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Enrico Federico Jest: A Skilled Scientific Instrument Maker in Turin during the First Half of the 19th Century

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Abstract: Enrico Federico Jest was the progenitor of an important family of scientific instrument makers who remained active in Turin until 1900. His career as a "mécanicien" began in 1810. In 1814, he became the "machinist" of the Physics Cabinet at the university. He held this position until 1849. In 1852, he handed it over to his son Carlo. Handwritten documents reveal Enrico's intense mechanical activity. As well as cleaning the machines, Enrico had to repair them and build new ones, all while trying to keep costs within an annual budget. His most frequent task was to prepare and carry out the *public and private experimental physics experiments* once a week. Over the years, Enrico took on new roles outside the university. Some sources mention him in Turin as a machinist in Arsenal's Physics Cabinet and some technical schools. In the 1830s, Jest set up a business making scientific instruments for schools and private customers. Turin's workshop and warehouse were located in Via Po, near the "Palazzo della Università". In 1839, with the help of his son Carlo, Enrico was the first to introduce the daguerreotype in Piedmont. He probably first proposed the sale of photographic material in Italy in one of his commercial catalogues. Jest is also remembered for being the first to introduce the Armstrong hydro-electric machine in Italy, which was invented in England in 1840. A beautiful machine, signed "E. Jest in Torino 1844", is now in the "Giovanni Poleni" University Museum in Padua.

Keywords: Machinist, Scientific instruments, Turin, Enrico Federico Jest, Instrument maker

1. Introduction

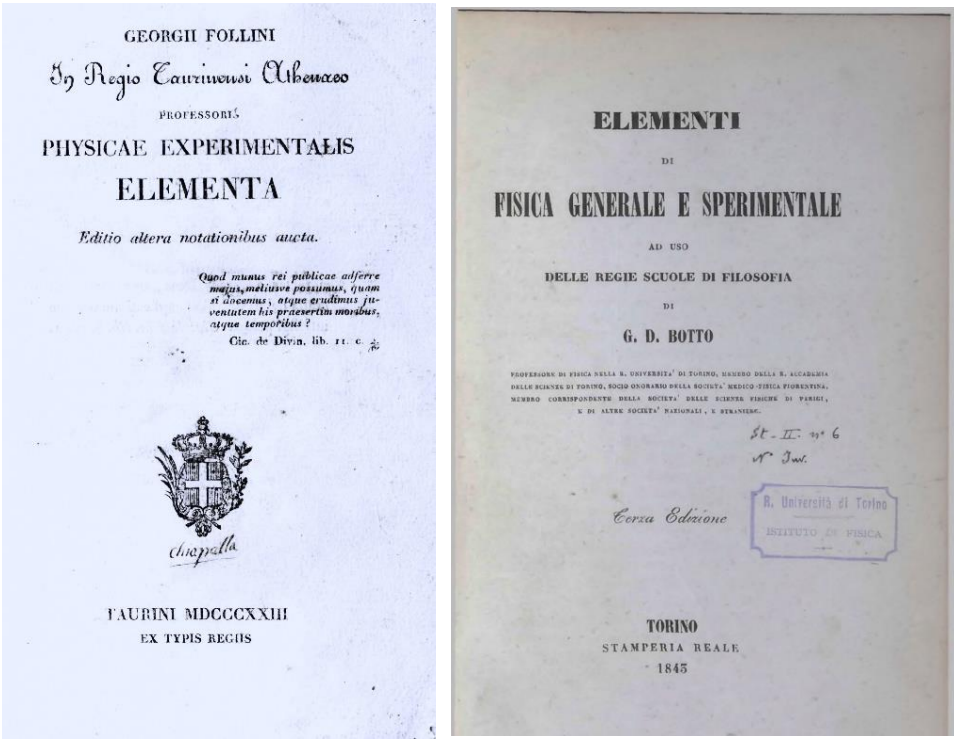
Among the scientific instrument makers who operated in Turin in the 19th century, a leading role in the development of the physical sciences was played by Enrico Federico Jest (1778 - c. 1860), the progenitor of a family of scientific instrument makers who remained active in Turin until 1900. Enrico Federico maintained his activity as a machinist and builder for the first half of the 19th century. We know that his son Carlo continued his business in the second half of the century until the ripe old age of 86. In addition to their institutional commitments, the Jests developed a thriving trading business in their artefacts. In ninety years of fervent and continuous scientific activity, they distinguished themselves in the field of scientific apparatus construction in Italy as one of the longest-lived and most qualified families. However, their little family-sized workshop could only export its products in the ancient Savoy territories, even though they had various gripping commercial apparatus. For this reason, nowadays, most instruments signed by the Jests are preserved in historical high schools and schools in Piedmont, Liguria, and Sardinia, particularly in Turin, Genoa and Cagliari.

2. Enrico Federico and the Physics Cabinet of the University of Turin

Enrico Federico was born on December 1, 1778, in Couvet, in the principality of Neuchâtel, a historically famous location for its thriving business of watchmakers and precision instrument makers. His father came from Blancheroche in Franche-Comté (Ceriana-Mayneri, Quarati & Spallone 1995, p. 3), and

Enrico Federico was the eldest son. According to some documents, in 1805, Enrico Federico was already in Turin and with his marriage to Ignazia Teresa Negro in 1811 (with whom he had eleven children), he acquired the title of "*mecànicien*". Little is known about his progeny, but their son Carlo Alessandro, born in 1813, was the only one, to our knowledge, who followed in his father's footsteps.

Similarly, Enrico Federico's first years of activity had no record; however, in 1814, he became a machinist of the Physics Cabinet at the University of Turin, located in *via Po*, where the Turin[1] University Rector's Office is located nowadays. During those years, the great and vigorous activity of Enrico Federico developed and grew under the supervision of the notable director of the Physics Cabinet, which, in 1814, was assigned to the priest Gorgio Follini (1756-1831), professor of experimental physics at the same atheneum. The latter was not well known among other physicists in Turin in the first half of the 19th century since he previously taught philosophy at the R. Collegio in Ivrea. Nevertheless, he was the Turin Academy of Sciences secretary from 1822 to 1826, succeeding Abbot Antonio Maria Vassalli Eandi (1761-1825) and dealt with electrical phenomena and possible applications of electricity in medicine.


GEORGII FOLLINI

In Regio Taurinensi Atheneo

PROFESSORIS

PHYSICAE EXPERIMENTALIS

ELEMENTA

Editio altera notationibus aucta.

Quod munus rei publicae adferre maius, melius possumus, quam si docemus, atque erudimus juventutem his praesertim moribus, atque temporibus?

Cic. de Divin. lib. II. c. 2.

TAURINI MDCCCXXIII

EX TYPIS REGIIS

ELEMENTI

DI

FISICA GENERALE E SPERIMENTALE

AD USO

DELLE REGIE SCUOLE DI FILOSOFIA

DI

G. D. BOTTO

Terza Edizione

TORINO

STAMPERIA REALE

1843

Fig. 1. Title pages of the treatises on physics by G. Follini (1823) and G. D. Botto (1843, third edition).

He wrote several papers and two treatises: *Teoria elettrica brevemente esposta ad uso della studiosa gioventù* (Ivrea, 1791) and *Physicae experimentalis elementa* (Torino, 1823, Fig. 1).

Under his leadership, the Physics Cabinet acquired numerous scientific instruments, some of which were built by Enrico Federico. In addition, Follini was responsible for public and private physics experiments performed during the academic year, and everything revolved around these laboratory activities.

On November 1, 1826, Follini retired and was succeeded by Giuseppe Domenico Botto (1791-1865),

[1] This information is reported in *Calendario Scolastico de Regi Stati* in which one can also read a brief description of the Physics Cabinet (Regia Università 1826, p. 63) and from the report given by Craveri (1753, p. 48) in his *Guida dé forestieri per la Real Città di Torino*.

a great physicist who was on probation as a lecturer of Experimental Physics. Unfortunately, he was immediately subjected to a disciplinary inquiry because he was compromised with the revolutionary uprisings in 1821. The inquiry was successfully concluded only in 1828,[2] and Botto received an official position to teach and direct the Physics Cabinet. Under his direction, Enrico Federico constructed several scientific apparatuses, the most important of which were a magnetoelectric motor and an Armstrong electric machine (see Chapter 8). Botto is also remembered for devising a new system of electric telegraphy (1849) and for his experimental studies, including theoretical interpretations, on the magnetic, thermal and chemical effects of electric currents and their induction by natural and artificial magnetism. He also published a treatise on Physics (Fig. 1), which was a considerable publishing success with at least four editions (Torino, Stamperia Reale 1830; reprints, 1836, 1843, 1850).

3. The economic salaries of the University Physics Cabinet staff

The discovery, in the Historical Archives of the University of Turin, of the payment warrants[3] (ASUT 1798-1839) for the university staff for the period 1816-1839 allowed us to compare the annual salaries of lecturers and directors Follini and Botto and the one of machinist Jest. The graph in Fig. 2 shows the salary as a function of the year of pay. Two periods related to the two directorships of Follini and Botto, respectively, can be distinguished from the data shown.

Let us analyse the first period from 1816 to 1826. Except for the first year (1816, Lire 450) Jest's salary remained stable at 600 lire for all the years of Follini's directorship. The salary of the latter, initially of 1800 lire, increases at least three times in the years 1817-1820, 1821-1824 and 1825-1826, respectively, reaching 2500 lire in the last two years, i.e. about four times Jest's salary. Probably due to retirement, Follini's salary dropped to 2300 lire after 1826.

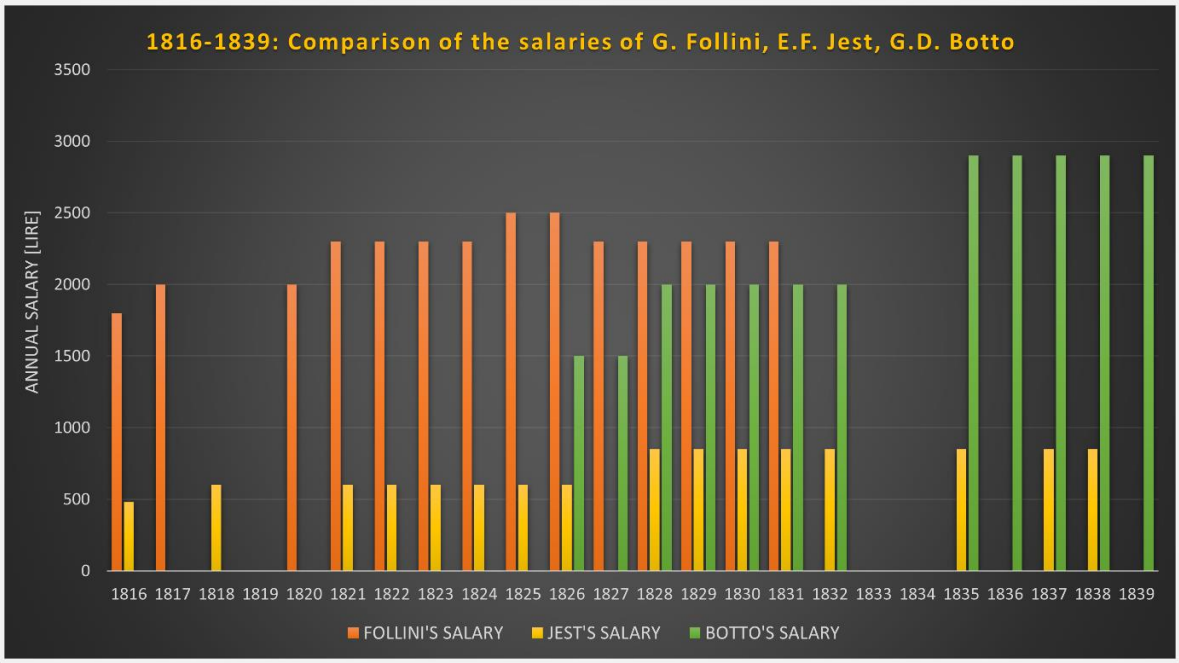


Fig. 2. Comparison of the salaries of G. Follini, E. F. Jest and G. D. Botto for 1816-1839. Information retrieved from "payment warrants" in the University of Turin Historical Archives.

[2] The sequence of events is detailed in L. Briatore (1985, pp. 131-133).

[3] A reading of the warrants shows that the salaries of Turin University employees, particularly those of the Physics Cabinet, were paid in four instalments, one per quarter.

As for the second period, from 1826 to 1839, we do not have Jest's salary for 1827, but presumably, it remained stable. In 1828, with the new director's duties, Jest received an increase of 62.50 lire per quarter and his salary thus rose from 600 to 850 lire per year, maintaining at that rate for the next ten years as well. We recall that Mr. Botto succeeded Follini as a lecturer on probation in Experimental Physics in 1826 and 1827. Probably due to this condition, his salary in these two years was reduced compared to his predecessor and equal to 1500 lire.

In 1828, Botto received an official position as director of the Physics Cabinet, and his salary increased to 2,000 lire, remaining the same until 1832. During 1828-1832, Botto's salary stayed slightly more than double that of Jest. Finally, Botto received a decisive economic increase in 1835-1839 with the addition of 900 lire of fixed payments, probably related to the fact that he became a member of the Turin Academy of Sciences in 1835. In this period, the analysed data provide us with the most significant gap between the machinist and the director of the Physics Cabinet salaries; to sum up, the latter's results more than three times higher than the machinist's.

4. The duties of the machinist

The analysed manuscripts show that Enrico Federico, as a machinist in the Physics Cabinet of the University, had an obligation to perform several duties to be performed during his working hours under the watchful supervision of the director. The first fulfilment concerned cleaning and maintaining the entire machine park efficiently and actively. This duty was preparatory to his second one, which was the preparation and execution of public and private physics experiments. These experiments took place once a week in a room close to the Physics Cabinet in the "palace of the Royal University". They were attended by the Philosophy Course students and by "many amateurs of physical cognition".

Another notable assignment that the machinist had to perform concerned the requests of the director to repair or modify pre-existing apparatus and to meet the necessity of new machines. These tasks benefitted public and private experiments, presenting innovations that gradually appeared on the scientific market while physical studies progressed. It is interesting to point out that the machinist was obliged to perform work annually with an estimated value of 250 lire for these activities. This amount was counted by the director based on the actual work performed.

The machinist's responsibility was to collect so-called "provisions", i.e., the materials needed to carry out the required work and the costs incurred were fully reimbursed and thus excluded from the tally of labour rendered. For example, among these provisions were foxtails or sheepskin, both used for electrostatics experiments, Batavia's tears, tin foil for electric batteries, silk, silver thread, crystal vases, camphor and shellac.

The following paragraph gives more insights on how the latter were handled. When the director of the Cabinet needed some of them to construct new machines necessary for the execution of weekly experiments, Enrico Federico prepared a list of materials with the expenses incurred; this document was then given to the director, who undersigned the expenses and forwarded it to the University bursar, who would proceed to reimburse the amount.

Finally, it should be noted that in addition to his activities at the Physics Cabinet, Enrico Federico often collaborated with other university institutes; in particular, he worked for the Parella hydraulic plant directed by Giorgio Bidone (1781-1839) and the chemistry-pharmaceutical laboratory directed by Vittorio Michelotti (1774-1842). The papers studied also reveal that he accumulated other assignments outside the University; some sources mention him as a machinist in the Physics Cabinet at the Arsenal and at some technical schools in Turin.

5. The purchases of the university's physics cabinet

The directorships of Follini and Botto produced a considerable increase in the number of scientific instruments as public and private physics experiments needed a conspicuous variety of apparatus to carry out exhaustive education. Several scientific instruments were therefore purchased, and the costs involved were not negligible. In this regard, data collected from the Historical Archives of the University of Turin allowed us to analyse the purchase of the Physics Cabinet from 1815 to 1839.

The data shown in the graph (Fig. 3), shows that the period with the most lavish expenditure at the Cabinet was between 1827 and 1829, with a peak corresponding to 1828. This is probably attributable to the fact that in 1828, Botto officially started teaching and directing the Physics Cabinet, which, according to his intentions, needed a significant improvement. Clear evidence of this hypothesis is a note-spend of 600 lire, dated August 7th, 1829, for a trip to Paris where he should choose some physics machines to be installed at the Physics Cabinet the following year.

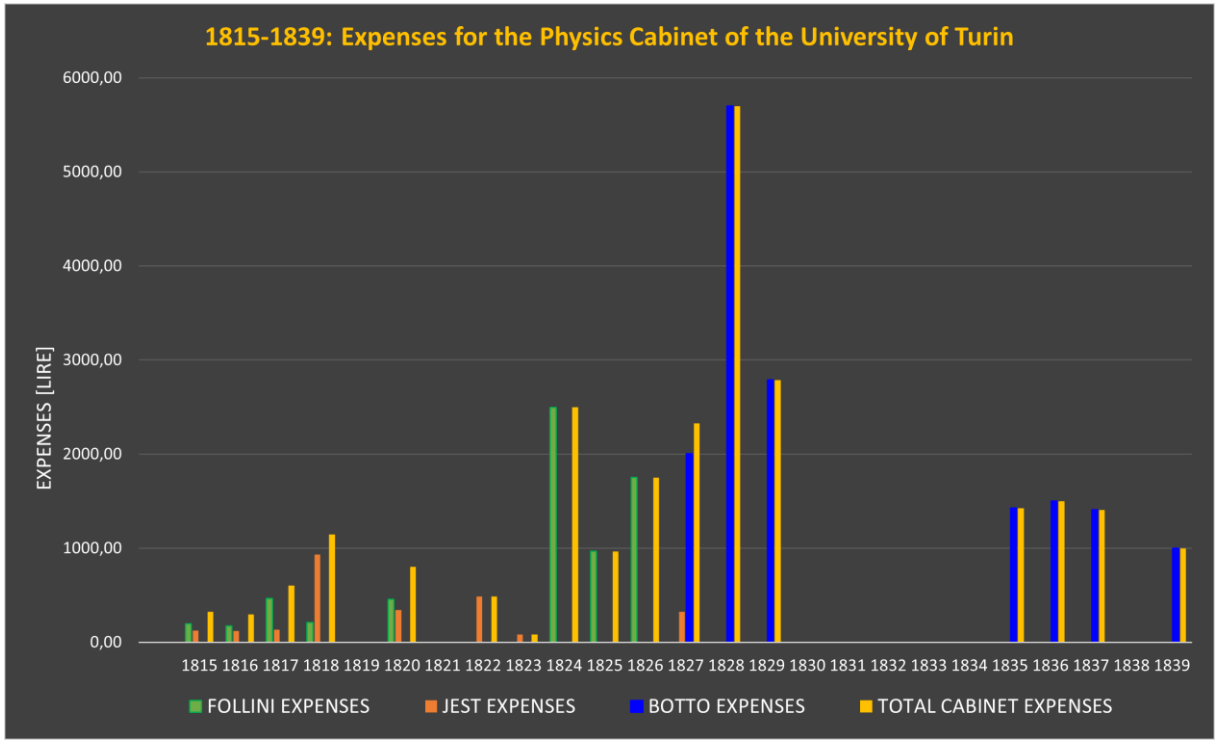


Fig. 3. Expenditures made for the Physics Cabinet in the period 1816-1839. Information retrieved from "payment warrants" in the University of Turin Historical Archives.

6. Turin's Public Exhibitions of 1829 and 1832

Between 1829 and 1858, the Public Exhibitions of the Products of Industry of the Royal States were held in Turin. These exhibitions, strongly desired in 1827 by the King of Sardinia Charles Felix of Savoy, were intended to promote the increase of Arts and Industry in the kingdom's territories and were initially planned to be held every three years (Archivio 2003; Bassignana 2006; Panei 2004). In particular, six exhibitions (1829-1832-1838-1844-1850-1858) were held in Turin for over thirty years. Enrico Federico participated in the Exposition of 1829 and 1832 with four and two scientific instruments, respectively (he did not join in 1838 and 1844).

During his first attendance in 1829, he presented a barometer, a thermometer, a hygrometer by Saussure, and an Atwood machine to verify the mechanical laws of falling bodies. He was awarded a medal by the Royal Chamber of Agriculture and Commerce "for the beautiful precision of the execution

of his instruments, and particularly for that of Atwood's machine"[4] (Regia Camera 1829, p. 33).

During his second attendance, in 1832, Enrico Federico exhibited two scientific apparatuses for the Turin Arsenal, which had commissioned them from him, namely a "machine by which the explosion force of the elastic fluid of war powder, reduced to the temperature of atmospheric air, is determined" and a "Pitot tube that serves to measure water currents"[5] (Esposizione pubblica 1832, p. 34).

7. The workshop for the trade of scientific instruments

In addition to his institutional activity at the Physics Cabinet, Enrico Federico managed his workshop, which consisted of a laboratory and warehouse where, on request, he built scientific instruments for the benefit of private clients and educational institutions. We have yet to determine precisely when he began this activity, but since the first commercial catalogue dates from 1836, it is reasonable to assume that he started around 1830. Moreover, we know that until 1860, his workshop was in Via Po 46, while it is reported that, in 1861, the workshop was in Via Po 13, which is next to the University's Rector's Building, where the Physics Cabinet was located.

Furthermore, in 1836, Enrico Federico published his first 64-page trade catalogue in French (see Fig. 4), showing no less than 908 scientific apparatuses and furnishings divided into the following areas of physics study: mechanics, hydrostatics, pneumatics, compression, hydrodynamics, meteorology, heat, hydrogen fires, Charles aerostats, acoustics, electricity, magnetism, electromagnetism, electrochemistry, optics, various mineralogical instruments, mathematics, spheres or globes.

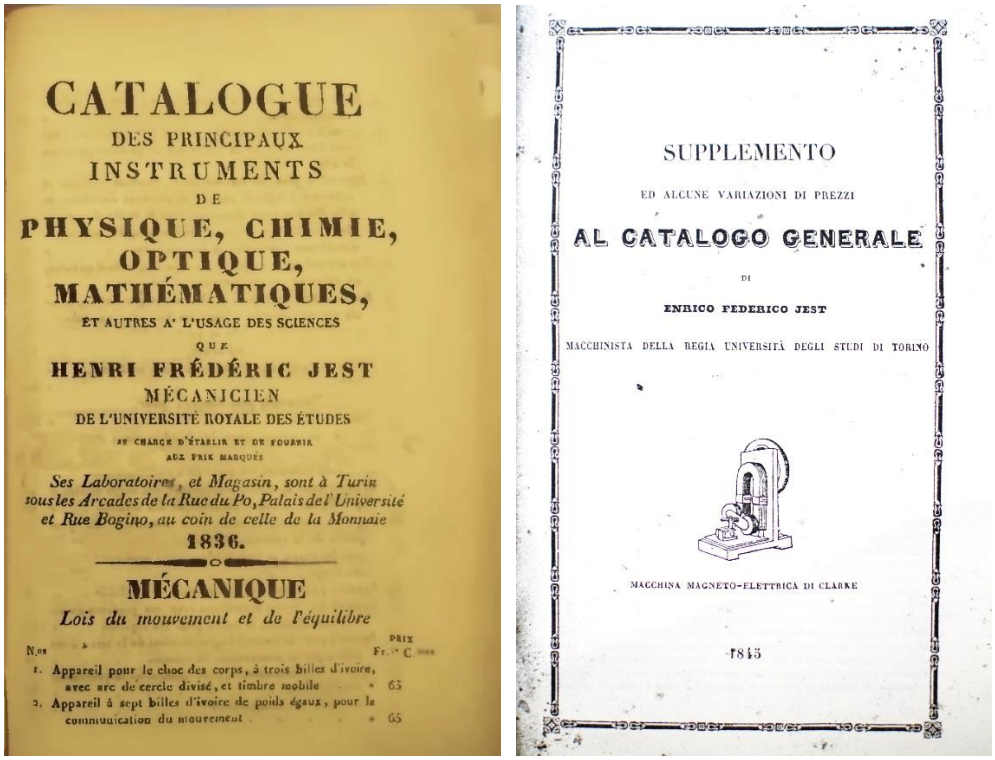

CATALOGUE
DES PRINCIPAUX
INSTRUMENTS
DE
PHYSIQUE, CHIMIE,
OPTIQUE,
MATHÉMATIQUES,
ET AUTRES A' L'USAGE DES SCIENCES
QUE
HENRI FRÉDÉRIC JEST
MÉCANICIEN
DE L'UNIVERSITÉ ROYALE DES ÉTUDES
Ses Laboratoires, et Magasin, sont à Turin
sous les Arcades de la Rue du Po, Palais de l'Université
et Rue Bogino, au coin de celle de la Monnaie
1836.
MÉCANIQUE
Lois du mouvement et de l'équilibre
1. Appareil pour le choc des corps, à trois billes d'ivoire, avec arc de cercle divisé, et timbre mobile
2. Appareil à sept billes d'ivoire de poids égaux, pour la communication du mouvement
SUPPLEMENTO
ED ALCUNE VARIAZIONI DI PREZZI
AL CATALOGO GENERALE
DI
ENRICO FEDERICO JEST
MACCHINISTA DELLA REGIA UNIVERSITÀ DEGLI STUDI DI TORINO
MACCHINA MAGNETO-ELETTRICA DI CLARKE
1845

Fig. 4 The two trade catalogues of scientific apparatus from 1836 and 1845, published by E. F. Jest.

[4] "per la bella precisione dell'esecuzione de' suoi strumenti, e particolarmente per quella della macchina di Atwood" (Regia Camera 1829, p. 33).

[5] "macchina colla quale si determina la forza di esplosione del fluido elastico della polvere da guerra, ridotto alla temperatura dell'aria atmosferica" e un "Tubo di Pitot che serve alla misura delle correnti d'acqua" (Esposizione pubblica 1832, p. 34).

In 1845, Enrico Federico published in Italian the *Supplemento ed alcune variazioni di prezzi al catalogo generale* (Fig. 4), in which there was a description of no less than 243 apparatuses divided into different instrumental types: daguerreotypes and related accessories, chemicals for photography; constant current batteries; machine for the effects of voltaic current; electrometallurgy and related printed works; electromagnetism; miscellany. This catalogue must be considered chronologically one of the firsts published in Italy with a proposal for the trade of apparatus and accessories for photography. So far, the only catalogues known are the ones from 1836 and 1845. However, the title of the 1845 catalogue suggests the presence of a previous one yet undiscovered, the "general catalogue".

8. The scientific instruments

Among the numerous apparatuses built by Enrico Federico, a magnetoelectric motor and a peculiar steam electric machine deserve special attention. Botto designed the engine, which is one of the first models of direct-current electrical motors. Botto presented a prototype in August 1834 in a communication entitled *Notizie sopra l'applicazione dell'elettro-magnetismo alla meccanica*.
A paragraph of this paper states: "The apparatuses discussed in this announcement were constructed by Mr. Jest, a machinist of the R. University of Turin, who with the same precision and success build every other kind of physical instrument"[6] (Botto 1834, p. 6). In 1836, Enrico Federico built the final version of the motor as Botto requested (Botto 1836).

Fig. 5. Armstrong's machine (built by E. F. Jest) preserved in the "Giovanni Poleni" Museum, University of Padua, and the title page of the related publication.

In the 1836 catalogue, this engine was sold for 500 francs. Jest also proposed a smaller and cheaper model, costing 250 francs. In 1844, Enrico Federico built an apparatus known as Armstrong's Hydro-Electric Machine (Fig. 5), the most powerful electrostatic generator devised in the first half of the 19th

[6] "Gli apparecchi in questo annunzio menzionati furono costrutti dal sig. Jest macchinista della R. Università di Torino, il quale con pari successo ed esattezza eseguisce ogni altro genere di strumenti fisici" (Botto 1834, p. 6).

century. It was first designed in England by engineer George Armstrong (1810-1900) in 1840, and Enrico Federico pioneered introducing and marketing it in Italy. This generator could be ordered in different sizes; the price ranged from 300 to 2,000 francs, and 12 to 15 cm sparks could be obtained with a medium-sized machine.

Fig. 6. Armstrong's machine signature preserved at the "Giovanni Poleni" Museum, University of Padua.

The chronicles of the eighth meeting of Italian scientists, held in Genoa in 1846, inform us that on September 26, Enrico Federico performed some electrostatic experiments using his Armstrong machine. A model of the latter signed *Macchina Idro-elettrica E. Jest in Torino 1844* (Fig. 6), is currently preserved at the "Giovanni Poleni" Museum in Padua. It is a rare piece of the Physics Cabinet of the University of Padua; as Zantedeschi wrote between 1845 and 1848, Antonio Perego, a physics professor of the time, purchased it.

9. Daguerreotype and electroplating

In October 1839, Enrico Federico, with the help of his son Carlo Alessandro and his student and collaborator Antonio Rasetti, was the first in Piedmont and one of the first in Italy to introduce the photographic technique recently devised by the French chemist Louis-Jacques-Mandé Daguerre (1787-1851). On October 8 of that year, Enrico Federico, with the help of his son, took his first photographic shot in Turin. It was a view that portrayed the Church of the Gran Madre di Dio taken from Piazza Vittorio. Three days later, he repeated the experiment in Piazza Vittorio, at the home of Felice Romani, poet and man of letters, taking a photograph of Piazza Castello.

Finally, in 1842, Enrico Federico attempted to photograph the Shroud of Turin. However, he failed because of the reduced brightness of the day, the dust raising from the ground and the short duration of the exposure.

In the last months of 1839, Enrico Federico, once again with Carlo's help, started his first experiments in electroplating. His only knowledge was the information Abbot Giuseppe Baruffi gave, returning from one of his usual trips. After his stay in St. Petersburg, Baruffi, professor of Positive Philosophy at the University of Turin (in September and October 1839), wrote some notes concerning

the production of some copper low-reliefs obtained using a new electrochemical process performed at the laboratory of Moritz Hermann Jacobi (1801-1874), the father of this procedure.

In the Piedmont Gazette of October 25, 1839, Baruffi wrote about his experience in St. Petersburg: "the physicist of great experience showed me a stupendous copper relief which he had realised using the electric current: a new result worthy of serious attention".[7] Moreover, in the Gazette of November 19, 1839, he added: "I will tell you of certain beautiful low reliefs in copper, obtained by the celebrated Jacobi without melting the metal itself and only by the action of Electricity".[8]

In August 1840, publishing an advertisement in the Piedmont Gazette, Enrico Federico presented at his atelier the two new techniques with respective apparatuses: the daguerreotype and the galvanotype. The two new techniques were also advertised in the Gazzetta Piemontese of August 24, 1842:

> JEST Mécanicien de l'Université, rue du Po, n. 46, Fabrique constamment des daguerréotypes pour vues et portraits, de tous modèles et grandeurs, depuis 100 à 300 francs, et fournit toutes les pièces et objets détachés; enfin, tout ce qui concerne la photographie. - Les plaques, grandeur ordinaire, 6 fr. chaque. - Le portrait au Daguerréotype, d'après nature, pour 6 à 8 fr. - Galvanotypes, 25 fr. - Médaille représentant LL. AA. RR. Victor - Emmanuel et Marie - Adélaide (éditeurs Jest et Rasetti), se vend au profit de l'asile des pauvres: en cuivre 4 francs; en argent 15 francs. Cette Médaille se trouve à Turin chez le susdit; et près tous les bureaux de poste aux lettres de l'état se reoivent les demandes, et se transmettent gratis de port (Ceriana-Mayneri, Quarati & Spallone 1995, p. 12).

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[7] Gazzetta Piemontese 25 ottobre 1839: "il dotto fisico valentissimo mi fece vedere uno stupendo rilievo in rame da lui ottenuto or ora con la corrente elettrica: fatto nuovissimo e degno di seria attenzione".

[8] Gazzetta Piemontese 19 novembre 1839: *"*io vi parlerò adunque di certi bellissimi bassi rilievi in rame, ottenuti dal celebre Jacobi senza fusione del metallo stesso e solo mediante l'azione dell'Elettricità*"*.

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