The group FQM318 builds first resonant cavities for a particle accelerator to be used in medical applications

I. Martel

A team of Andalusian companies and universities led by Prof. Ismael Martel Bravo and Dr. José Sánchez Segovia have built the first prototypes of the resonant cavities to be used on a future proton linear accelerator for applications in the treatment of cancer.

The industrial R&D project is entitled "ICH15: Design of a proton accelerator with structure type CH/IH for production of radioactive isotopes and treatment of uveal tumours".

The project has been funded by the Centre for the Development of Industrial Technology (CDTI, Spain), a public body of the Spanish Ministry of Science and Innovation, whose chief objective is to help Spanish companies to increase their technological profile.

The main objective has been the design study of a room-temperature CW linear accelerator able to feed, simultaneously, a beam line dedicated to the industrial production of radioisotopes for cancer, and a proton therapy facility dedicated to direct tumour irradiation.

The linear accelerator operates at 200 MHz, reaching an energy of 70 MeV protons and 5 MeV/u light-ions (A/Q=3) and a maximum beam intensity of 5 mA.

The R&D activity has covered several technological challenges of the design and construction of this accelerator. An important achievement has been the system managing the large beam intensities differences needed for industrial radioisotope production (~mA) and proton therapy (~ pA).

The accelerator (a prototype is shown in the figure with the team of researchers) consists of four main sections:

1) RFQ injector

2) focusing solenoid

3) IH cavity

4) CH cavity

Although the prototype does not operate with real beam, it fulfils the design specifications.

The engineering and technology transfer developed during the three years of hard work has been a very important technological step for the Spanish industrial consortium, which is composed of the companies TTI NORTE (leader), ATI SISTEMAS, CELESTIA, FAYSOL and SEVEN SOLUTIONS.

The team of researchers and engineers with the prototypes of RF cavities at the Nuclear Technology Lab of the University of Huelva.

ELECTRIC POWER GENERATION SYSTEM

J. M. Andújar

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Inventors: J. M. Andújar, F. Segura

This invention consists of an electric power generation system, which produces electric power regulated directly from hydrogen by means of an electrochemical reaction, which is intrinsically more efficient than combustion and minimizes the adverse effects associated with the combustion process, excessive noise, polluting emissions and maintenance. The system can work continuously (24h/day for 365 days a year), that is, during the entire time that hydrogen is supplied, so unlike other sources of renewable energy, the production of electrical energy is independent of weather conditions.

The system comprises a series of modules, so that it can work with the number of modules it requires at any time, thus allowing for the generation of a regulated power in the range from 0 to "n * p", being "n" "the number of modules and" p "the power of each of them assumed all equal. If this were not so, it could be from 0 to (p1 + p2 + ... + pn).

The developed system also has two additional features that makes it particularly simple: it is air-cooled and it does not require high hydrogen supply pressure, since it can actually operate at ambient pressure (similar to 1 bar). For this purpose, the bipolar plates that delimit each cell of the stack will be made in an appropriate way, with mechanized channels whose geometrical configuration and diameter allows for this low pressure.

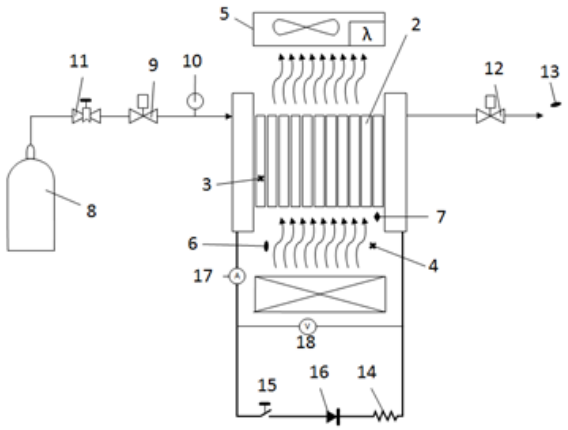

Figure 1. Single module

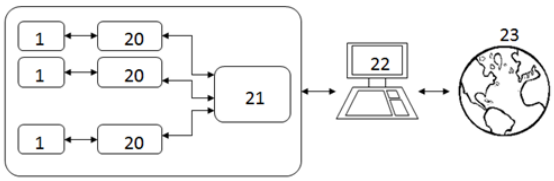

Figure 2. Control and monitoring subsystem

The electric power generation system has a series of modules (Figure 1) of PEM cell stacking, fed by a source of hydrogen, whose pressure should be regulated preferably at near ambient pressure. It also includes a control and monitoring subsystem for each stack, which can be activated and deactivated individually (Figure 2).

The control and monitoring subsystem can monitor the modules by receiving, for each one, the signal of an ammeter, a voltmeter of the stack and a subsystem of voltage detection per cell for each cell of the stack of the module. This reception can take place in a first level of the control and monitoring subsystem, by means of local controllers for each module, which are coordinated at a higher level by a single higher control unit. A cell management subsystem verifies from these signals that the cell does not run corrosion currents.

INHIBITOR SYSTEM OF HARDWARE ATTACKS ON A L2C BUS, SLAVE MODULE AND RED THAT INCLUDES IT

R. Jiménez-Naharro

Patent Number: ES2647941A1
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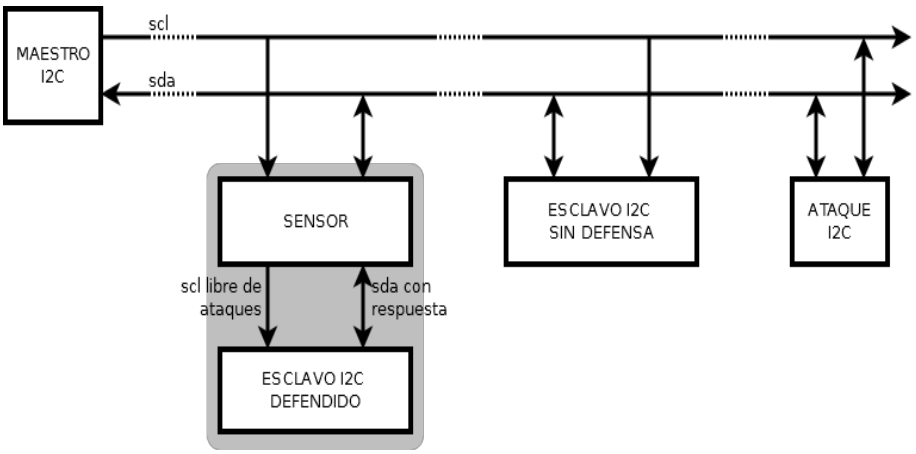
Inventors: R. Jiménez-Naharro, F. Gómez-Bravo, J. A. Gómez-Galán, M. Sánchez-Raya, J. Medina-García

This invention belongs to the field of industrial robotics. In particular, it relates to security against hardware attacks on communication between devices connected through the I2C protocol. The invention has two fundamental missions: (1) It must detect the presence of an attack in the communication process by monitoring the frequency of the synchronization signal (SCL) in real time; (2) In case an attack has been detected, the detection of a response is known by the system. Therefore, the invention presents a solution for attacks by faults in robotic environments.

The device consists of a sensor that monitors the frequency of the SCL synchronization signal and a slave element that implements the functionality on the I2C bus. The sensor design is completely hardware and digital, and therefore, it can be implemented in a specific application circuit (ASIC) or in a programmable device (such as FPGA or CPLD), allowing for its integration in the same substrate as the slave element that contains this form of a single block.

It can also be used externally to the slave element.

The sensor consists of four elements: (a) A detection system for the start of frequency monitoring. (b) An oscillator that generates the clock signal that controls the monitoring. (c) A period measurement element of the synchronization signal through the count of operation cycles of the internal clock generated in the oscillator element. (d) An element that generates the appropriate response according to whether an attack has existed or not.



Architecture of the attack process.