METHOD AND DEVICE FOR THE IMPLEMENTATION OF POLYMERIC MICROSTRUCTURES COMPOSITE AND NOT POLYMERIC MICROSTRUCTURES COMPOSITE AND NOT SO OBTAINED WITH MICRO AND NANO INTERNAL ARCHITECTURE CALLED

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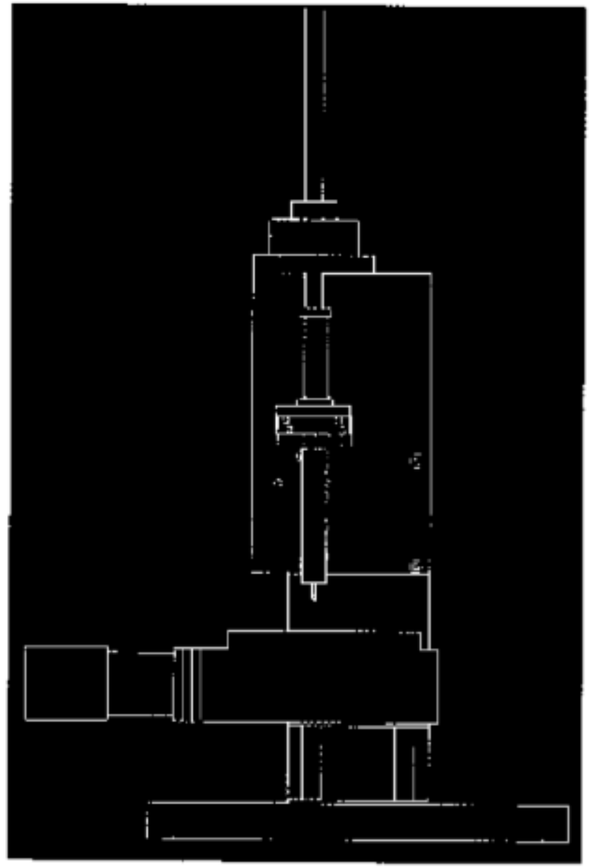
Invention

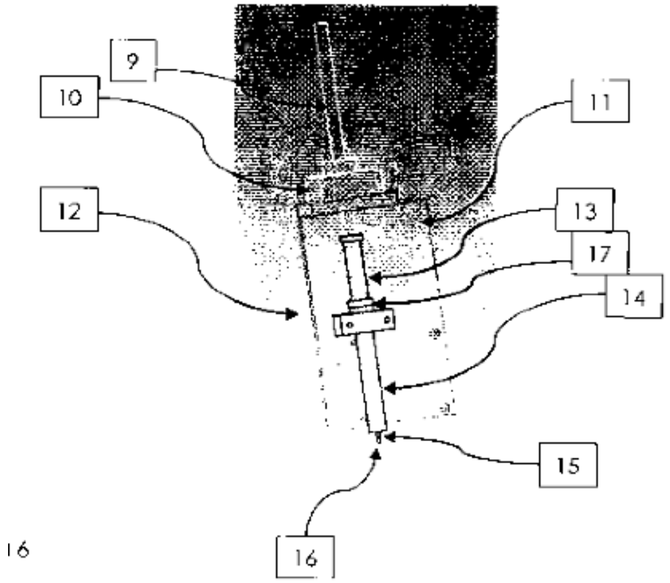
The patented invention relates to t**echniques for fabricating composite polymer microstructures and not** applicable to the field of **Textile Engineering**.

The patent claims the use of a method and related device for the fabrication of polymer microstructures with defined internal architecture, according to which a mixture, containing a polymeric material, liquid, gel-like or containing some particulate matter and/or cells is extruded under hydraulic pressure through a syringe terminating in a capillary conduit of size ranging from millimeter to micrometer. The relative position of the syringe, with respect to a substrate where deposition of the mixture occurs, can change so that the resulting microstructure exhibits a **shape determined with very high precision**.

The research aims to develop new techniques and devices for **biomaterial frameworks** to produce immunogenically tolerated biological substitutes that grow with the patient.

Drawings
& pictures





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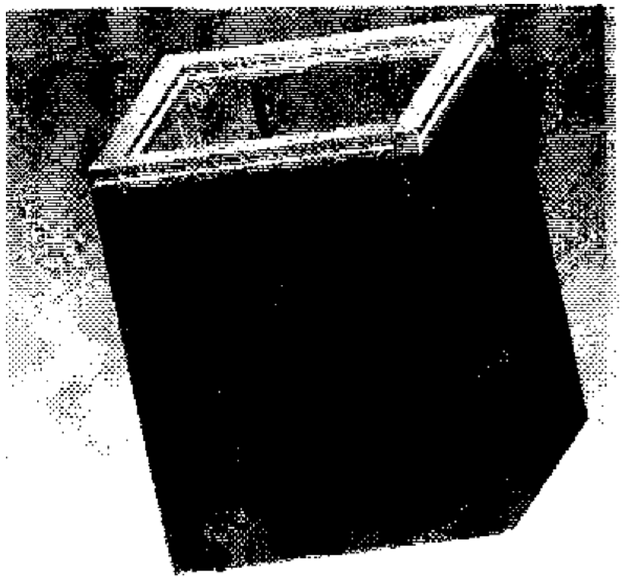

Industrial applications

The present invention finds advantageous implementation in the field of polymer microstructures for uses in **Tissue Engineering**.

The traditional approach is to produce a **tissue construct *in vitro* by inserting selected cells** taken from the patient or a matched donor, embedded in a three-dimensional framework of bioerodible polymers, into a bioreactor, where the cells proliferate and generate the extracellular matrix. Once the neo-tissue has generated itself, it is implanted in the appropriate anatomical location, where it acquires the appropriate functional architecture.

The structures, where the cells grow, must have certain characteristics necessary for the proper fulfillment of the various cellular functions:

a) be made of **biocompatible material**, to avoid the triggering of inflammatory reactions by the neo-tissue;

(b) preferably be **bioerodible**, so that a second intervention is not necessary once the neo-tissue has generated;

(c) possess adequate **mechanical properties to simulate the biological environment**, as closely as possible, and avoid the phenomenon called stress-shielding, which consists of inadequate mechanical stimulation of the neo-tissue due to too much rigidity of the structure that leads the neo-tissue toward atrophy;

(d) possess **defined microstructure and nanotopology** to appropriately guide cell growth, provide adequate surface area for adhesion and homogeneous nutrient flow.

Possible developments

Fabricated structures are designed from polymeric, biocompatible, bioerodible material, soluble in organic solvents and nonsoluble in aqueous solvents; particularly preferred for tissue engineering the following material resulted to be bioerodible polymeric scaffold, such as **polylactides, polycaprolactone , polyurethane and polyglycolides**, etc. The solvent preferably used is an organic solvent, preferably low boiling, particularly having a boiling temperature below 85 °C. Typical organic solvents are chloroform, dimethylacetamide and acetone. Generally, the solvent used instead for particulate removal is aqueous.

The research team has been working for years on the design and development of composite and non-composite polymeric microstructures, obtained with well-defined internal micro- and nano-architecture, and is studying similar and increasingly cutting-edge technologies, with the aim of increasing the technological maturity of its findings and adapting the microstructures to various needs.

The team is interested in collaborating with industrial partners and considering possible licensing or transfer of the invention for commercialization by interested companies.

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