# BOLOGNA'S HIDDEN CANALS IN THE 20TH CENTURY

## FIRST HALF OF THE 20TH CENTURY

### THE 1889 REGULATORY PLAN AND THE FIRST PAVING OVER OF THE CANALS

The plan opening the exhibition introduces the theme of urban transformation that brought about the first paving over of canals in the city's north-western area.
In 1884-85, the Municipality of Bologna entrusted Mr Edoardo Tubertini, engineer, with the drafting of the Regulatory and Expansion plan of the city. He was supported by a committee made up of important figures from the city's cultural scene.
The technical report presenting the plan made no reference to the uncovered canals. It did however identify the area of industrial factories using water from the Reno Canal as an "unhealthy region" to be redeveloped by opening a major new road linking Piazza Malpighi to the railway station.
The redevelopment works were declared as being of public benefit, pursuant to the so-called "Naples law" (15th January 1885), which provided for total expropriation and credit facilities for builders working in the redevelopment areas. The Regulatory Plan was approved on 11th April 1889.
The map shows the expansion of the new districts in the areas within and outside the city walls, with greater growth north of the railway line. The map highlights the areas not yet built on within the walls, intended for prestigious housing along the major road links (Via Indipendenza, the Via Irnerio - Via dei Mille route, Piazza Umberto I, the Via Principe Amedeo - Via Carlo Alberto route). The new road network shown in yellow and the plotted course of the uncovered canals highlight the points of intersection that would be the first to be paved over in the 1920s and '30s.
The first work to pave over the Moline Canal - Aposa stream was carried out in 1925-26 in connection with the extension of Via Indipendenza and the opening of the new flyover over the railway. Other construction sites, set up between 1928 and 1934, would radically change the Cavaticcio and Navile Port areas, with drastic demolition and paving over work.
The numbers marked on the map and the corresponding photographs indicate the various works presented in the two parts of the exhibition: the construction sites of the first half of the 20th century can be seen on the left and those of the latter half of the century are on the right.

# 1. PAVING OVER THE MOLINE CANAL AND APOSA STREAM (1925-1926) COMPLETION OF PIAZZA XX SETTEMBRE AND VIA INDIPENDENZA

In September 1924, “Il Comune di Bologna” magazine reported on the progress of works on the new flyover, designed by engineer Ezio Bianchi of the Railway Works Office and by engineer Leonida Barigazzi. The work was of great importance for the development of the districts north of the railway line, provided for in the Regulatory Plan of 1889. It was therefore necessary to complete **Via Indipendenza** and finalise the adjoining **Piazza XX Settembre** with **Porta Galliera** in the centre.
In 1925, the City Council approved the project for the paving over of a 150-metre section of the Moline Canal and Aposa stream near Porta Galliera. The mayor, Umberto Puppini, set the date for completion of works as the 30th May 1926. The *Consorzio Bolognese Cooperative costruzioni e trasporti* of Bologna was awarded the contract to channel the waterways with brick walls according to the drawings provided by the Technical Office.
The digging works are documented in the general views of the area to the east of Porta Galliera: in some photos we can see various buildings and chimneys in the area towards Porta Mascarella; in the distance is the first gas holder of the gasworks.
The area reclaimed by paving over the canals remained empty until the Council sold the plot for the **construction of the G.I.L.** (Italian Youth of the Lictor) Building, inaugurated in 1939. The building was short-lived: it was demolished in 1957 to make room for the **coach station**, which was built following the total paving over of the two canals and the completion of Viale Angelo Masini between 1952 and 1958.

# 2. PAVING OVER THE RENO AND MOLINE CANALS (1928-1932)

**2a. Extending Via Carlo Alberto**
**2b. Widening Viale Giovanni Vicini**
**2c. Intersection between Via Riva di Reno and Via Casse**

In 1928, Mayor Leandro Arpinati presented the Consorzio del Canale di Reno [Reno Canal Consortium] with the plans for three works provided for in the **1889 Plan**: the paving over of the *Moline Canal–Aposa Stream* to extend Via *Carlo Alberto* (now Via Amendola), the paving over of the *Reno Canal* to widen Viale *Vicini* and the paving over of the *Reno Canal* between *Via Casse* and *Via Azzo Gardino* to complete Via Principe Amedeo (now Via Marconi).
As a result of problems associated with the **canal's** short **dry period**, it was decided to use a reinforced concrete slab as the covering structure: the piers on which to rest the beams would be built during the dry period and the concrete would then be cast during the normal regime of the canal.
The paving over of the Reno Canal on Viale Vicini (13.65 metres) left a section exposed (7.50 metres), which was railed off with an elegant parapet. In 1930, the paving over works of another section of canal was authorised, between the Masi school and the Davia barracks.
To complete Via Carlo Alberto and link Piazza Umberto I (now Piazza dei Martiri) to the railway station, the Moline Canal was paved over between the works of the *Calzoni company* and the buildings of the Poggioli brothers (the former *Galliera Mill*), which would later make way for the block between Via Amendola, Viale Pietramellara, Piazza XX Settembre and Via Boldrini.
To pave over an initial 57-metre section of the Reno Canal between Via Azzo Gardino and Via Casse, a reinforced concrete slab was created. This was supported by longitudinal beams resting on pillars outside the canal bank walls.

# 3. PAVING OVER THE CAVATICCIO CANAL (1931-1933)

The Cavaticcio Canal, **a branch of the Reno Canal**, was used from the 13th century to feed water into the **Navile Canal** and provide many production activities along the first section of the watercourse with energy. The water from the Reno Canal passed through underground pipelines controlled by *sluice gates*, to reach the **mills**, before being returned to the Cavaticcio.
In 1994, thanks to the **15-metre height difference** between the flow of the Reno Canal and the lower level of the Cavaticcio Canal, the Council was able to install a hydroelectric power plant on the waterfall, implementing a design dating back to 1911, which had long-remained on paper.
The opening of Via **Principe Amedeo** (which became Via Roma and is now Via Marconi), provided for in the 1889 Plan to link **Piazza Malpighi** to Piazza Umberto I (now Piazza dei Martiri), required the expropriation and demolition of the buildings on **Via Fontanina**, **Vicolo Poggi** and **Via Pugliole di San Bernardino**. The area - considered unsightly due to its proximity to the modern buildings that replaced the houses in Via Casse - underwent a radical transformation. The works to channel the first section of the Cavaticcio posed complexities: the brick covering would have to follow the vertical geometry of the bottom of the canal, which lay at an angle of 34° with respect to the road.
Works began in 1931 by the *Nobile e Forti company*. A **viaduct** with nine arches held up by square-based pillars was erected to support Via Principe Amedeo. In October 1932, when the most important works had already been completed, “Il Comune di Bologna” magazine published a number of construction site photographs by the *Bolognesi e Orsini company*.

# 4. PAVING OVER THE NAVILE CANAL AND DEMOLISHING THE PORT (1934-1935)

Once work on the Cavaticcio Canal was complete, the Technical Office prepared the project **to extend Via dei Mille** (now Via Don Minzoni) as far as Viale Pietramellara. The intervention involved paving over a 180-metre stretch of the Navile Canal, from *Ponte del Ranuzzino* (the Ranuzzino Bridge), outside the walls, to the city's bakery (Forno del Pane Comunale), now home to MAMbo.
In order to complete the road, a number of buildings of the Port designed by **Jacopo Barozzi da Vignola** in 1548 had to be demolished.
Falling victim to the demolition were the former Custom-house of the port (**ex Dogana del porto**),where goods transported along the waterway arrived and from where they departed, the Ship Gate (**Porta delle navi**), created under the walls, the adjacent **gatehouse** and other buildings on Via Mura Lame, including the **former Church of the Most Holy Crucifix of the port**. The intervention was approved by the Mayor Angelo Manaresi on 23rd June 1934. The contract was awarded to the *Nobile e Forti company*, which had previously been working on the Cavaticcio.
In August, "Il Comune di Bologna" magazine reported on the demolition of the former Custom-house, telling the story of the "rescue" of the high relief in terracotta portraying the **Virgin Mary with child and the Archangels Michael and Gabriel** by Camillo Mazza, affixed to the façade of the Custom- house in 1667 as an ex-voto offering. The sculpture was removed and placed at the top of the monumental staircase in the Palazzo Comunale, home to the city council.
The only building spared was the **Salara** (1783), the Salt and grains warehouse, restored by Bologna City Council between 1992 and 1995.In 2011, with the demolition of the reinforced concrete covering, the dock basin was reclaimed, giving the former Navile port a proper revamp.

# SECOND HALF OF THE 20TH CENTURY

After the *post-war Reconstruction Plan* (1948), the municipal technical services prepared the General Regulatory Plan. This was finalised in 1955 before being approved by the Ministry of Public Works in 1958.
The need to pave over the canals had already come to light with the programme for building *Roads and sewers*, entered in the Extraordinary Budget of 1952. Priority was given to the run-down area to the north and east of Montagnola Park and to the **paving over of the Aposa stream and Moline Canal** to complete Viale Angelo Masini.
In 1954, the City Council launched the **project to pave over the Reno Canal** in its entirety, starting from the section between Via Marconi and Via San Felice, then from the stretch in Via della Grada and, last but not least, from the section between Viale Vicini and Via della Crocetta, which enabled Via Sabotino to be opened.
The City Council's decisions (dated 1954, 1956 and 1959) shed light on the reasons behind a decision that would change the ancient hallmark of the city of water forever. Reasons repeatedly quoted were the need to **modernise the road network** and at the same time solve **problems relating to hygiene and urban aesthetics**, caused by the lack of sewers in the areas alongside the canal.
Hiding the watercourse was the fastest way to meet the requests of the residents to free the areas from the unbearable smells caused by the mixing of canal water with the filthy sewage. The **requests of the owners of the properties lining the canals** led to the paving over of various sections of the Reno Canal and Moline Canal running parallel to Via de' Falegnami and Via Capo di Lucca. Only the short sections parallel to Via Augusto Righi were spared. After the opening up of the **windows** onto the canals from Via Malcontenti, Via Piella and Via Oberdan in 1998, these stretches are now considered a true tourist attraction for the city.

# 5. VIA G. MARCONI VIADUCT IN THE POST-WAR PERIOD

Despite the launch of the Reconstruction Plan in 1948, the housing crisis was still extremely serious in the early 1950s. Many council-owned buildings were occupied by the homeless: more than 4000 people, according to estimations. In 1952, the City Council regularised the occupation of premises “by disaster victims and evictees”, subject to the regular payment of rent based on the condition of the buildings. Lodgings were often made in **inadequate places that failed to meet the most basic hygiene requirements**. In the Via Azzo Gardino area, the arches of the Via Marconi viaduct were filled in to serve as housing. On 31st August 1952, the “Giornale dell’Emilia” newspaper led with the headline, “*Nine families living under a bridge*”, exposing the degradation of those lodgings. The Council was demanding 400 lire per month from those poor souls, to charge for the drinking water system for the lodgings.
After the **bombing** of 25th November 1943, which hit the Cavaticcio Canal tunnel, killing hundreds, a **large crater** remained where the first section of the canal had once run. The situation was only resolved when the **Cavaticcio Canal was re-routed under Via Marconi**. In 1955, the Council finalised the project to enable the future construction of a **hydroelectric power plant** that would exploit the roughly 15-metre waterfall. Mr Ugo Stefanelli, an accountant, acquired the plot to the west of Via Marconi in 1956 in exchange for the vast area to the east of Via Stalingrado, intended for the trade fair. The transaction made it possible to complete the side to the west of Via Marconi and build Largo Caduti del Lavoro.

# 6. PAVING OVER THE MOLINE CANAL AND APOSA STREAM (1952-1957)

## COMPLETING VIALE ANGELO MASINI

The redevelopment of the area between Via Irnerio, Via Mascarella, Viale Masini and the Montagnola Park was a priority for the implementation of the 1948 **Reconstruction Plan**.
In 1952, the City Council took on the redevelopment of the area north of the Montagnola Park, near Viale Masini, between Via Indipendenza and the point where the *Aposa stream* and *Moline Canal* leave the city, near Via Capo di Lucca. The presence of the two canals, still uncovered, had prevented a huge part of the area from being built on, due to the "degraded and unhygienic conditions of the land bordering the canals." The paving over project provided for expenditure of 50 million lire.
It was necessary to proceed as a matter of urgency, for reasons relating to **hygiene and town planning**. With a loan of 125 million lire from the Cassa di Risparmio in Bologna, it would also be possible to purchase certain areas.
In December 1955, the contract was finalised with the *Nobile e Forti* company, winner of the tender. The works underwent a few changes (demolitions, excavation work, changes to the covering structure of the Aposa stream, restoration work on the walls below the Montagnola park, paving over of an additional 26-metre section of the Moline Canal). This resulted in an increase in expenditure of more than one million lire.
Once the paving over of the canals was complete, the Council purchased the **G.I.L.** (*Italian Youth of the Lictor*) **building**, the large white palace in rationalist style designed by the engineer Luciano Petrucci and later demolished in 1957. The **Coach station** was then built in 1967 on that very area, using the design produced by architects Luigi Vignali and Luigi Riguzzi.

# 7. PAVING OVER THE RENO CANAL

## BETWEEN VIA MARCONI AND VIA GALLIERA (1952-1959)

The course of the canal under **Palazzo Gnudi-Scagliarini**, on Via Riva Reno, is documented in a miniature from the *Insigna degli Anziani Consoli* (1732) and in a beautiful engraving of 1833 by Antonio Basoli. The first paving over of the canal section between the building and **Via Galliera**, carried out back in 1896, was redone in 1959 due to the precarious conditions of the road surface. In 1952, the City Council earmarked 7 million lire for the paving over of a 30-metre section nearer **Via Marconi**.

In 1955, at the request of the residents in **Via de'Falegnami**, the Council resolved to pave over the section of canal behind the buildings. The owners of the buildings lining the canal shared the costs by paying half.

In 1956, the Council finalised an agreement - to pave over another section of canal near **Via Nazario Sauro** - with the owner of a building under construction on the right bank of the canal; the owner would bear the expenses for the covering on the side where his property stood, while the Council would pay for the covering for the other bank.

And so the Reno Canal disappeared from sight, continuing its course beyond Via Galliera, slotted in between the houses. Even the views from Via Malcontenti, Via Piella and Via Oberdan were hidden, to conceal the **truly unsightly, unhygienic conditions**. The Council only dealt with the problem in 1984, by building appropriate sewage pipes. However, the **reopening of the viewpoints over the canal** was put off until 1998, when it was carried out in accordance with the project funded by the *Ansaloni Building Cooperative*, under the direction of architect Francisco Giordano. Ever since, citizens have been able to rediscover the long-hidden history of the Bologna of water.

# 8. DIVERTING THE CAVATICCIO CANAL

## THROUGH THE NEW PIPELINE ALONG VIA MARCONI (1952-1954)

In 1953, the Council decided to sell the building land of more than 3000m2 , located between Via Marconi, Via Riva Reno and Via Polese and another council-owned area destined for the building of the future Via Giacomo Leopardi. The sale had long been hindered by the presence of the Cavaticcio Canal, which brought the area down in value. The Council had only obtained permission **to divert the canal under Via Marconi** in 1952, from the Consorzio della Chiusa di Casalecchio e del Canale di Reno [Casalecchio Lock and Reno Canal Consortium], which owned the rights to the Cavaticcio.
The cost to carry out the work, borne entirely by the Council, would be largely financed using the reparation funds for the damages suffered by the Cavaticcio during the war.
The land to be sold also included a small property belonging to the Consortium, used for regulating the water, and the so-called **Sega dell'acqua**, the old building constructed on the Reno Canal at the branch stream of the Cavaticcio. The agreement provided for the allocation of other premises to the Consortium, intended for the lodging of the guardian of the floodgate controlling the new pipeline. The lodge would be located in the building that would stand on the area freed up by the Cavaticcio.The design for the diversion had been ready since 1952: a **floodgate** and a **drain** were planned at the top of the pipeline to overcome the difference in level between the bottom of the Reno Canal and the bottom of the Cavaticcio canal beyond Via Marconi.
The sale of the area to businessmen Augusto Musiani and Cesare Baldiserra of Bologna, the exchange of properties with the Consortium and the project to divert the Cavaticcio were all approved in 1954.

# 9. PAVING OVER THE RENO CANAL (1954-1957)

## 1ST LOT - FROM VIA MARCONI TO VIA SAN FELICE

In 1954, the City Council unanimously approved the project for the paving over of the Reno Canal in the section between Via Marconi and Via S. Felice. This was the first step towards channelling the entire canal.
The order was dictated by **reasons relating to hygiene and aesthetics**: the canal was a dumping ground for sewage from the area, which had no proper sewage system, and for rubbish thrown in illegally by the residents of the buildings lining the canal. The paving over of the canal would also **improve the road system**, by creating two roads with a central area to be used as a green space and for parking.
With the demolition of the old ruins on Via Reno and transfer of the Manifattura Tabacchi (Tobacco Factory) to the new establishment in the northern outskirts of the city, a modern and definitive layout was finally to be given to a **central zone in the city undergoing rapid expansion**, considering the intense building development on Via Marconi and Via Lame and in the area where the *Palazzo dello Sport (Sports Stadium)* would be erected. Despite its historical importance, the Reno Canal was no longer any use for industry by this time.
The dimensions of the covering (530 metres), the digging procedures, demolition work and characteristics of the materials to be used would require an estimated expenditure of 97 million lire, to be funded by taking out a loan with the Consorzio di Credito per le Opere Pubbliche in Rome.
The site was opened on **21stSeptember 1955** in the presence of the Mayor, Giuseppe Dozza, and many city authorities. The works, contracted out to the *Costruzioni Callisto Pontello* company of Florence, were completed between 1956 and 1957.

# 10. PAVING OVER THE RENO CANAL ON VIA DELLA GRADA (1956-1958)

## 2ND LOT - FROM VIA SAN FELICE TO VIALE VICINI

The project for the channelling of the canal in the section between Via S. Felice and the ***Opificio della Grada (Grada Factory)*** was submitted to the City Council in 1956. It was considered as the 2nd lot of the works already started between Via Marconi and Via S. Felice. It was deemed a **necessary measure from both a hygiene and a town-planning perspective**: completion of the covering was in fact urgent in order to complete Via della Grada, before proceeding along Via Sabotino, where the new subsidiary road would join the Via Emilia.
The photographs document the various phases of the works (from digging the bottom to reinforcing the banks and constructing the supports for the reinforced concrete slab) and the building transformations of the postwar period. Some of the apartment blocks present today can in fact be seen in the photographs.
We can also see the building of the **Reno Baths** (demolished in 1961), commissioned by the surgeon G. Bergonzoni and built in 1804. In those days it was known as the *Bagni della Carità* (Charity Baths), as it was next to the S. Maria della Carità Church. The complex, built for social and health purposes, offered “bath and shower” services. However, use of the canal water posed hygiene problems, due to the presence of the public wash-house upstream and,
above all, of the *Grada tannery,* which remained operative until 1841. In 1873, the owner, Mr Michele Mamo, engineer, refurbished the Baths complex in neo-Gothic style, as documented in the photographs taken in the early 20th century. However, hygiene conditions in the establishment stayed exactly the same, as emerged from the reports of various doctors who deemed the waters used for washing to be a vehicle for disease and infections.

# 11. PAVING OVER THE CAVATICCIO CANAL(1955-1956)

The paving over of the Cavaticcio Canal was resumed in the mid-1950s as part of the redevelopment of the district encompassing Via Marconi, Via Riva di Reno, Via Lame and Via Pietramellara, which was almost entirely destroyed during the war. The paving over of the canal had become necessary in order **to improve the road network and use of the building land**. The project for the **channelling work in Via Fratelli Rosselli** (64 metres) was resolved on in the City Council meeting of 21 September 1955 (Agenda no. 13). 10,800,000 lire (plus 509,360 lire for contingencies) were budgeted, to be financed by selling council-owned land.
The following year, the contract was entered into with the *Società Anonima Imprese Edilizie (S.A.I.E.)* construction company of Bologna, winner of the tender. The project showed the best hygiene and construction characteristics and there were plans for the future to extend the covering of the canal upstream and downstream of the section in Via Fratelli Rosselli. The canal carried sewage, meteoric water and waters from the Reno Canal. However, due to the characteristics of its banks, it was impossible to carry out proper maintenance of the bottom and sides, which were infested with rats and insects.
On 29th November 1956 (Agenda no. 126), the City Council approved the paving over of another section of the Cavaticcio Canal (55 metres) on **Via Cipriani**, for a total amount of 9 million lire. The works would enable Via Milazzo to be linked to Via Bovi Campeggi, as provided for in the *Reconstruction Plan* and *General Regulatory Plan*.

# 12. PAVING OVER THE RENO CANAL IN VIA SABOTINO (1959-1965)

## 3RD LOT - FROM VIALE VICINI TO VIA DELLA CROCETTA

On 8th July 1959, the City Council unanimously approved the project to pave over the Reno Canal on the section along Via Sabotino, from Viale Vicini to Via della Crocetta, rounding off the previous works of the 1st and 2nd lots.
The 3rd lot of paving over work of the Reno Canal (727 metres) was required in order to build a major **road running parallel to Via Emilia**, provided for in the recently approved *Regulatory Plan*. It was essential to pave over the canal, not only for **town-planning**, but especially for reasons relating to **hygiene and aesthetics**, as sewage from the buildings in the large area without sewage pipes was being discharged into the canal, and all sorts of rubbish were being thrown into the canal along the long open sections, causing major inconveniences during the period of drought in the summer months.
In December 1959, a loan of 102 million lire was taken out with INPS (the Italian National Social Welfare Institution) to finance part of the cost, with a change to the 1959 budget due to the decision to extend the covering along certain sections upstream of Via della Crocetta.
In September 1960, the contract was awarded to the *Costruzioni Toschi Company* in Bologna, for 125,328,000 lire. To make the covering seamless as far as Via Montefiorino and given the need to carry out further digging works and to move the course of the canal towards the left bank due to the presence of an unsafe wall on the right bank, the total amount rose to 165,328,000 lire (resolution of 29 July 1963, implemented in November 1964). The works were carried out and completed in 1965.

# 13. PAVING OVER THE MOLINE CANALE (1926-1974)

## BETWEEN VIA DEL PALLONE, VIA ALESSANDRINI AND VIA CAPO DI LUCCA

From the 13th to the 18th century, a distinctive feature of this section of canal was the presence of **15 grain mills** exploiting the **9 waterfalls** to activate the **vertical water wheels**. During the 19th century, the mills were converted into other activities, such as **tanneries and rice hullers**.
The first paving over operations (1926-1933) were carried out by Cassa di Risparmio, the owner of various buildings in Via Pallone, Via Irnerio and Via Capo di Lucca. In 1967, an application was made for the paving over of a section of canal between Via Capo di Lucca and Via Alessandrini for the construction of the *State Telephone Exchange* building (project of 1968-1974, designed by the architect Enzo Zacchiroli, now home to the University of Bologna) in the area of the former *Cavallo Aposa Mill*. Other applications to pave over the canal were submitted between 1969 and 1971 by private individuals.
However, until the late 1960s, the section of **canal incorporated within the block** between Via Alessandrini and Via Capo di Lucca was still largely uncovered. The hygiene conditions of the watercourse and the run-down buildings along the banks led to requests to extend the reinforced concrete covering, leaving **only the initial stretch uncovered**, between the first and second waterfalls.
In the photos we can still see the **footbridges** for accessing the **floodgates**, used by the old mills, the **spacing wheel** of the former *Cavallo Mercato Mill* and the **paddle wheel** of the former *Leone Aposa Mill* [now preserved in the Museum of Peasant and Farming Culture of San Marino (Museo della Civiltà Contadina di San Marino) in Bentivoglio]. We can also see the **suspended bathrooms** built on the back of the houses, from which the sewage flowed directly into the canal.

# OPIFICIO DELLE ACQUE

## EDUCATIONAL ARCHIVE CENTRE

The OPIFICIO DELLE ACQUE, dedicated to collecting and disseminating records of the history of Bologna's waterways, is opening its doors to the city in the former Opificio della Grada [Grada factory], home to the Consorzi di Reno e di Savena [Consortia of the Reno and Savena Canals]. The rooms on the ground floor of the building, which was constructed on the Reno Canal in 1683 as a tannery, have been restored. This means that educational activities, exhibitions and in-depth informative sessions can be scheduled, so that visitors can learn about Bologna's waterway system and about the many historical, technical, production-related, economic, town planning and environmental aspects in relation to water as a precious resource for the community.
The **artificial waterways system** created in Bologna in the 12th and 13th centuries is considered to be one of the most effective of those built in Italy in the Middle Ages. Over the course of eight centuries, its infrastructure has been fine-tuned to feed into a network of open and underground pipelines spread over the urban and out-of-city areas, benefiting production activities, navigation and the water safety of the city.

Until the mid-19th century, this system was protected by specific Assunterias, tasked with managing the distribution of waters from the **Savena stream** and **Reno river**, using the two dams which to this day still supply water to the **Savena Canal** and **Reno Canal**.

Administration of the waterways system later passed to the industrialists, craftsmen and farmers using the pipelines, in other words to those directly concerned with the proper functioning of the network, who united to form the **Consorzio della Chiusa di Casalecchio e del Canale di Reno** (1851) [Consortium of the Casalecchio Dam and Reno Canal], the **Consorzio della Chiusa di San Ruffillo e del Canale di Savena** (1885) [Consortium of the San Ruffillo Dam and Savena Canal], and the **Consorzio degli Interessati nelle Acque del Canale di Savena in Bologna** (1887) [Consortium of the Stakeholders of the Waters of the Savena Canal in Bologna].

The technical and administrative work of these institutions is documented in the **Historical archives of the Consortia**: the material preserved there includes manuscripts, printed texts and maps, from the mid-16 th century to the present day.

Since 2019, the Consortia have identified themselves using the shared name of **Canali di Bologna**, a joint identity to simplify communication.

# OPIFICIO DELLE ACQUE
## EDUCATIONAL ARCHIVE CENTRE

The San Ruffillo and Casalecchio di Reno dams lie at the origin of Bologna's waterway system, of which building began in the 12th century to obtain motive power for the grain mills and operate various types of machinery used to process paper, clothes, leather and metals. From the 14th century, water energy was harnessed to turn the spinning **wheels of the silk industry**, which developed the most during the 17 th century, employing up to 25,000 people and exporting its
products all over Europe, where they were extremely popular.
The **San Ruffillo Dam** was built on the Savena stream in 1176 by Bologna City Council, to feed into a canal dug to supply water to the moat around the outside of the second city walls, known as the "Torresotti" walls. The main pipeline then went on to distribute the water to the dense water network spread over the eastern part of the city, to the right of the course of the Aposa stream.
The **Casalecchio Dam** was built on the river Reno in 1191, at a point more downstream from the current position. It was constructed by private stakeholders interested in harnessing the water energy to turn the wheels of the mills and of the various types of factories concentrated in the north-western part of the city, including within the third city walls.

In 1208, Bologna City Council acquired the right to canalise all the waters leaving the city to supply water to the **Naviglio Canal**, constructed during the 13 th century, with navigation locks added later on. This waterway enabled trading with the Po hinterland and Adriatic coast, generating development and wealth for the city and its local area.

Nowadays, Bologna is served by a water network of over 60 km. This architectural and technical heritage is one of its kind in the region and controls and preserves the land, protecting the city from flooding and guaranteeing minimum run-off even during periods of drought. The task of the Consortia is to maintain and enhance the network, by continuously restoring the structures, redeveloping the pipelines and adapting to new needs.

# 1. THE HYDROELECTRIC POWER PLANT OF THE ISTITUTO ORTOPEDICO RIZZOLI [RIZZOLI ORTHOPAEDIC INSTITUTE] IN THE GRADA FACTORY (1898 - 1926)

The Grada Factory, built on the Reno Canal in 1683 by Giovanni Battista Mengarelli, retained its original function as a **tannery** until 1841. This activity was carried on over time despite changes in ownership of the building: from Mengarelli to Cardinal Pompeo Aldrovandi in 1725, from Aldrovandi to the Chapter of S. Petronio in 1775, up to the purchase in 1791 by the Assunteria della chiusa di Casalecchio, now the Consorzio della Chiusa di Casalecchio e del Canale di Reno [Casalecchio Lock and Reno Canal Consortium]. As the factory was of great importance for the flow management of the canal, the Assunteria bought it to improve the distribution of water to users. Following a number of improvements, the tannery remained operative until, as a result of the leather industry crisis, it was converted into a **grain mill**.
The plan of 1868 outlines the rooms on the ground floor and the equipment proposed by the leaseholder Annibale Bernardi, manager of the mill, to adapt the plants for use as a Rice mill, keeping the 3 wheels, the millstones and other mechanisms. The change in use would require less motive power and an economic advantage could be gained by using a system of grolle (wooden cups) and pistrini (mills) to polish the rice.

The factory stakeholders of the Reno Canal had often complained about water distribution problems in the city caused by the mill. So, in 1877, the Assunteria decided to appoint a Guardian, who would live on location, to control the **spillway** and **floodgates** that supplied the **two existing side by-pass canals**.
On 24th January 1897, consideration was given to the possibility of renting out the **Grada waterfall**. And so, in March 1898, Special Commissioner Giuseppe Boriani submitted to the Consortium the application of the Governing Body of the Istituto Ortopedico Rizzoli [Rizzoli Orthopaedic Institute] for the installation of a **Hydroelectric Power Plant in the factory to generate and transmit electric power**, to be used to power and light the Institute. The lease contract was prepared in July, with an expected duration of 29 years, and then registered with a notarial act.
With an announcement in the press on 4th November 1898, the Commissioner called a Meeting of the Stakeholders to resolve on the Lease of the waterfall at the Grada factory to the Rizzoli Orthopaedic Institute, amongst other things.

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The **plant design of the motors in the Grada factory**, by the engineer Filippo Canonici, was presented to the Consortium on 16th January 1899, complete with the technical report and a 1:100 drawing with plan, section and legend of the rooms where the hydraulic motors would be housed for the transmission of power to San Michele in Bosco. **Two American-type, free-intake reaction water turbines** were to be **installed under water**, marked on the drawing with the letters T and T1. The turbine T was installed in the **main side by-pass canal** of the factory, adjacent to the Reno Canal. T1 was installed in the **secondary side by-pass canal**, used to turn the old **paddle wheel R**.
The wheel activated the **pump p**, which raised the water to irrigate the vegetable garden owned by Borghi Mamo, on the southern border of the factory; with the new plant, the pump would operate by harnessing the energy supplied by the turbine T1.
The supply to the turbines was to be regulated by two floodgates F - F1, operated by the rooms that the Consortium had leased to the Institute; these were separate from the **gatehouse A** and from the **spillways S - S1**, established for the maximum and minimum water level, and from the **weir P** used to manage the flow of the canal. At full capacity, the turbine T1 had a capacity of 4000/4850 litres, and the turbine T of 3000/3500, depending on the water conditions in the canal. The devices for transmission of the power to the **generator D of electric power** to be transferred to S. Michele in Bosco were positioned in the ground floor rooms above the side by-pass canals. The plan shown here and the photograph of the rooms show the distribution of the various devices and of the generator.

1. Plan and elevation of the Grada Factory adapted as a grain mill in 1868. ACCCR, Carteggi, 1867- 1868.
2. Announcement for the second calling of the Meeting of the Stakeholders, on 20th November 1898 at the Palazzo Comunale, home to the City Council.
3. Plan and section of the factory, with the position of the two turbines and the plants of the Rizzoli Institute's Hydroelectric Power Plant. Plan by Mr Filippo Canonici, engineer, 16th January 1899. ACCCR, Carteggi, 1899.
4. The machines of the electric power "generating station", positioned in the ground floor rooms of the Grada factory. BCABo. *The Rizzoli Orthopaedic Institute in S. Michele in Bosco*, Officine Arti Grafiche, Bergamo 1910.

# 2. ELECTRIC POWER, FROM THE GRADA POWER STATION TO THE SAN MICHELE IN BOSCO HILL

The **Rizzoli Orthopaedic Institute** was opened in 1896 after the Province of Bologna acquired the former S. Michele in Bosco monastery, thanks to the legacy of the famous **Bolognese surgeon, Francesco Rizzoli**. The huge building and the type of treatment offered (surgery, electrotherapy, kinesitherapy) required the provision of modern technical systems, designed to serve the whole hospital.
The Institute was equipped with a **thermal power plant** for the generation of motive power and lighting, made up of **two unexplodable multi-tubular boilers** manufactured by the Tosi firm in Legnano, operating at a maximum effective atmospheric pressure of 8:5. The steam generated was used for heating, sterilising equipment and other uses within the hospital.
In 1898, the Institute planned to increase electric power production by harnessing the energy from the waterfall at the Grada factory. The **waterfall** varied from 0.72 metres at ordinary canal capacity to 1.06 metres in periods when the level was very high. Water was available all year round, except during the **dry period** (or "tòlta d'acqua", when the water supply was cut off), which lasted between 15 and 25 days. Annual averages were 8m3 for capacity, 0.90 m for the drop and a theoretical power of 96 horsepower. **Two American-type reaction water turbines**, **fully submerged in the water**, were selected to maximise exploitation of the small waterfall and the little space in the **two side by-pass canals** under the building. The turbines were manufactured by the Bologna-based Alessandro Calzoni company. The largest turbine was able to develop power of between 28 and 51 horsepower, while the smallest could generate between 22 and 37 horsepower.
In 1900, the Rizzoli Institute presented the Consortium with the plan by the engineer Filippo Canonici for the installation of a **third turbine**, with a capacity of 2100 to 2500 litres, which would be able to generate between 15 and 27 horsepower. The speed of the turbines ranged from 34 to 37 revolutions per minute. Each turbine was independent from the others, but they were all connected to the same horizontal drive shaft, fitted with two bevel gears of different diameters. The motion was transmitted via a belt to the electrical rotating machine installed in the ground floor room. A secondary drive operated a pump that raised the water to irrigate the land surrounding the building.
The **power generating station** included a three-phase alternator by the Oerlikon company, which was capable of absorbing a power of 60 effective horsepower with 800 revolutions, 40 periods and a voltage of 3600 volts. All the safety measures had been adopted in the rooms (high-voltage lightning arresters with ground wire and plate, wooden flooring, insulated wires).

# 2. ELECTRIC POWER, FROM THE GRADA POWER STATION TO THE SAN MICHELE IN BOSCO HILL

The **receiving station** positioned in S. Michele in Bosco was reached via a 2488- metre-long **electric power line** made up of three electrolytic copper wires having a diameter of 3mm, "with insulators with double casing fixed to poles secured with iron clamps on the upper part of the old walls."
The line reached Porta d'Azeglio, then crossed the Military Arsenal (now the Staveco area), held up by poles fixed into the ground, and followed the S. Michele in Bosco panoramic road up to the receiving station unit on the approach road to the Institute. From this unit, electricity was distributed inside the hospital, where rooms fitted out with **X-ray and radioscopy** equipment were in operation.
To compensate for the lack of power during periods when the canal was dry, the Institute had entered into a contract with the **Società elettrica bolognese** [Bolognese electrical company] for the supply of high-voltage three- phase electric power (3000 volts), with a line that branched off from Via S. Mamolo. The voltage was reduced by a transformer manufactured by the Ganz company, which was needed both for power generated at the Grada Factory and power from the Bolognese company.
As the years passed, the Institute required more and more electric power and the Grada plant proved insufficient. In 1908, the Rizzoli Institute submitted a request to the Consortium to be able to sublet the power plant to private individuals who had requested to use it, and the request was granted. The lease agreement was due to expire on 28th February 1928. However, in as early as January 1926 the President of the Rizzoli Institute communicated that the power plant had been closed once and for all, as the Institute had made other arrangements for the supply of electricity. As the Consortium had no intention of cancelling the contract early, in December 1926 it asked for time to decide on the right of pre-emption over the purchase of the machinery and to start negotiations with third parties to exploit the waterfall.

5. Plan to install the third turbine in the Grada Hydroelectric Power Station. Watercolour drawing from 1900 by Mr Filippo Canonici, engineer. ACCCR, framed maps.
6. Announcement of 25th August 1900 to notify citizens of the application by the Rizzoli Institute to install a third turbine at the Grada. ACCCR, Carteggi, 1900.
7. The internal walls near the Church of S. Valentino della Grada in the late 19th century. BCABo. GDS. Walls and Gates of Bologna, no. 0354.
8. External walls of Porta S. Isaia with the power line poles. BCABo. GDS. Walls and Gates of Bologna, no. 0353.
9. Power line fixed to the external walls, between Porta Saragozza and Porta d'Azeglio. BCABo. GDS. Walls and Gates of Bologna, no. 0403.
10. View of the city from the S. Michele in Bosco hill. BCABo. The Rizzoli Orthopaedic Institute in S. Michele in Bosco, Officine Arti Grafiche, Bergamo 1910.

# 3. WATER WHEEL AND SWITCHBOARD OF THE CONTROLS OF THE FORMER LAZZARI MILL ON THE GHISILIERA CANAL

The Ghisiliera Canal is a branch of the Reno Canal crossing a large area to the north-west of Bologna, through the districts of Bertalia and Trebbo, before flowing into the Reno river after 10.43 km. It is named after the Ghisilieri family, owners of the farmland outside Porta San Felice. The branching point **(1)**, which is no longer visible after the paving over of the Reno Canal along Via Sabotino, was located at the ancient Ponte degli Stecchi [Stecchi Bridge], upstream of the intersection of the Ravone stream **(2)** with the Reno Canal. The courses of the Ghisiliera and Ravone run parallel to each other northwards before passing under the Via Emilia, at the point where the Osteria del Chiù [Chiù Tavern] was located **(3)**, before continuing westwards, flowing alongside Via del Chiù **(4)**.
The **Piletta Mill (5)** was built on the first section of the canal. It was operative until 1987, called the **Vancini Mill**.
The Ravone stream and Ghisiliera canal now flow parallel to each other next to Via del Chiù, running alongside the Prati di Caprara urban forest **(6)**.
From 1473, Francesco Ghisilieri was granted use of the waters of the Ravone stream and of the canal to power the **Ghisilieri or Ravone Mill (7)**, which was a working mill called the **Lazzari Mill** until 1990. In 1997, the building was expropriated by Bologna City Council to build the high- speed South-West link road. The switchboard and iron horizontal water wheel exhibited here were salvaged before it was demolished.
After abandoning the course of the Ravone stream, the Ghisiliera Canal heads north, following Via della Volta, before receiving the **Lame Canal (8)**. It passes the San Martino di Bertalia Church **(9)**, then continues as far as the former **Pescarola Mill (10)**, at 44 Via Selva di Pescarola, operative until 1952. The mill was built in the early 16th century by Giovanni II Bentivoglio and was later transferred to the Malvasia family. Before joining the Reno river, the Ghisiliera Canal powered the **Borgognino** or San Guglielmo **Mill (11)**, operative until 1955, built in 1525 by Ercole Borgognini in partnership with the Ghisilieri family. Not far away, before the outflow into the Reno river, you can still find the ancient **Spillway (12)** for regulating the waters, which remained operative until the late 19th century.

# 1. THE ORIGINS OF THE GRADA FACTORY ON THE RHINE CANAL

The construction of a first building erected across the Rhine Canal, in the form of a simple **walled up casemate** built on a stone vault, is reported by Giuseppe Guidicini (*Cose notabili della città di Bologna*, vol. IV, p.318, Bologna 1869). The concession to build was issued on November 7, 1580, with an Apostolic brief by Pope Gregory XIII, to Marcantonio Battilan and Giovanni Battista di Casy, in order to "put a hydraulic building inside". The vault had a length of 98 feet (37.24 m) and a width of 30 (11.40 m), but the two concessionaires could only use the part located "on the corner towards the walls and towards the garden of Girolamo Zaccaria" on the border with the right bank of the canal.
On May 4, 1680, making a request to the *Assunteria dei Magistrati (the Magistrates Office) and the Arte dei Pellacani* (*the Tanners Guild*), Giovanni Battista Mengarelli, "having learned how to tan calfskin in the English style and cowhide in the Hungarian style, wishing to practice and introduce this profession in this city", asked to be able to erect a building on the west side of the Rhine Canal, "with the possibility of placing a paddle wheel at water level without restricting the canal in any way". The assignment took place on April 1st 1681 and documents from the Assunteria testify that, in 1683, the building was already erected.

## Grada tannery - From the 1786 takeover to the transformations of the 19th century

The **tannery** activity was practised until 1841, despite the changes of ownership of the building: from the Mengarelli heirs to Card. Pompeo Aldrovandi in 1725, from the Aldrovandi family to the Chapter of St Petronius in 1775, until the purchase by the *Corpo degli Interessati del Canale di Reno* (Consortium of the interested parties in Rhine Canal). The Tannery had been purchased by cardinal Aldrovandi, a prestigious figure of the papal curia of Bologna, to help the *Mengarelli* heirs who were burdened with many debts. When the prelate died (1752), the senatorial family Aldrovandi inherited the building, while the profits of the tannery were destined to the Chapter of St Petronius. In 1775, the Aldrovandi family sold the factory to the Chapter, committing the canons to use the income to complete the *Aldrovandi Chapel* with the Cardinal's funeral monument.

# Grada tannery - From the 1786 takeover to the transformations of the 19th century

The *Archives of the Rhine Canal Consortium* preserve the plan and the report by architect Gian Giacomo Dotti (4 September1786) who describes the tannery one hundred years after its construction, on the occasion of the sale to the ***Interessati del Canale di Reno*** (Interested parties in Rhine Canal). The position of the factory, built directly on the canal, allowed to regulate the flow of water and its distribution to users in the city.
The accurate description of the building has allowed to recognize the rooms intended for the different processes of the tannery and design the construction of the model, made by the Segno/Disegno Laboratory of Francesco Bortolotti.
Following the crisis of the tanning sector, the tannery manager closed the activity in 1841; in 1854, the rooms on the ground floor of the factory were rented as a **Mill**.
Between 1867 and 1878 a new tenant carried out various works to turn the mill into a **Rice husking** machine, considering the activity more profitable.
In 1892, after a fire that affected the central part of the building, a partial reconstruction and the remaking of the internal floors was carried out; the hydraulic wheel was removed and another body was built on the canal.
Later, the factory was rented to the Rizzoli Orthopaedic Institute, in order to exploit the water fall from the canal to build a hydroelectric power plant, equipped with turbines to generate electricity for the hospital; the plant remained in operation from1899 to 1926.

**> For this topic, please refer to the panels displayed in the basement of the factory.**

# 2. TANNERY PRODUCTION IN THE EIGHTEENTH CENTURY

The **Conceria della Grada**, one of the most important tanning factories in Bologna, between 1736 and 1756 was run by the entrepreneur Domenico Ambrosini in partnership with Count Raniero Aldrovandi, at the time owner of the building, with the support of the banker Graziadeo Coen of Ferrara.
A study by Alberto Grandi [*La pelle contesa* (The sought-after leather), Giappichelli, Turin, 2000) showed that in 1738, Grada tannery processed about 40% of the Bolognese leather and marketed even a larger percentage. According to the data provided by the Tribunes of the People, in July 1738, 9.134 finished or semi- finished leathers were deposited in the tannery.
However, the evaluation provided by Mr. Ambrosini was much higher, in fact “the tanned adult cow hides were 2.852, which had produced 5.683 stamped leathers and 5.753 bellies, for a total of 11.436”. In addition to these leathers, you should add 2,869 calves that, once tanned, resulted in 3,946 “split leathers”, 878 castrated animals, 85 horses and 398 goats, for a total of 16.743.
So, 7.609 more than those reported to the Tribunes of the People; probably, there was also a way to provide for the collection of leathers that escaped the controls.

# 3. THE LEATHER TANNING PROCESS

After tanning the skin of some animals (cattle, sheep, horses, pigs, dogs, cats, rabbits) you can obtain products with different characteristics. The skin of the animal has 3 layers: **epidermis**, **dermis**, **hypodermis** (connective tissue). The layer used for tanning is the dermis: the upper part that includes the **hair bulbs** is called **Grain**, while the underlying part, which is harder, is called **Split**.
There are three operations that allow to use skins:

1. **Preservation**, stops skin decomposition through drying or salting.
2. **Tanning**, is a mechanical and chemical operation that stops the development of bacteria.
3. **Post-tanning treatments**, drying, greasing, staking, dyeing, decoration.

**Today, tanning can be done in various ways:**

- using **tannins of vegetable origin** (barks, Mount Tabor oak acorns, Aleppo oak galls), which give a brown, more or less dark colouring.
- using **chromium**, a chemical element (Cr) extracted from chromite, used in metallurgy in the composition of alloys. Chromium salts colour hide green- blue, simplify the tanning phases and reduce processing time to 24 hours. With chrome tanning, you get suede.

During tanning, a lot of water is used, so the so-called **riviera operations** were carried out along a canal, as in the case of the *Grada tannery*, or the *Tanneries in via de' Pellacani* (via G. Petroni) that used water from the Savena Canal.
Hides were sent to the tanneries already **dried** and treated using the **salting method** to prevent decomposition. The first processing consisted of **rehydration**, or **soaking**, which lasted up to five days. At the Grada tannery, this phase took place on the ground floor where the tanks were located.
The final washing was done by immersion in the canal, near a wooden pier that surmounted the floodgate where iron bars were stretched to hang hides.
Then, hides were immersed in tanks with the addition of **milk of lime** (limewater: dilute aqueous solution of calcium hydroxide) to remove hair. Calcium hydrate acted on **mucin**, the cementing substance of fibres, to destroy it. For a bacteriological process, the destroyed mucin produces **ammonia**: the intense odour was an indication of loss of proteins, the main components of the hide. In order to avoid damage, the hide had to be removed very quickly from the lime solution.

# 3. THE LEATHER TANNING PROCESS

The process lasted several weeks, with immersion in **liming tanks** with different concentrations and ended in a **fresh lime pit** which contained a solution with a lime content varying from 5% to 10% of the hide weight.
The processing took place in an environment on the ground floor, with masonry tanks placed along the walls; here, work conditions were very bad for the strong fumes. At the end of the Liming, process, the hides were put on trestles with convex surface to be scraped using curved blade knives with double handles. The **scrapingphase**, which removed hair and grease residues, took place in the courtyard on the south side of the building, equipped with racks to hang out hides in the air.
After **hair removal**, the hides were immersed in other tanks to be softened, a process called bating which removed any impurities: a process that varied according to temperature, weather conditions, season and type of hide.
For the **softening**, they used a hot infusion of dog dung at 35°-36° degrees for different times depending on the nature of the hides; for those intended to produce heavy and thick leather for saddles, they used an infusion of bird droppings to prevent cracks.
In order to remove any impurities, the hides were once again processed on a trestle, where the worker exerted strong pressure using a slate slab, sharpened like a double-edged blade knife, embedded in a wooden handle.

## Vegetable tanning substances

Hides ready for **tanning** (a process that transforms the hide layer into leather with substances called **tannins**) had to remain soaked in **round tanks**, called ***tubs*****,** with tannic liquids of different densities, obtained from **shredded tree bark**, especially **oak** (Quercus suber), or **chestnut** (Castanea sativa), or fruits such as **Mount Tabor oak acorns**, (Quercus Ithaburensis), or **Aleppo oak galls** (Quercus infectoria).
In the Grada Tannery, the tanks were in a room equipped with a **furnace** to heat up water. At the beginning of the process, the hides were soaked in a **tannin-poor tanning liquid**, to slowly absorb the substances. They added **ground oak bark** to the solution, which was already used and poor in tannin. The soaked hides were moved every day, for three or four days, then they were transferred to a second tub with higher tannin content, for seven or eight days. The cycle was repeated in a third and a fourth tub, increasing the concentration of tannins.

## Vegetable tanning substances

At the end of these steps, the hides were checked and if they were not well tanned, the treatment was repeated; afterwards, they were placed in **deep tanks**, alternating layers of ground bark until the tank was filled. For the full filling, called **cap**, other tannic solution was poured and left to act for two or three months.
The tanning process could take up to a year for **heavy leather** and required a lot of manpower. The long processing times meant that assets were locked up, with a high economic risk for entrepreneurs. Once tanned, leathers were transferred to the finishing process. It was just at this stage that the hides were split into two parts to allow them to dry by hanging them in the well-ventilated covered roof terraces.

## The machines used in the Grada Tannery

To crumble the bark, they used the **fulling mill**, a machine that acted with alternating motion of vertical rods, equipped with metal tips or very resistant wood. Rods were moved by cams fixed on a horizontal shaft connected to the vertical *hydraulic wheel* located on the canal.
The wheel was moved from below by the water of the canal conveyed by a ***sluice gate system***. The shaft of the wheel was connected to another bucket wheelthat raised water up to the internal distribution channel to fill the tanks, but also to irrigate the garden adjacent to the building.

To grind the  galls and the bark, they also used a **vertical wheel grinder** (*pistrino*), that was fed by a *hoppermounted* above. The whole system required expensive maintenance: the *hub* of the large wheel had to be constantly greased to avoid excessive friction. The other machines were subject to different wear and tear depending on their use: in the *fulling mill*, the most stressed parts were the cams that induced the alternating motion of the hammer rods. They did not use iron joints for the parts that needed periodic replacements, but they used *wooden pivots (wooden pins)* crammed in holes.

# The last stages of leather processing

The top floor of the Grada Tannery (covered roof terrace) was used to lay the hides under the truss of the roof, where good ventilation was guaranteed by large low arched windows.

**Drying** took place gradually: to prevent the direct action of the sun, *marsh reed mats* (*reed wattles*) were used on the openings and then rolled up.

The painting by Annibale Marini (Bologna 1860-1893) represents the courtyard of a Bolognese tannery, provided with a large tank (*battocchio*) for the collection of water, surrounded by characteristic buildings with covered roof terraces used to dry the hides.

To take the hides to the roof terrace, they used a lifting machine (called **rodone scalastrato** in the appraisal of Architect Gian Giacomo Dotti) equipped with such a straddle to allow to bring the load inside the building once reached the height, without having to move the whole structure. It was essential that the part where the *pulley* was fixed could extend outside, in order to be subsequently withdrawn with the load inside the environment.

# From leather to decorated leather techniques

Leather hasthermo-insulating properties, hygienic and resistance characteristics,,suitable for making footwear, clothing, animal harnesses, wall and furniture coverings, cases and book-binding.

**Leather for upholstery**

The use of leather to cover entire walls became widespread in the West through the Arabs, who created several centers in Spain for the processing of stamped leather decorated with gold embossing, blind embossing, or relief embossing. These techniques also spread in Italy and northern Europe (Antwerp, Rouen). Decorated stamped leather for upholstery was used in the residences of the Medicis in Florence, the Gonzagas in Mantua and the Sforzas in Milan. Venice, Milan, Florence, Naples and Bologna were famous centers for these productions.

# From leather to decorated leather techniques

A valuable example is the large **Basil** (16th century) that covered the chapel of the Bargellini family in Sant'Agata Bolognese, today preserved in the Medieval Civic Museum in Bologna.
On clean and squared cowhide, they applied the silver leaf, then coloured with transparent yellow paint to simulate gold; using wood or metal matrices, the patterns of the ornaments were impressed, finished with punches and then coloured. Using this technique, they also made **Altar frontals**, also known as antependia with sacred scenes, widespread in many Italian regions. Because of its resistance, leather was used to upholster various furnishing elements: a fine example is the armchair from Palazzo Pepoli kept in the Davia Bargellini Museum in Bologna.

**Leather for cases**
They used cow and sheep hides, depending on the type of case to be made. The **cuìr bollì** (**boiled leather**) technique provided for the immersion hides in boiling water and modelling on wooden shapes, followed by rapid drying to harden the product. A treatment with resin and wax gave the object a dark brown coloring, as in the case of the valuable **case for touchstone** (16th century), decorated on one side with a courtly scene and on the other side with floral motifs (Bologna, Davia Bargellini Museum)

To obtain **Morocco leather**, they used goat skins, which were thinner and softer than cowhides, tanned with black walnuts that gave a light brown or reddish colour. Morocco leather was used to make gloves and shoes, to cover cases of liturgical objects (chalices, pyxes, monstrances), or for profane objects such as cutlery holders or jewel boxes. The decorations were made with impressions on gold leaf, obtained with punches of small irons, as in the case of the Cutlery box (19th century), covered with Morocco leather (Bologna, Davia Bargellini Museum).