other finger assembly of the four finger assemblies and each finger assembly of the four finger assemblies does not include a force sensor.

16. (Currently Amended) The end effector of claim 10, wherein at least one of the four finger assemblies includes: (i) a proximal housing assembly with an internal proximal recess, and (ii) a medial housing assembly includes a tongue that is positioned within the internal proximal recess of the proximal housing assembly; when the at least one finger assembly is in an uncurled position.
17. (Currently Amended) The end effector of claim 10, wherein at least one of the four finger assemblies includes a proximal housing assembly having: (i) an exterior surface with a curvilinear extent ~~in a first direction~~ across a width of the finger assembly, and (ii) an interior surface ~~that is with a~~ curvilinear extent across the width of the finger assembly in the first direction and a curvilinear extent across a length of the finger assembly second direction, and wherein the interior surface includes a plurality of projections.
18. (Currently Amended) The end effector of claim 10, wherein ~~at least one of the four finger assemblies include a textile that covers that a glove~~ surrounds an extent of said end effector finger assembly.
19. (Currently Amended) An end effector for a humanoid robot, the end effector comprising:
- a frame;
 - a plurality of finger assemblies removably connected to the frame, each finger assembly of the plurality of finger assemblies comprising:
 - a motor assembly including: (i) a motor having a motor housing, and (ii) a motor shaft having a motor shaft axis, and wherein the motor shaft is configured to rotate about said motor shaft axis;
 - a worm drive gear coupled to the motor shaft and configured for rotation about: (i) the motor shaft axis, and (ii) a worm drive gear axis, and wherein the motor shaft axis and the worm drive gear axis are coaxial;
 - a worm wheel in geared engagement with the worm drive gear and configured for rotation about a worm wheel axis in response to rotation of the worm drive gear, and wherein the worm wheel axis is perpendicular to the worm drive gear axis;

a worm drive link having a first end and a second end, and wherein the first end of the worm drive link is fixedly connected to the worm wheel so that the worm drive link is configured for rotation about the worm wheel axis in response to rotation of the worm wheel about the worm wheel axis;

a proximal drive link having a first end and a second end, and wherein the first end of the proximal drive link pivotably connected to the second end of the worm drive link; and

a biasing member configured to bias an extent of the proximal drive link toward a first location, and wherein the extent of the proximal drive link is in the first location when the finger assembly is in an uncurled position.

20. (Original) The end effector of claim 19, wherein each finger assembly of the plurality of finger assemblies lacks a mechanical cable configured to actuate any component of the finger assembly, and includes a textile covering.
21. (Original) The end effector of claim 20, wherein each finger assembly of the plurality of finger assemblies is configured to be swappable with every other finger assembly of the plurality of finger assemblies.
22. (Original) The end effector of claim 19, wherein a finger assembly of the plurality of finger assemblies includes: (i) a proximal housing assembly with an internal proximal recess, and (ii) a medial housing assembly which includes a medial tongue;

wherein said medial tongue is positioned within the internal proximal recess of the proximal housing assembly, when the finger assembly is in the uncurled position; and

wherein said medial tongue is not positioned within the internal proximal recess of the proximal housing assembly, when the finger assembly is in a curled position.

23. (Currently Amended) The end effector of claim 19, wherein a finger assembly of the plurality of finger assemblies includes further includes:

a knuckle ~~assembly~~ positioned adjacent to the proximal assembly;

a proximal assembly positioned adjacent to the knuckle assembly and that includes the worm drive link, the proximal drive link and ~~[[the]]~~a proximal link;

a metacarpophalangeal joint formed between the knuckle assembly and the proximal assembly; and

a first finger encoder configured to collect data related to rotation of the metacarpophalangeal joint.

24. (Currently Amended) The end effector of claim 19, further comprising a main medial link pivotably connected to both the proximal link and ~~[[the]]~~a proximal drive link and including a medial link recess configured to receive an extent of ~~[[the]]~~a medial drive link; ~~and a~~, wherein the medial drive link is pivotably connected to ~~[[a]]~~the main medial link by at least one first pivotable coupling located on a first side of a sagittal plane extending through the finger assembly and at least one second pivotable coupling located on a second side of the sagittal plane.