

MINIMALLY INVASIVE SURGICAL END-EFFECTOR COMBINING SCISSORS, HOOK AND GRASPER

1.0 Abstract

The use of single-functional instruments during Minimally Invasive Surgical (MIS) procedures, where each instrument is capable of performing only one particular function, requires the surgeon to make a lot of instrument swaps during one operation to carry out all the required functions. This results in increased operation times and increased danger of hitting the human organs unnecessarily. To overcome this problem, efforts have been made towards combining a number of end-effectors in one instrument to produce a multi-functional instrument. This invention, nicknamed **UMMISEF (for University of Malta Minimally Invasive Surgical End-Effector)** aims to contribute in this direction through the design of a novel laparoscopic instrument which combines the underlying working principle of three commonly used MIS end-effectors, namely the scissors, hook and grasper in one multi-functional instrument. The novelty of this invention lies mainly in the particular combination that is used, which will help the surgeon to perform less instrument swaps and therefore will reduce operation times considerably. The combination of functions which can be performed by the **UMMISEF** instrument also makes it possible for it to be used in other applications, apart from surgical, that require the use of cutting, lifting and grasping functions in a constrained environment e.g. wiring, maintenance and repair.

1.1 Abbreviations

| ABBREVIATION | DEFINITION |
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| CA | Clip Applier |
| CO ₂ | Carbon Dioxide |
| G | Traditional end-effector Grasper |
| G _U | UMMISEF grasper concept |
| H | Traditional end-effector Hook |
| H _U | UMMISEF hook concept |
| L | Laparoscope |
| LC | Laparoscopic Cholecystectomy |
| MIS | Minimally Invasive Surgery/Surgical |
| S | Traditional end-effector Scissors |
| S _U | UMMISEF scissors concept |
| UMMISEF | University of Malta Minimally Invasive Surgical End-Effector |

1.2 Glossary

| TERM | EXPLANATION |
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| Electro cauterization | The process of destroying tissue using heat conduction from a metal probe heated by electric current. The procedure is used to stop bleeding from small vessels or for cutting through soft tissue. |
| End-effector | The part of the laparoscopic instrument (generally found at the tip of the |