Jacopo Bozza and the electric telegraph in Sicily

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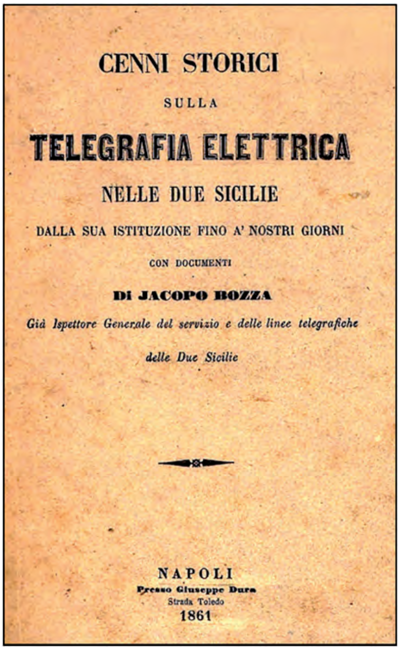
Abstract: The Bourbon government began building its first telegraph lines in 1852. The first line starting in Naples headed northward, in order to reach the town of Terracina, a border station in the Papal State as well as a junction point with the papal telegraphic lines leading to Rome. At the same time, other telegraph lines headed south in order to reach the regions of Puglia and Calabria, and in particular the city of Reggio (Calabria), which would then allow Sicily to be connected as well, by means of a submarine cable. Intentions were not immediately followed by facts and the Naples-Reggio line was only completed with some delay, in 1856. At the beginning of 1857 the Bourbon central government appointed a highly skilled specialist, Ernesto D'Amico, as Royal Director (Delegate) in charge of the development of the electric telegraph network service in Sicily. The complex technical-administrative work started promptly and the first "temporary provisions for the performance of the service" were enforced. In December 1857, an *Electric Telegraphy Directorate-General* and a *Scientific Committee* formed by physicists, chemists and mechanics were each established in both Naples and Palermo. In Palermo, both the *Directorate-General* and the *Scientific Committee* dealt with many crucial matters, from the training of the Royal Telegraphic Corps and of local staff, the dispatch taxes and tariffs, the choice of equipment and materials, up to the classification and organization of telegraphic stations. As for the layout of the network lines, coastal routes were chosen. The reason was that the coastal routes had been used until then for visual or optical telegraphy, an ancient, well-organized and well-established coastal communication practice that had allowed for a good defence of the island against raids from the sea. The first Palermo-Messina line was opened in June 1857, and by the end of September, the entire telegraph network was completed, all along the coastal perimeter. At the same time, in January and June 1858, two submarine cables were laid along the Reggio-Messina Strait. After ups and downs related to break-downs, malfunctions, inadequate performance and new cable-laying works (nineteen in total!), the connection with the mainland, until then managed by sea, was finally achieved by cable in 1863.

Keywords: Sicily, Samuel Morse, Telegraphy, Jacopo Bozza, Ernesto D'Amico.

1. Introduction

In 1861, the book *Cenni storici sulla telegrafia elettrica nelle Due Sicilie dalla sua istituzione fino a' nostri giorni* was published in Naples by Jacopo Bozza,[1] a skilful technician and businessman, but also a polemical and controversial character of his time.[2] After a very brief military career as marine officer in Venice and some unfortunate attempts at being an entrepreneur in this city, Bozza moved to Naples shortly after 1851 to embrace the career of telegraphic systems entrepreneur.


CENNI STORICI
SULLA
TELEGRAFIA ELETTRICA
NELLE DUE SICILIE
DALLA SUA ISTITUZIONE FINO A' NOSTRI GIORNI
CON DOCUMENTI
DI JACOPO BOZZA
Già Ispettore Generale del servizio e delle linee telegrafiche
delle Due Sicilie

NAPOLI
Presso Giuseppe Dura
Strada Toledo
1861

Fig. 1. Frontispiece of Jacopo Bozza's book on the history of electric telegraphy in the Kingdom of the Two Sicilies

From 1856 and until the fall of Francesco II (1859) he built most of the Bourbon electric telegraphy network, including some undersea lines that were the first to be created in Italy and some of the very few in Europe not to be built by the British, who had the monopoly of undersea cable laying. Appointed general inspector of the royal telegraphic service in December 1858, after a series of events that depicted him to Bourbon circles as a poorly qualified technician and a most able speculator, Bozza

[1] Born in 1824, very little is known about Bozza. So far, he has been mostly studied for his pioneering contributions to the birth of the Italian iron metallurgy (Nesti 2010).

[2] His bad reputation as a ruthless speculator began mainly in the post-unification period when Bozza took over the property of Pietrarsa's factory (born in 1840). It was the biggest engineering plant in Italy, but it was already struggling with financial and production problems. To solve these problems, he increased the work-time and reduced salaries and jobs, which sparked a serious riot that ended up in bloodshed.

ended up being charged with spying on the King and arrested. He was released a few days later and, in order to defend himself against the charges, he wrote the aforementioned work which, even if based on a personal and heavily biased point of view, remains one of the most important historical documents for the study of the birth of the telegraphic system in Sicily and Southern Italy.

2. The birth of telegraphy under the Bourbons

According to Bozza's account from the Kingdom of the Two Sicilies, Ferdinando II became acquainted with the emergent electric telegraphy in 1851. The King, immediately understanding the importance of this new technology, ordered the construction of an aerial telegraphic line supported by poles. From Naples, this line headed northwards to reach the town of Terracina, a border station in the Papal State as well as a junction point with the telegraphic lines of that State. It was necessary to quickly link the fast developing telegraphic network of Naples with those of Rome and the rest of Europe. By means of a decree dated June 18, 1852, an "electromagnetic telegraphic line" was established between Naples and Terracina which, starting from the Royal Palace of Naples, reached the railway station of the city and continued along the intermediary stations of Caserta, Capua, Mola and Gaeta. From July 1852 to 1854, starting from the articulated joint station in Cancello (located just a few miles from Naples), the works kept advancing both towards the south and the north simultaneously. To the north, the line of Gaeta was extended until Terracina and connected to the line of the Papal State.[3] To the south, the Nola-Avellino line was extended up to Ariano (1854), in the direction of Puglia, and up to Salerno (1853), in that of Calabria. A priority to this latter line was given: the project was to reach the extreme tip of Calabria, pass the Strait through submarine cables, and thus connect Sicily to the continent. The works began in 1856 on two distinct segments, the Napoli-Cosenza and the Cosenza-Reggio, each with different contractors. The first section, the Napoli-Cosenza line, was entrusted to Errico Pellegrino[4] (1823-?), an engineer of bridges and roads with excellent knowledge of telegraphy. The works on the second segment, the Cosenza-Reggio line, started later, approximately in the middle of 1856, and were entrusted to Jacopo Bozza who, thanks to a very competitive economic offer,[5] convinced the Bourbon government to reward his proposal and thus carried out his first contract[6] in the Kingdom. Since that moment and until the fall of Francesco II, Bozza

[3] At the beginning, the exchange of dispatches was rather difficult because one state used the Morse system and the other one used the Henley system; the latter used a dedicated secret code had to be decoded by the employees who were obliged to keep it in the strictest confidence.

[4] According to the historical account of Bozza, this capable mechanic was very gifted for telegraphy. Thanks to their skills and abilities, he and his fellow-mechanics Giovanni De Normann and Giacomo Arena played a key role in building the very first telegraphic lines around Naples.

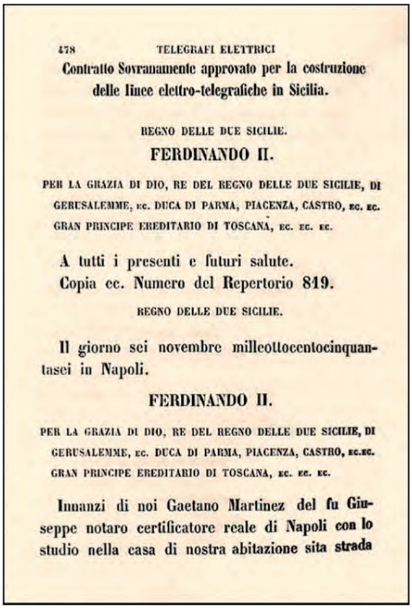
[5] He proposed to build the Cosenza-Reggio Calabria line at the cost of 137 ducats per mile instead of 800 as previously agreed with the Minister of Finances.

[6] Bozza took it upon himself to finish the entire line in four months.

managed to gain the esteem of the Neapolitan authorities, soon obtaining similar contracts in Sicily, in Puglia and Abruzzi. Thus he became the main entrepreneur of the whole telegraphic network of the Bourbon state.[7]

3. The project of a telegraphic network in Sicily

Meanwhile, in 1856, at the time when the works for the Napoli-Reggio line were being carried out, the King ordered that Sicily should also have an electric telegraphy system. Under the direction of Giovanni Cassissi, Minister Secretary of State for the affairs of Sicily and Naples, a committee was created in August that year.



478 TELEGRAFI ELETTRICI

Contratto Sovranamente approvato per la costruzione delle linee elettro-telegrafiche in Sicilia.

REGNO DELLE DUE SICILIE.

FERDINANDO II.

PER LA GRAZIA DI DIO, RE DEL REGNO DELLE DUE SICILIE, DI GERUSALEMME, EC. DUCA DI PARMA, PIACENZA, CASTRO, EC. EC. GRAN PRINCIPE EREDITARIO DI TOSCANA, EC. EC. EC.

A tutti i presenti e futuri salute.
Copia ec. Numero del Repertorio 819.

REGNO DELLE DUE SICILIE.

Il giorno sei novembre milleottocentocinquantasei in Napoli.

FERDINANDO II.

PER LA GRAZIA DI DIO, RE DEL REGNO DELLE DUE SICILIE, DI GERUSALEMME, EC. DUCA DI PARMA, PIACENZA, CASTRO, EC.EC. GRAN PRINCIPE EREDITARIO DI TOSCANA, EC. EC. EC.

Innanzi di noi Gaetano Martinez del fu Giuseppe notaro certificatore reale di Napoli con lo studio nella casa di nostra abitazione sita strada

Fig. 2. Frontispiece of the signature of the contract dated 6th November, 1856, for the piecework construction of the electro-telegraphic lines of Sicily

It was charged to prepare a project to determine the most convenient and effective route for the island's telegraphic lines and to choose the most appropriate stations that would be joined together. The committee, trying to reconcile the different needs of both public and private service, stated that "the electric telegraphy system should run along the existing land roads in order to facilitate maintenance and surveillance, and should connect the most important cities from a government, military, administrative and commercial standpoint" (*Telegrafi* 1857, pp. 471-472). In short, the chosen layout ran

[7] From 1856 to 1859, Bozza built almost 4000 kilometres of telegraphic lines in the Kingdom of the Two Sicilies, also taking on the laying of four or five submarine cables.

along the coastline and covered the entire perimeter of the island, so as to enable communication between "almost all the county seats, the main parade grounds and the most important cities in terms of richness, industry, trade and population". The possibility was then considered to run a submarine cable from Messina all through the Strait, so as to link the island to the mainland and in order to maximize the usefulness of the communications. In the project, Messina was singled out not only as the point of junction with the telegraphic network coming from the coast of Calabria, but also as the place where the works should begin. In fact two different and opposite lines were meant to originate in the city: one along the Tyrrhenian coast and one along the Ionian coast. The first one was to reach Palermo, then pass through Trapani and head to Sciacca;[8] the second one was to reach Siracusa and then proceed through Terranova (nowadays Gela) to finally reach Girgenti (known today as Agrigento).[9] And, according to the project laid out by the committee, it was from this last city that the only deviation towards the inland was to be built, so as to compensate the lack of roads and to reach cities that were considered important and strategic, such as Caltanissetta, Piazza and Caltagirone.[10] The project was approved on August 22nd by the King in the *Ordinary State Council* and immediately transmitted to the lieutenant-general of the Royal Dominions beyond the Lighthouse: the Prince of Castelcicala, Paolo Ruffo di Bagnara. A public bid was announced for the granting of the contract (*Contratto* 1857, pp. 478-502) and Jacopo Bozza contended, along Werner Siemens and Georg Halske[11] from Berlin. Bozza won, as his bid was considered economically more advantageous, and on 6th November 1856 the contract for the piecework building of the telegraph system was signed in Naples (Fig. 2). The contract stipulated that the "best materials" were to be used for building the lines and that the machines using the Morse system "with the recently made improvements" were to be adopted, as well as a clause that required all the works for the entire electric telegraphy network of Sicily to be finished within sixteen months. Bozza took on the responsibility of carrying-out the entire project "at his own expense, risk and danger" and even expressed his willingness to lay a submarine telegraphic cable, which at that time was a trying technical and practical challenge, with high financial risks.[12] Sicily's government immediately appointed as delegate for the Sicilian electric telegraphy one Ernesto D'Amico,[13] a skilful young

[8] More specifically, the projected stations along the Tyrrhenian coast were: Milazzo, Patti, S. Stefano, Cefalù, Termini, Palermo, Alcamo, Trapani, Marsala, Mazzara and Sciacca.

[9] The stations along the Ionian coast and the Sicilian Sea were: Taormina, Catania, Augusta, Siracusa, Noto, Modica, Terranova, Licata and Girgenti.

[10] According to the project, the only inland line was to be the Girgenti-Catania line, as proven by Marzolla's telegraphic map (see Fig. 6). But that route was changed sometime in the first months of 1858.

[11] Founded in 1847, the Siemens and Halske Company quickly became the leader in the building of telegraphic lines and equipment in all of Europe.

[12] The development of underwater telegraphy started in 1850, thanks to the decisive contribution of the British. However, the first cable laying attempts were unsuccessful and important financial resources were wasted.

[13] D'Amico (1826-1896) issued from an ancient and noble Sicilian family, became the general director of telegraphs in the Kingdom of Italy in 1865 and occupied this position until 1886. He had the merit of validating the Morse system and of expanding the Sicilian network to no less than 1100 km and 28 offices, in only three years.

man with both technical and administrative competences. His task was to supervise the building of the lines and to verify the gear and the materials upon their arrival. This way, during this crucial and delicate initial phase, lieutenant-general Paolo Ruffo di Bagnara, who had both civilian and military powers and commanded the telegraphs (considered as military equipment), could count on the support of a first-rate technician such as D'Amico for all matters technical and scientific. And, in case of potential controversy regarding the quality of the materials employed or in matters of compliance to the execution rules, he could count on the judgement of the administration of Sicilian engineers of bridges and roads.

4. The organisation of the telegraphic service in Sicily

Starting with the first months of 1857, the technical-administrative procedures were initiated and the first provisions for commissioning the service were issued. On 25th April of the same year, in Palermo, lieutenant-general Castelcicala issued the firsts "provisional instructions"[14] of the service, reserving the right to "bestow definitive approval after affecting the modifications that experience would suggest". On 13th November 1857, Castelcicala wrote: "As soon as the electric telegraphy service was initiated in Sicily, the need arose for rules that would regulate payment methods, the tools for controlling the stations' accounting operations and for keeping track of the tallies between Sicily and the mainland" (*Regolamento* 1857, p. 3). However, these were temporary provisions that had been issued either in order to commission the service, or to assess its difficulties and to improve its effectiveness. The organisation of the entire Bourbon telegraphic network needed to be rendered more functional one geographic area at a time. To this end, in December 1857, a Directorate General for Electric Telegraphy and a Scientific Advisory Committee were each established both in Naples and in Palermo. The Directorate General was in charge of supervising the ongoing construction works and of managing the supply of the telegraphic service from an economic, technical and administrative standpoint, in the two Royal Dominions. The Palermo-based Directorate was placed under the command of Lieutenant-General Castelcicala and the Scientific Advisory Committee composed of professors of physics, chemistry, applied chemistry and mechanics, joined its forces to the Directorate's in order to advise the lieutenant-general on "the doubts that may arise in reference to the functioning of the Electro-Telegraphic service, on the application of physical and mechanical theories and on the improvements that might become necessary as a consequence of new discoveries" (*Organamento* 1858, p. 698).

For administration purposes, the Sicilian network was broken down into areas called "divisions", each under the command of an inspector and having a maximum length of one hundred Naples miles (185 km). Within the same "division", the telegraphic stations were further classified into three categories: 1st class stations,

[14] They referred to some interesting aspects, such as dispatch transmission and reception methods, fees, the management of consumable materials and general administration accounting, which fell in the competence of the ministry of finances (*Approvazione* 1858, pp. 665-693).

which were open day and night, 2nd class stations for day-time service only, and 3rd class stations that were reserved for the exclusive use of the Royal Government. Inside the stations, the reception-transmission of the messages was entrusted to military officials from the Royal Telegraphic Corps, the so-called technical clerks, who were divided in interpreters and signallers.

Fig. 3. Booklet containing the accounting regulations applicable to electric telegraphy in Sicily, published in Palermo at the end of 1857

The latter were in charge of the maintenance of the machines and of dispatching private messages, while interpreters were in charge of managing confidential, government and diplomatic messages, namely of composing and interpreting codified correspondence.

5. The Morse system in Sicily

As a matter of general knowledge, in Europe the first Morse machines were introduced in 1851 by the Austro-German Telegraphic Union which also comprised the territory of Lombardy and Veneto, the Extended States, and the Dukedom of Parma and Piacenza. Successively, the Morse system was also adopted in the Papal State. In Sicily, as we have already shown, the choice of the Morse system had been provided for by the committee in charge of drawing up the telegraph layout as early as the second half of 1856.

In the contract for the execution of the works, Bozza was required to provide each telegraphic station with a well lined with masonry, on the bottom of which the metal mass for grounding the telegraphic circuit was to be buried; usually, the metal mass was a rather large copper plate. Furthermore, the contract also required that each telegraphic station be provided not only with the necessary furnishings and with various materials for repairing the lines, it also had to be equipped with two complete sets of Morse machines, each with its own batteries which, in their turn, had to be guaranteed to function for at least one year. The cost of each set, comprising the various accessories for the necessary repairs and the spare parts, was established at 160 ducats.

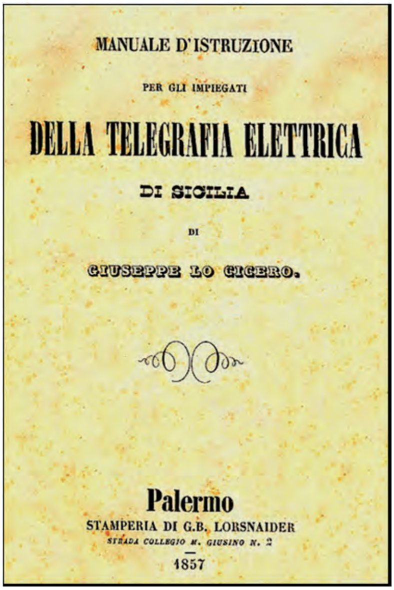


Fig. 4. Frontispiece of the instructions handbook for Sicilian telegraph operators, published by Lo Cicero at the end of 1857

As for the Morse model to be adopted, Bozza was asked to make a proposal and showcase a sample-machine on which the government would then give its final approval. Bozza proposed the new Morse telegraphic machine sold by the Bern-based instrument maker Mathäus Hipp[15] (1813-1893). The machine was accepted by the Government and the Swiss instrument maker became the main supplier of telegraphic machines for the emergent Sicilian telegraphic system.[16] Once the first materials were secured, there was still the matter of the technical training of the local staff. A very first provision was made in the State Council of January 22nd, 1857 that a considerable number of officers be trained under Bozza's supervision "to handle the Morse

[15] As excellent precision instrument maker, Hipp took an interest in telegraphy starting from around 1850. In 1852 he was appointed by the Swiss Federal Council at the head of the Workshop for the construction of telegraphs, a newly constituted structure based in Bern, and technical director of the Administration of Swiss Telegraphs.

[16] In this respect, the writings of Weber and Favre (1895-1896, p. 224) are quite interesting: "En 1856, le gouvernement napolitain fit une étude comparative de tous les systèmes en usage en Europe, et se décida pour les appareils suisses. Le même système fut adopté par la Sicile, les Etats pontificaux, et enfin le reste de l'Italie".

mechanism" (*Provvedimenti* 1858, pp. 663-664). A great number of those officers were chosen from the ranks of the Royal Corps for optical and visual telegraphy, on the basis of certain selective criteria.

ISTRUZIONI PRATICHE
PER
GL'IMPIEGATI TELEGRAFICI
SULLA MANUTENZIONE
DELLE MACCHINE
DEL
TELEGRAFO ELETTRO-MAGNETICO ALLA MORSE
DETTATE
DAL CAV. LUIGI PEROLLO
INGEGNIERE MECCANICO DELLA REAL TELEGRAFIA ELETTRICA
IN SICILIA.

PALERMO
STABILIMENTO TIPOGRAFICO DI FRANCESCO LAO
DECORATO DELLA MEDAGLIA D'ORO DEL MERITO CIVILE DELL'ORDINE DI FRANCESCO I
E PREMIATO CON MEDAGLIA D'ORO DAL REAL ISTITUTO D'INCORAGGIAMENTO.
Salita Crociferi n. 86.
1858.

Fig. 5. Frontispiece of the practical instructions for the maintenance of telegraphic machines in Sicily, published by Perollo at the end of 1858

Optical and visual telegraphy was an old coastline communication technique, well rooted and organised, which had previously proven effective in the defence of the island against attacks coming from the sea. However, impromptu solutions aside, the problem remained of organising training courses and publishing materials for a systematic basic training on all aspects of the Morse system and, more generally, on the theoretical and practical principles of electric telegraphy. In order to meet this requirement, the Government of Sicily initiated a course for the training of technical personnel to be employed in the Sicilian telegraphic system. The charge was entrusted to Giuseppe Lo Cicero,[17] who was already a member of the telegraphic committee of Sicily. Lo Cicero started his training programme[18] in 1857 and repeated it over the following years, until 1861. In order to facilitate learning, Lo Cicero published a

[17] Lo Cicero (Carini 1898-Palermo 1887) first taught metaphysics and mathematics in the public school of Carini, his native town, then taught mathematics and physics at the Archbishop's Seminary of Monreale. In 1851 he embarked on a ten-year university career in Palermo, where he first served as a "physics demonstrator" until 1856; between 1857 and 1861, he served as an *ad interim* physics professor. In 1861 he left the university in order to dedicate himself to secondary-level education, which he steadily served until his death (Riccò 1891, pp. 3-22).
[18] The course, offered freely, lasted for eight months.

telegraphic handbook (Lo Cicero 1857, Fig. 4), in the first year of teaching the course; he then had it republished in a new, revisited and extended version, in the last year of the training programme (Lo Cicero 1861), before he left the field of university education permanently. The 1857 handbook was essentially a concise experimental physics course, divided into 4 parts, allowing only for the theoretical and practical study of electricity and magnetism. This, however, was not relevant for the preparation and, more importantly, for the maintenance of the machines, a matter that was far from unimportant and was in fact a source of great concern. The main points of this matter were dealt with by word of mouth or through the dictation of brief, handwritten instructions.[19] In order to fill this technical and administrative void, in 1858, Luigi Perollo, a mechanical engineer of the Royal telegraphic corps of Sicily, published a brief handbook (Perollo 1858, Fig. 5). This consisted of only about fifty pages,[20] containing practical instructions for the maintenance of the machines that were in service in the telegraphic stations of Sicily. The small handbook also provided a precise and lively description of the parts composing the set of Morse machines acquired from Hipp and approved by the Scientific Advisory Committee of Palermo. Finally, as concerns the Morse devices that were used, let us briefly refer to two of them: the receiver or writing machine and the current generator. The writing machine was of the dry printing type[21] and had suffered several modifications at the hands of the Swiss instrument maker which rendered it particularly effective and innovative. Specifically, the gearing that set the paper strip in motion[22] was not actuated by weights, as had been the case with previous models, but by means of a clock spring. The device, which presented five screw-terminals,[23] could be transformed into a translation machine[24] and several Morse messages could be inscribed in parallel rows on the same paper strip (Lo Cicero 1857, pp. 89-91). Equally innovative turned out to be the choice of the battery used in Sicily. Indeed, this choice largely benefitted from the work done in the field by Ernesto D'Amico, the delegate to Sicilian telegraphy, who, in order to fix a malfunction[25] of the Daniell battery, proposed a modified model called "Daniell

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[19] For example, Bozza dictated some instructions on the maintenance of electric batteries which were circulated in the telegraphic stations of Sicily. These instructions were then published in the Luigi Perollo's handbook (Perollo 1858, Articolo VIII, pp. 25-44).

[20] Prior to its publication, this work was most likely circulated as a handwritten booklet.

[21] A tip of steel fixed in the pen holder printed in relief the points and lines of the Morse code on the paper strip. In the first years after the unification of Italy, this model was replaced by one that printed in ink, which, provided the operators were very skilled, could produce 18-20 words a minute.

[22] More precisely, the strip passed between two cylinders that moved in opposite directions. The strip moved forward as a result of friction.

[23] The first three terminals performed the same functions as those which were present in the Morse key, while the last two were connected to the local battery and charged the pair of electromagnets inside the machine.

[24] The translation mode of Morse signals didn't require any operators and could automatically process an incoming dispatch, retransmitting it to the next station. Essentially, the printing point acted as a Morse key. This method rendered the relay of a dispatch quicker and avoided all possible mistakes due to the repeated manual resend operations.

[25] The porous vessel of the Daniell battery presented the inconvenient that, in time, its very permeability diminished as the pores were clustered by copper, which caused the battery to start functioning poorly or even stop working altogether. To eliminate this defect were designed several variants of the Daniell cell without diaphragm, also called "gravity battery", the main of which were the Minotto, the Callaud, the D'Amico and Candido.

without diaphragm". At first, this model was only used in Sicily, but after the Italian Unification, given its many qualities,[26] it was adopted by the Italian telegraphic administration and was named the "D'Amico battery", or the "Italian battery".[27]

6. The construction of the Sicilian network and the submarine cables

The works for the Sicilian telegraphic network started in December 1856 and by June 1857 Bozza had already managed to finish and open the Messina-Milazzo-Patti-S.Stefano-Cefalù-Termini-Palermo line to the public. However, the official inauguration of that segment only took place on October 15th, 1857, with a significant delay that was customary in the Kingdom of the Two Sicilies, on occasion of Queen Maria-Theresa of Austria's name-day. Between June and September 1857, Bozza continued working, first along the Western and Southern coasts,[28] then along the Ionian coast[29] to the east, in order to unite the two segments at the end of September 1857, in the city of Modica. Finally, in February 1858 the two internal ramifications[30] were completed, namely the Girgenti-Caltanissetta and the Terranova-Caltagirone-Piazza lines. In the meantime, in October 1857 discontentment broke out among the traders of Palermo, Messina and Catania. In fact, the messages were dispatched to Messina, where they crossed the strait by boat and arrived at Naples or abroad with great delays, mostly because of the scarce effectiveness of the Henley machines[31] that were in service on the Calabria segment. To solve this inefficiency, lieutenant Ruffo and D'Amico came into play and were granted a contract by Ferdinando II for running a submarine cable under the Strait of Messina. After some resistance from the central administration, the contract was finally entrusted to Jacopo Bozza. Thus, the cable was run through the Reggio-Messina Strait in January 1858, between the station at the Church of Canitello (Reggio) and the second tower of Ganzirri (Messina), which is a 3 km run. For the purpose, Bozza used a submarine cable that had been already purchased in London by the Bourbon government, in 1855, and that was being stored at the Arsenal while

[26] One of the most important such qualities was the constant supply of electricity over very long periods of time, as long as four or five months; the only precaution necessary was to replenish the copper sulphate crystals on the bottom of the container from time to time.

[27] This battery had the same structure as the Callaud battery, but was set apart by the fact that the glass vessel had a central constriction. It contained two liquids in contact – a saturated solution of copper sulphate and water that had been acidified with sulphuric acid – which remained separated by virtue of their different densities, and two electrodes, one of zinc and one of copper, shaped as a foil cylinder with a vertical slit and as a thick thread or strip, respectively. First, water was poured into the vessel, then, slowly, a solution of copper sulphate which, weighing more, would deposit on the bottom of the recipient (Ponzoni 1873, pp. 7-11).

[28] After the Messina-Palermo line, the segment was continued so as to include the towns of Trapani, Sciacca, Girgenti, Licata and Terranova.

[29] From Messina it was prolonged towards Catania, Siracusa and Noto.

[30] As already mentioned (see note 10), a single inland line was provided for in the original project, namely the Girgenti-Caltanissetta-Piazza-Caltagirone-Catania line.

[31] These machines, completely unsuitable for long telegraphic segments, with their frequent malfunctions, constituted the Achilles' heel of the Bourbon telegraphic system, especially along the lines of the Tyrrhenian dorsal and at least until the end of 1858.

waiting for a worthy opportunity to be used.[32] In order to achieve this delicate task, Bozza had to modify the war brig Principe Carlo, so as to transform it into a cable laying ship, and to furnish it with the electrical machinery[33] and instruments that were needed for testing the integrity of the cable during the cable-laying procedure.

Fig. 6. The telegraphic network in Sicily at the end of 1857. Detail from Benedetto Marzolla, *Carta della telegrafia elettrica in Europa*, Naples 1857[34]

This connection functioned for 9 months, then it was broken and repaired, but in April 1860 it was broken again and was subsequently abandoned. In the meantime, in order to render communications swifter, the Bourbon government struck an agreement with Bozza to have a second submarine cable driven through the Strait,[35] which happened on June 2nd 1858, on a longer route connecting the Messina Citadel to the Reggio new fort, on a total distance of approximately 11 km.[36] This connection remained in service until the end of November 1860, when it too was abandoned, and, until April 10th 1861,[37] the Strait was once more crossed by boat. All these problems were caused by the rocky bottom of the Strait and by the strong currents that engendered frequent tear-

[32] It was a three conductor cable, about 4 miles long, rather heavy at about 9 tons per mile, purchased from Glass, Elliot & Company at the government's expense.
[33] Most notably, he designed a gigantic cable-laying wheel with brakes, weighing 4 tons, the parts for which were ordered from the machine shops of Pietrarsa and from a privately owned establishment (Zino Henry) and then assembled in the Naples Arsenal.
[34] The map is a detail of a lithograph by B. Marzolla (1801-1858), a cartographer and geographer who served as an army engineer at the Reale Officio Topografico della Guerra in Naples.
[35] This one-conductor telegraphic cable, some 20 km long, was also purchased in England from Glass, Elliot & Company.
[36] This cable laying procedure and the previous one were closely monitored by a commission from the University of Naples, appointed by the government and composed of Luigi Palmieri, Giuliano Giordano and Raffaele Napoli. The commission was supposed to monitor the works that were being done and to draw up the final reports, in order to validate the reimbursement of the expenses incurred by Bozza.
[37] In that year, the government laid two new one-conductor cables but they were already broken the following year.

ups of the cables.[38] In 1863, in order to avoid the strong currents, a cable was extended outside of the Strait, on a longer itinerary, between the little towns of Bagnara Calabra (Calabria) and Torre Faro (Sicily). The choice proved to be the correct one and this cable worked well for more than twenty years.

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[38] In order to get an idea of the difficulties they encountered, it suffices to say that between 1858 and 1882 no less than 19 cables were laid and broken in the Strait!

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