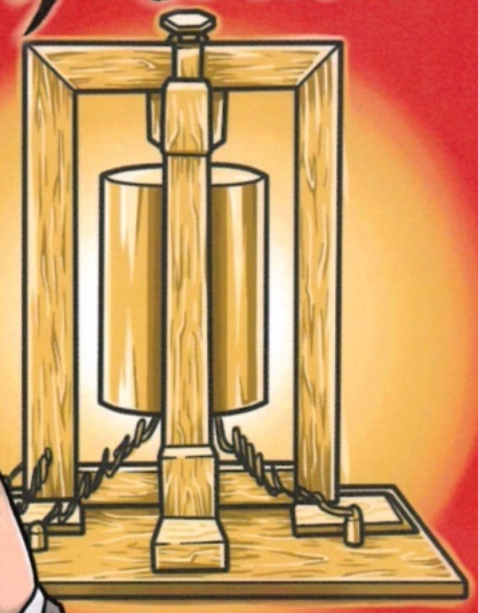
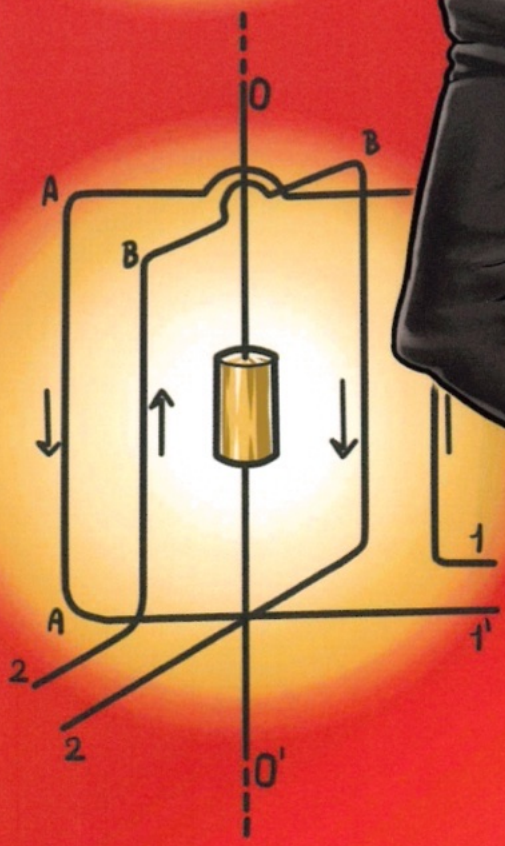
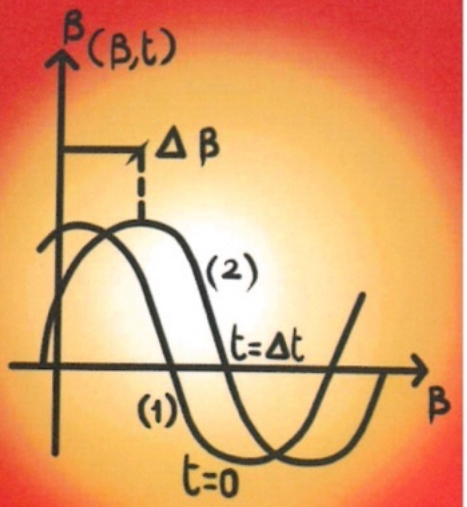
Galileo Ferraris

the revolutionary scientist







$$(1) \rightarrow \frac{3}{2} B_M \cos(\beta)$$

$$(2) \rightarrow \frac{3}{2} B_M \cos(\beta - \omega \Delta t)$$

Carla Pugliaro Denis Limotto

Galileo Ferraris
The rivolutionary scientist

Translation from italian
by Professor Maurizio Repetto
(Politecnico di Torino)

Edizioni Effedì

MUNICIPALITY
OF LIVORNO FERRARIS

THANK YOU FOR YOUR SUPPORT:

FONDAZIONE
Cassa di Risparmio
di Vercelli

Politecnico
di Torino

ENERGY DEPARTMENT
POLITECNICO DI TORINO

The rights of translation, electronic storage, reproduction and total or partial adaptation by any means (including microfilm and photostatic copies) are reserved for all countries.

Copyright © 2022
Effedi Produzioni SRL
Vercelli, via Feliciano di Gattinara 1

ISBN 979-12-81182-04-2

Cover by Denis Limotto.

The bond of those living in Livorno Ferraris with Galileo Ferraris is strong and a source of deep pride. Over the years, all the different municipal administrations and the entire community have worked hard to keep his memory alive (in 1925, Livorno Piemonte became Livorno Ferraris) and to disseminate and enhance his life, studies, and inventions, by setting up the "Museo f.lli Ferraris" in 1931, a museum dedicated to the two Ferraris brothers, organising various initiatives, such as the recent successful Galileo Day events, and promoting several publications. Among the biographies of this famous scientist, such as, those by Luigi Firpo in the book "Gente di Piemonte" (People from Piedmont), and Giovanni Zannini "Galileo Ferraris. Una grande mente, un grande cuore. Quello che le biografie non dicono" (Galileo Ferraris. A great mind, a great heart. What the biographies don't say), is the work of our fellow citizen Gian Franco Giuliano, "Galileo Ferraris. L'uomo, lo scienziato" (Galileo Ferraris. The man, the scientist), taken from the book "Uomini di Scienza e di Cultura" (Men of Science and Culture), recently reprinted with the sponsorship of the Municipality of Livorno Ferraris.

These contributions are now enriched by the remarkable and original work of Denis Limotto, a young artist from Livorno Ferraris, who, with firm yet sophisticated linearity and sobriety, depicts the significant phases of the life and works of Galileo Ferraris (even the geometrically shaped comic bubbles recall the scientist's mathematical mind), together with the texts by Carla Pugliaro, life and soul of the Association "Amici del Museo Ferraris" (Ferraris Museum's friends). Comics, which started out as pure entertainment, are now part of that group of communication tools to which traditional media, such as radio, television, the Internet, newspapers, and books, belong. Comics have become an integral part of popular culture; indeed, they have gained an increasingly important role within the community of readers, both children and adults.

I therefore wish you all a pleasant reading.

Mara Bianchetti

Culture Councillor
for the Municipality
of Livorno Ferraris

Galileo Ferraris is one of the key persons that promoted the birth of our Politecnico di Torino. He developed his academic carrier at Museo Industriale di Torino, which evolved up to what is today known as Politecnico di Torino. In fact, after his master degree in civil engineering, he became "assistant" and after full professor in "Fisica Tecnica" (Technical Physics). Thanks to the evolutions of his studies in electro-magnetism, in 1888-89 he founded the School of Electrotecnics opening the wide research trajectories of this scientific field.

Pure genius, he plays his scientific role though a modern approach: its famous prototype of "rotating magnetic field" is a clear example of his inclination towards technological transfer, his studies to supply "energy in each single house" underlines his will to translate his research in terms of positive impact on the society, his commitment as public administrator in the municipality of Torino and of Livorno Piemonte (today Livorno Ferraris) highlights his devotion to serve his community.

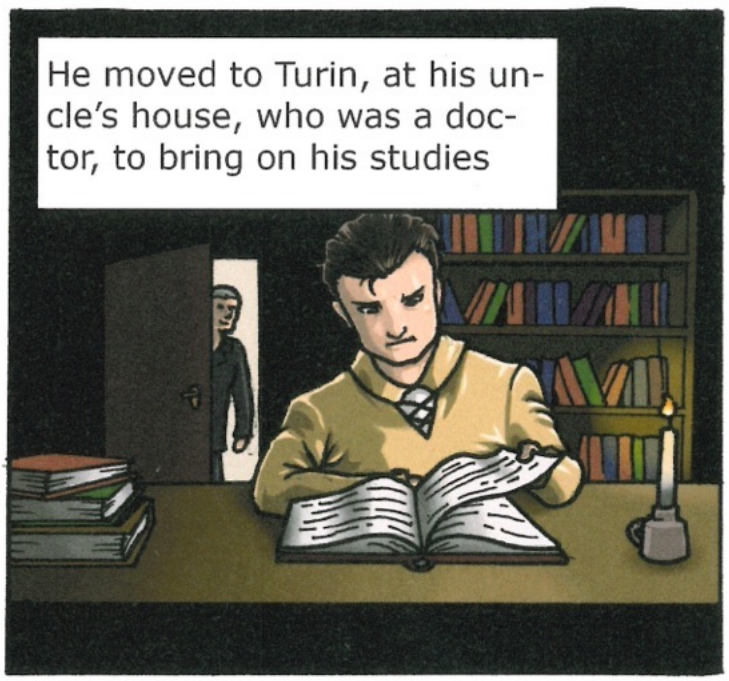
The story telling of this comic is able to show a clear picture about the most significant moments in Galileo Ferarris life: a life spent on studying and developing "technological innovation for the society" embodying the pure spirit of our Politecnico di Torino.

Prof. Guido Saracco

Rector of Politecnico di Torino

Galileo Ferraris was born in Livorno Piemonte on October 30th, 1847

Son of a chemist, Luigi Ferraris, and of Antonia Messi; grows in a large family with three brothers and as many sisters.



The purpose of the Congress was to find electrical measurements units valid for all the nations represented.

Ohm → Resistance

Ampere → Corrent Unit

Volt → Driving force

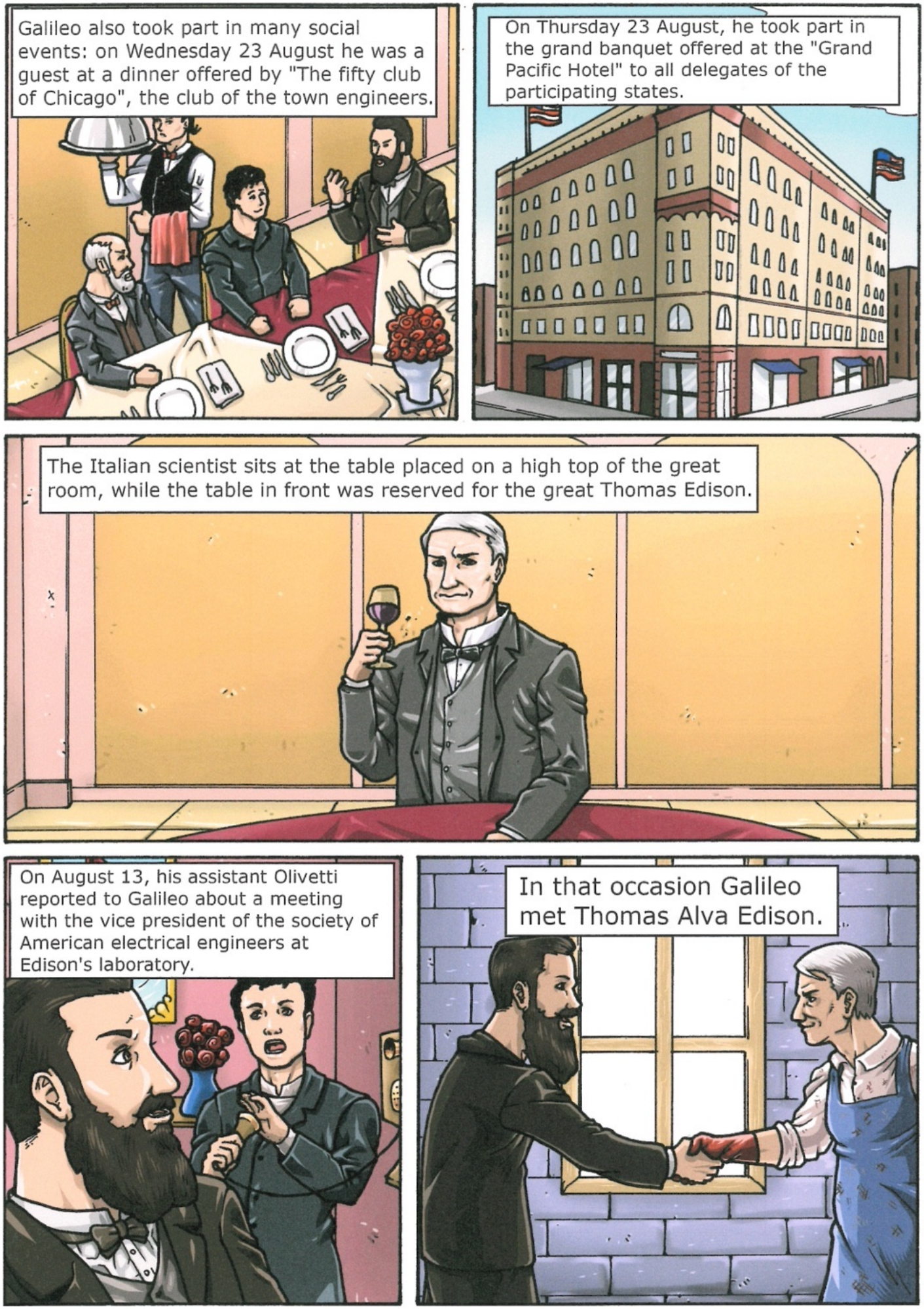
Coulomb → Electrical Quantity

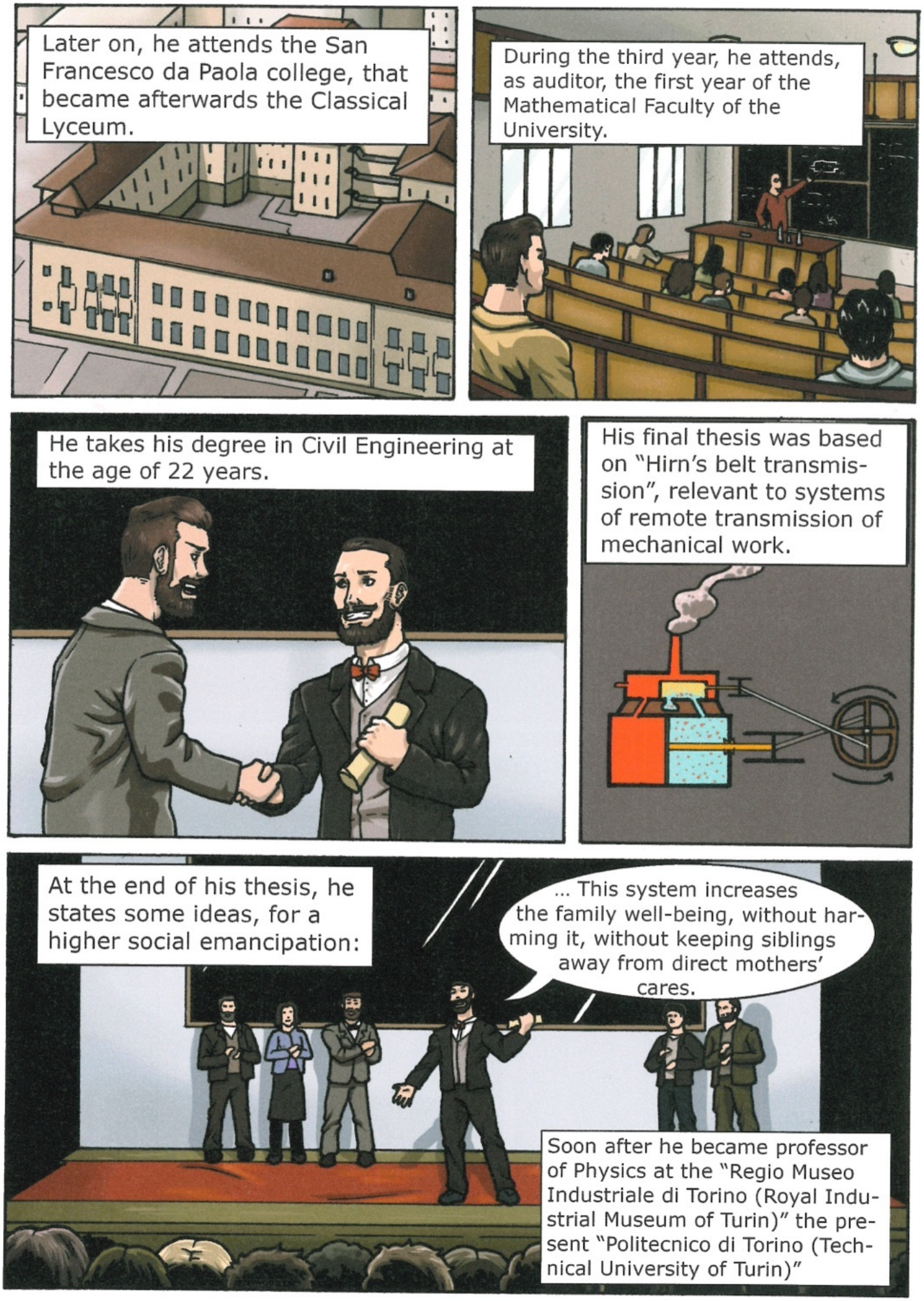
Farad → Unit of Electrostatic Capacity

Joule → Work

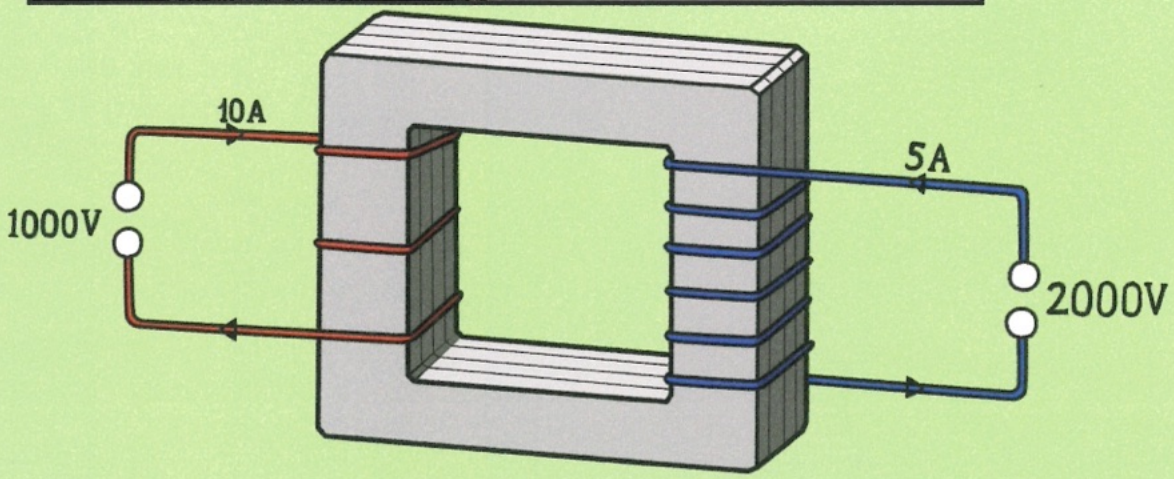
Watt → Power

Henry → Induction Unit


Galileo also took part in many social events: on Wednesday 23 August he was a guest at a dinner offered by "The fifty club of Chicago", the club of the town engineers.
On Thursday 23 August, he took part in the grand banquet offered at the "Grand Pacific Hotel" to all delegates of the participating states.
The Italian scientist sits at the table placed on a high top of the great room, while the table in front was reserved for the great Thomas Edison.
On August 13, his assistant Olivetti reported to Galileo about a meeting with the vice president of the society of American electrical engineers at Edison's laboratory.
In that occasion Galileo met Thomas Alva Edison.

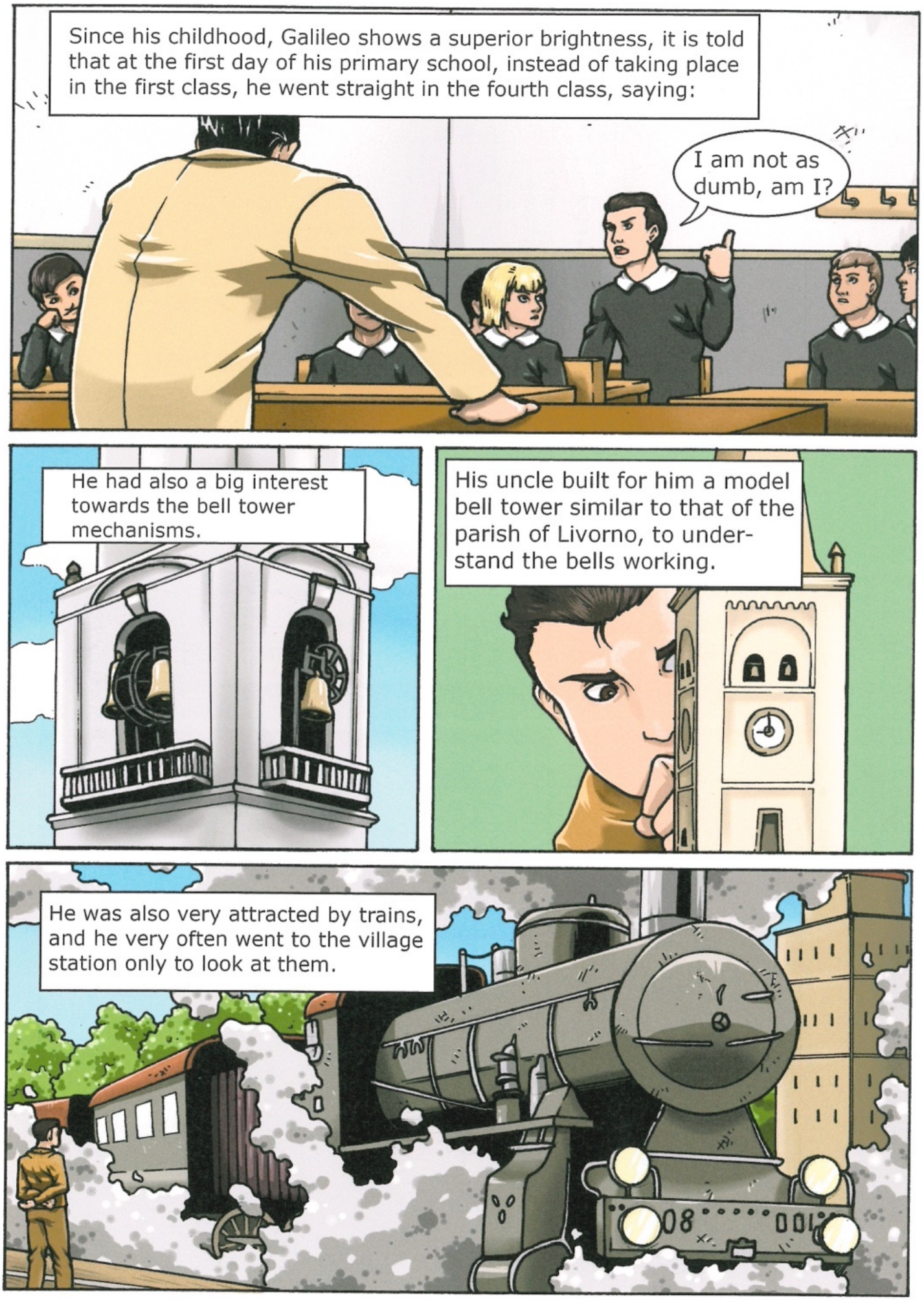

Later on, he attends the San Francesco da Paola college, that became afterwards the Classical Lyceum.
During the third year, he attends, as auditor, the first year of the Mathematical Faculty of the University.
He takes his degree in Civil Engineering at the age of 22 years.
His final thesis was based on "Hirn's belt transmission", relevant to systems of remote transmission of mechanical work.
At the end of his thesis, he states some ideas, for a higher social emancipation:
... This system increases the family well-being, without harming it, without keeping siblings away from direct mothers' cares.
Soon after he became professor of Physics at the "Regio Museo Industriale di Torino (Royal Industrial Museum of Turin)" the present "Politecnico di Torino (Technical University of Turin)"

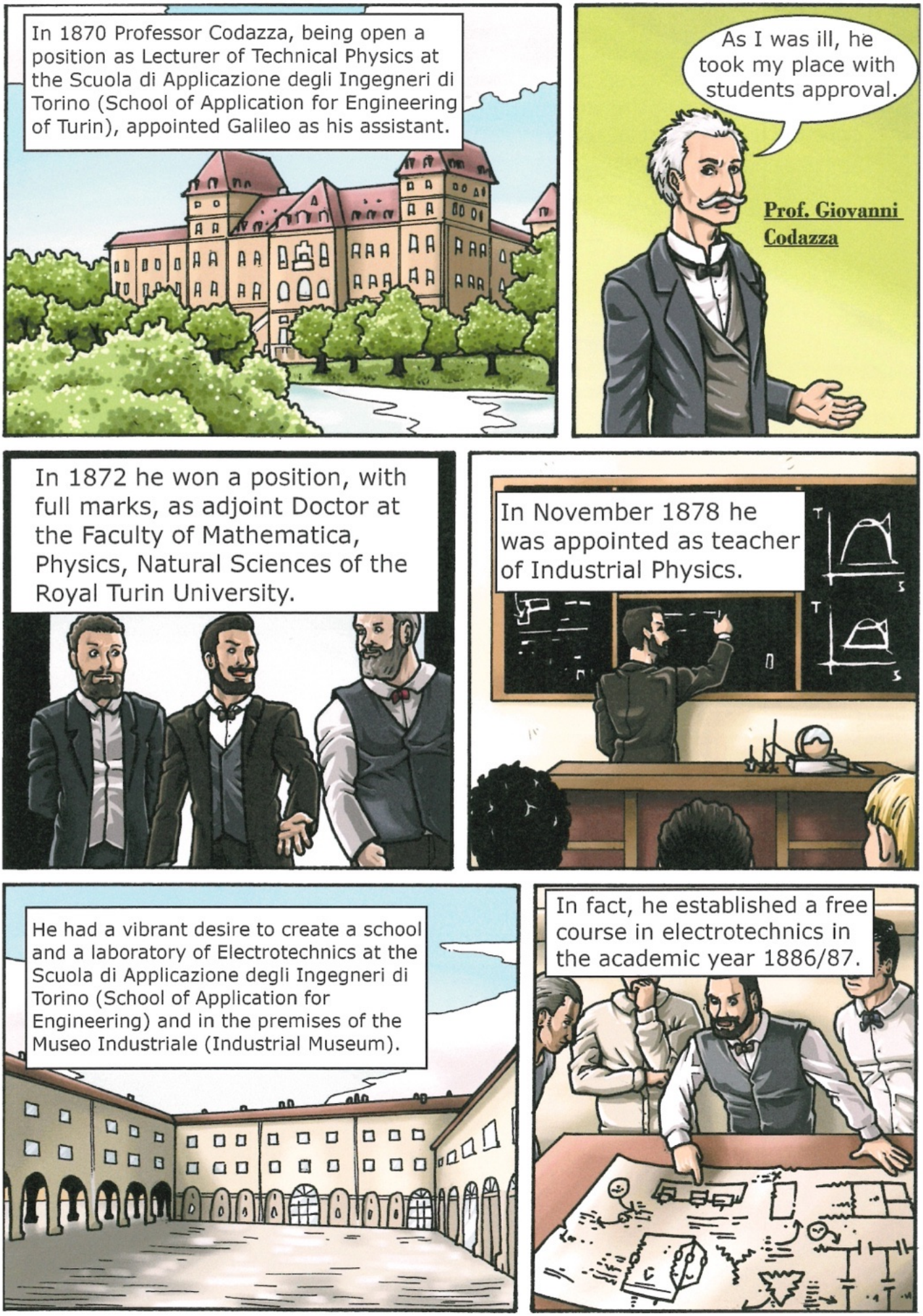
Following his studies he became to devise the transformer theory.

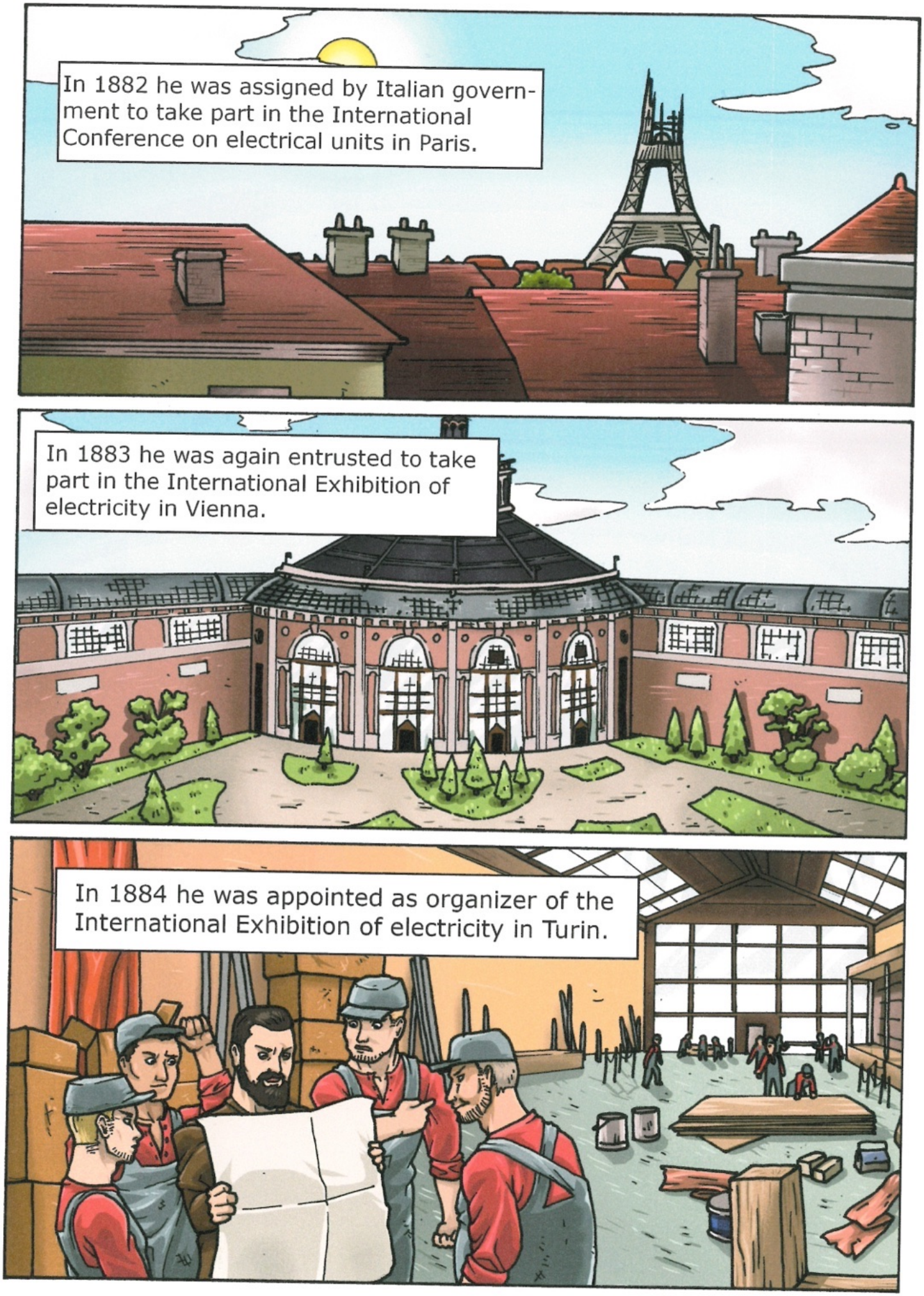


$$\frac{I_p}{I_s} = \frac{V_s}{V_p} = \frac{N_s}{N_p}$$

This theory is still used today in the courses of "Politecnico di Torino (Technical University of Turin)".

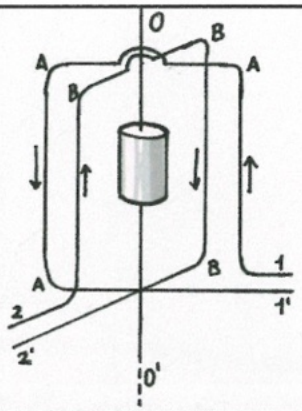

Since his childhood, Galileo shows a superior brightness, it is told that at the first day of his primary school, instead of taking place in the first class, he went straight in the fourth class, saying:
I am not as dumb, am I?
He had also a big interest towards the bell tower mechanisms.
His uncle built for him a model bell tower similar to that of the parish of Livorno, to understand the bells working.
He was also very attracted by trains, and he very often went to the village station only to look at them.


In 1870 Professor Codazza, being open a position as Lecturer of Technical Physics at the Scuola di Applicazione degli Ingegneri di Torino (School of Application for Engineering of Turin), appointed Galileo as his assistant.
As I was ill, he took my place with students approval.
Prof. Giovanni Codazza
In 1872 he won a position, with full marks, as adjoint Doctor at the Faculty of Mathematica, Physics, Natural Sciences of the Royal Turin University.
In November 1878 he was appointed as teacher of Industrial Physics.
He had a vibrant desire to create a school and a laboratory of Electrotechnics at the Scuola di Applicazione degli Ingegneri di Torino (School of Application for Engineering) and in the premises of the Museo Industriale (Industrial Museum).
In fact, he established a free course in electrotechnics in the academic year 1886/87.


In 1882 he was assigned by Italian government to take part in the International Conference on electrical units in Paris.
In 1883 he was again entrusted to take part in the International Exhibition of electricity in Vienna.
In 1884 he was appointed as organizer of the International Exhibition of electricity in Turin.

In 1889 he was called by Frankfurt municipality to solve, together with other scientists, the problem of energy distribution in town.

In 1891 in Frankfurt and in 1893 in Chicago, he begins to gain acknowledgments and honors for his discovery of rotating magnetic field.

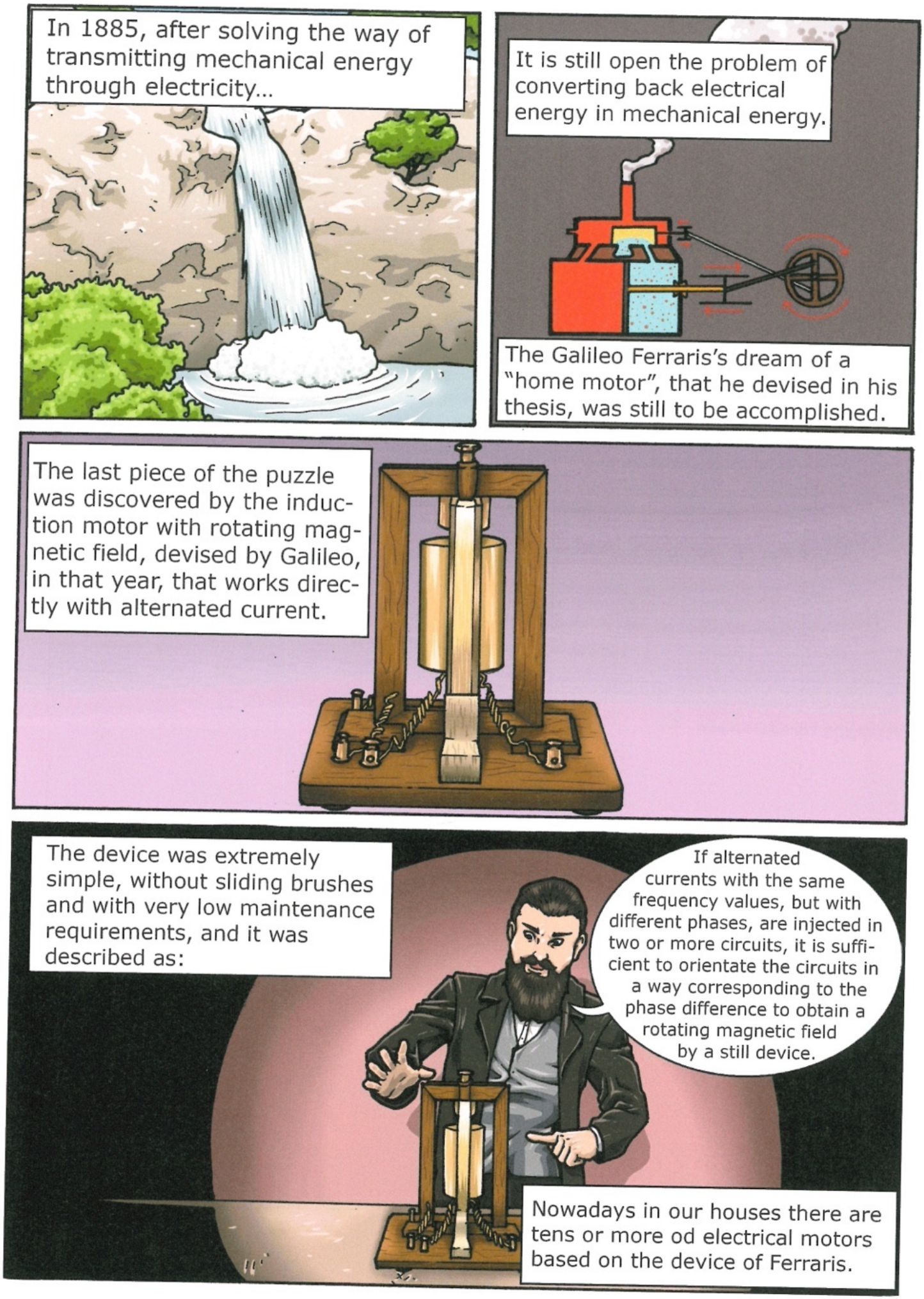


Galileo was also member of the Royal Academy of Science in Turin and partner of the Accademia dei Lincei.

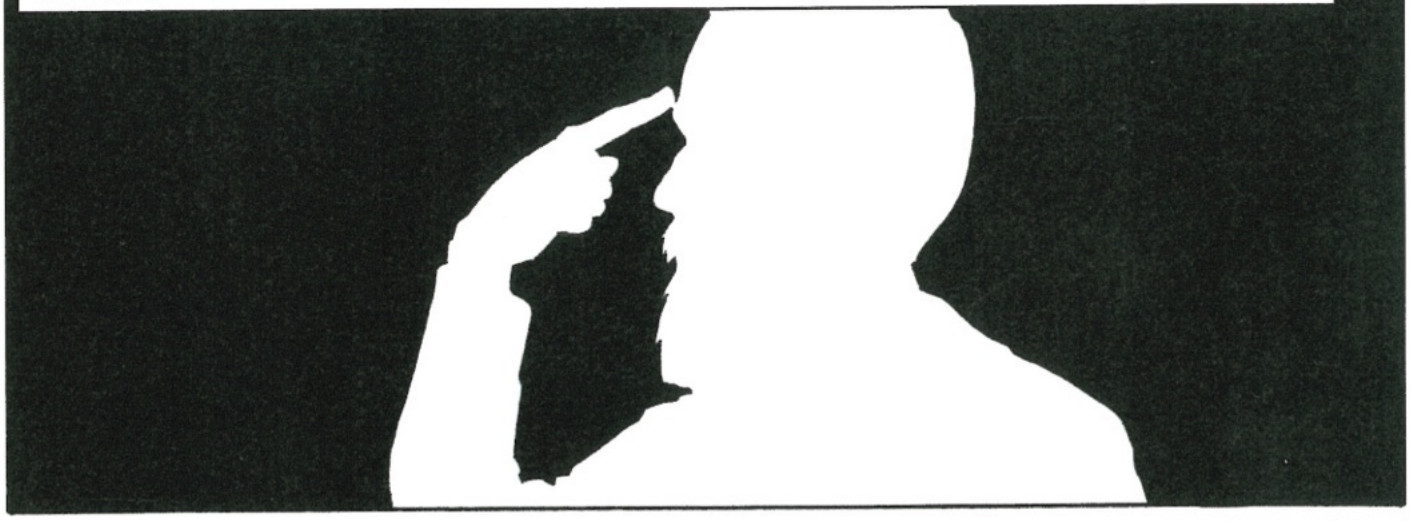
In 1897 he was appointed president of the Higher Italian Commission of metrology, gaining several other acknowledgments.

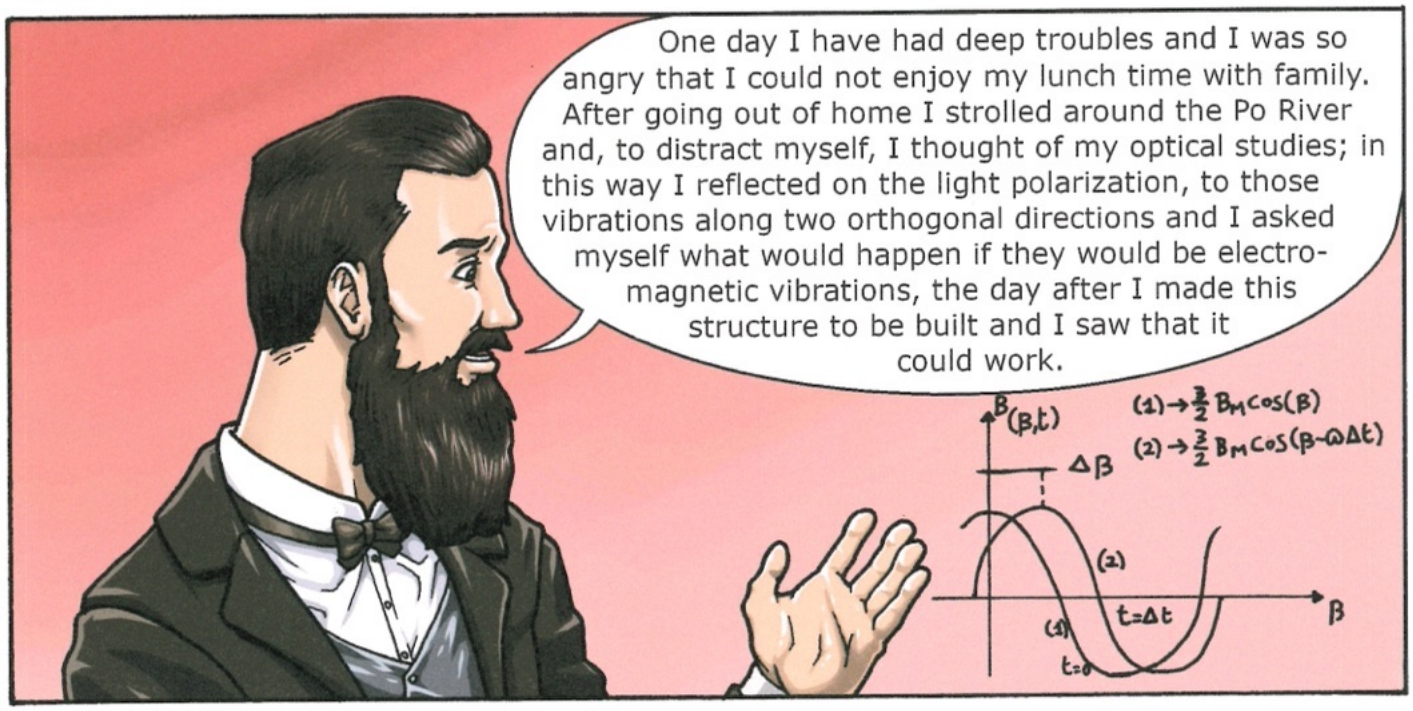
As last deed, in 1896, he established in Milan the "Italian Electrotechnical Association". This is his aim:

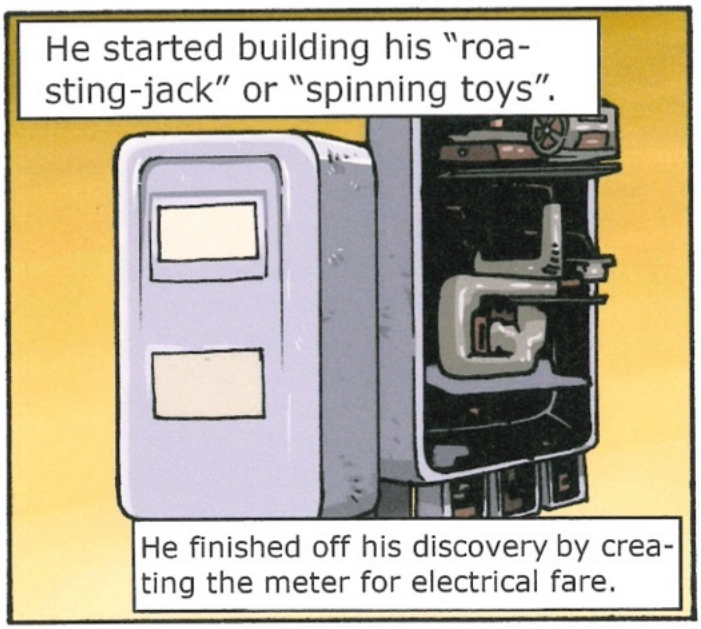
To see the young forces of Italy working in the field of electrotechnics, joined, united in brotherhood, to encourage and develop in Italy the study of electrotechnics and to contribute to its progress.

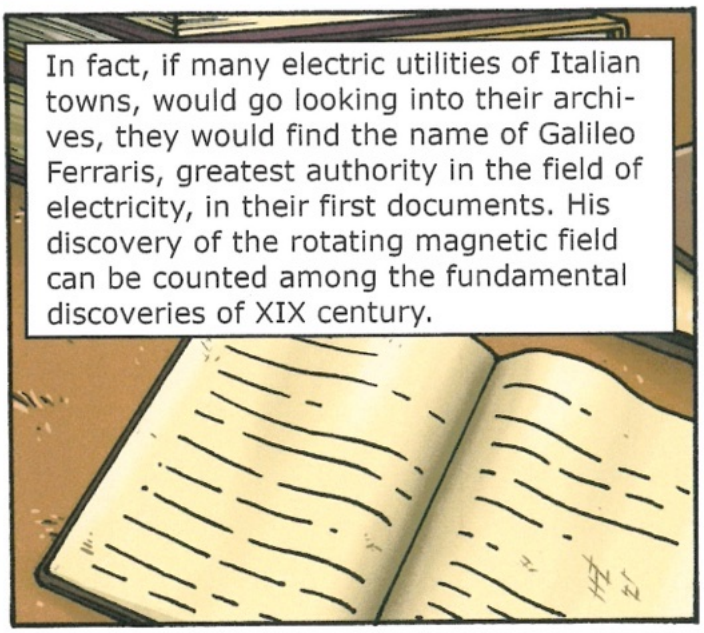

In 1885, after solving the way of transmitting mechanical energy through electricity...
It is still open the problem of converting back electrical energy in mechanical energy.
The Galileo Ferraris's dream of a "home motor", that he devised in his thesis, was still to be accomplished.
The last piece of the puzzle was discovered by the induction motor with rotating magnetic field, devised by Galileo, in that year, that works directly with alternated current.
The device was extremely simple, without sliding brushes and with very low maintenance requirements, and it was described as:
If alternated currents with the same frequency values, but with different phases, are injected in two or more circuits, it is sufficient to orientate the circuits in a way corresponding to the phase difference to obtain a rotating magnetic field by a still device.
Nowadays in our houses there are tens or more od electrical motors based on the device of Ferraris.

The so much praised discovery of rotating magnetic field, it was not a matter of chance or of a venal research, but of the synthesis ability of the mind of the scientist that was able to pick up the same concept in different phenomena.







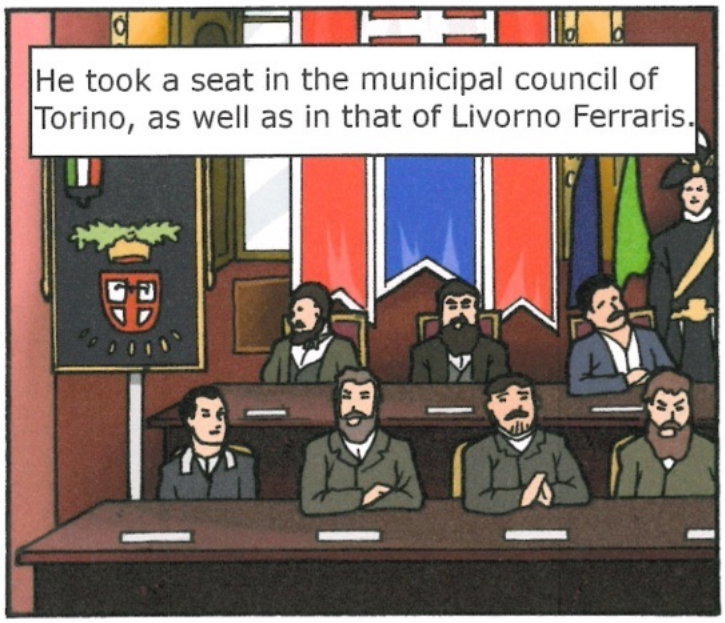


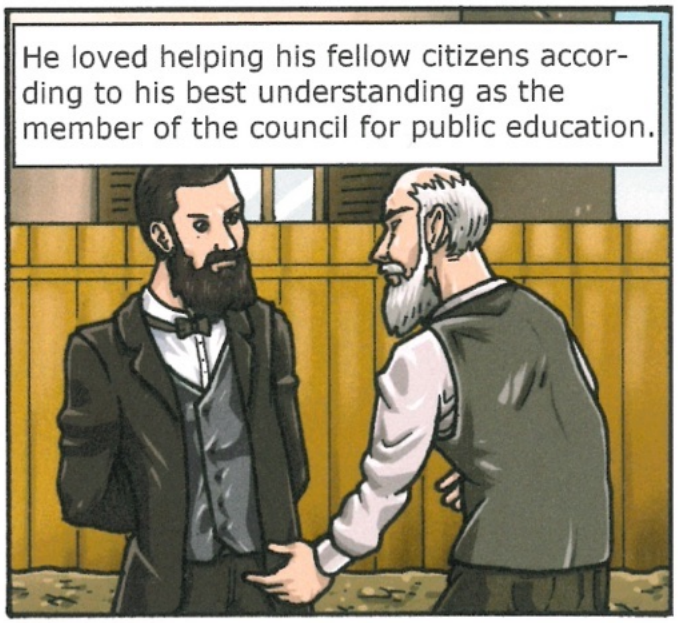
When his parents named Galileo, as the name of one of the greatest Italians ever lived, they evoked a great future on the child's head, they consecrate the child to the exact sciences, to those sciences that will bring him worldwide fame in the future.

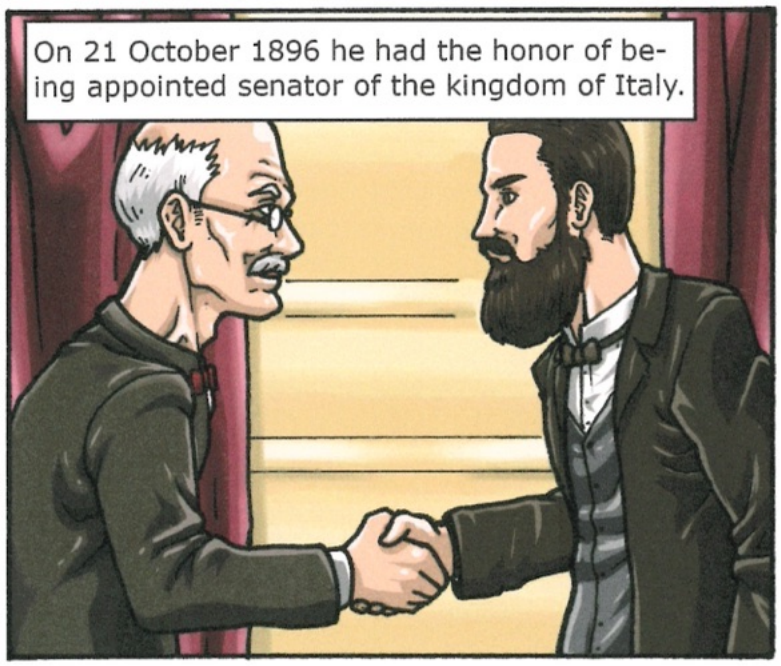
His father took great care of the child and was very strict with him, which is why Galileo was happy when he gave him satisfaction with his results.

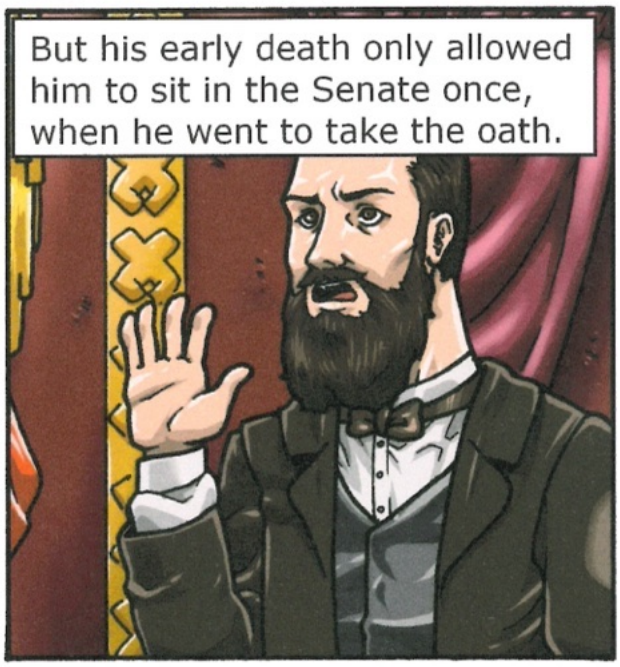
He loved greatly the town of Torino, as he told:

Here I have sacred memories, here in the calm of the studio, in the atmosphere saturated with fruitful intellectual energies, in this city that I love so much, I wanted my brother's dear remains to dwell.

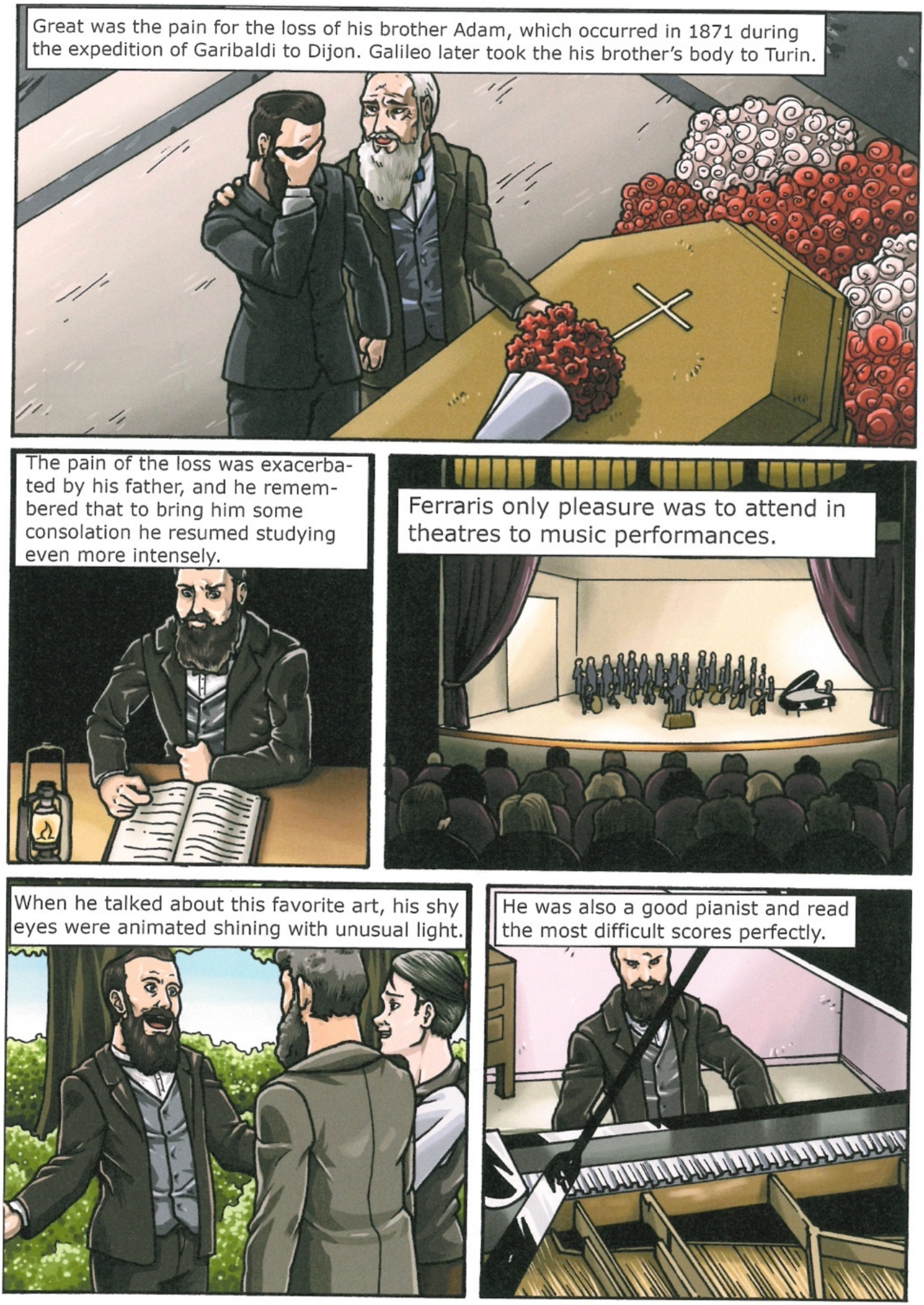

He took a seat in the municipal council of Torino, as well as in that of Livorno Ferraris.

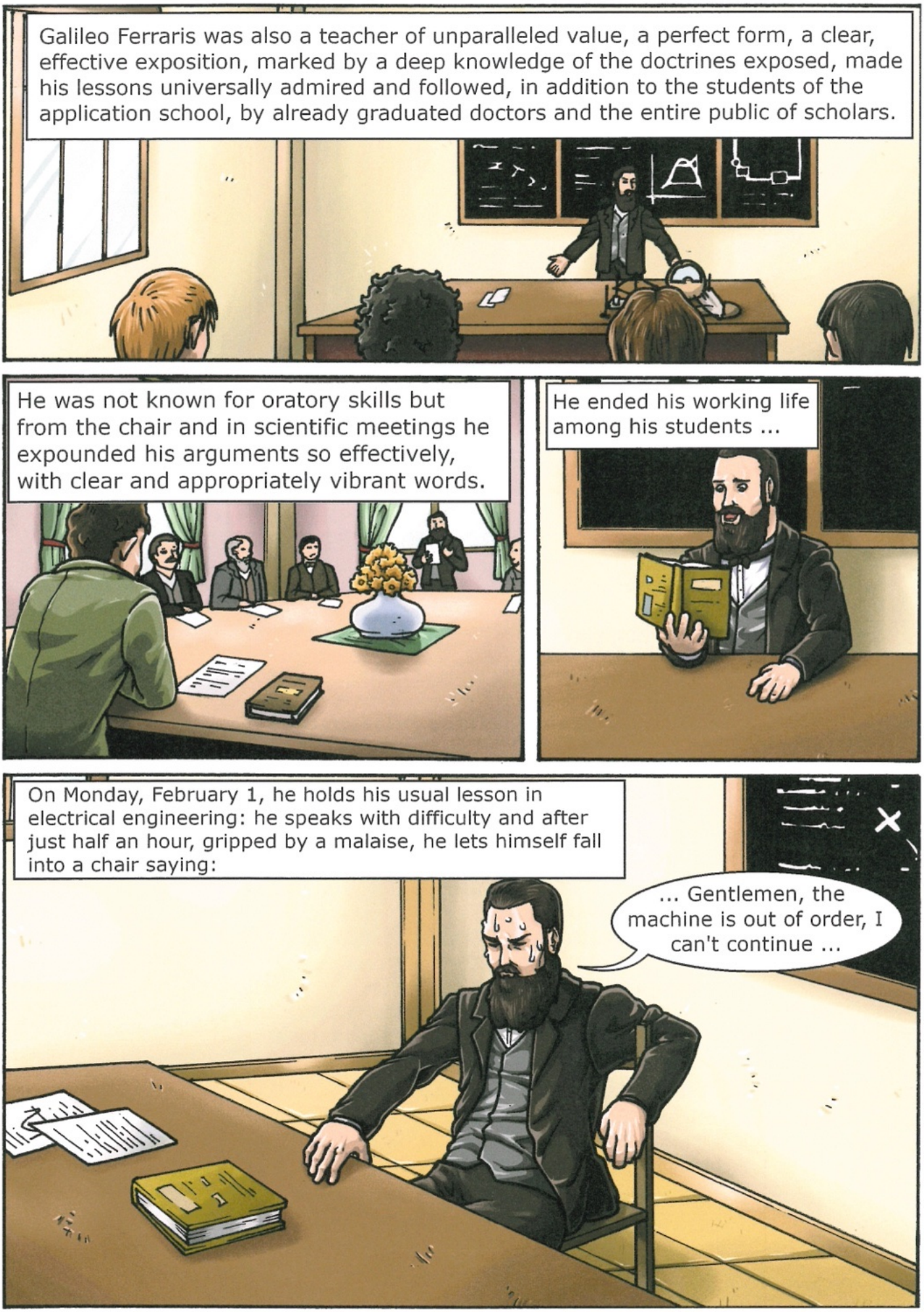

He loved helping his fellow citizens according to his best understanding as the member of the council for public education.


On 21 October 1896 he had the honor of being appointed senator of the kingdom of Italy.


But his early death only allowed him to sit in the Senate once, when he went to take the oath.

One of his "rare" political thought is significant:
A country is great and prosperous, as its citizens are strong, intelligent and free.


Great was the pain for the loss of his brother Adam, which occurred in 1871 during the expedition of Garibaldi to Dijon. Galileo later took the his brother's body to Turin.
The pain of the loss was exacerbated by his father, and he remembered that to bring him some consolation he resumed studying even more intensely.
Ferraris only pleasure was to attend in theatres to music performances.
When he talked about this favorite art, his shy eyes were animated shining with unusual light.
He was also a good pianist and read the most difficult scores perfectly.


Galileo Ferraris was also a teacher of unparalleled value, a perfect form, a clear, effective exposition, marked by a deep knowledge of the doctrines exposed, made his lessons universally admired and followed, in addition to the students of the application school, by already graduated doctors and the entire public of scholars.
He was not known for oratory skills but from the chair and in scientific meetings he expounded his arguments so effectively, with clear and appropriately vibrant words.
He ended his working life among his students ...
On Monday, February 1, he holds his usual lesson in electrical engineering: he speaks with difficulty and after just half an hour, gripped by a malaise, he lets himself fall into a chair saying:
... Gentlemen, the machine is out of order, I can't continue ...

He was rescued immediately, but he still wanted to walk home.

But here a high fever assails him, in six days a pleuropneumonia is fatal. He died on February 7, 1897.

Very moving is the chronicle marked by the diary of her niece Vigia.

Monday February 1: "Uncle Galileo sick with the flu, pleurisy is threatened"

Tuesday 2: "It seems that Uncle Galileo is doing a little better"

Wednesday 3: "During the night, very acute pains in the diaphragm and intercostal muscles. Consultation with dr. Mignolo "

Thursday 4th: "Illness increases"

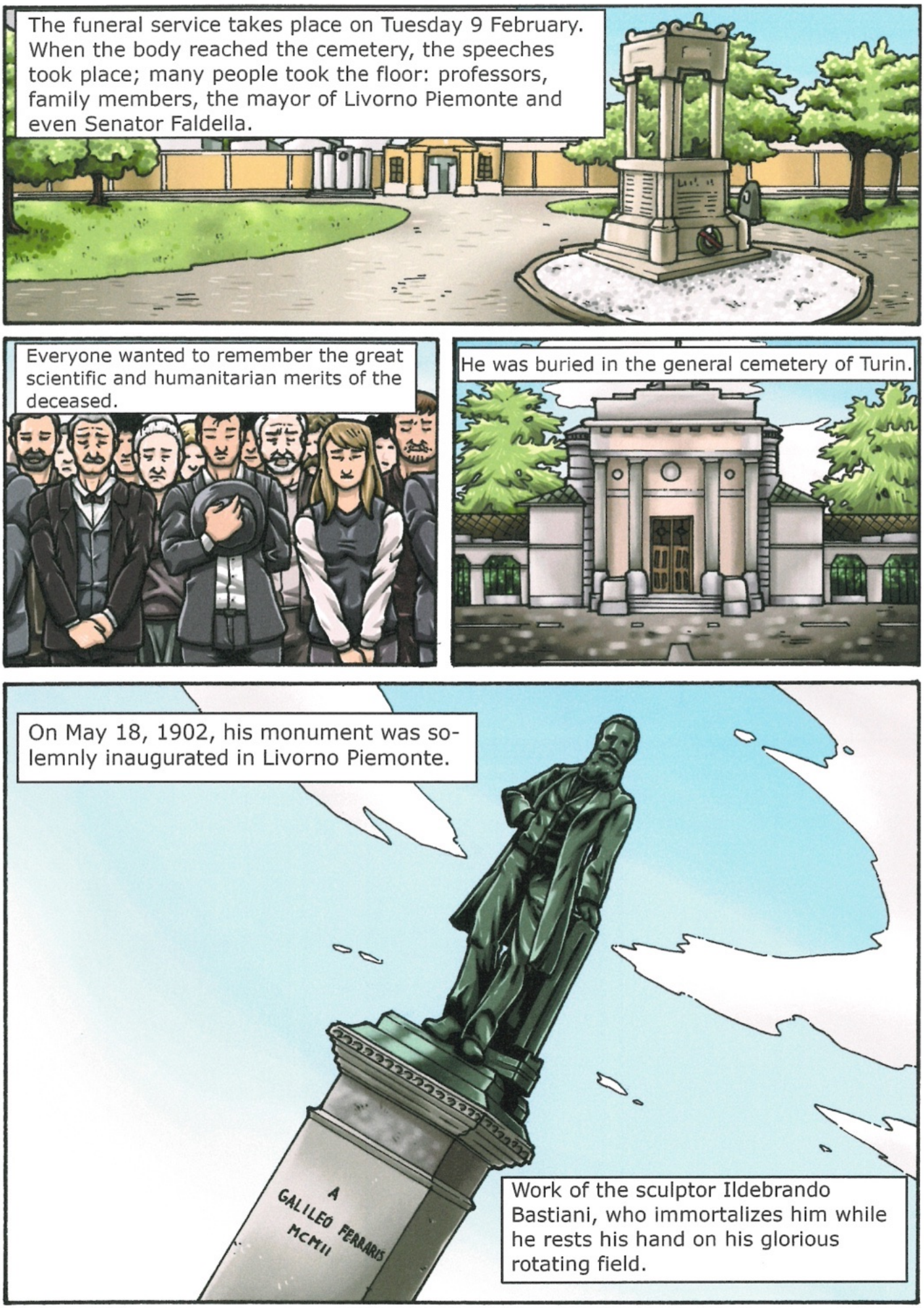
Friday 5th: "Illness worsens"

Saturday 6: "Conditions more and more serious due to the extreme weakening "

Sunday 7: "Consultation in the morning, brain phenomena occurred: desperate case. Any attempt is useless "

05:25 am:"Zio Galileo passed away peacefully. My God,what a misfortune! What will become of us without the incomparable man who loved us so much?"

Monday 8: "Uncle sleeps peacefully, covered with flowers, watched by the weeping students"


The funeral service takes place on Tuesday 9 February. When the body reached the cemetery, the speeches took place; many people took the floor: professors, family members, the mayor of Livorno Piemonte and even Senator Faldella.
Everyone wanted to remember the great scientific and humanitarian merits of the deceased.
He was buried in the general cemetery of Turin.
On May 18, 1902, his monument was solemnly inaugurated in Livorno Piemonte.
A GALILEO FERRARIS MCMII
Work of the sculptor Ildebrando Bastiani, who immortalizes him while he rests his hand on his glorious rotating field.

On 29 June 1925, the municipality of Livorno Piemonte changed its name to Livorno Ferraris, honoring its great fellow citizen.

It was an event not only known at local level, but of national interest.

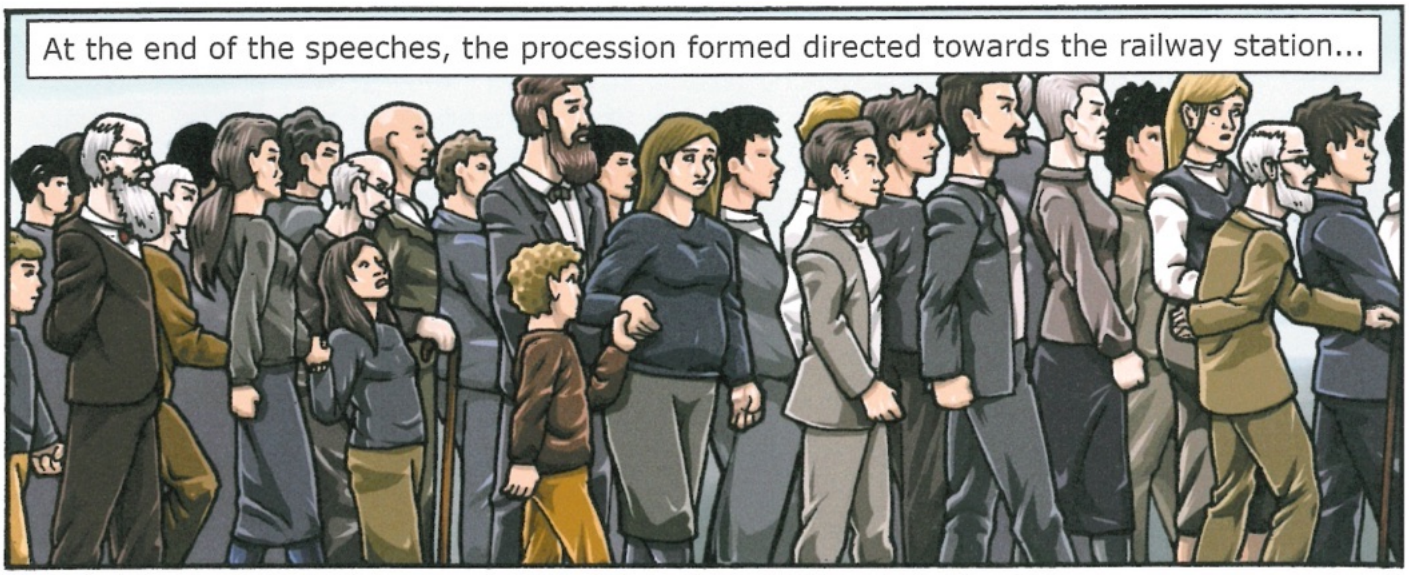
Livorno Vercellese cambia nome.

All personalities present and the great attendance to the event, wanted to honor the memory of the Ferraris.

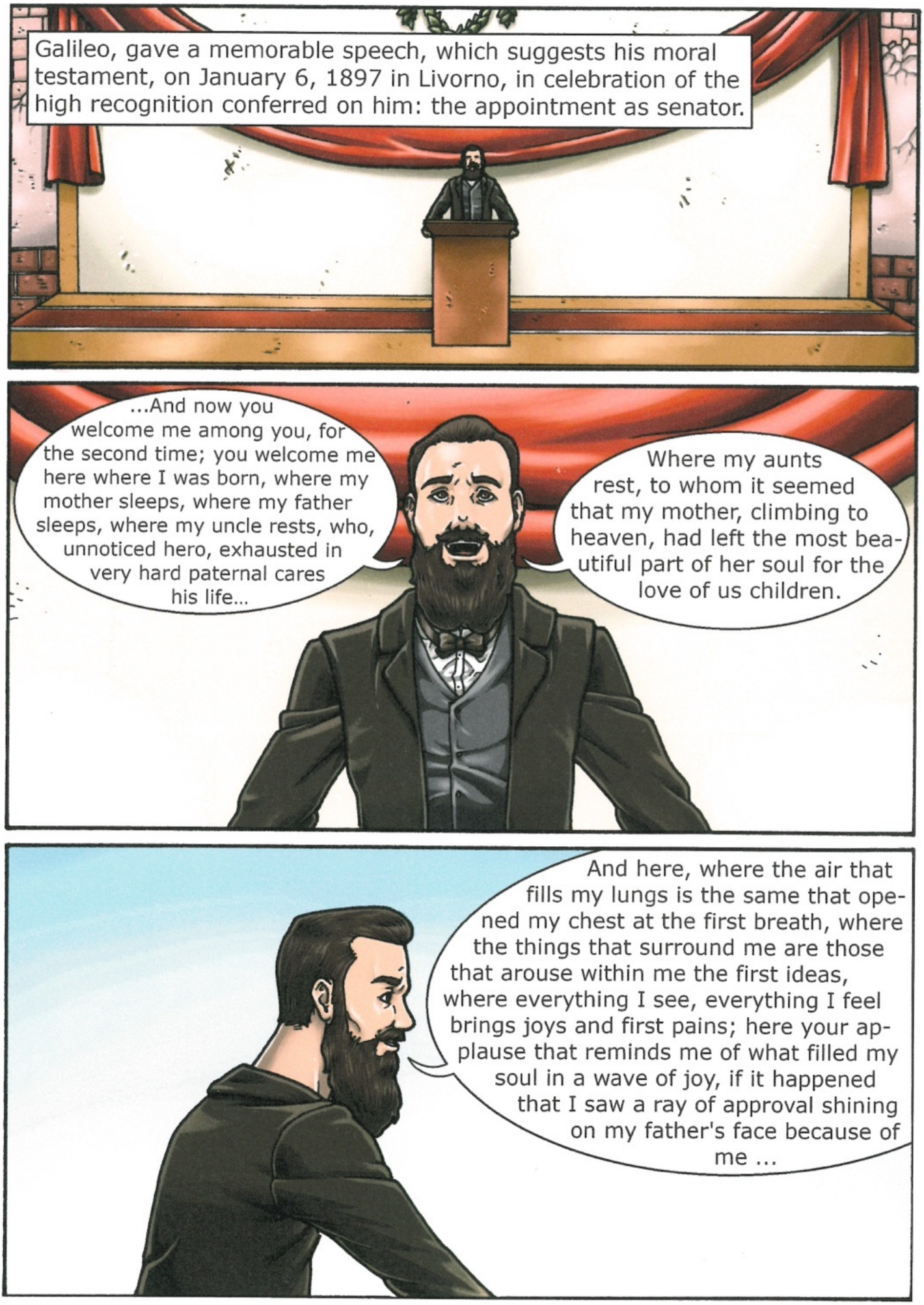
Eng. Carlo Montù

Achille Giovanni Cagna

Camillo Olivetti


At the end of the speeches, the procession formed directed towards the railway station...

The entrance was hidden by a curtain, once removed it showed the very fresh writing "**Livorno Ferraris**".
Livorno Ferraris


Galileo, gave a memorable speech, which suggests his moral testament, on January 6, 1897 in Livorno, in celebration of the high recognition conferred on him: the appointment as senator.
...And now you welcome me among you, for the second time; you welcome me here where I was born, where my mother sleeps, where my father sleeps, where my uncle rests, who, unnoticed hero, exhausted in very hard paternal cares his life...
Where my aunts rest, to whom it seemed that my mother, climbing to heaven, had left the most beautiful part of her soul for the love of us children.
And here, where the air that fills my lungs is the same that opened my chest at the first breath, where the things that surround me are those that arouse within me the first ideas, where everything I see, everything I feel brings joys and first pains; here your applause that reminds me of what filled my soul in a wave of joy, if it happened that I saw a ray of approval shining on my father's face because of me ...

"Let my mind, staring into the future, take pleasure in the vision of a generation intent on nothing else that the sake of the country, no longer divided by struggles of personal parties, but by struggles of ideas, which leave no trace of bitterness in the soul, like the hurricane leaves no trace in the sky..."

"... The propitious sun, make fruitful your camps, may your free and beautiful children grow up, Livorno. Smile on them, constant star, love."

Edizioni EFFEDÌ
via Feliciano di Gattinara 1 – 13100 Vercelli
EFFEDI PRODUZIONI SRL - P.I. 02754730022

www.edizionieffedi.it
info@edizionieffedi.it
Tel. 333 1322641

Finished printing in OCTOBER 2022
by Booksfactory Print Group

Carla Pugliaro. Born in Livorno Ferraris in 1950, she graduated in Mathematics in 1975 at the University of Turin. She has taught this subject for more than thirty years and since 1997 she has dedicated herself to the care of the f.lli Ferraris Museum, in Livorno Ferraris, with the help of her students, who have collaborated in carrying out the various activities and as guides.

Denis Limotto was born in Vercelli on 3 October 1995. In Livorno Ferraris spent his childhood drawing; at the age of 15 he decides to continue his studies on art by attending the Ambrogio Alciati Art School in Trino, and then attending the International School of Comics in Turin. After his studies he still continues to draw, because he thinks that drawing has always been the only tool to be able to bring people into unexplored places.

ISBN 979-12-81182-04-2

9 791281 182042

Euro 15,00