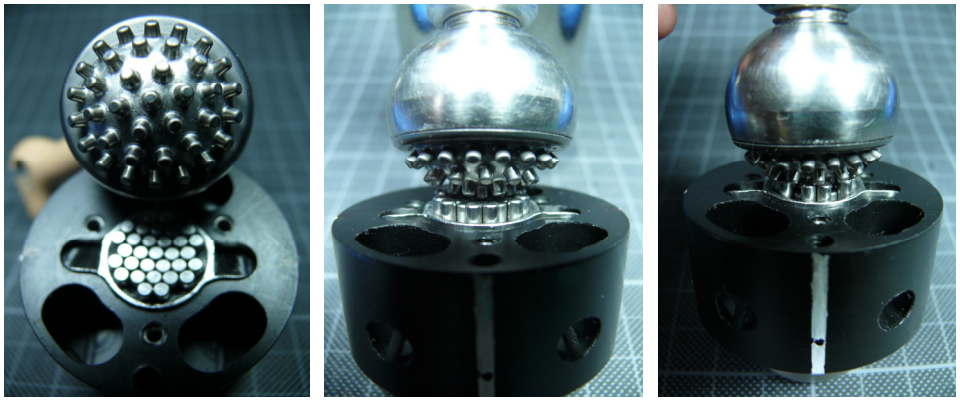
CIVIC

Continuous Internal Variable Interlocking Concept

The Robo-Flex PL (Passive Locking) 3D ball joint technology has produced the hybrid version CIVIC, (Continuous Internally Variable Interlocking Concept), best described as a three dimensional mechanical gear drive mechanism. Unlike its predecessor which can not move into a new locking position without first being disengaged, CIVIC features a **permanent** linkage between the two engaging surfaces. This linkage enables a continuous flow between locking positions and exponentially increases the potential of the CIVIC concept for other innovative applications, including robotics.

CIVIC Know-How: A ball joint, connected to a Terminal Device (TD) and held in place by a shell-like enclosure is able to move completely around its own axis and/or tilt in all directions within its confines. A portion of the ball is comprised of ball race protuberances that are permanently interlinked with a crown of pressure sensitive, spaced actuators. Bound only to the race protuberances, the actuators control the movement of the ball joint. When the actuator assembly is moved within a small horizontal plane, it directs the angular and rotational deviations of the ball-race and consequently the TD attached thereto. Every degree of tilt and/or axial rotation by the TD is directly proportional to the directional changes made by the actuators. In essence, the two components move in tow.

This hybrid system is based on the interaction between ball race protuberances and actuators. Directional changes by the actuator assembly enables the tips of the spring loaded actuators to continuously self adjust their various extensions into the concavities between the race protrusions as they yield to the fluctuating pressures of the protuberances in a smooth cam action. To safeguard the unhindered self-adjustment of actuators, the race protuberances must not contact the top rim of the actuator enclosure while being manipulated. The counteracting interdependency between actuators and protuberances tilts the TD to the left when the actuator assembly is moved to the right and vise versa. A turning motion of the actuator entity causes the TD to tag along a 360 degree pathway whatever the preset angle.



a) Race & Actuators b) Actuators Pre-Engaged c) Actuators Engaged

The chaotic interplay between protuberances and the closely spaced actuators could be replaced by two highly compatible interlinking surfaces. Spacing the actuators to fit the triangular openings between protuberances modeled according to the triangular divisions of a platonic solid such as the Icosahedron, the shape of actuators and protuberances can be optimized. Furthermore, changing the height of protuberances and lengthening the protruding actuators, will alter the depth of penetration between the two entities. Various depths of penetration as well as enhanced locking characteristics can also be achieved by raising or lowering the actuator assembly.

An electronic positioning system capable of controlling the directional and rotational movements of the actuator body interlinked with its race counterpart acts as the control center for the robotic actuation of the CIVIC joint mechanism. Simultaneous directional and rotational changes by the actuator assembly renders a true representation of three dimensional movements while constantly maintaining a 3D interlock between ball race and actuators throughout the entire repositioning process.

Alternative TD positioning modes may also include the use of linear controlled actuators. Also, the linear activated motors pictured in a tubular wrist housing, (CIVIC web page) could be remote and linked by wire to the peripheral drive and actuator body.

Werner O. Merlo
CEO Medical Bionics Inc.