

SENSORIZED HIGH-THROUGHPUT BIOREACTORS FOR IMPOSING HYDRODYNAMIC PRESSURE AND SHEAR STRESS ON CELL CULTURES



INVENTORS: Arti Devi Ahluwalia
Carmelo De Maria
Giovanni Vozzi
Daniele Mazzei

PATENT STATUS: GRANTED

PRIORITY NUMBER: PI2009A000033

PRIORITY DATE: 30/03/2009

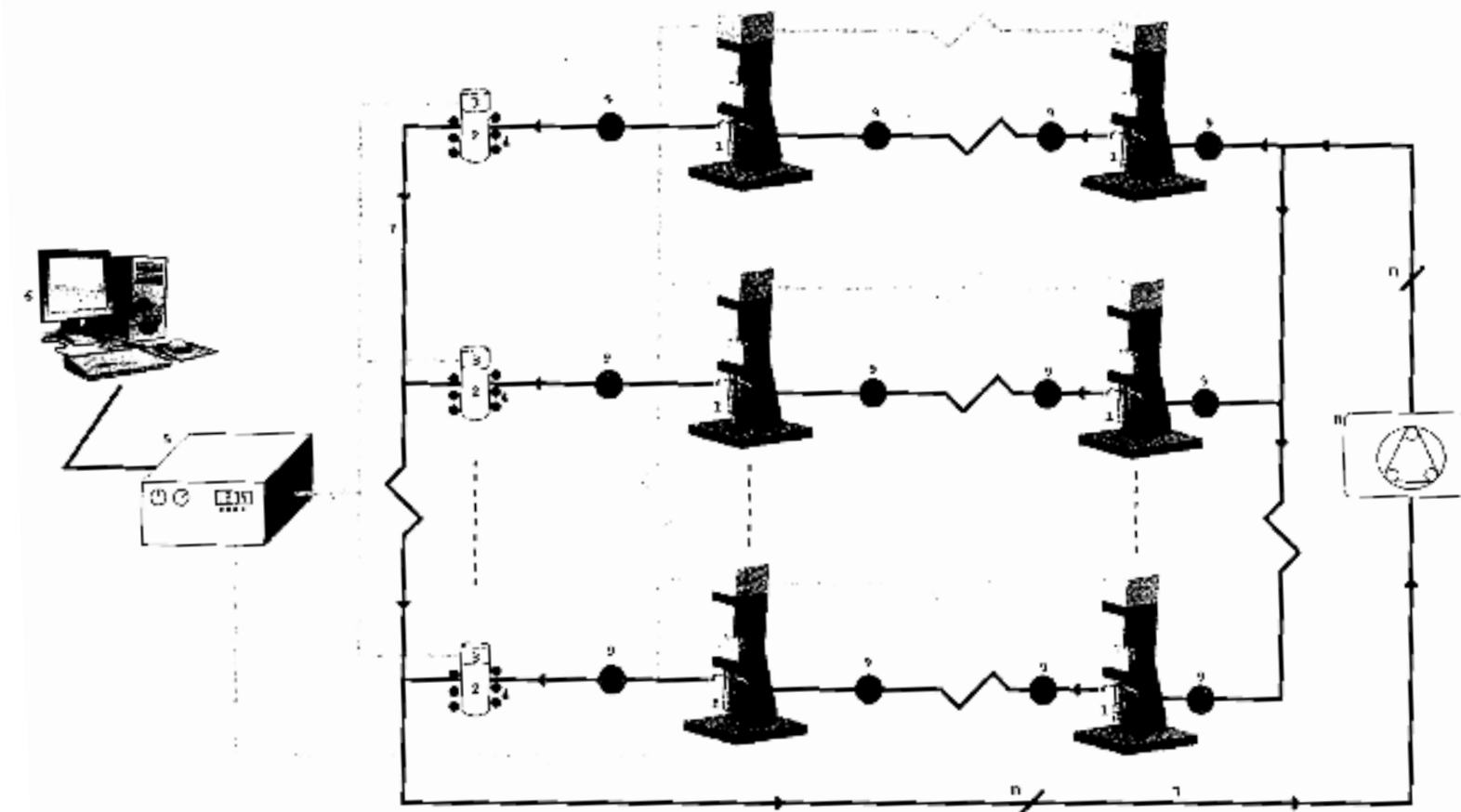
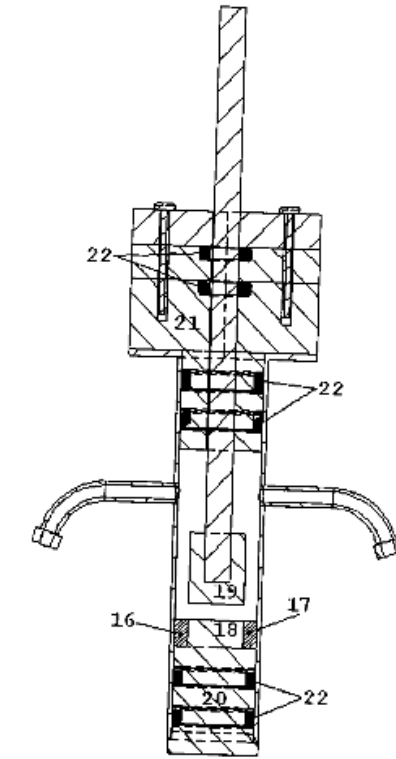
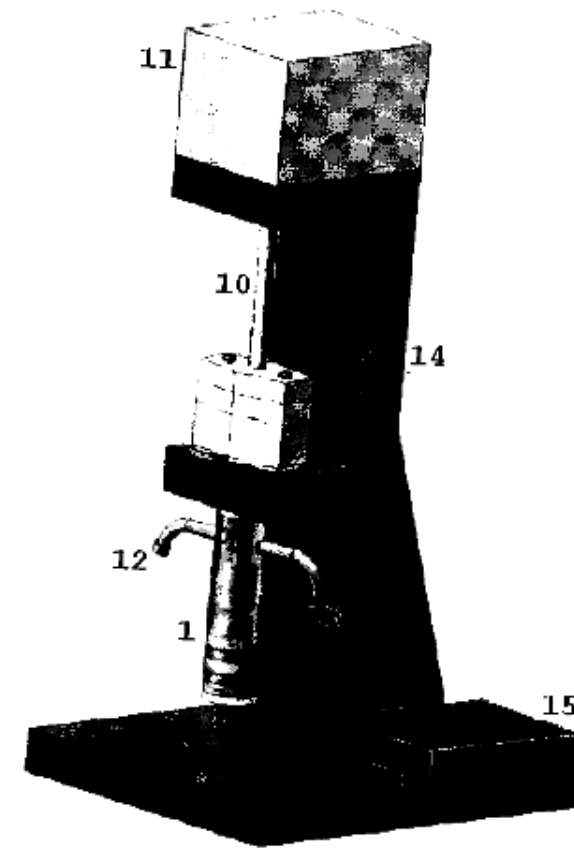
Invention



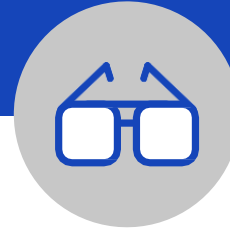
The invention relates to a **sensorized high throughput bioreactor**, that can be placed in series and/or parallel with similar systems, to expose cultures of the same or different cell groups to mechanical stimuli, such as **hydrodynamic pressure and shear stress**, simulating physiological and pathological conditions present within an organism.

The device can be used for the culture of cellular constructs and/or tissue explants, autonomous from an incubator (free-standing), with contained volumes of culture medium. The culture chambers are made of **biocompatible and easily sterilized material** and can be interconnected with each other, in series and/or parallel, through **a perfusion circuit**. Within these chambers, cellular constructs and/or explants may be subjected to different pathophysiological environments simulated by physical-chemical stimuli. Specifically, pressure and shear stresses are realized through the movement of a moving part within the culture medium in accordance with **hydrodynamic pressure generation mechanisms**.

Drawings
& pictures



Industrial applications



The invention finds application in the field of **Tissue Engineering**, with the aim of promoting cell proliferation and differentiation for the **development of functional biological constructs**.

The studies aim to develop systems using contained volumes of culture medium that can reproduce a physical stimulus of hydrodynamic pressure and shear stress in addition to other mechanical and/or chemical stimuli. Such systems will be suitably sensorized so as to study the **influence of such stimuli on normal cellular activities** and **in reproducing the metabolic processes of appropriate biological systems or organs**.

Possible developments



The invention consist of the **design and construction of the device** with biocompatible and easily sterilized material in the particular use for **simulation of physiological and pathological conditions in cellular constructs**. The use in "high-throughput" manner and sensorized configurations and the connection types, in series and/or in parallel through a perfusion circuit, were considered innovative.

Pressure is generated through the movement of a piston placed inside a culture chamber. Such a culture chamber has a **volume of a few millimeters**, and is **equipped by a perfusion and oxygenation system**.

Cell testing experiments have been conducted with positive results, showing that cells exposed to hydrodynamic pressure are more viable. The system has been extensively characterized with FEM simulations.

The research team is interested in collaborating with industrial partners, to increase the technological readiness level of the invention, and to consider licensing or transferring the patented invention for commercialization by interested companies.

For more information:



Tech Transfer Office of University of Pisa

Headquarters: Lungarno Pacinotti 43/44, Pisa (PI) 56126

Web site:: www.unipi.it/index.php/trasferimento

E-mail: valorizzazionericerca@unipi.it

For more information:



Ufficio Regionale di Trasferimento Tecnologico

Sede: Via Luigi Carlo Farini, 8 50121 Firenze (FI)

E-mail: urtt@regione.toscana.it

