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The Scientific Instruments in the Museum of the Politecnico di Torino

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Abstract – The paper wants to illustrate scientific instruments in the collections of the Museum of Politecnico di Torino, distributed in various departments in respect of both historical consistency and didactic use.In particular the attention is focused on scientific instruments for electric and electrotechnicalmeasurements.

I INTRODUCTION

Every institution must take care the memory of his origins, especially in order to gain the awareness of his state and the reason for his future developments. Not only objects and collections, but also documents and historical apparatus are the framework of a system through which one can better understand today's reality.

The Politecnico di Torino owns, since his beginning, noteworthy collections of tools, machines and models used both for didactic activity and exhibited in museums open to public. The birth of Politecnico di Torino dates back to 1859, when the Government of the Regno di Sardegna promulgated the Law "On the Reorganization of Public Education", well known with the name of the author, Gabrio Casati.

The Legge Casati contains new rules, unchanged until the Riforma Gentile (1923),as well as ideological premises and pedagogic-educational choices of the new Italian state establishing three-year courses fortechnical studies. The law lays the foundations for the new Italian school structure, from higher education to elementary schools. Moreover the new system of Engineering studies was settled: it divides the school career of engineers into two stages, attributing to the universities a first theoretical or preparatory stage, and creating new schools for the second stage devoted to applied sciences.

The introduction of a technical specialization at university level was crucial for Piedmont, where until 1847 the teaching of Engineering was carried out at the University in the Mathematic courses. The course of the studies was divided into four years, focussed on analysis and sciences at the expense of applied sciences and materials such as construction and mechanics, with the exception of the hydraulic couse. As a matter of facts, due to the contribution of Francesco Domenico Michelotti,the "Plant for Hydraulic Experiences" of the Parella school already existed in 1765. In the first School Ordination, born with theoretical-practical aims, scientific visits and practical laboratory experienceswere foreseento complete oral lessons and theoretical courses.Similarly, in the Regio Museo Industriale, established two years after the Scuola di Applicazione, in the site ofvia dell'Ospedale (currentlyPiazzale Valdo Fusi), an employee of the Ministry of Agriculture, Industry and Commerce, promoted industrial studies through the permanent exhibition oftheinstruments of development and progress offered by industry in order to be a way of spreading the technical consciousness. At the Regio Museo Industriale, several exhibitions of raw materials, devices, objects, artifacts were set up.

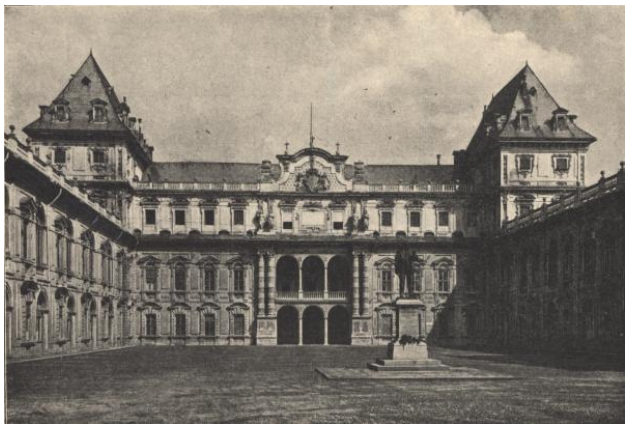


Fig. 1. The Castello del Valentino, site of the Scuola di applicazione per gli ingegneri.

In 1906, the Scuola di applicazione per gli ingegneri and the Regio Museo Industriale were unified in the Politecnico. They both had precious collections, some of which were used exclusively for didactics, others exhibited in museums open to public. After elaborating his regulation, in 1911 the Politecnico's Board of Directors started with the reordering, updating and resettlement of the collections. The collections of the

Regio Museo Industrialewere moved to Castello del Valentino, located in the central building of the castle and opened to public, as well as those of the Scuola di applicazione per gli ingegneri located in a wing of the castle. The Politecnico owned and managed the Museo di Geologia e Mineralogiaand the Museo Industriale. In addition to these museums, there were also rich collections of didactic artefacts, such as the collection of materials of the Gabinetto di Architettura Antica e Tecnica degli Stili, or the Curioni Collection of Modelli di costruzioni or the collections of the Modelli di Meccanica or of the Strumenti di Topografia. After some movements of the collections from the Castello del Valentino to via dell'Ospedale, in the night of 8th December1942, during a bombing of allied forces, the Museo Industriale was laid to the ground and only a few pieces of the collections survived, in particular those belonging to the Museo di Geologia e Mineralogia relocated to the Museo Industriale in 1936, occupying the spaces left free from the Scuola di Elettrotecnica moved to new headquarters. After the bombing, the surviving materialwas moved to the Castello del Valentino, waiting for the definitive transfer in 1958 in the new building of Politecnico in Corso Duca degli Abruzzi.



Fig. 2. The Laboratory ofFisica Sperimentale of the Museo Industriale.

At present the material of the collections is stored in different departments of Politecnico in respect of both historical consistency and didactic use. The Museo del Politecnico takes care of the valorization of the collections of historicalinterest andorganizesexhibitions and didacticactivitiestogether with otherinstitutionsin order to maintain the memory of itsorigins, especially in order to gain the awareness of his state and the reason for his future developments. In addition toartefacts and collections, documents and historical apparatus too are the framework of a system through which one can better understand today's reality.

II SCIENTIFICINSTRUMENTS COLLECTIONS

The attention is focused on the collections of scientific instruments for electric and electrotechnical measurements, stored in the Dipartimento di Scienza Applicata e Tecnologia (DISAT), with the description of the characteristics of the most representative ones for the history of science. DISAT was born in 2012, joining most of the chemical and physical expertise of Politecnico and consequently its historical collections.

The collection of electrical measuring instruments and equipment includes electrometers, galvanometers, ammeters, voltmeters, used for teaching and research from 1920 to 1960. The Perucca's wire tapping electrometer (1927), the static galvanometer for direct current of Nobili and the Ayrton- Mather. There are also three sets of scientific instruments for didactic purposes, one for induced currents experiences, one for experiences under vacuum, one for experiences with rarefied gas, kept at the Physics Department. The first collection includes educational tools, including Rühmkorff's spool, Righi's oscillator, Tesla's transformer, Pacinotti's ring, and Palmieri's circle. Pioneering equipment in the vacuum field forms the second collection. Some molecular pumps such as Gaede (1930) and other equipment, built between 1920 and 1930, were used for electrology experiments by Eligio Perucca. The third collection includes instruments for the study of discharges into rarefied gases, including Geissler tube, Röntgen tubes with regulator, Lecher tube, incandescent lamps (Edison effect) and Crookes radiometer.



Fig. 3. New Leiss electrometer (Modello Perucca 1926) thin wire (inventory n. 50)



Fig. 4. Pacinotti machine model (Pacinotti ring): device with which, superimposing a large number of pulsed f.e.m. that are suitably offset, a constant voltage is obtained.

Regarding the Chemistry collections, they contain instrumentations for chemical analysis and testing equipment from 1920 to 1940. Among the measurement instruments two collections of equipment, one for electrical measurements and the other one for physical measurements may be found, including instruments used for polarized light studies of 1960.

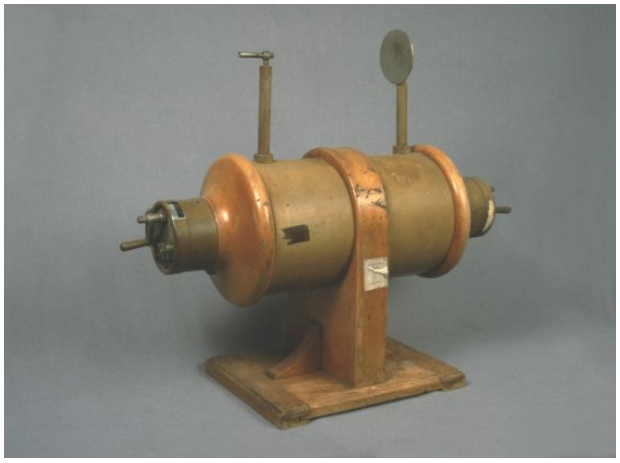


Fig. 5. Roof of Rühmkorff. It consists of a coil containing a cylindrical core of sweet iron wires on which are wound two isolated series of windings, with different sections, constituting the primary and secondary circuit.

III. ELIGIO PERUCCA

Eligio Perucca, born in Potenza in 1890 by Piedmontise parents, studied at the University of Pisa where he graduated brilliantly in 1910 at the age of twenty. After moving to Torino, since 1911 he was the assistant of prof. Naccari at the Institute of Physics at the University of Torino where he started his research activity while teaching in a high school in Torino. In 1922, Peruccatook the place of Quirino Majorana at the Chair of Experimental Physics at the Politecnico di Torino where he taught until 1960. Perucca's research covers several aspects, both theoretical and experimental, of optics, electromagnetism, thin film and metrology. In 1911 Perucca began his studies on the polarization of light and in 1913 built a twilight electricity analyzer, known as Bravais-Perucca Bilamina, still today not overtaken by precision. Perucca then applies to the study of the Volta effect, of which he was able to measure the value of many metals couples with metrological precision, even under experimental conditions. He was able to correlate the Volta effect with the Peltier effect, the photoelectric effect and the thermoelectric effect. In 1928 Perucca discovered that Fermi's theory of free electrons in metals provided an exhaustive explanation of the relationship between the constants of the photoelectric and thermal effects and the constants of the Volta and Peltier effects.



Fig. 6. Two Field Lippich Twilight Analyzer. A device used for the determination of straight-line polarized light when it crosses a certain thickness of optically active substances.

In 1928 Perucca discovered that Fermi's theory of free electrons in metals provided an exhaustive explanation of the relationship between the constants of the photoelectric and thermal effects and the constants of the Volta and Peltier effects.
In 1930 he discovered the photoelectric contact effect or of the barrier layer and the construction of a new type of electrometer, known as the Perucca electrometer, which brought together high sensitivity and low electrical capacity.Perucca is head of the Polytechnic Engineering Faculty of Turin in 1946-47 and from 1947 to 1955 is rector. Over the years, it has devoted itself to the reconstruction of the entire university complex, destroyed during World War II, with particular attention to the Institute of Physics, whose Laboratory had itself equipped In addition to being rector, Perucca was also president of the Accademia delle Scienze di Torino, vice-president of the Accademia Nazionale dei Lincei, representing Italy for the Pure and Applied Physics Union, in the National Research Council. He received the Gold Medal of Benemerito of the School, of Culture, of Art. He died in Rome on 5th January 1965.

IVCONCLUDING REMARKS

As written in the Strategic Plan, Politecnico focusses its strategies on a great commintment in social and economic field, in order to its campuses into central hubs of an international network of academic, industrial and institutional partners, with the aim of sharing results for an even more collaborative and cross circular research. Politecnico creates and dissemminates new scientific and high-tech content knowledge, trains architetcs and engineers to face the challenges of our constantly changing society with competence and social responsibility, not forgetting the past.

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Fig. 7. Nobili galvanometer