A MAGNETICALLY COUPLED DISPOSABLE COMPLIANT TOOL TIP FOR ROBOTIC SURGERY

IITM Technology Available for Licensing

PROBLEM STATEMENT

- Generally, it is noted that robotic surgery facilitates to restore part of the lost dexterity in contrast to a minimally invasive laparoscopic tool which includes Endoscopic surgical tool having one&more Degree of freedom(DOF). In conventional robotic surgical tool, the power transmission run along the length of the tube through conduits in the tool shaft which couples the actuator elements and the tool tip.
- These tethers **do not have mechanical seals**, so during surgical procedures **bodily fluids & tissue find their way into the narrow crevices of the tool tip, &** to the **drive** pulleys of the actuators located at the distal end of the tool. Further, the **problem of bio fouling** is still not eliminated as the coupling is still exposed to body fluids.
- Hence, there is a need to mitigate above challenges.

INTELLECTUAL PROPERTY

IITM IDF Ref. 1491; IN Patent No: 388781

TECHNOLOGY CATEGORY/ MARKET

Technology: Hermetically sealed surgical tool assembly; **Industry:** Surgical Device; **Applications:** Surgical Tool;
Market: The global **minimally invasive surgical instruments** market is projected to grow at a **CAGR of 7.4 %** during 2023to**2026**;

TECHNOLOGY ALONG WITH IMAGE

- The present invention describes a tool assembly that has a **hermetically sealed part & a disposable part** that comes in contact with the surgical site that are **magnetically connected to provide actuation**. Said tool assembly comprising:

a) **a disposable tooltip assembly** actuated by **tethers** & connected to a plurality of **outer permanent magnets**; and

b) **a tool shaft assembly** having a **hermetically sealed barrier** configured to be an extension of the surgical tool, & to facilitate attachment thereto, & actuation of the tool tip assembly.

- Said **hermetically sealed surgical tool assembly for robotic surgery**, is configured to **connect to a disposable surgical tool tip assembly** having an end effector and to provide a plurality of **degrees of freedom** to the end effector. (Refer figures.1, 2 & 3)

FIG.1:Illustrates prototype of the compliant tool tip assembly;

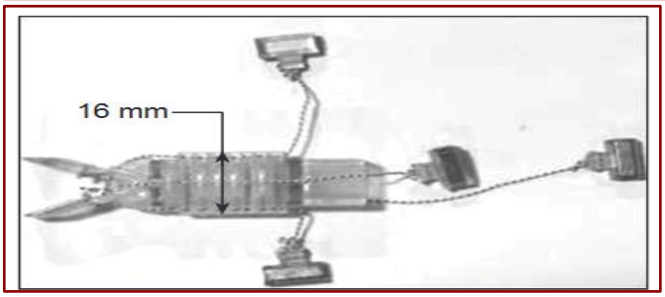
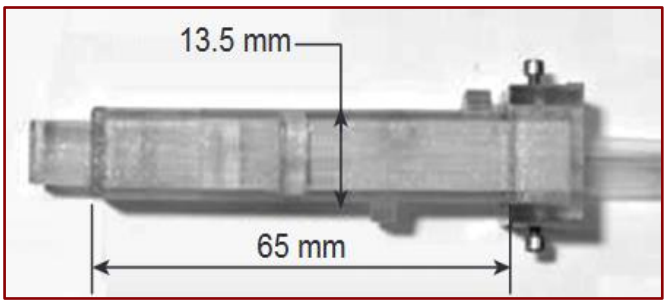


FIG.2:Illustrates prototype of the Tool shaft assembly;



TRL (TECHNOLOGY READINESS LEVEL)

TRL- 4, Proof of Concept ready & validated

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TECHNOLOGY IMAGES

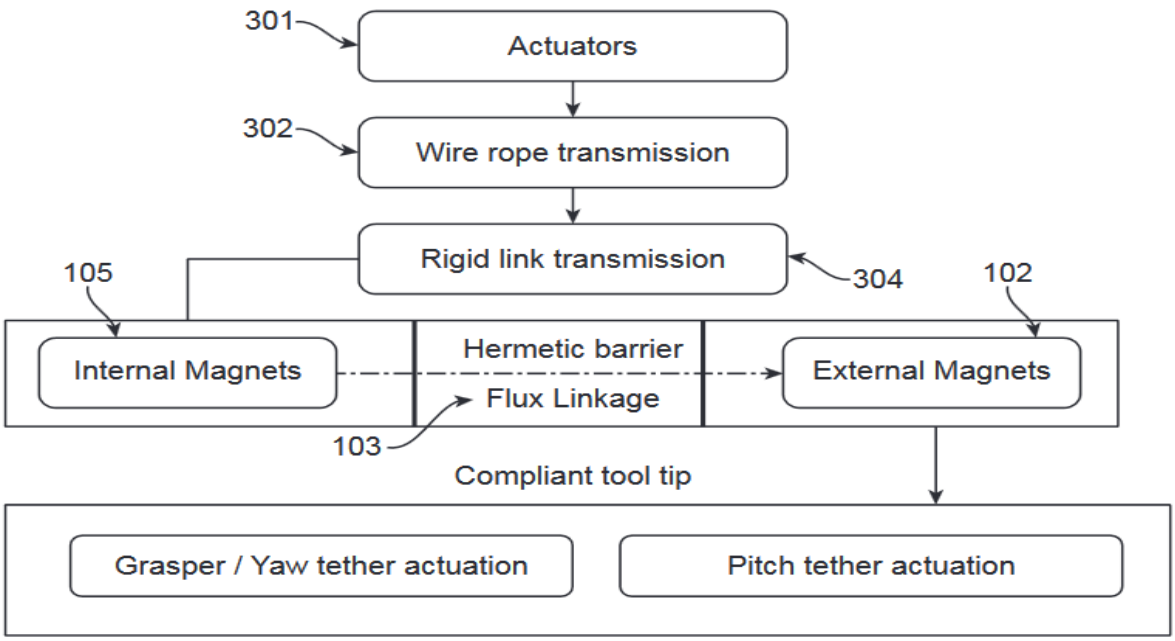

Fig.3: Illustrates a schematic of the power flow from the actuators to the tooltip.

KEY FEATURES / VALUE PROPOSITION

❖ *Technical Perspective:*

1. Facilitates the hermetic sealing of a **valuable surgical robotic tool** to **prevent biofouling** and to use an **end effector that is disposable**.

2. The **monolithic & interchangeable tooltip** provides a **plurality of degrees** of freedom to the end effector.

3. The tool assembly further includes **a plurality of rigid links with inner permanent magnets** which are magnetically couple to the **outer magnets** to transfer power from the actuators to the end effector through the hermetic barrier to **manipulate the tooltip** with the **plurality of degrees of freedom**.

4. The **modified hybrid flexure increases** the **buckling strength** of the tool tip by **a factor of 2 to 2.5** in comparison to simple flexure. Further, the **off-axis stiffness** of the flexure is **improved** by the hybrid flexure **by a factor of 1.5 to 2** over simple flexure.

5. Present invention facilitates by **mitigating bio fouling.**

❖ *Industrial Perspective:*

1. Provides a hermetically sealed surgical tool assembly to connect to **a disposable surgical tool tip end effector** for a **tele-operated surgical robot** applicable in surgical units in the Hospitals/Medical Institution.

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