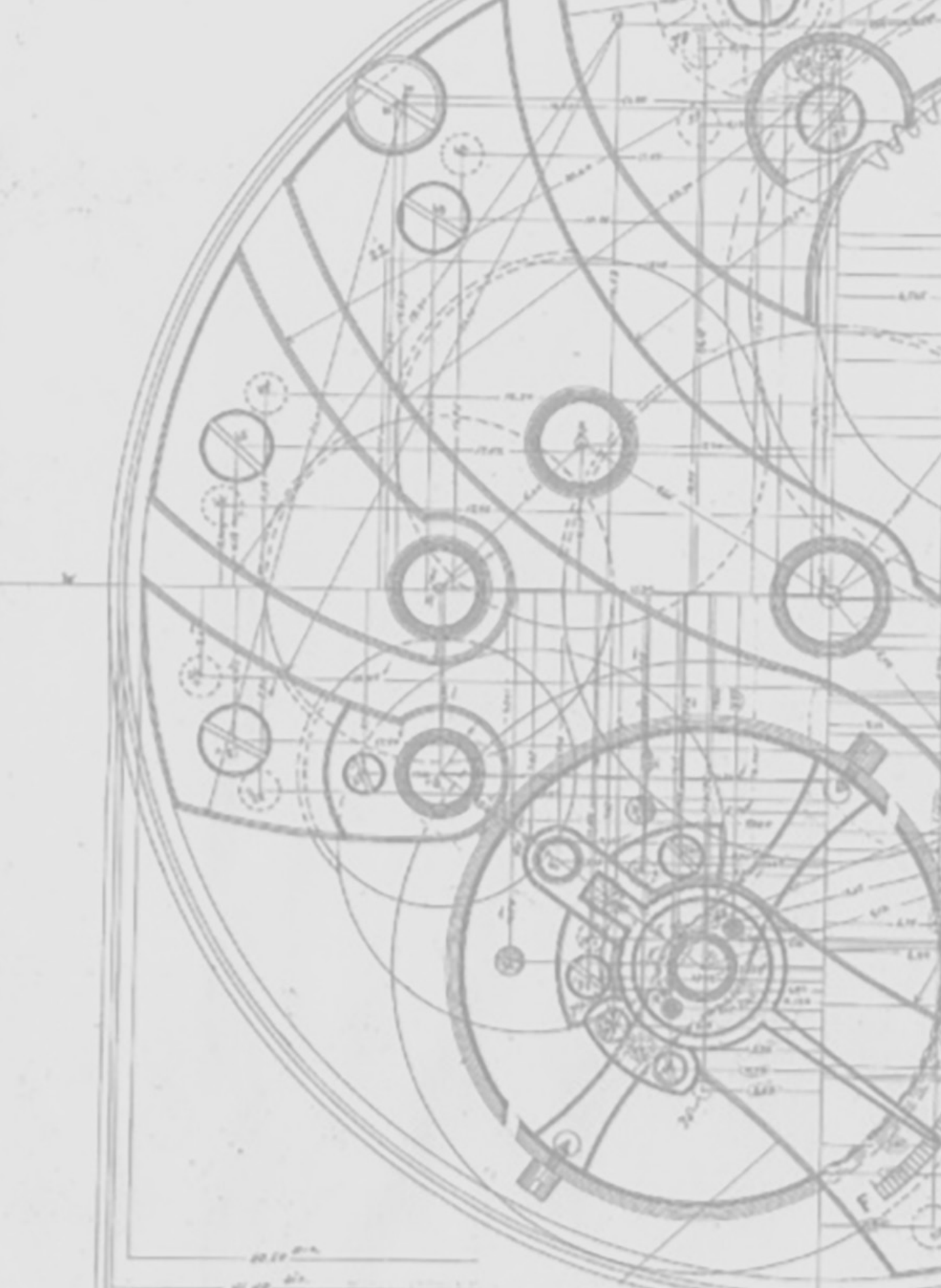


Factory Buildings of the Watchmaking Industry

Jonas Inhelder | EPFL Architecture





Master Thesis
EPFL Architecture

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Factory Buildings of the Watchmaking Industry
École polytechnique fédérale de Lausanne, EPFL ENAC Architecture
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Cover: Former factory building of Bulova, Photo by Jonas Inhelder
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Abstract

In terms of the built environment architecture has always been the expression of its social and economic environment. The famous French author Victor Hugo wrote: “The greatest products of architecture are less the works of individuals than of society.” (Hugo, 1831) Nevertheless, the discipline of architecture often seeks to reach unexplored forms of architectural conceptions. Nowadays architects find inspiration for their designs around the world, as the widespread global communication network enlarged the field of reference for architectural projects. Using the example of the Swiss watchmaking industry, this master thesis looks at architecture from another perspective. The architects who planned watch factories focused more on the specific needs of watch companies than on impressive references. The discourse presented in this master thesis shows an architectural conception contributing to efficient and optimal production processes.

The watchmaking sector has always strongly relied on the built environment. Urban and architectural structures in watchmaking areas are a result of the industries prosperity, but also a reason for its success. Over the course of more than three centuries, during which the several different building typologies of the watch industry appeared, these buildings always were expressions of a society influenced by watchmaking. What first began with marginal changes to small farm houses evolved into huge factories. The range of different manufacturing buildings in the watchmaking industry is enormous. In particular the factory buildings that emerged during the industrialisation period were constructed to increase quality and amount of the produced watches. The objective of this particular architectural conception and design was to improve the production processes by creating optimal conditions for watchmakers. This master thesis presents the architectural characteristics of watchmaking factories by analysing a selection of representative buildings.

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1. Introduction

1.1. Preface

The Swiss watchmaking innovation and production began in Geneva. During the 17th century the industry spread out along the Jura Mountains. Before the industrialisation the components of a watch were produced by several independent craftsmen and then assembled to one piece. Therefore, the *établisseur* established a network of highly specialised craftsmen and then promoted the final product. In the second half of the 19th century the Swiss watchmaking industry came under pressure because of the growing mass production by US watch companies. Because the local brands had to reach the same efficiency, the production process was concentrated under one roof. For this reason watchmaking factories appeared around 1880.

1.2. Thesis

The buildings of the Swiss watchmaking industry were constructed to guarantee optimal conditions for the production of watches. Firstly, this meant establishing good workplaces for the watchmaker's craft. Secondly, it also includes the compatibility with mechanisation to optimise quality and quantity of the product. These watchmaking factories were designed to enable and support precise and efficient production processes. The present master thesis proves the existence of common architectural characteristics that ensure environmentally good production spaces.

Objective

The characteristics of a production space depend on several factors. The specialisation of the factory, the number of employees, the scale of production but also the decade of construction influences the built structure. The exploration of various work places leads to a profound understanding of the similarities and especially of the important characteristics that allow a precise and efficient production process. The objective

of this work is to define these common characteristics. Through this, the relation between program and architecture becomes obvious. This connection was important for the construction of watchmaking factories and still remains essential for architectural designs being developed today. Therefore, the present work proposes how architects today can learn from the conception of these historic buildings, but also directly from their discovered qualities.

1.3. Method

The present thesis consists of a theoretical discourse and a field survey. For a better understanding of the economic background, the first part gives a historical overview by presenting the most important developments in the watchmaking industry over the last four centuries. Then this chapter also introduces the industry's impact on architectural and urban issues. This section describes the various emerged building typologies, furthermore it contains an introduction to the urban development and then concludes with the mapping of watchmaking buildings in the region. The second part of this thesis then presents the executed field research, by introducing the factories that were studied. Each building analysis contains historical information as well as a description of the constructions present condition. To ensure that these buildings are representative for production spaces of the watchmaking industry, the selection of the objects followed specific criteria.

To verify the proposed thesis, the conclusion then points out the specific characteristics found during the building analysis and presents them, also by using the historical background for explanation. This last section also analyses the modifications and transformations performed on the buildings and then finally, it proposes how contemporary architecture can benefit from the architectural heritage of the watchmaking industry.

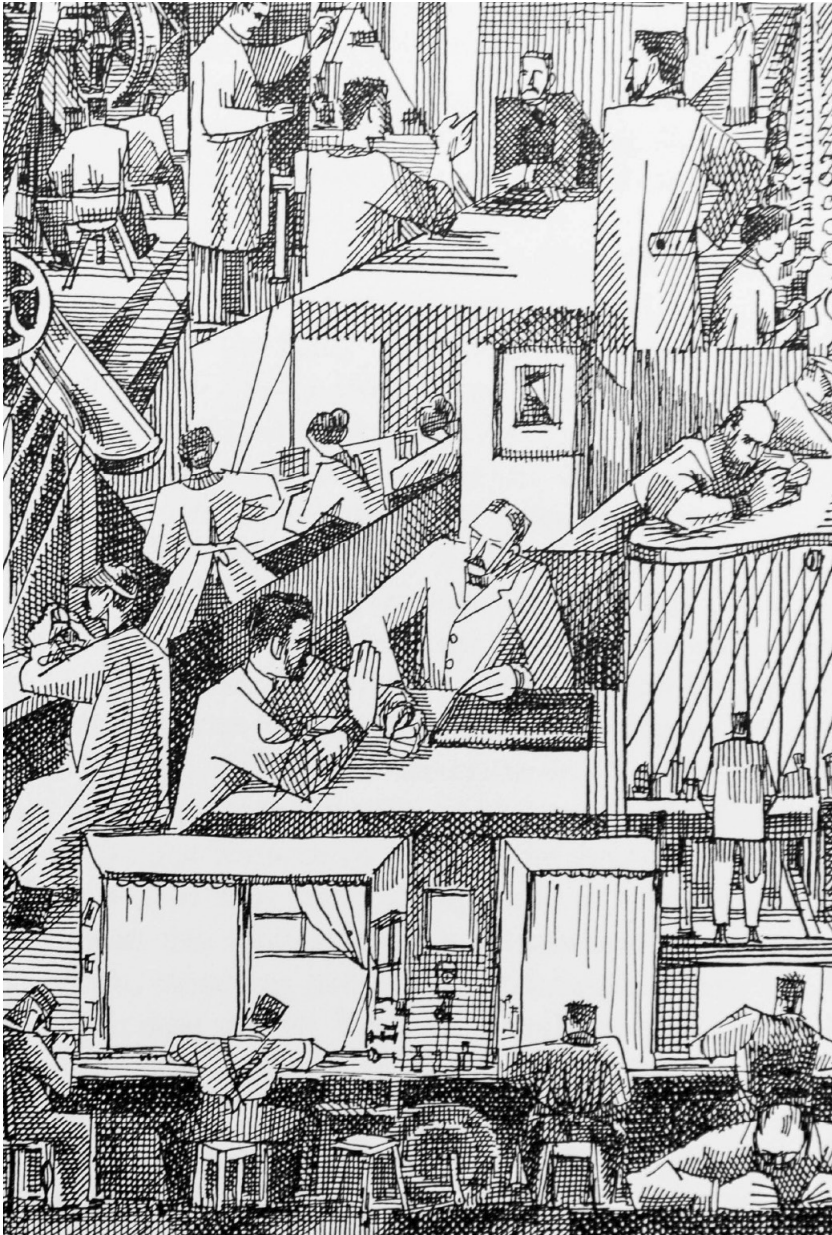


Fig. 1 Marcel North, Illustration
Watchmaking Industry (ETA, 1951)

2. The Swiss Watchmaking Industry

The watchmaking industry is a significant economic sector of Switzerland in general and for the Jura Mountain range in particular. Over the last two centuries, the industry has greatly contributed to the economic development of this area, situated in the north-western part of Switzerland. Watchmaking had and still has a considerable impact on political, social, cultural and environmental issues. Especially the built environment, urban development and the architectural expression are strongly affected by the watchmaking industry. To understand the correlation between the industry and its influence on the built environment this section describes the history of the industry, then explains the building typologies created by the watchmaking sector and demonstrates the impact on urban development. Finally, this part also gives an overview of the present heritage, by mapping the existing buildings of the watchmaking industry.

2.1. Milestones of the Watchmaking History

The development of watchmaking in Switzerland is complex and of course influenced by a multitude of factors. However, the historical development can generally be divided into four periods. Each of these phases was characterised by a crisis, that always made transformations necessary. These transformations then led into the industry's next period. (Donzé, 2009)

The first era began in the 17th century and was characterised by a horizontal organisation where every watchmaker produced particular components and usually worked in his own home. The *établisseur*, after having collected the single components from the craftsmen, was then responsible for the *assemblage*, marketing and sale of the finished product. By 1860 the US market had established standardised production processes and was therefore able to offer cheaper watches. This competition became a problem

for the craftsmen production in Switzerland and forced Swiss watchmakers to restructure their production. Consequently, the first watch factories were built and traditional tools were replaced by machines. This second period between 1880 and 1920 was characterised by industrial production methods. The upcoming protectionism after the First World War encouraged the political and economic elite to introduce cartel measures which shaped the third period. The regulations prohibited the export of movements and other watch components and aimed at protecting the assembling of complete watches in Switzerland. The abolishment of the cartel regulations in the 1960s led the industry into the fourth phase, which was dedicated to liberalisation and globalisation. The upcoming technology of quartz watches then provoked the largest crisis of the industry so far. The so-called quartz crisis took place in the 1970s and early 1980s. (Donzé, 2009)

Beginning of the Swiss Watchmaking (before 1870)

Swiss watchmaking started in the 16th century in the city of Geneva, which had already enjoyed an international reputation in the fields of goldsmithery and jewellery making since the middle ages. As a consequence of the confessional split of the Protestant Reformation in Europe, many refugees took up sanctuary in Switzerland. During this time Geneva, the so-called the City of Calvin, became a new hometown for many foreigners, many of which had fled catholic France. After having settled in Geneva, these people made use of their capital, commercial networks and technical know-how. The protestant laws restricting the wearing of jewellery and the ban of manufacturing religious objects imposed by Calvin encouraged Geneva goldsmiths and jewellers to redirect their knowledge and apply their art in another domain: pocket watches. In the beginning of the 17th century watchmakers were organised as corporations to restrict access to their profession. As production grew, the branch was divided into new corporations, operating according to the model of *dispersed manufacture* already existent in other

industries. Swiss watches were popular not only in Europe but all over the world, bringing wealth to the city. These factors led to Geneva being the first city known for its watchmaking. (Desaules, 2015; Donzé, 2009)

The enormous success of the sector during the second half of the 18th century required more manpower. The availability of labour force was an important reason why watchmakers expanded to the Jura Mountain range. Also, the prevailing more liberal conditions in this area encouraged the fabricants to distribute the work outside of town. This expansion contributed to the quick distribution of watchmaking know-how. Especially the peasants living in the Jura Mountains developed their knowledge of watchmaking. While they were busy tending their crops during the summer, watchmaking offered them a welcomed additional income throughout the winter months. By the beginning of the 19th century the Swiss watchmaking industry was no longer exclusively based in Geneva, but also common in the territory of the Jura Mountains. (Desaules, 2015; Donzé, 2009)



Fig. 2 Lucien Grounauer, Le commis, 1941 (Dossier de candidature UNESCO, 2009)

Before the appearance of the first factories in the last third of the 19th century the watchmaking industry was organised in a system called *établissage*. The enormous growth of the industry during the 19th century, encouraged by the expansion to new markets, called for a stronger specialisation during the production process. While watches were originally produced by only a few craftsmen and often centralised at one place, the increasing production numbers brought more specialised and separated ateliers. The number of individual operations needed to produce one single watch grew from 54 in 1830 up to a hundred in 1870. The activities of each watchmaker were reduced to one small step in the production chain, the production of one specific component. This development resulted in many independent ateliers. For example, in 1870 the municipality of La Chaux-de-Fonds counted 1'308 ateliers. The most important person in the whole production process was the *établisseur*, who took on an intermediary role. The *établisseur* distributed the work to several subcontractors, of which some had their own subcontractors as well. Finally, the *établisseur* collected the produced components and assembled the watch, often in his own atelier. The system was rather complex and appeared in several different variations. (Blanchard, 2009; Donzé, 2009)

Industrialisation of Watchmaking (1870-1920)

The system of *établissage* reached its peak in the early 1870s. Swiss watchmaking then entered a phase of profound modernisation of its structures, characterised by the emergence of factories and industrial production processes. The mechanisation of work and the concentration of numerous watchmakers in factories did not happen suddenly. On the contrary, the change came slowly, but brought constant and unavoidable transformations. The industrialisation of the Swiss watchmaking industry was favoured by two factors: The increased competition with US watch companies on the one hand and the global economic crisis during the 1870s on the other hand challenged the watchmakers. (Donzé, 2009)

The first industrial watch factories appeared in the emerging watchmaking nation of the United States, which soon challenged Switzerland's leading position in the sector. Based on the concept of interchangeability of machine-made parts, a principle that was adapted from the weapons industry, these companies were the first in the world to mass produce cheap watches. Back then, the two main US watch factories were Waltham Watch and Elgin Watch, founded in 1854 and 1864. During the Long Depression from 1873 to 1896 the economic impact of the new American competitors became even more perceptible. This was accompanied by the production of larger quantities, higher precision and, in particular, the simpler interchangeability of components in service cases, which greatly reduced the cost of repair works. This situation forced Swiss watchmakers to modernise their production through the introduction of machines, in order to lower the price of their products. Another goal was the diversification of the commercial outlet of the Swiss watch market in order to be less dependent on the US market. With the change of production modes, industrial factories also appeared in Switzerland. In opposition to the system of *établissage*, the production processes were optimised and production locations concentrated. (Donzé, 2009; Stas, 2013)

But the movement of concentration was limited. Swiss watchmaking did not abandon its particular structure, which is called *industrial distraction* by economists. This concept refers to industries in the same territory whose organisation is based on multiple small and medium-sized enterprises that, while competing with each other, are still interdependent. These industrial systems, such as the textile and footwear industries in Italy or nowadays the Silicon Valley in the United States, are still characterised by a common technical culture that promotes the mobility of individuals and the creation of new businesses.

The industrial districts thus enable specialised products to be flexibly and competitively priced against the standardised mass production of large companies. In the case of the Swiss watch industry, the organisation in the form of an industrial district allowed manufacturers to present a wide range of products on the global market and thus to exercise a virtual monopoly around 1900. (Donzé, 2009)

During the 19th century watch brands were still largely unknown. In Switzerland, legal regulations on trademark protection came only into force around 1880. Therefore, either the names of the manufacturers or those of the dealers who purchased and sold these products were noted or engraved on watch dials. Watch brands in the present sense emerged with the period of industrialisation at the beginning of the 20th century. (Stas, 2013)

The Watchmaking Cartel (1920-1960)

After a short period of euphoria immediately after the First World War, during which sales figures increased, the Swiss watch industry fell into an existential crisis from 1920 onwards. The number of sold watches fell, which immediately provoked high rates of unemployment. The subsequent fall in prices made the situation even worse. The crisis of 1920-22 had further disastrous consequences. The emigration of qualified workers abroad resulted in the transfer of know-how to other countries, and thus increased competition for the Swiss industry. (Donzé, 2009)

This economically difficult period of the interwar years also reinforced another problem, the so-called *chablonnage* practice. Which means the export of separate parts and components, instead of the completely assembled watch. The complete product was assembled abroad, with the objective to avoid custom taxes on the finished watches. Many Swiss manufacturers were worried about this practice, mainly because of the

transfer of know-how. In order to counteract this development, trade associations were founded. These were already known since 1909, as 15 manufacturers of pointers joined forces and founded the Universo AG. After the First World War, the difficult economic situation at the beginning of the twenties led to further associations. In 1924, the Association of Swiss watch manufacturers FH was founded. In 1926, the most important manufacturers of raw tools merged to form Ebauches SA. To protect the domestic industry the sector reorganised itself completely by creating a watch cartel that brought together all watch producers on a national level. With the objective to avoid the *chablonnage* practice, they introduced a system of minimum prices among watchmakers. In 1930, when the watchmaking industry was again struck by crisis, the cartel was reinforced by the creation of ASUAG in 1931. (Garel & Mock, 2016; Gäumann, 1999)

ASUAG (Allgemeine Schweizerische Uhren AG) was a company that combined the factories of movements and the manufacturers of regulating components under one roof, without affecting their economic autonomy. It was founded with organisational and financial help from the Swiss Federal Government. The pre-existing Ébauches SA was incorporated during the founding year. The company controlled the production of movements and prevented the export of raw and non-assembled watches for final assembly abroad. By 1941, all manufacturers of movements and key components had been bought or contracted by ASUAG. This concentration was only possible because the Swiss Federal Council had declared the export of stencils, movements and other components to be subject of governmental approval. (Watch-Wiki, 2014a)

The cartel organisation continued until the 1960s and allowed the maintenance and expansion of the watchmaking industry scattered in a multitude of small and medium-sized enterprises. This corresponded to the situation of the entire Jura arc, where politicians were anxious to maintain one of the only industrial activities of the region. (Donzé, 2009)

Liberalisation and Globalisation (1960-2000)

During the 1960s the Swiss watchmaking industry entered another period of history, affected by commercial, organisational and technological mutations. The decade brought the appearance of new players on the world-wide watch market (Japan, USA, USSR, France, Germany). Their increasing success was essentially based on the mass production of standardised products, and challenged the position of Switzerland as market leader. The upcoming globalisation forced domestic companies to strengthen their competitiveness, which made it necessary to abolish the cartel structures. Foreign capital was invested in the Swiss watch industry while Swiss money was also invested in production units in Southeast Asia. Although the global watch market was in transformation, the absence of a highly rationalised production industry had no bigger impact until 1970, the golden years were continuing. (Desaules, 2015; Donzé, 2009)

The crisis that followed was provoked by several factors. The oil crisis affected the export market, competitiveness was weakened because of the missed adaption to the structures of global capitalism, and the exploitation of the electronic watch market came too late. The watchmaking sector was literally dissolving, hundreds of small and medium-sized production facilities disappeared. The geographic concentration of the industry along the Jura Mountain range turned the crisis into a regional problem, the demographic exodus from the Jura region was close to 10%. (Desaules, 2015; Donzé, 2009)

For years, the Swiss watch industry was dominated by two large corporations, which were also amongst the largest watch manufacturers in the world. These were the companies ASUAG and SSIH (Société Suisse pour l'Industrie Horlogère), which had emerged around 1930 by the merger of Omega and Tissot. After smaller crises over the years, the two main watch corporations entered a critical period in the 1970s, brought around by cheap electronic watches produced by foreign competitors. (Gäumann, 1999)

The rescue for the impending liquidation of both companies was the merger of the two large companies ASUAG and SSIH into the SMH (Schweizerische Gesellschaft für Microelektronik und Uhrenindustrie) in 1983. In addition, an artistic and emotional product of the highest quality at low price, the Swatch, was launched. Due to the complicated implementation and explanation of the abbreviation SMH in other languages, the name was changed into Swatch Group in 1998. (Gäumann, 1999)

The Watchmaking Industry Today

Nowadays watch companies are usually owned by a mother concern. Only a few brands such as Rolex or Breitling are still independent. The most important groups are Swatch, Richmond, LVMH and Kering. The world's largest watch concern, the Swatch Group, is the most powerful company in the Swiss watch industry due to the many component producers it owns. The Swatch Group is by far the top supplier of watch movements to the Swiss industry, mostly because of its movement-production company ETA. According to the 2013 annual report, the Swatch Group has 184 subsidiary companies and more than 30'000 employees. (Deshpande, 2017)

Over the last couple of years, the big watch groups have been buying up more and more watch companies and especially suppliers. This trend is increasing and changing the structures of the Swiss watchmaking industry again. Subcontractors are coming under pressure and the number of independent suppliers is rapidly decreasing.

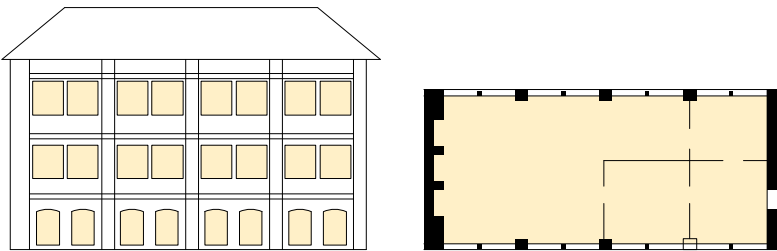
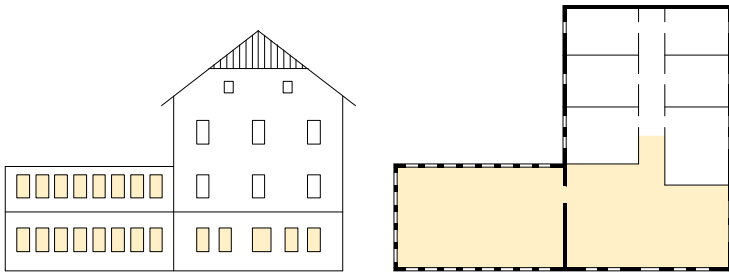
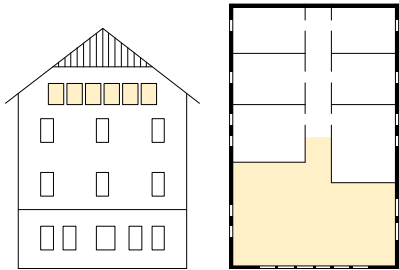
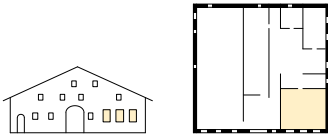


Fig. 3 The building typologies of the watchmaking industry: The farm, the workers home, the workshop and the factory

2.2. Building Typologies

A watch is a very complex structure. For its production, precision and know-how are the key elements. Historically, several different steps and locations, usually geographically separated, were needed for the manufacturing of a watch. In order to meet the specific requirements of the watchmaking industry the architecture adapted to the needs: at the beginning of the watchmaking craft, the working stations used to be in peasants' homes on their farms. Later they were to be found in workers' homes in cities. Watchmaking ateliers were also established in residential areas, either on the ground floor or in the attic. The small studios adjacent to the houses then gradually developed into manufactories, eliminating living space completely. Above all, the essential factor of lighting decided the appropriate architectural solution. (Jeanneret, 2017) The following section gives an overview of the several building typologies that emerged during the last two centuries.

The Farm

The origin of the Jura Mountain industry is the farmhouse. As a result of climate and geology, the farms have a simple typology with a square plan and a large gabled roof to collect as much rainwater as possible. The thick outer walls with only a few small windows were constructed largely in masonry while wood was used for the internal frame and layout. The farmers living of agriculture and livestock had to survive harsh months in winter time. During this period, various ancillary activities in connection to metal work developed, allowing farmers to earn additional money during winter. At the beginning of the 17th century the manufacturing of lace and later the production of parts for clocks and watches generated an additional income for farmers. These activities had such a profound influence on the farmers that in order to meet the requirements of the watchmaker guild

they either enlarged their window fronts or built small workshops. Many farm buildings became multi-purpose houses with residential rooms on the one hand and areas dedicated to agriculture and the production of watch parts on the other hand.

Later the watchmaking influence generated even new typologies. The economical and utilitarian architecture of the 18th century no longer adapted the traditions of ancient times. On the contrary, the watch industry required spacious, well-lit rooms. Many modifications were made to the original building plan of farm houses. The houses of this period were higher, because they now had a first floor, while originally farm houses only consisted of a ground floor. Furthermore, additional windows were put into the walls, in order to let flood in more light. By the middle of the last century the primitive type was completely altered. (Cortat, 2014; Jeanneret, 2007)

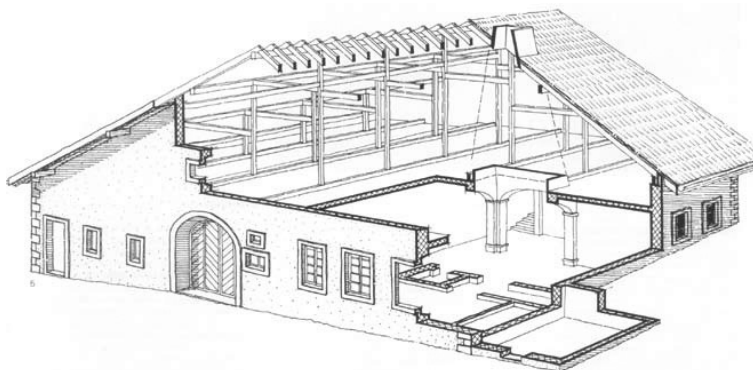


Fig. 4 Interior of a farm house, Les Corsettes, 1614 (Dossier de candidature UNESCO, 2009)

The Workers Home

At the end of the 18th century a new type of building came into existence, breaking with the tradition of watchmaking on farms. From the beginning of the 19th century up to the Second World War, large apartment blocks dedicated to workers were built in the same manner and based on the same plan. Therefore, they all had the same typology. The workers dwelling normally consisted of three rooms, a kitchen and commodities, which was in total about 80 m² of living space. Regarding comfort and layout all apartments in a building were identical. Often a communal garden expanded on the south side of these buildings. With the construction of these apartment blocks, the urban areas developed and also the watchmaking sector adapted to this new environment. Watchmaking, or at least a significant part of the production of components does not require special energy, heavy equipment or special installations. Due to the lack of unacceptable nuisances such as odour or noises, there was also no incompatibility with this industry being located in the proximity of living spaces. Therefore, watchmaking ateliers were established in rooms of residential buildings such as workshops on the ground floor or in the attic. The urban building served the watchmakers needs by allowing to insert strips of windows interrupted only by limestone mullions. This horizontal bay allowed the generous illumination of integrated workshops in the buildings in an economic way. These modification are still very visible on many buildings of the 19th century, both in La Chaux-de-Fonds and Le Locle. (Jeanneret, 2007)



Fig. 5 Fritz Zuber-Bühler,
L'horloger et sa famille, mid 19th
century (Dossier de candidature
UNESCO, 2009)

The Workshop

At the beginning of the 19th century workshops were created, joining several workers together. Their needs were similar to these of their accommodation: they required little space, good lighting and good heating. It was not uncommon for an artisan and house owner to set up a workshop in his home or in the vicinity. Today, these houses often still bear traces from the past, with their projecting window fronts in contrast to the residential building facades. Consequently, the small workshops were grouped around the housing estates. The second half of the 19th century, bringing the change towards the mechanisation of processes, but also the increasing numbers of produced goods, required larger spaces. Many residential houses received additional annexes containing watchmaking workshops. These buildings were characterised by a rational architectural expression.

By the end of the 19th century the watch production was effected by two types of complementary and competing establishments. There were the smaller workshops in residential buildings, gathering a few people, where the work was done either by hand or with the help of small machines. Their products were then entrusted to a manufacturer or sold on the market. Then there was a second establishment, consisting of factories where components were produced in large numbers, or watches were manufactured in whole or in part. (Jeanneret, 2007)

The Factory

The Swiss watchmakers recognised the benefits of automating the manufacturing process during their journey to the United States, and especially by visiting the Philadelphia World Fair in 1876. During this time, the US watchmaking industry was one step ahead. In particular the companies Waltham Watch and Elgin Watch already had huge factory buildings, where they could produce large amounts of watches. Consequently, the first watch factories appeared in the Jura Mountains as early as 1880. (Donzé, 2009)

These constructions were completely separated from residential houses, and served commercial purposes only. In general, they produced only one type of component. It should be noted that this change in production methods did not affect all watchmaking activities in a similar way. Winding and assembly operations were spared and continued to be carried out by small workshops. The mechanisation of the production processes mainly affected *ébauches* and watch cases. The system of *établissage* continued as the watch activities were geographically distant and the manufacturers sold their products to institutions, which were responsible for assembling the parts and selling the finished watches. (Jeanneret, 2017)

The term manufacture is defined by the federal decrees protecting the Swiss watch industry since the mid-1930s. According to these public law texts, a watch manufacture is a factory that produces all or part of its *ébauches* internally and assembles them to watches or movements before selling them. It differs from the producers of spare components and the workshops for *ébauches*, which deliver only semi-finished products to the market. Also, they are different from the *établisseurs*, as these do not produce their own movements and limit their business to the assembly of watches. (Pasquier, 2008)

Factory buildings of watch companies also became important in a completely different context. Several watch brands used their production buildings for representational purposes. On adverts, they not only presented the product, but also the production building. In some cases, even the whole site of a company was shown.

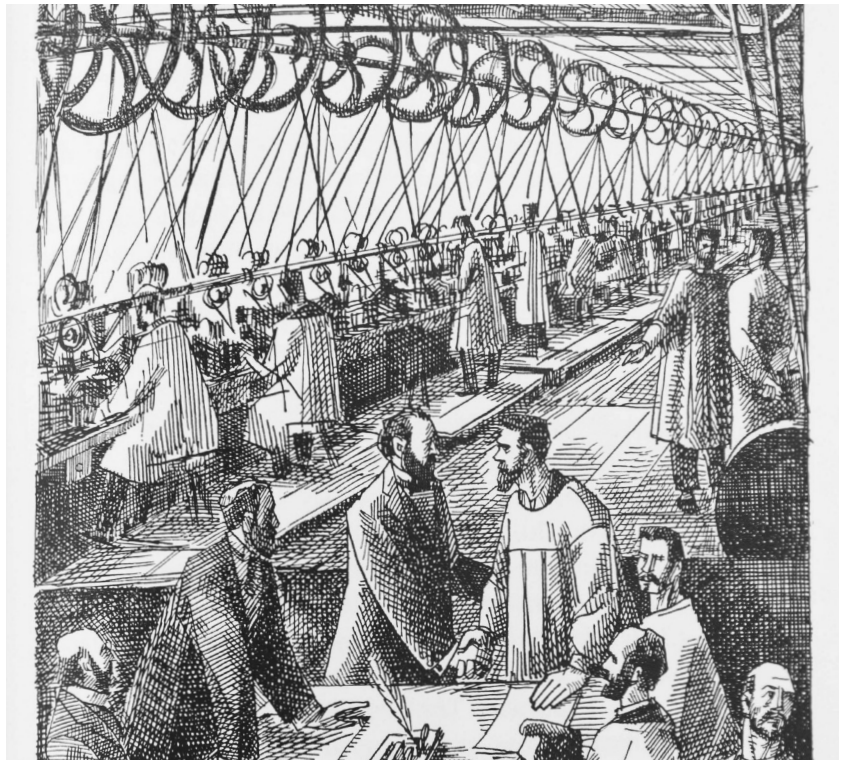


Fig. 6 Marcel North, Illustration of the production room (ETA, 1951)

HORLOGERIE DE PRÉCISION

CH. TISSOT FILS

Successeur de
CH-ÉMILE TISSOT
LE LOCLE
et **Genève**

*
Maison fondée en 1853
*



Chronomètres de poche montres compliquées
Montres civiles en tous genres, or, argent et acier
CALIBRES SPÉCIAUX — MONTRES EXTRA-PLATES
Spécialité de genres russes et allemands
— Prix de série à l'Observatoire de Neuchâtel —
Primés aux diverses expositions universelles
Paris 1900 **GRAND PRIX** (Collectivité locloise)
— Succursale à Moscou —

Fig. 7 Advertisement of the company Tissot from the year 1913 (Tissot, 2017)

2.3. Impact on Urban Development

Before the appearance of factories, watchmaking did not require particular infrastructure calling for the development of a particular architectural model. Through small interventions workshops could quickly be set up in suitable rooms of residential buildings and when not needed anymore, the space could easily be used for residential purposes again. But this mode of production still had an impact on the built environment and the urban order. The watchmaking industry in particular had a strong influence on the urban development of this area, as small villages transformed into regional centres, and several small towns emerged. Many places flourished during the period of industrialisation, but some already enlarged during earlier phases. Probably the most impressive example is the city of La Chaux-de-Fonds. This town's structure is characterised by a regular orthogonal grid. But the planning did not result from an act of will by a monarch, a general, an industrialist, or a utopian. Moreover, the design is based on implicit social consensus. The need for rationalism and pragmatism in favour of an efficient and successful watchmaking industry left no room for fantasies. (Jeanneret, 2007) This section explains how watchmaking contributed to the development of this small town in the Jura Mountains.

In 1794 a devastating fire destroyed the centre of La Chaux-de-Fonds and ruined 52 houses. The wooden wall-to-wall structures of the buildings facilitated this major fire. Two lessons were learned: Firstly, the necessity of using fire-retardant materials and secondly the importance of designing a deliberate urban plan, preventing the extension of fire. Consequently, building regulations were issued as well as a plan for the reconstruction of the village. The restrictions banned the use of wood, and the urban plan favoured a simple geometry with wide avenues and regularly spaced

Fig. 8 Charles-Henri Junod, Plan de La Chaux-de-Fonds en 1841 (Dossier de candidature UNESCO, 2009)

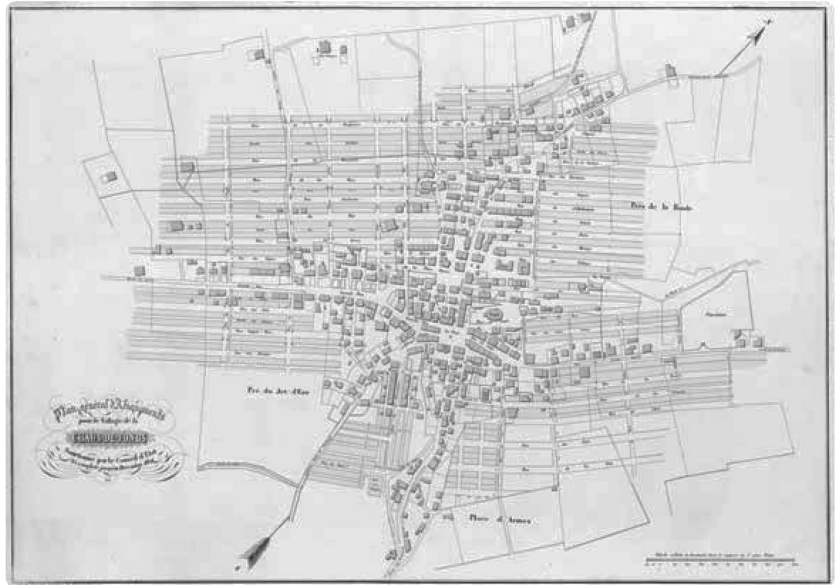


Fig. 9 Heinrich Siegfried, La Chaux-de-Fonds, 1863 (Dossier de candidature UNESCO, 2009)



residential blocks. Soon the rapid growth of La Chaux-de-Fonds required an expansion strategy. In 1830 an urban plan was elaborated by Charles-Henri Junod, the inspector of the duchy of Neuchâtel. At first the community and the cantonal authorities were troubled, but the adaption of this plan marked the proper starting point for the modern La Chaux-de-Fonds with its orthogonal layout, which often is wrongly labelled as an American model. With the execution of the urban plan, the town became a rational and economically efficient factory serving the watchmaking industry. (Jeanneret, 2007)

The exact motives of Charles-Henri Junod for the development of the expansion plan are not recorded, but at least three of the factors taken into consideration were aiming at the progress of the watchmaking industry: the light, the optimisation of the transport routes and the opportunities for further development. For optimal lighting, Junod preferred the urban development of the city's northern slope. He profited from the flat and regular slope in a manner that permitted the planning of residential areas and communal gardens, as well as sufficient space to guarantee the natural illumination of apartments, workshops and later that of factories. For the practicality of transport routes, he planned completely straight and wide streets, which facilitated snow removal during winter months. The functioning of transport routes was crucial for the production network of watchmaking. Then for the development possibilities, Junod did not propose a self-contained city, but designed a system which could repeat itself without end. (Jeanneret, 2007) The urban development of the neighbouring town Le Locle was based on very similar circumstances. In 2009, the two cities have been awarded World Heritage status by Unesco, due to the unique watchmaking town-planning.

Starting from the second half of the 19th century also other towns in the north-west of Switzerland benefited from the growing watchmaking industry. The successful companies often settled in more favourable areas. The construction of large factories required flat lands. Moreover, the availability of labour force in the Jura valley was limited. This resulted in an extension of the watch production to the Swiss plateau. Cities along the Jura Mountains (Biel, Grenchen, Solothurn) accommodated the largest watch factories. In particular the cities of Biel and Grenchen experienced a phenomenal boom. The demographic development of Biel went from 6'000 habitants in 1850, to more than 30'000 residents in 1900. Over ten major factories opened during these years. One of them was Louis Brandt & Frère (today Omega) which moved from La Chaux-de-Fonds to Biel in 1880. In 1922 only one company employing more than 200 workers remained in La Chaux-de-Fonds. (Donzé, 2007)

2.4. Territorial Spreading

The economic watchmaking region is located in the north-west of Switzerland, including North-Vaudois, the Canton of Neuchâtel, the Bernese Jura, the Biel region and the south-western part of the Canton of Solothurn. In the beginning of the 20th century, more than 80% of Swiss watch companies were located in this region, until 1970 this figure increased to 92%. (Pasquier, 2008)

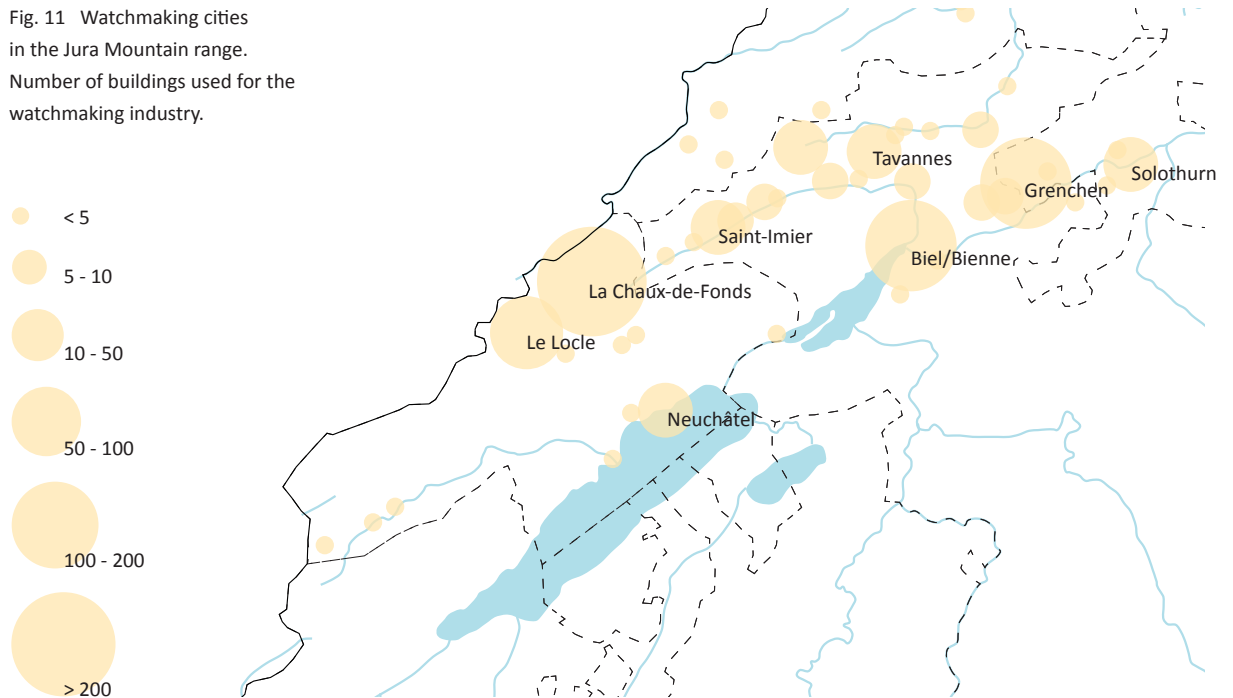
The here presented mapping illustrates the locations of buildings and sites that are connected to the watchmaking industry. Among them are currently used sites, but also locations that served the industry in the past. Moreover there are listed watch manufactures, factories and workshops which are or were occupied either by a watch company or by subcontractors. The maps impressively demonstrate the huge amount of watchmaking sites and represent the industries strong connection to the Jura region.

This simple graphical demonstration is based on a database with more than 700 addresses of watchmaking buildings. The data was collected from several sources (see bibliography), and additionally from the visit of the area. Nevertheless, the mapping does not claim completeness.

Fig. 10 The Jura Mountain range in the north-west of Switzerland



Fig. 11 Watchmaking cities in the Jura Mountain range. Number of buildings used for the watchmaking industry.



Buildings used by the watchmaking industry:

+ in the past

× in 2017

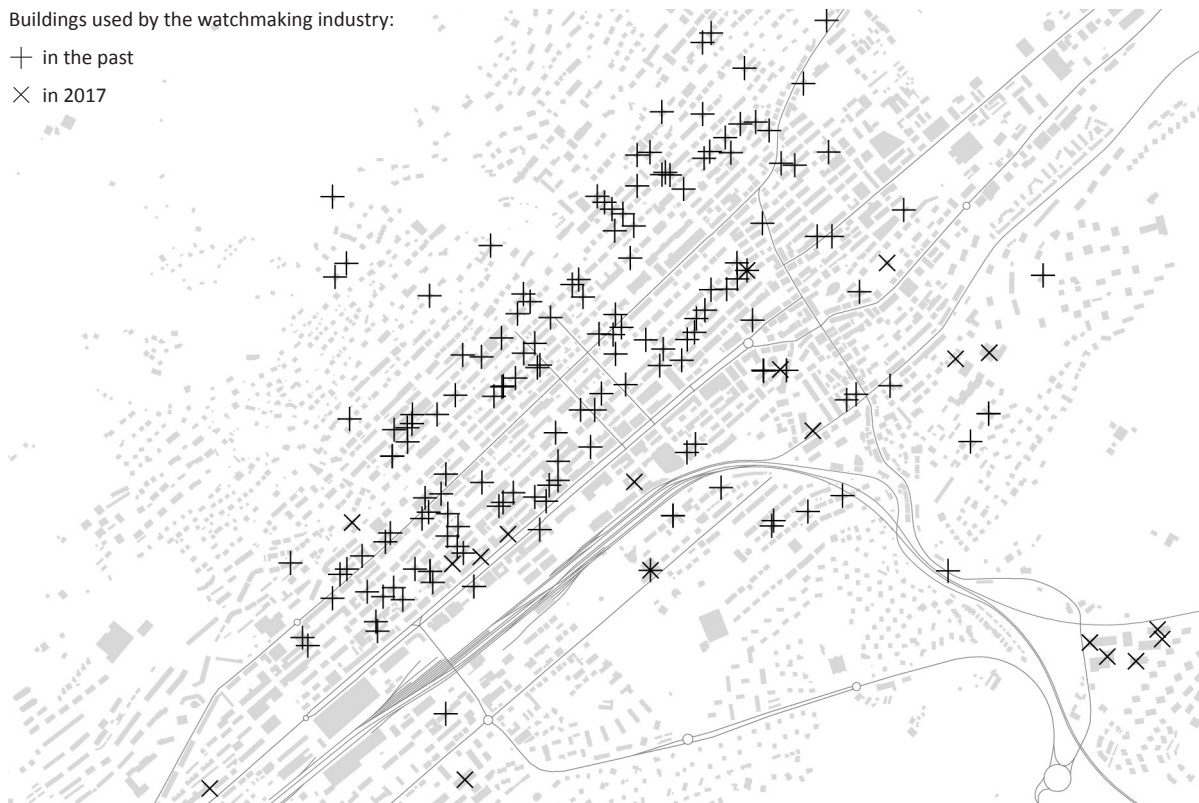


Fig. 12 La Chaux-de-Fonds, map 1:20'000

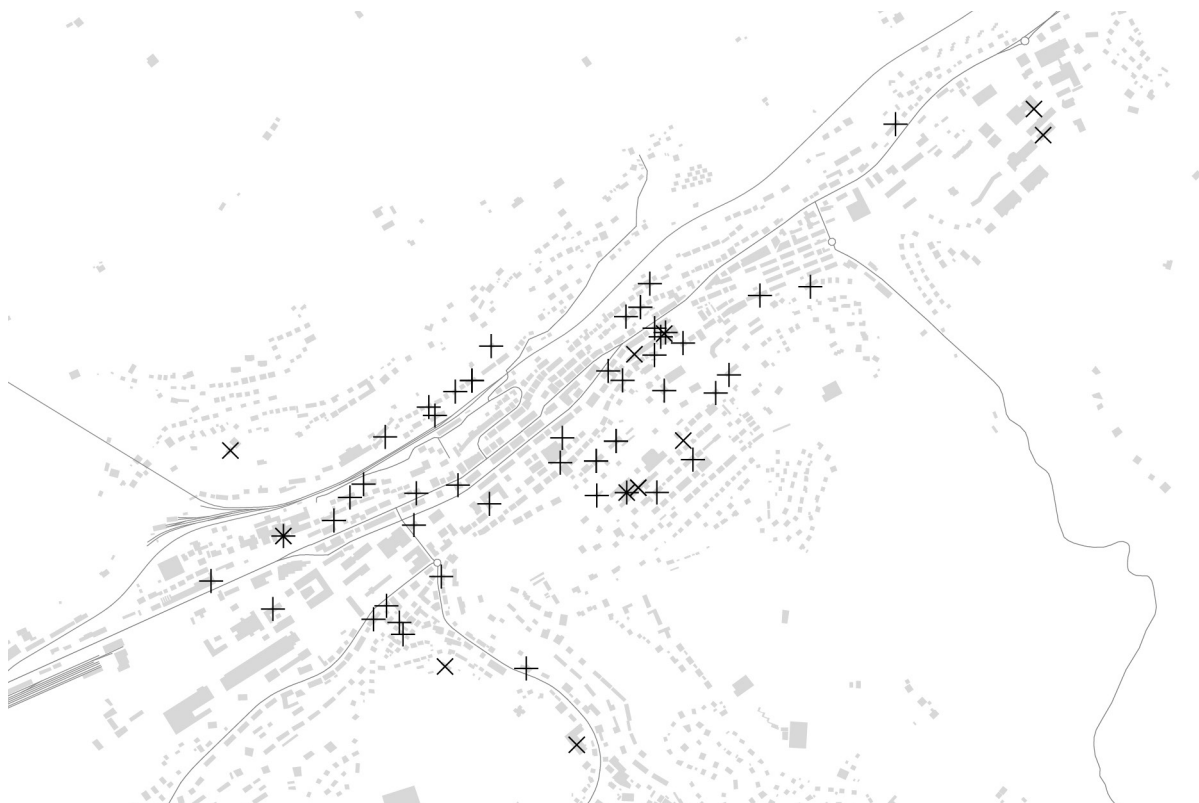


Fig. 13 Le Locle, map 1:20'000

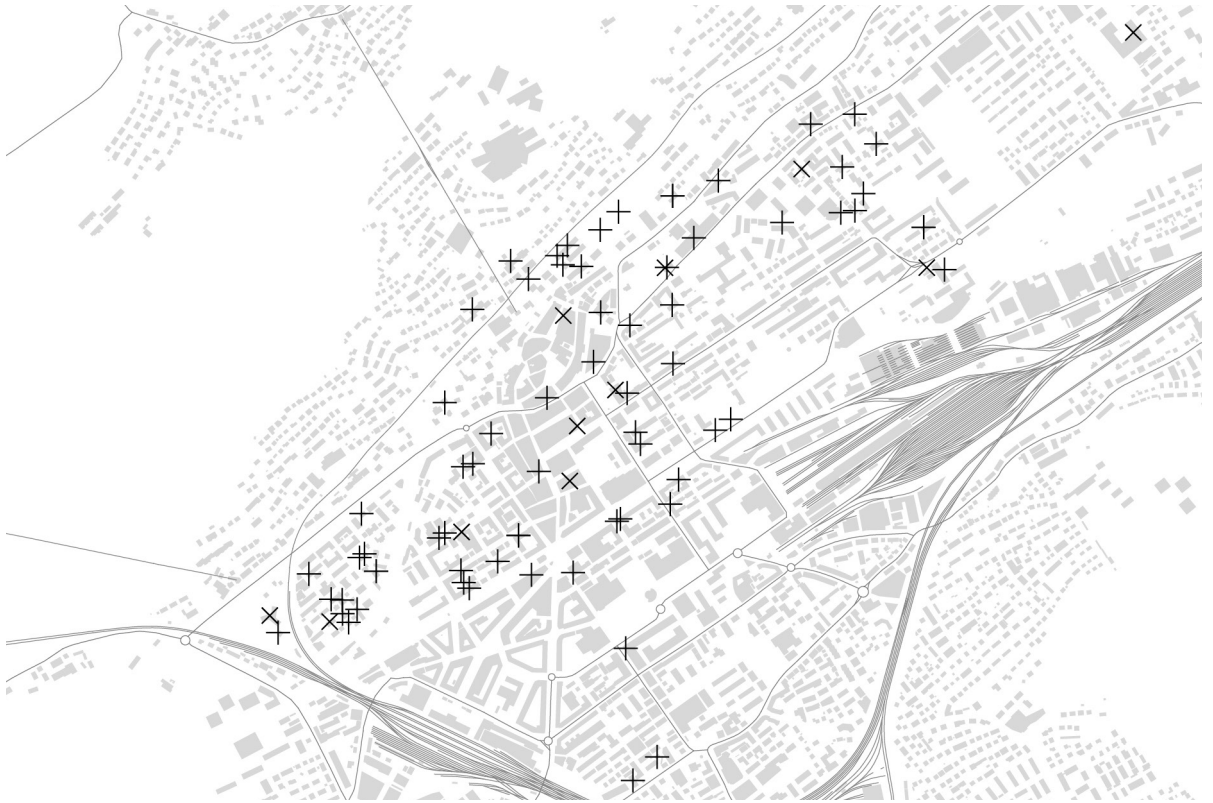


Fig. 14 Biel/Bienne, map 1:20'000



Fig. 15 Grenchen, map 1:20'000

3. Building Documentation and Analysis

This master thesis aims to analyse the architectural characteristic of the production infrastructure within the watchmaking industry in Switzerland. Therefore, it must be ensured that the selected buildings were constructed with the objective to support the production process of watches.

The previous historical overview revealed that over time a broad range of building types were used as production spaces by watchmakers. In the beginning, the watchmakers used pre-existing buildings, where they often made some structural changes to optimise their working conditions and production processes. For example, they added several new windows or they changed the room distribution. But these changes always depended on the existing structures. Originally, these buildings were not constructed to serve watchmaking. Later, with the mechanisation of the watch production, the companies began to build factories. These structures were intentionally designed to answer the specific requirements of the industry and they were built to increase the amount and quality of the production.

The selection of buildings for the profound analysis in this thesis only contains buildings constructed after the period of independent craftsmen, but before the automation of the production processes in the second half of the 20th century. Some of the buildings are still used by the watchmaking industry today. Others however, were transformed and serve a different

program. The geographical locations of the selected building are spread over the Jura Mountain range. There are factories in urban surroundings as well as examples in rural areas. In the present documentation, these buildings are sorted by construction year.

The description of each building is divided into three parts. General information is presented in the first section, touching on the company, the history of the brand, the year of construction, the location, the typology of the building as well as later transformations. The second part is dedicated to presenting one specific building on the production site. There are specifications about the building dimensions, orientation, external appearance, facade, structure, materialisation and room organisation. Finally, the third part talks about the inner characteristics, such as room dimension, actual and former program, access, production process, work places, lighting, ventilation and vibrations.

The knowledge presented in the documentation was obtained from multiple sources. Historical information is based on literature, historic plans and documents, but also on discussions with people during the visit of the buildings. The plans were redrawn with information retrieved from historical documents and measurement work on site. Actual photos of the buildings were taken by the author with permission of the building owners.



3.1. Tavannes

Rue de Pierre-Pertuis 4, Tavannes

The company Tavannes Watch emerged from the collaboration of the community of Tavannes, a watchmaker from Le Locle and a tradesman from La Chaux-de-Fonds. At the age of 18, the watchmaker Henri-Frédéric Sandoz had his own atelier with several employees in Le Locle. To increase production, he planned to open an American-style factory. Amongst other things, the competition by Zenith made it impossible to realise this project in his hometown. Therefore, he accepted the offer of the *Bürgergemeinde* (burgher community) of Tavannes, which provided him with the construction of a factory building. The watch industry had not yet arrived in Tavannes and the town was affected by emigration. The investment in a factory building was supposed to boost the industry and create new jobs. In 1891 the company was founded with the financial support of the family Schwob from La Chaux-de-Fonds. (Gagnebin-Diacon, 1996)

The building was constructed in 1890 by carpenters of the *Bürgergemeinde*. The factory is located in the centre of the village. For the first extension in 1907 Sandoz hired the young architect René Chapallaz. He constructed a building with roughly the same volume directly behind the first one. Before the First World War, the company moved to the eastern end of the village, close to the river and the railway station, where the same architect constructed a much larger factory. Already in 1917, another building dedicated only to the fabrication of precision tools and machines, was added. This factory was built for 300 employees and became the future company Tavannes Machines. (Gagnebin-Diacon, 1996)

In 1969, the companies Cyma, Tavannes and DOXA joined forces to form Synchron AG, to which since 1972 also belongs the company Auréole. Since 2008, Tavannes Watch is independent again and sells watches mainly in the US. (Watch-Wiki, 2016e) Most of the buildings are still existing, but used for different programs.

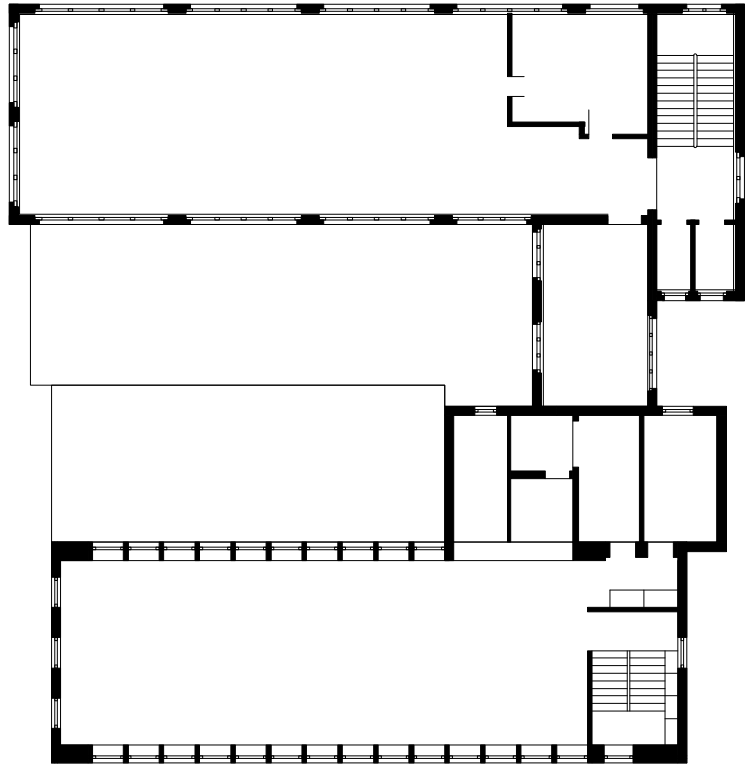
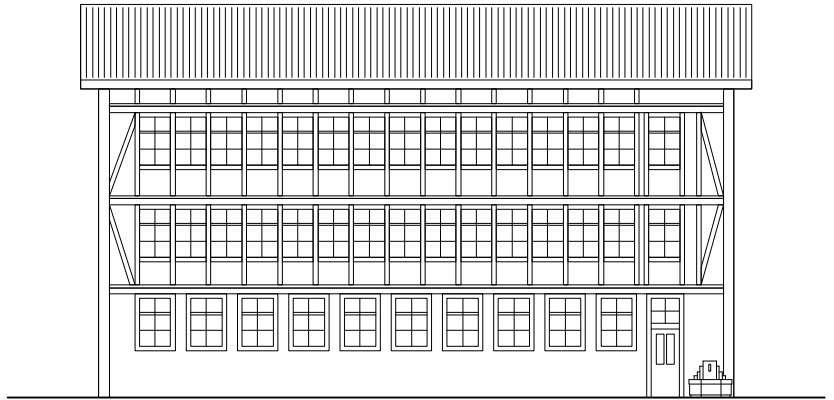
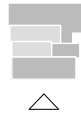
Fig. 16 South facade of the former factory building with historic lettering

The analysed building is located on the initial site of the Tavannes watch company. Originally this area held three buildings, but only two of them still exist today. The two buildings are situated one behind the other with both main facades facing south. They both have a staircase in the eastern corner. These two main volumes are interconnected by a two-story building. While the southern factory was transformed into apartments some years ago, the northern building still serves commercial functions. The ground floor is used by a carpenter atelier, the first floor houses a mechanical workshop and the second floor is occupied by a fitness centre.

While the volume of the two remaining buildings is almost similar, the structural system and the facade are completely different. The southern factory was constructed by carpenters from the village, consequently they built a wooden construction with a half-timbered structure. The wooden beams, visible on the facade, create a strong regularity. The arrangement of small windows follows this structure. With an overall length of 21 m and a width of 7.30 m, the dimensions of the factory are appropriate to the surrounding buildings of the village. The building is in good condition, because a renovation was done some years ago. On the facade, the historic lettering of Tavannes Watch was refreshed.

The northern building was constructed seventeen years later. For this reason, the structural system is made of reinforced concrete. Then masonry was used for the walls, and a houndis system for the floor constructions. The arrangement of the facade follows the regular grid of the structure. Large windows were placed between each column, which reach from the bottom all the way up to the roof. The facade of the eastern building part, containing staircase and sanitary rooms, has a different pattern. The building is about 24 m long and 7.30 m wide.

1:250 2m 3m 5m



The original production room of the southern building was 18 m long and went over the whole building width. The room was accessible from the staircase in the eastern end of the building. Natural light came through the windows of both facades. The interior room height was generous to support the lighting. Due to the later transformation into a residential building, the room is nowadays divided into small spaces serving the new program. Today each floor contains two apartments, which have a living/dining room with kitchen plus three or four additional rooms.

Some rooms of the northern building still serve as a mechanical atelier. The company which uses these spaces, produces small pieces and components for different industries. Due to the very few transformations, some materials of the original interior remained unchanged. For example, the wooden herringbone parquet probably dates back to the initial construction. The large windows are subdivided into several fields, with casements in the middle row. No measures were installed to protect the workers from direct sunlight. Because of heavy machinery the structural system had to be strengthened. Massive steel beams were installed under the ceiling. These are supported by steel pillars which were aligned with the facade and placed in between the concrete columns. The steel supports are in front of the windows and visible from outside. Due to this modification, the structural grid was narrowed and the static loading capacity doubled.

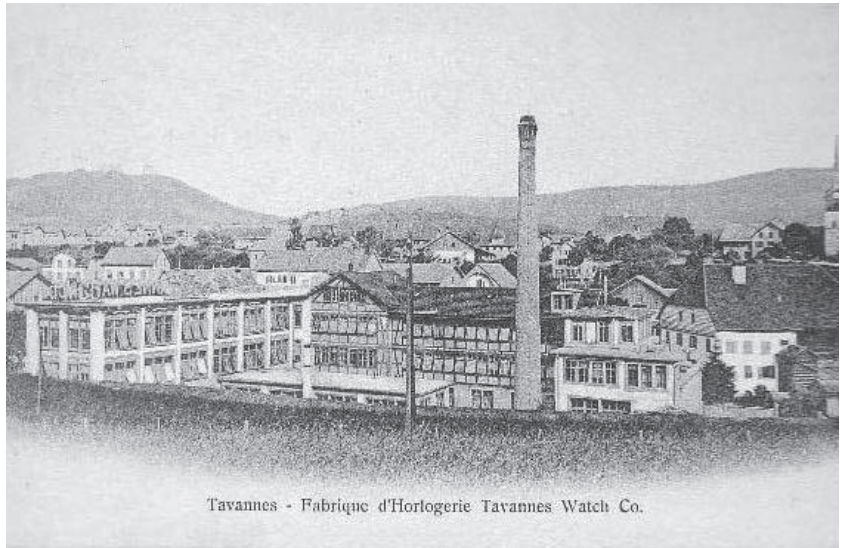


Fig. 17 Historic photo of the factory building, view towards south (Watch-Wiki, 2017)



Fig. 18 Historic production room, view towards west, photo undated (La fabrique et le village, 1996)



Fig. 19 North building, interior second floor, view towards west



3.2. Solvil et Titus

Rue de la Serre 24, La Chaux-de-Fonds

The brand's founder Paul Ditisheim was born into the small social circle of industrialist families leading the Swiss watch industry at the time. He attended the Horological School in La Chaux-de-Fonds. After receiving his diploma at the age of 13 he worked for his family's Vulcain manufacture until 1892. In this year, he founded his own brand, Solvil and Titus. Ditisheim's watches were awarded multiple prizes by several institutions at the time. Through specific studies on the impact of atmospheric pressure and the magnetic fields on watches he further improved his products. Thanks to various inventions, he was able to develop the most precise chronometers ever produced. In 1925 the founder Paul Ditisheim separated from the stock company because of substantial differences. While the management wanted to produce simple watches in large numbers instead of precision clocks and marine chronometers, Ditisheim did not agree with this strategy. Today the brand's name is owned by the Hong Kong based Stelux Holding. (Watch-Wiki, 2014c; Wikipedia, 2017)

The building is located in the centre of La Chaux-de-Fonds and was constructed between 1900 and 1910. (Thomann, 1965) Paul Ditisheim commissioned the architect Henri Grishaber to build the factory. The three-floor building is an extension, added perpendicularly to an older residential building on 25, rue du Parc. (Othenin-Girard, 2014)

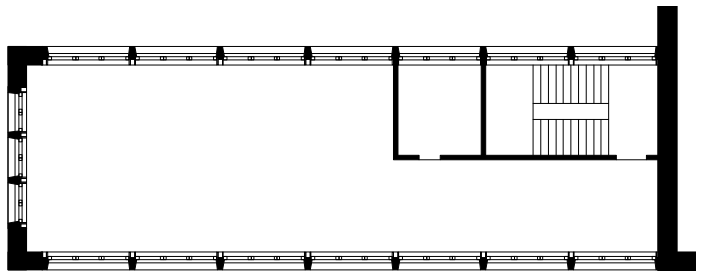
Today, the ground and first floor are occupied by a day care centre. The second floor still serves the watchmaking industry. The small watchmaker atelier Arrigoni-Laufer specialises in the restoration and decoration of high range watches. They work for well-known brands such as Blancpain, Girard-Perregaux, Audemars-Piguet and Vacheron-Constantin.

Fig. 20 Factory annex, view towards north-west

The already existent residential building is aligned with other buildings along rue du Parc, the main facade facing south. The factory extension was built in front of this facade and along the crossroads, which follows the slight natural slope. Even though the two constructions are structurally connected, they can only be accessed through separate entrances from different streets. The entrance of the factory is located on the west facade in the northern corner. The main door leads directly into the staircase. Originally the floors were connected directly to the residential building.

The factory stands out of the urban structure because of its perpendicular orientation. Also, the flat roof is exceptional for the neighbourhood. The composition of the facade follows a structural system, which is based on a regular grid consisting of seven axes. The last window on the south side is positioned approximately one meter away from the corner of the house, thus emphasising the importance of the buildings corners. The windows and parapets of the first and second floor create separate fields detached from the structure. The ground floor is designed as base level and the window arrangement is slightly different from the upper floors. The building facade consists of artificial stone mounted on the concrete structure. On the southern facade, the lettering “Chronomètres Ditisheim” is still visible, but partly covered by advertising.

1:250 2m 3m 5m



The building disposes of one production room per floor. These ateliers are directly accessible from the staircase in the north of the building. The secondary rooms for toilets are located in the same area. The production room extends over four rows of the structure and has windows on three facades.

Originally the workplaces were arranged along the windows. Today they are located in the middle of the room surrounding two tables. Only secondary work stations with specific tools or machines still stand in front of the windows.

The windows are divided by one horizontal and two vertical bars. The natural light entering from three sides creates a regular background lighting. Additionally, lamps are installed on the ceiling and each workplace is equipped with individual artificial lights. The windows facing south and west are equipped with interior sun protection.

There is no air conditioning, only natural ventilation by opening of windows. Acoustic matters are not an issue at the moment. Vibrations however, are strong and difficult to handle. For example, watchmakers have to interrupt their work when someone is passing behind them.

Fig. 21 Watchmaking atelier on the second floor, view towards south



Fig. 22 Watchmaking tools along the windows



Fig. 23 First atelier building of Paul Ditisheim (Dossier candidature UNESCO, 2009)





3.3. Zenith

Rue des Billodes 30-36, Le Locle

In 1865, Georges Favre-Jacot founded the “Fabrique des Billodes” which he installed in an existing house located west of Le Locle. With the first enlargement in 1875, the first building brought together dwelling and business under one roof. The membership of Georges Favre-Jacot in a commission responsible for urban projects followed by the modification of the direction of the Billodes road to allow the construction of new factories testify to the political influence of the industrialist. Between 1881 and 1890 several additional factory buildings were constructed. Already in 1882, the company had around 300 employees. Because of the success encountered by the Georges Favre-Jacot watches, the development of new models and the acquiring of new markets, the production capacities reached their limits at the end of the 19th century. (Piguet, 2005)

At the beginning of the 20th century the mechanisation of the production processes became relevant. From 1903 to 1906, the establishment experienced an unprecedented extension, as in three years the natural slope was colonised by five new constructions. Among them is an impressive 70 m long factory of mechanics and drafts (Billodes N° 36b), as well as a 40 m extension (Billodes N° 32b), occupying the summit and the north-east of the site. Connected by many footbridges, stairs and passages, the factory of Georges Favre-Jacot became a complex network of buildings. With the transformation of the company into a public limited company in 1911, the Zenith brand was created. One year later the company built another impressive building in the north, a workshop intended for big tools, such as machines for the decoupage. (Piguet, 2005)

Despite the many transformations and strong interventions, most of the original constructions still exist. Some facades were completely replaced by new construction, predominantly with buildings deriving from the 19th century. Today, most buildings on the site are still used by the company for the purpose of watchmaking.

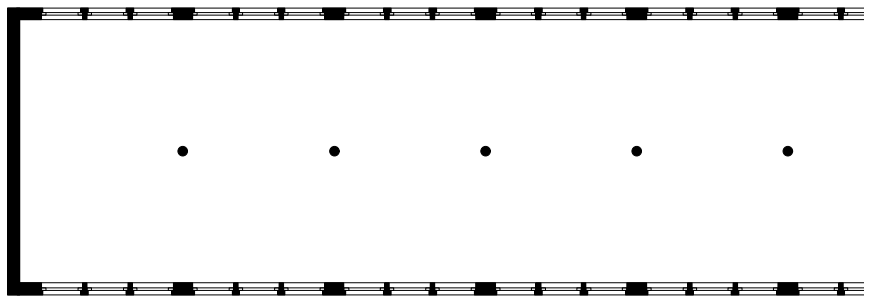
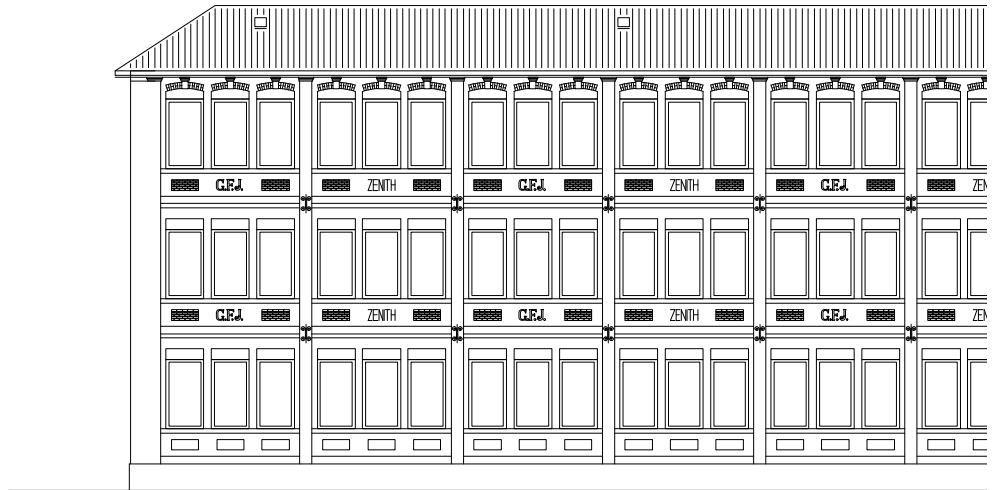
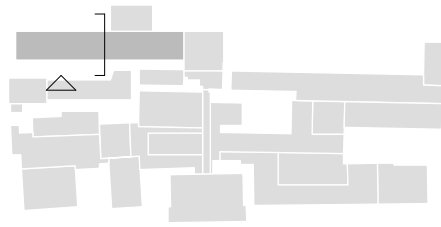
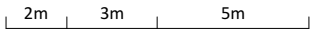
Fig. 24 South facade of the factory building

The presently documented building is built into the slope and located on the upper end of the Zenith area. The main facade is facing south. Measuring almost 70 m, the factory is the longest continuous volume on the site. It was constructed in 1905 by the architects Jean and Eugène Crivelli. From the beginning the three-story building was used as a mechanical atelier for the production of *ébauches*. The factory consists of the long production part and an annex construction for technical offices at the east end. While the floors in the head-building are subdivided into several rooms, the long west wing is one big space. The building width of 9.50 m required an additional middle row of structural supports.

The building stands out of the Zenith complex because of its large dimensions and the position at the top of the slope. But also, the strong appearance of the facade with its regularity is imposing. The arrangement of the windows is subordinated to the structural grid. Each range between two supporting pillars measures 5 m and contains three windows. While the openings on lower floors have rectangular shapes, the windows on the second floor have a slightly arched lintel, made out of brickwork. The surface under each window is decorated either with exposed brickwork or lettering. Besides the word Zenith, the letters G.F.J, which are the initials of the founder Georges Favre-Jacot, are visible as well. Both building parts have a hipped roof shape, though their orientation is perpendicular to each other. Also, the roof of the annexed volumes is a couple of meters higher than the other.

Some hundred meters away, facing into the factories direction, the residential house of Georges Favre-Jacot stands in the slope. He constructed his villa in collaboration with a promising young architect, Charles-Edouard Jeanneret-Gris, who later was known as Le Corbusier. This mansion overlooks the Zenith site, and the location almost allowed a view into the factory building.

1:250



The production spaces are accessible from the distribution area in the annex building. The first floor serves the mechanical production process, the second is occupied by craftsmen's workplaces. The rooms have an enormous length, but are separated into several ateliers by lightweight walls. Also, the rooms height is generous, and serves the purpose of illumination. Today the rooms height allows the use of large production machines.

The continuous row of windows on the southern facade allows a lot of natural light inside. Because of the buildings positioning on the slope, the lighting is strong even during winter months. Today the direct sunlight poses problems and the slat blinds are lowered most of the time. The rooms are equipped with three lines of artificial ceiling lamps and each workplace has its own desk light.

Originally the craftsmen's workplaces were located along the southern windows. Behind them was a counter for the temporary storage of components. On the northern side the larger machines were installed. Today the workplaces are oriented perpendicular to the windows and along the northern facade to. The room centre is still used for storage.

The ceilings are characterised by different technical installations. These are several electric channels and infrastructure for air conditioning. The massive and round pillars in the middle of the room have imposing cast iron capitals. The concrete beam in longitudinal direction is visible.

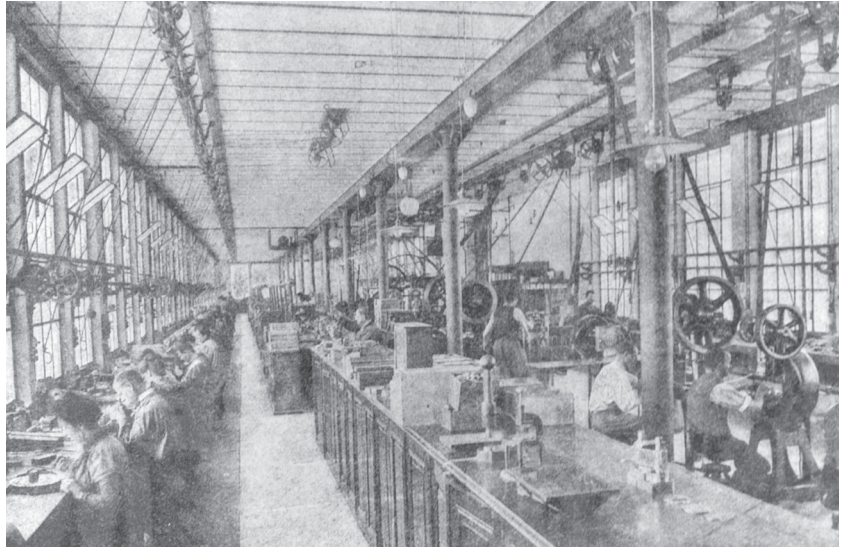


Fig. 25 Historic view of production space, photo undated (Zenith, 2017)



Fig. 26 Interior on the first floor with atelier space, view towards west



Fig. 27 Interior on the ground floor with production machines, view towards west



3.4. Alpina

Oberer Quai 51, Biel/Bienne

At the end of the 19th century, small and medium-sized watch dealers suffered from increasing competition. Gottlieb Hauser therefore founded the cooperative “Union Horlogère” in 1883, which later created the watch label Alpina. Two goals were pursued: the search for manufacturers, who would reliably supply watchmakers with high-quality watches and accessories, and the negotiation of interesting conditions as a result of group orders. From the beginning, there was a cooperation with the company Straub & Cie., which processed parts from different manufacturers to complete watches. In 1890, the relocation of the cooperative headquarters to Biel took place. In 1908, the successful company celebrated its 25th anniversary. On this occasion, the name Alpina was registered as a protected watch brand. (Stas, 2013)

The here documented building was built in 1907 by Josef Straub, president of the cooperative “Union Horlogère” and owner of the watch manufacture Straub & Cie. The factory is located in the centre of the city, directly on the bank of the Suze river. The asymmetrical building design already took into account a possible future extension on the opposite. (Kanton Bern, 2017b; Watch-Wiki, 2016d) During the 20th century an extension was then effectively built, but in a different style.

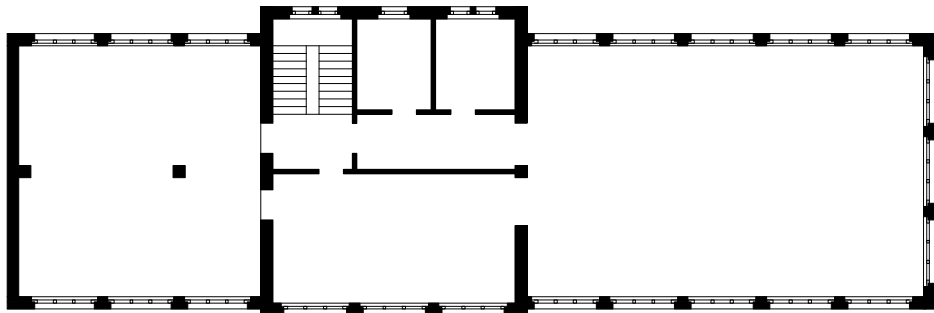
Meanwhile, the building was used by the company Wenger, which is nowadays known for its pocket knives, but earlier also produced watches. (Stas, 2013) While there is a centre for physiotherapy on the lower floors, the third floor and the attic have been converted into apartments. The brand Alpina made a comeback in 2002 when investors took over the trademark rights and founded Alpina Watch International S.A. (Watch-Wiki, 2016d)

Fig. 28 Former Alpina factory beside the river, view towards north-east

The factory creates an ensemble with the neighbouring construction on the east, which is designed in the same style and situated along the northern bank of the river. (Kanton Bern, 2017b) The middle section houses the entrance, a staircase, offices and secondary rooms. This part was built at the same time as the production rooms in the eastern part of the house. The western extension of the building was added later in the 20th century. The entire building volume is around 30 meters long, of which well over two-thirds belong to the initial construction. The building depth of the side wings measures 9 m, the middle part is one meter wider. This difference leads to an offset in the north facade.

The main facade is orientated south along the river and clearly represents the history of the building. The appearance of three building parts is emphasised by the arrangement of the windows, the shape of the roof, and even the different ornaments on the facade. While the main volume has visible brick decorations, the production wing is kept simple. While the west extension has a flat roof, the east wing has a saddle roof oriented west-east. The roof ridge of the middle building part is turned by 90 degrees, and on top a small bell tower was placed.

The building disposes over a socle floor, with small rectangular windows. The main entrance is kept plain and located at the western end. The windows on the first floor are larger. The window lintels are slightly curved and create, supported by a circumferential cornice, a separation from the upper floors. Because of continuous facade elements the second and third floors appear as one entity. While the fourth floor of the production wing lies in the attic, the main tract disposes of an impressive and generous arched window.



The internal organisation follows the building repartition. The north-western corner is dominated by the staircase. Located along the north facade are also some sanitary and storage rooms. On the south side each floor has a small office room with direct access to the former production areas. None of these side wings have any room partitioning. Today these spacious rooms are used for physiotherapy courses and as a fitness centre. On each floor, the rooms run over the whole building width and have windows on three facades. All the windows are subdivided into three fields by two vertical bars. They are high enough to allow in sufficient natural light for today's use, even in the middle of the room.

Besides the windows and the structural grid not much reminds of the former watchmaking factory. Surfaces were completely changed and steel frames used for to the physiotherapy courses were installed on the ceilings. For artificial lighting, simple flood lamps were place on the wall between the windows, facing upwards, so that the light reflects from the ceiling. The horizontal heating tubes passing below the windows date back to older times. Some of the rooms are equipped with acoustic panels. Despite the gym activities, vibration does not pose problems.



Fig. 29 Historic view of the factory building before extension, photo undated (Watch-Wiki, 2017)

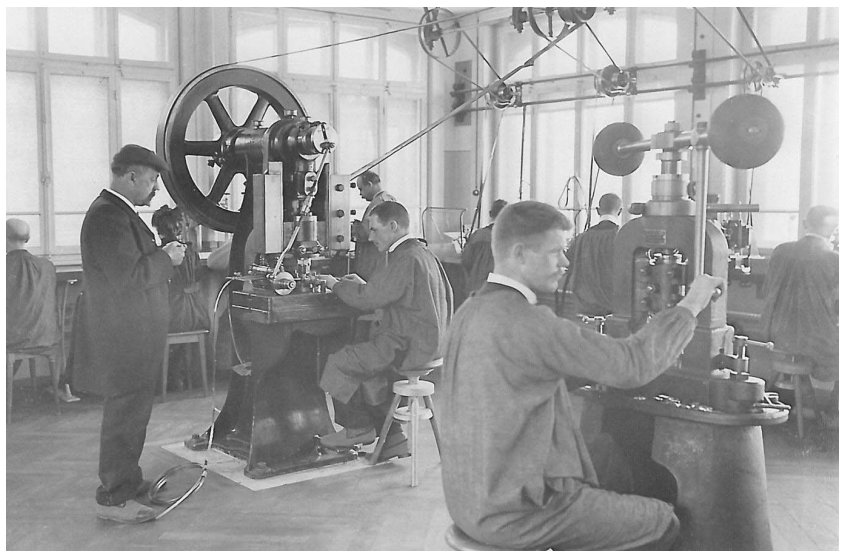


Fig. 30 Historic view of the production space, photo undated (Watch-Wiki, 2017)



Fig. 31 Interior on the first floor, view towards east



3.5. Tissot

Chemin des Tourelles 17, Le Locle

In 1853 Charles-Félicien Tissot (assembler of gold cases) founded the manufacturing and trading office “Charles-Félicien Tissot & Fils” in Le Locle together with his son. From the beginning the firms catalogue included a wide assortment of pocket watches and pendants, most of which were made of gold or had elaborate ornaments. At national and international exhibitions and competitions, the watches received several awards. In the 19th century, Tissot watches were intended for export to the USA and Russia. Even at the Tsar’s Court the timepieces were worn. To expand serial production Charles Tissot constructed the first factory building in 1907 and started mechanical production supported by electrical motors. Then in 1917 the company began producing its own movements and therefore was transformed into a manufacture. (Pasquier, 2013; Tissot SA, 2017)

In 1930, Tissot and Omega joined forces. This strengthened both companies’ market position and gave customers access to a wider range of products. The SSIH (Société Suisse pour l’Industrie Horlogère) was the first Swiss watchmaking association. In 1933, Paul Tissot created a new sales and advertising action plan, named the Tissot Plan. This provided selected models of watches, which were tailored to the respective market, as well as systematic and targeted advertising campaigns and the free issuing of a catalogue to the dealers. In addition, Tissot offered its customers a one-year warranty even in the event of an accident. (Tissot SA, 2017) The watch company remained family-owned until 1971, then the merger of SSIH and ASUAG resulted in the Swatch Group. (Pasquier, 2013)

Today the Tissot complex has seven buildings and is located on the south slope of Le Locle. The factory is surrounded by residential houses. Originally most of the buildings were constructed for production purposes. Nowadays the watchmaking is located elsewhere and the former factory serves logistic purposes, reparation as well as administration.

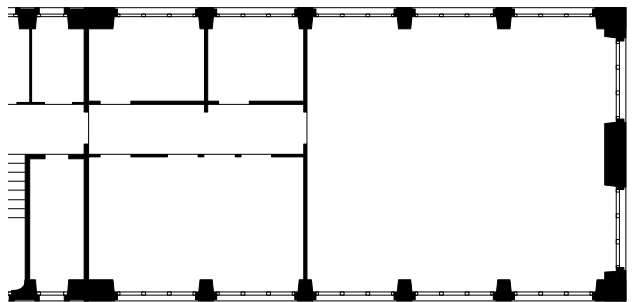
Fig. 32 First factory building of Tissot, view towards west

The here documented building part dates back to 1907 and was the first building on site. It was constructed before Tissot became a manufacture. At this time, the company bought the movements externally and focused on watchcases. The factory originally had only two upper floors. With the first extension toward the west in 1917 the builder also added another floor to the initial construction.

This building part is 18 m long and almost 10 m wide. The structural plan follows a regular grid of 3.30 m, with exceptions on the western end. The rooms on the ground and first floor have one middle pillar that was added with the first extension. This reinforcement was meant to prevent vibrations and to allow the construction of a second floor. The extension floor does not have these middle supports, because the roof structure traverses the whole building width. The staircase is located in the south-western corner of the building, surrounded by small rooms for storage and sanitary uses.

The facade follows the structural concept. The windows on the ground and first floor are 2.60 m wide and visually separated by each other by columns. These windows are subdivided into three vertical casements. The parapet is ornamented with three simple panels. Slightly arched lintels create the top end of the window field. The facade of the second floor extension has a complete different look. The windows are cut-outs in a completely flat surface. Even the strong regularity changes from one horizontal window in the lower floors to two vertical windows.

1:250 2m 3m 5m



Already in the beginning the ground floor was separated into several rooms. Besides the counter and a technical office, the larger production room for 20 employees was located to east. Two ateliers for around 30 employees were located on the first floor, one of them for the production of small components. During the 1917 extension two ateliers for another 35 employees were added.

All former production spaces have large windows to allow good lighting conditions even in the middle of the room. The openings are subdivided into six fields by one horizontal and two vertical bars. Three working places were installed directly before each window. Depending on the type of work, a second row of tables was sometimes placed behind the first. The complicated system of wheels and belts installed on the ceiling, provided each work place with physical energy, produced by a centralised electrical motor. The rotation energy was used to drive the watchmaker tools and machines. The centre of the atelier was used for bookkeeping or storage. Each square meter of the building was charged with a program.

Later the former production location on the first floor was transformed into an educational area for watchmakers. The floor is subdivided into three rooms. The largest of them is located at the east end of the building and has windows on three sides. While the room takes up the whole building depth, the room covers only 3/5 of the buildings length. This space functions as class room and is equipped with special tables for working on watches. Each window has three vertical casements. The background light basically comes from the outside. To avoid direct sun light, the exterior slat blinds can be lowered. Additional basic light comes from the lamps installed in the suspended ceilings. Then each table is equipped with special working lamps. The ventilation is still manually. New radiators were placed below each window.

Fig. 33 Project drawing of the factory building in 1907, view towards south-west (Tissot, 2017)

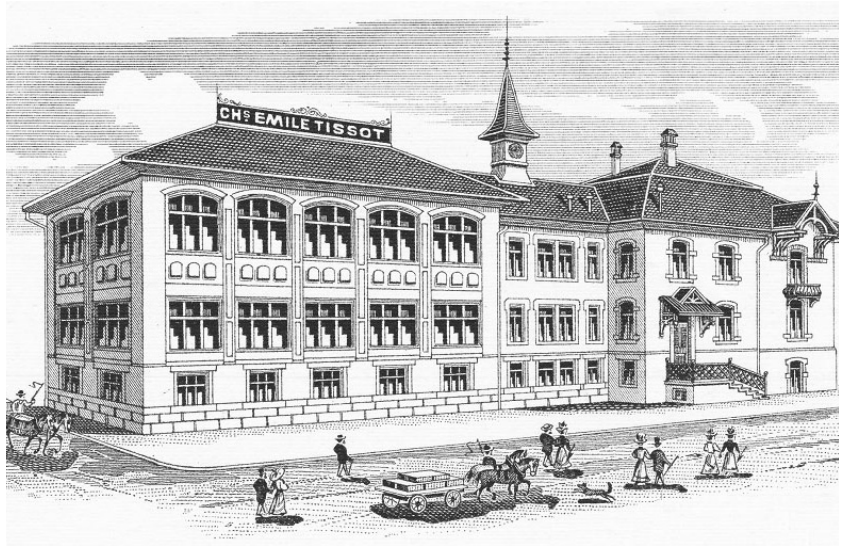


Fig. 34 Historic view of production space from 1923, view towards east (Tissot, 2017)

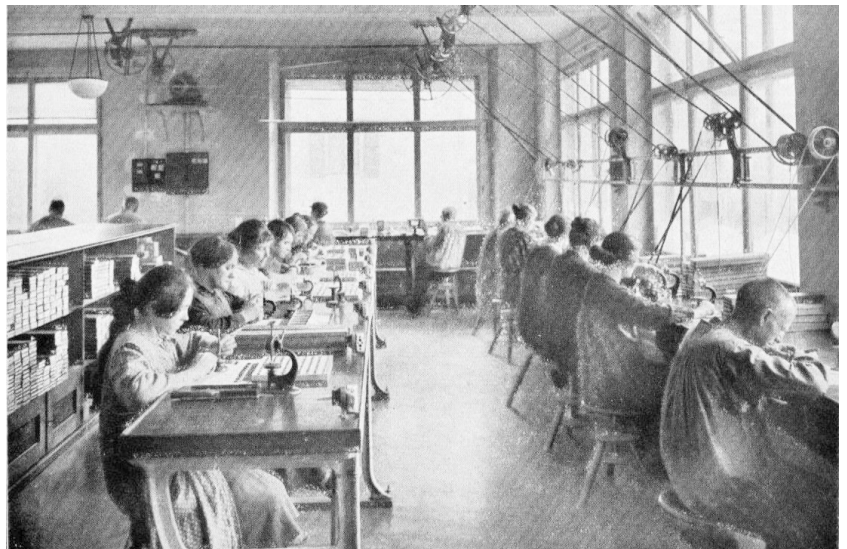


Fig. 35 Class room on the first floor, view towards east





3.6. Marvin

Rue de Bel-Air 21, Reconvilier

The Marvin Watch Company was founded in 1850 by Marc Marx and Emmanuel Didisheim in Saint-Imier. In 1892 the management of the company was taken over by the next generation which renamed it Albert Didisheim & Frères. The sales focus was the American market. The export to America was organised by the general agency in New York. With the construction of the new factory building in 1912, the company's name was changed to Marvin. (Watch-Wiki, 2016c)

In 1917, the three sons of Henri-Albert Didisheim took over the management. The production of manufactory-made fine movements was maintained despite the company's reorientation on wristwatches. In addition to his own clockworks, for a brief period of time Marvin also used Rolex movements. In 1973 Marvin was taken over by the Manufactures d'horlogerie Suisses Réunies (MSR). After they ceased operations in 2001, the trademark rights were sold to Time Avenue AG in the following year, which presented new models from 2007 onwards. (Watch-Wiki, 2016c)

The building complex of Marvin watches is located on a hillside, which is slightly ascending from southeast to northwest. The factory is conveniently situated between the old village and the railway station built in 1875. (Bourquin, 1984) Today the premises consist of three buildings. Located in the north-eastern corner of the parcel is the original factory, erected in 1912. Later the company added a new production building in the opposite corner of the site. The two main houses are connected by the third building, a hall with an industrial shed roof.

The watchmaking company abandoned the site during the 20th century. Today the area serves several other purposes. The hall is used as a mechanical factory. For example, on the second floor an association opened a small restaurant named Centre Espagnol. Other floors were transformed to apartments and several rooms are used for storage.

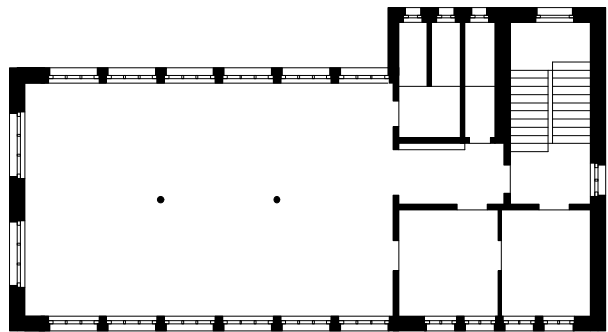
Fig. 36 Former factory building,
view towards north-west

In this documentation, the historic factory from 1912 was chosen for the analysis. The building was constructed by Eduard Groslimond, who realised several significant houses in the valley. He also constructed some other watch factories, such as Malleray Watch Cie., part of Tavannes Watch Co., the enlargement of the “Société horlogère” factory, the factory of Vogt & Cie. and the factory of Doriot watch cases. (Bourquin, 1984)

The building is oriented with its main facade toward the southeast. Disposing of four floors, the buildings volume is 20 m long and between 8.70 m and 10 m wide. The floor plan organisation demonstrates the clear partition of the building into two wings. Entrance, staircase, toilets and offices are situated in the eastern part. The western part houses a generous production hall.

The external appearance represents clearly the internal organisation. The two parts distinguish from each other by different roof shapes, and also by other measures of the structural grid. The mansard floor has recessed windows and is flanked by a cross-shaped roof with broken ribs to the south. The top floor of the eastern part is flanked by a balcony-loggia curved on consoles framed by windbreak walls. There are still traces of ochre paint on the facade, which were applied to the limestone masonry. The windows are framed by moulded cement. The former factory in the style of “Heimatstil” is an example for the high quality of the industrial architecture of this time. (Canton de Berne, 2017)

1:250 2m 3m 5m



The subsequently presented floor is not used for production anymore. Today the Centre Espagnol uses the second floor as a club house. The association installed a kitchen in the eastern part and uses the former production hall as restaurant room. The production area is located in the western part and about 12 m long. The room runs over the whole width of the building. Cast iron supports are arranged in the middle row. The restaurant is accessible through a small entrance room directly contacted to the staircase.

The windows are partitioned in a top horizontal element and three vertical wings below. All parts are subdivided by small bars. The windows were not replaced for years and are in bad condition. As they only have single glazing and provide poor isolation, exterior windows need to be installed during wintertime. Although the generous windows allow for a lot of natural light, the current tenants do not profit from these advantages, on the contrary they have installed curtains and rely on two rows of fluorescent tubes hanging from the ceiling for lighting.

Four tubes passing below the windows serve as radiators, allowing to heat the room. For the cooling in summer time a single fan is installed to the ceiling. This indicates that the generous window surface leads to high temperatures during the warmer season. No measures were taken to improve acoustic conditions.



Fig. 37 Factory building, photo undated (Histoire de Reconvillier, 1984)



Fig. 38 Centre Espagnol on the second floor, view towards west



3.7. Movado

Rue du Parc 117, La Chaux-de-Fonds

The watchmaker Achille Ditesheim founded a watch manufacture in La Chaux-de-Fonds in 1881. Together with six workers, he established an atelier on Rue 1er-Mars 13. This first house was a multi-storey residential building, as it was built by the hundreds, thus shaping the new cityscape. Watchmaker's ateliers were mostly located in the attic, due to the better lighting up there. In the first years, they produced pocket watches and on-board chronometers, later they began manufacturing wristwatches. The company grew very fast, already in 1897 Ditesheim had 80 employees. Because of this development the company moved several times. (Fallet, 2011; von Osterhausen, 1996)

In 1905 the brand Movado was created and registered. The same year the first factory was built at its current location. The building was designed for 150 workers and was state-of-the-art at the time. The building was enlarged in 1917 and again in 1948, by one extension each. This accounts for the growing workforce, which had risen to 300 employees by 1948. At this time, Movado had ascended to one of the largest companies in the canton of Neuchâtel. (von Osterhausen, 1996)

The Movado site is located in the more industrial western area of La Chaux-de-Fonds. Today the building complex is no longer occupied by the watch industry. It consists of three buildings, filling almost the whole urban block. Two of them are situated north along the Rue du Parc, they have three and four floors. The third building has only one floor and is located south, in front of the others. The whole site is nowadays property of the Canton of Neuchâtel. The former production rooms were transformed into offices and are used by different governmental departments.

Nowadays the brand Movado is part of the Movado Group Inc. based in Biel, Switzerland and New Jersey, USA. The whole company has approximately 1'300 employees. Among others, the Movado Group Inc. includes the watch brands Coach, Concord, Ebel, Hugo Boss and Tommy Hilfiger. (Movado Group Inc., 2017)

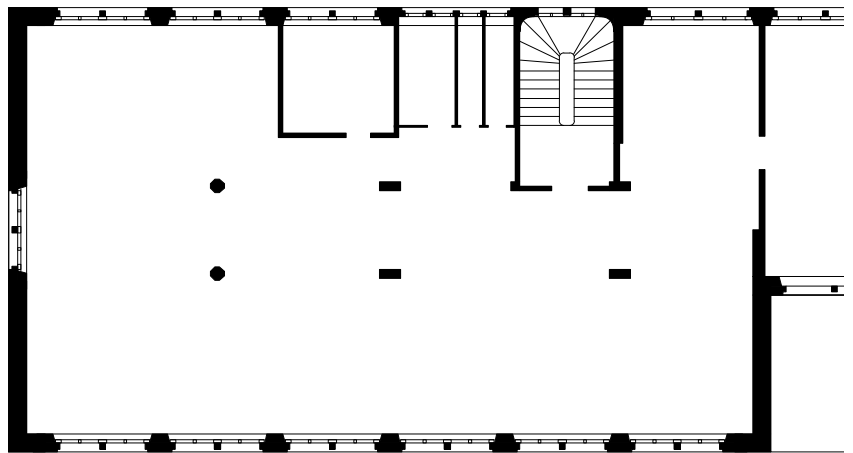
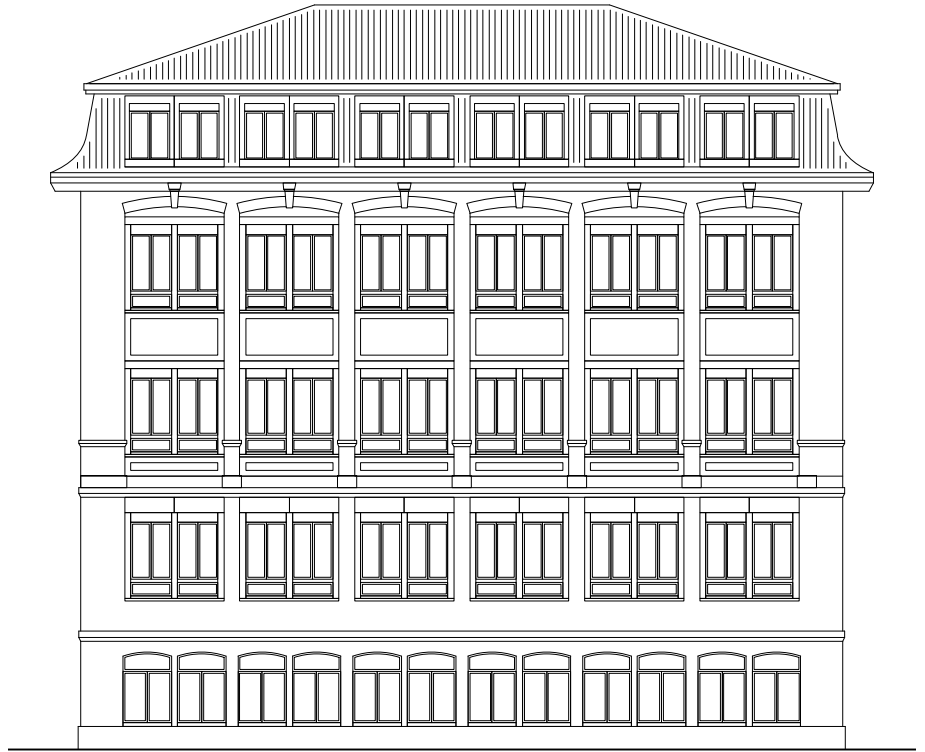
Fig. 39 North facade of the former Movado factory

The here documented building was constructed in 1917 as the second construction on the site. The width of the volume is about 15 m, which is more than the older factory with 9.50 m. Due to this difference in size, the buildings south facades do not have the same alignment. The overall length of both buildings, measured along the north facade is about 60 m. Both volumes are following the urban structure, orientated along the Rue du Parc. The factory extension has five floors, including the attic. The structure is based on a grid, containing six fields lengthwise and three fields in cross-direction. The main entrance is on the north facade, adjacent to the staircase.

The concept for the external appearance seems to have been inspired by the company's first factory building. While the south facade shows a regular structure, the regularity of the north facade is interrupted by the entrance and staircase. Because of a horizontal cornice between the ground and the upper floors, the lower part of the building appears as a socle, on which the upper floors stand. The structural grid functions as a base for the arrangement of the facade. Pillars rise along the first and second floor, where they end in simple formulated capital. Two windows per floor are placed between each pillar. Unlike the first building, the extension also has windows on the attic floor.

The production rooms were originally located on the first, second and third floor. They were accessible from a staircase in the northern half of the building. Later the rooms were transformed to offices, which are nowadays used by different departments of the cantonal government. On most floors they installed lightweight walls, creating small office spaces. In a recently renovated room on the third floor, the walls were removed completely to create open-plan offices. The building service of the Canton of Neuchâtel is currently planning on transforming other floors in the same fashion.

1:250 2m 3m 5m



The here presented room was originally used for the production of watches. Today this room serves as an open-plan office and holds around 12 work places. The entrance area is separated by low furniture, thus still allowing to overlook the whole space. The individual work places are located perpendicular to the facade and the windows. Common places and meeting tables are arranged in the middle of the room.

Located between two facade pillars are always two separated windows, which then are divided into three glass fields. While the lower part runs over the whole width, the upper part consists of two vertical wings. The natural light reflects on the ceiling, which is painted white and installed about 30 cm above the windows top edge. Beside the general artificial light in the circulation area, each work place has separate desk lamps. The windows allow in a lot of direct sun light, which is a problem for the employees working with computers. Therefore, curtains were installed to avoid direct sun light. Due to the closed curtains on the southern facade, artificial lights dominate almost half of the room.

For a comfortable room acoustic, the whole room was carpeted during the last renovation. There is no air conditioning and only manual ventilation.

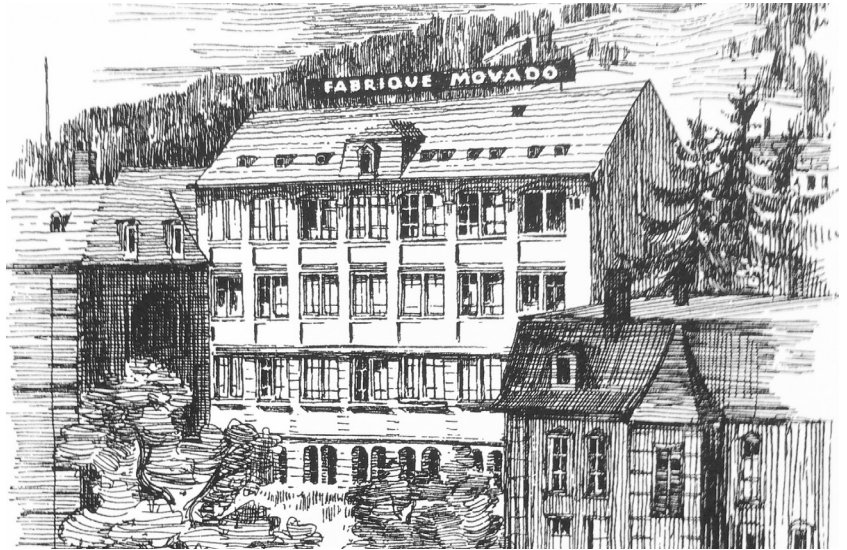


Fig. 40 The initial factory building, illustration undated (Movado History, 1996)

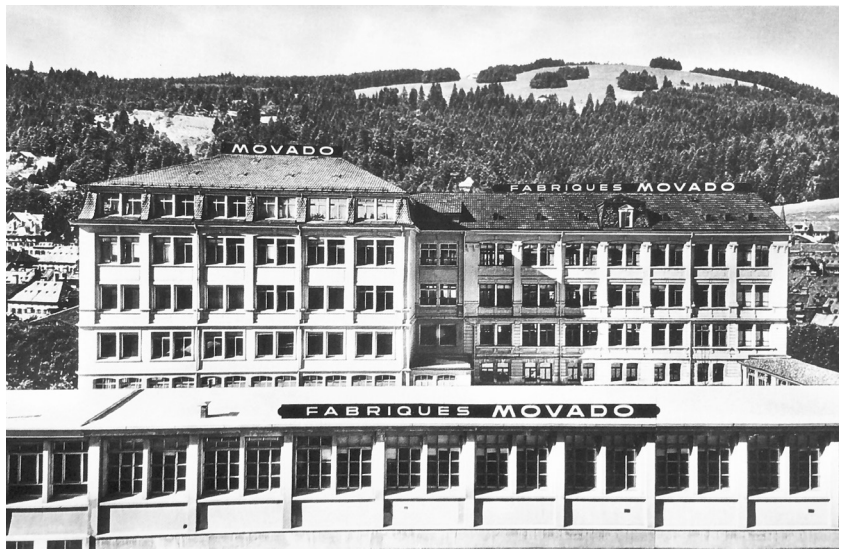


Fig. 41 The three building parts, photo undated (Movado History, 1996)



Fig. 42 Interior on the second floor, view towards south-east



3.8. Roamer

Weissensteinstrasse 81, Solothurn

In 1888 Fritz Meyer opened his own watch workshop in Solothurn and produced cylinder escapements which he sold to *établisseurs* or assemblers. From 1904 watches were produced under the name Meyer & Stüdeli. 1908 the new brand name Roamer was registered. In the 1920s the company opened its own watchcase factory and 1940 it extended to the production of watch dials. (Bubendorfer, 2015; Watch-Wiki, 2014b) In 1952 the whole company was named after the prestigious main brand Roamer. At that time, up to 1'200 employees worked in the factory. To the directors Leo and Ernst Meyer also social issues were important. Facilities such as nurseries, recreation rooms and canteens were anything but taken for granted at that time. (Toggweiler, 2013) In 1955, the first watertight Roamer watches went on sale, equipped with patented waterproof shell casing. This model was known as a particularly robust and accurate watch. The watch brand disappeared during the 1970s crisis, but then grew again in the 90s. Roamer took up its traditional past as a mechanical watch manufacturer with the launch of its new collection in 2003. (Watch-Wiki, 2014b)

In 1918 the company constructed a new factory in Solothurn. It is this building that became iconic for Roamers work, and featured on many of their advertisings and publications. (Bubendorfer, 2015) The building is located in the north of Solothurn, between the road and the railway line to Langendorf. Today the former production rooms of the Roamer complex are transformed into offices. In addition, different companies have installed their business in the complex. There are for example three architectural offices, but also a mail-order book house. Some of the newer building parts in the court still accommodate machine ateliers.

Fig. 43 East facade of the Roamer building with generous entrance, view towards north-west

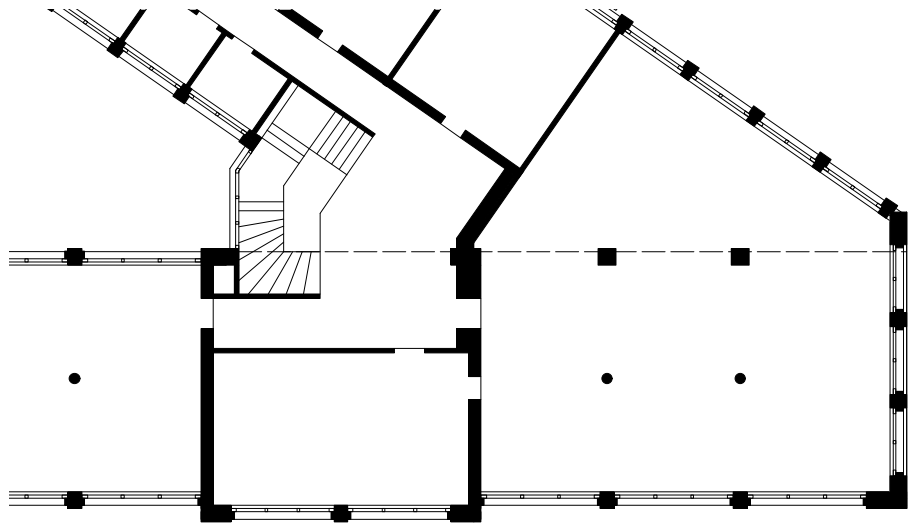
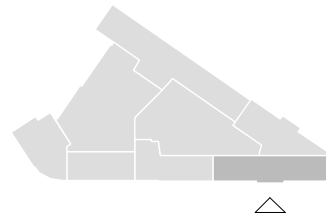
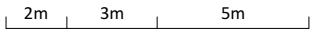
The triangle shaped site is limited by two roads and the railway line. The complex consists of several buildings creating a v-shaped perimeter block along both streets. Originally the area had several single standing factories. But over time, buildings were connected and room programs changed, furthermore the main access and the internal distribution were organised differently. The countless extensions and transformations formed a continuous perimeter block.

Nowadays, visitors arriving from the city of Solothurn face the simple and elegant side facade, which became iconic for the company. The generous entrance is located lateral of the building and faces the main road. The main distribution zone including staircase and elevator is placed behind the entrance area, in the former courtyard. The corridors of both building wings, located along the inner facades, are connected to this node. The former production areas are located along the external facade of the perimeter block.

The southern part of the here presented construction was built in 1918 as a single building and holds the oldest structures of the present complex. By studying historic photographs and a thorough analysis of the facade the original building becomes visible and its transformations obvious. The building volume consists of three parts and is designed symmetrically. The middle part was originally dedicated to distribution and offices. Both lateral wings were used for the production of watches. The overall length of the building is 37 m, of which the production wings take up 14 m each.

The structural system of the facade is based on a simple grid. The appearance is characterised by the vertical supports. The windows of the lateral volumes are larger than these of the middle part. The smaller windows and slight offset in the facade emphasize the office tract. While the factory had originally only four floors, today's construction has one more.

1:250



The interior distribution area is still located in the middle part, but was extended into the courtyard. The former production rooms are directly accessible from this area. The rooms go over the whole building width and have a middle row of iron supports. Windows were placed on both facades following the structural grid. Each field is separated into two horizontal rows with three vertical casements. While room organisation in the western part did not change, the eastern part was significantly modified. The creation of a perimeter block required the construction of intermediate buildings, which lead to the extension of several rooms. By adding a triangle shaped room, the initial rectangular plan was transformed into a polygon. One of the initial qualities of the building, the excellent natural illumination that reaches even the centre of the room, doesn't exist anymore.

Today one of these rooms is occupied by an architectural office. The workplaces are located along the windows, perpendicular to the facade. The natural light reflects on the ceilings and provides a comfortable background illumination. Nevertheless, artificial light from hanging lamps supports the atmosphere. The centre space of the room was transformed into a storage area. The built-in cabinets double as room dividers for the conference room. Two massive pillars indicate the alignment of the former facade. The historical office part was carefully renovated. Wooden build-in cabinets with ornaments demonstrate the elegant atmosphere of the former factory offices.

Fig. 44 Initial factory building before extension, view towards north (Denkmalpflege Solothurn, 2017)

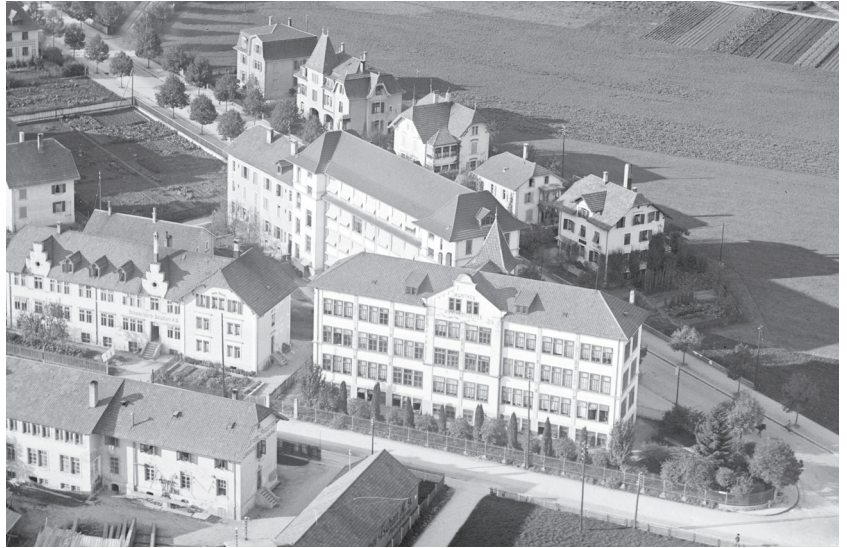


Fig. 45 Roamer building, photo undated (Watch-Wiki, 2017)



Fig. 46 Architectural office on the second floor, view towards east





3.9. Bulova

Weissensteinstrasse 9, Biel/Bienne

In 1875, the young Czech emigrant Joseph Bulova opened a watch and jewellery trade in New York. His craftwork, which he had learned in Europe, helped him to build a successful business. From 1887 he imported movements from Switzerland, which he installed into his own watch case. His philosophy was to produce high quality watches for an affordable price. The company soon started its own production in Switzerland. (Gäumann, 1999) The factory building itself was built in 1915 for the purpose of watchmaking. Detailed information about the first owner could not be obtained, however it is known that already in 1918 an additional floor was added to the west volume. (Kanton Bern, 2017a)

In 1927 the company Bulova moved its multiple ateliers into this building on Weissensteinstrasse in Biel. Just one year later more production space was needed and therefore the first extension was added to the factory building. Shortly afterwards, in 1929, the company started producing its own movements, which led to the transformation into a manufacture. (Gäumann, 1999)

The factory is located east of the city centre, not far away from the Omega site. The neighbourhood mostly consists of residential buildings which were constructed around 1900. (Kanton Bern, 2017a)

After the company moved into a new built factory in the 1950s, the building was used by a large printing shop. Because of the heavy printing machines several structures had to be reinforced. Furthermore an extension building along the north facade was added. This space has two floors and a generous window front. After the failure of the printing business the building was empty until 2009 when an architect bought the site and transformed the factory into apartments of different sizes. The large extension space to the north is nowadays used by a graphic design studio.

Fig. 47 South facade of the former Bulova factory with added balconies

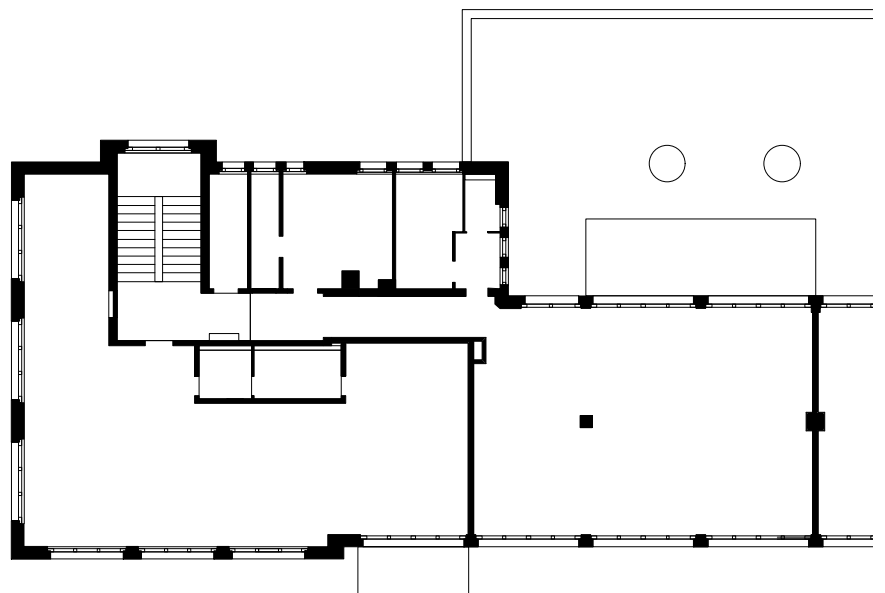
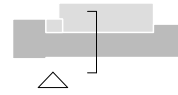
The building consists of two volumes, a west-facing head building and a long factory annex to the east. The factory is a representative example of Biels industrial and commercial buildings at the time, characterised by the typology of a transversely positioned reception and office wing in front of a long production building. (Kanton Bern, 2017a)

The office building disposes of a representative entrance portal in neoclassical style on the west facade. The limestone that was used and also appears on the corners of the building, creates a powerful impression. The volume is characterised by the pyramid hipped roof shape, with the clearly readable extension of the attic floor. The arrangement of the windows on the lower floors follows a simple regular grid while the windows on the upper floor are much smaller and equipped with shutters. The rooms are organised around the staircase and directly accessible from there.

The building has an overall length of 55.30 m, whereof the production annex measures 44 m. The volume of this eastern part is simple and the facade appears functional. The large windows are aligned on the regular structural grid. The hipped roof with low inclination seems discreet. The production rooms on the three floors are accessible through the office building or a second staircase in the north-eastern end of the building.

The distribution and room organisation have changed with the transformation of the program into a residential building. The office part including the main staircase now serves the western apartments. The other apartments are connected over the second staircase in the eastern building. Only the basement floor has a connecting corridor, the other floors are completely separated. To enable a certain living quality, balconies were installed to the southern and northern facade. These appear as simple boxes attached to the historical facade.

1:250 2m 3m 5m



The room being documented here is located on the second floor and accessible through the western staircase. The former production area was transformed into the living room of an apartment. Bedroom and bath are located in former storage rooms at the northern edge. The created space runs over the whole building width of around 8 m. The structural grid is also readable from the inside, pillars and beams are visible along the middle axis.

The generous room has large windows on both facades. Due to the low building width, the space is fully illuminated without any artificial light. The windows have the same dimension as the original ones, but the subdivision has changed. While the partition into three vertical casements remained, the bottom horizontal casement was removed out of practical reasons.

The historical subdivision allowed the watchmakers to work in front of the window, even when the upper casements were open. During sunny periods the room heats up quickly, thus requiring manual ventilation especially in summer.

Fig. 48 Graphic design studio in the annex construction on north side, view towards east



Fig. 49 Apartment on the third floor, view towards north



Fig. 50 Apartment on the third floor, view towards south





3.10. Schild

Mühlestrasse 12, Grenchen

Adolf Schild was the technical director of his brother's factory (Eterna) for 30 years. In 1896 he left the company to open his own studio with the support of his three sons. They started with 19 employees and solely focused on *ébauches* and movements. The company first specialised in small movements, then on wristwatches. Later they also produced alarm and car clocks. Schild produced many different movements and became one of the largest movement producers in Switzerland. After Adolf Schild's death in 1915, his sons took over the management of the company and converted it into a stock corporation. In 1919 the company constructed the fourth factory building, where the mechanical department was located. (Coulon, 1951; Watch-Wiki, 2016a)

In 1926 the holding Ebauches SA was founded, combining A. Schild SA and two other companies. In 1979 ASSA was acquired by the Fabrique d'ébauches ETA (former Eterna), and the site became Werk 2 of the company. Today the ETA SA Manufacture Horlogère Suisse has eleven production sites and about 8'000 employees. The company is owned by Swatch Group and functions as supplier to several watch brands. It produces components as well as complete watch movements.

The building complex of ETA Werk 2 is located in northern Grenchen and contains around 12 buildings which are dedicated to production and logistics. The building of the former A. Schild SA constructed in 1919 has been transformed into a vocational training school educating watchmakers from the whole Swatch Group.

Fig. 51 Facade of the factory building, view towards east

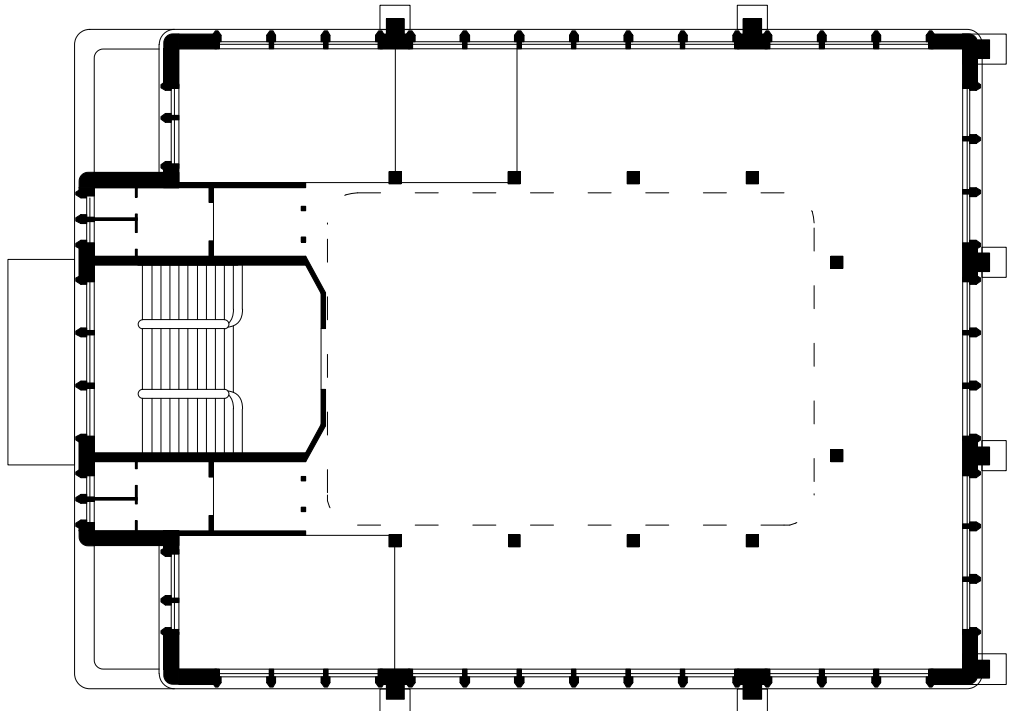
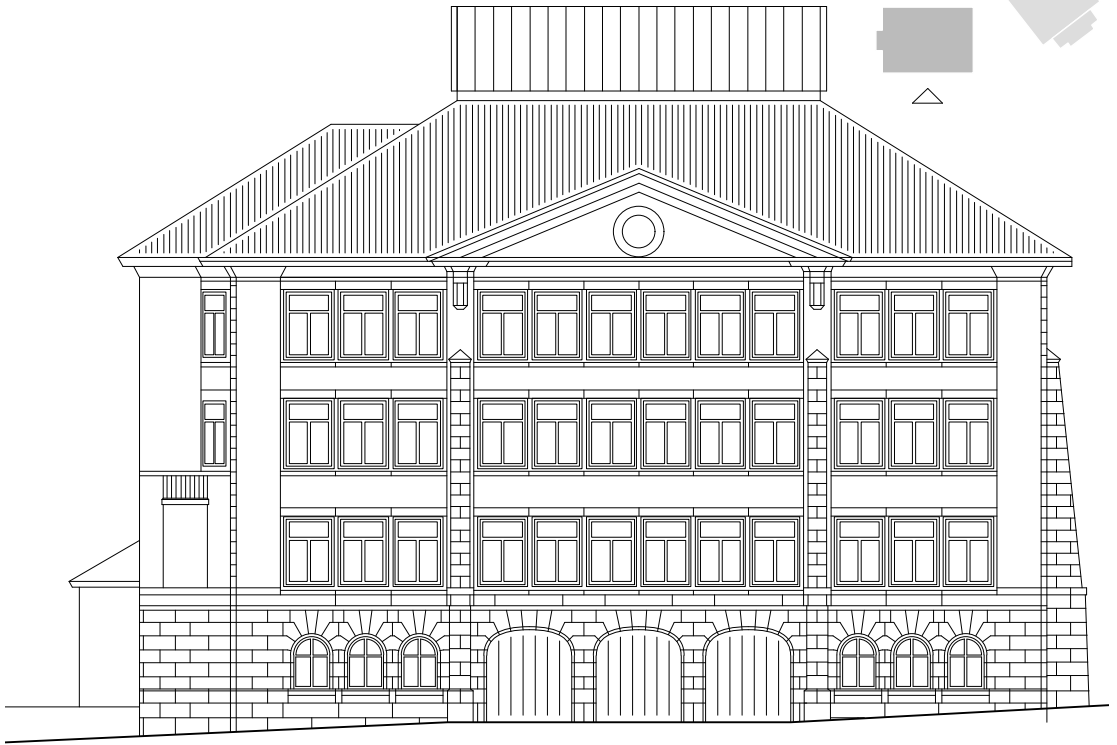
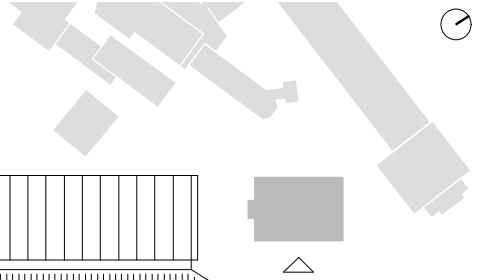
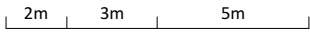
The main entrance of the building is located to the south-west. The representative entrance portal was made out of limestone. The door is framed by two columns, carrying a traversing arch. Above the entrance, there is a mighty building with huge windows. Behind it is the staircase. The central element is framed with terraces on both sides. These are accessible from the first floor.

The socle floor is completely constructed out of massive stone, created with much attention to detail. The three middle arches on the south-eastern facade were originally used as garage portals. All facades have a powerful expression. Several ornaments and decorations were installed. Consoles of limestone give the impression of supporting the roof. The cross-gabled roof is adorned with enormous roof glazing on the top. The windows on the southern and northern facade are arranged in a simple line one next the other.

The overall length of the building is 30 m, the width around 22 m. The floor plan is based on a regular grid and organised symmetrically. The generous staircase begins directly behind the entrance. Adjacent to this distribution area are sanitary rooms and a changing room. The remaining two thirds of the building are dedicated to production.

The historic building plans from 1919 also foresaw the possibility for a later expansion of the factory building. It was planned to attach another building on the northeast side.

1:250



The building has three production floors. While ground and first floor are occupying the whole surface, the second floor is a gallery, leaving free space in the middle. This creates a generous court which is extended under the roof. The top covering is constructed out of roof glazing. This allows light from above to reach even the first floor. Furthermore, it allowed the head of the company, who was located on the second floor to visually observe a large part of the production area.

Technical offices were located next to the entrance to the production area. An elevator is located in the middle of the production site. On the socle floor small vans could enter through the arched door and directly access the elevator. The building was planned with the production procedure already in mind.

The fact that the building served the mechanical department implies that the perfect lighting conditions were not as important as in other steps of the watch production. Nevertheless, the building is provided with background light through the court. And also the windows on the facade are quite big. But the buildings dimensions with a width of around 22 m, do not allow to illuminate every space perfectly.

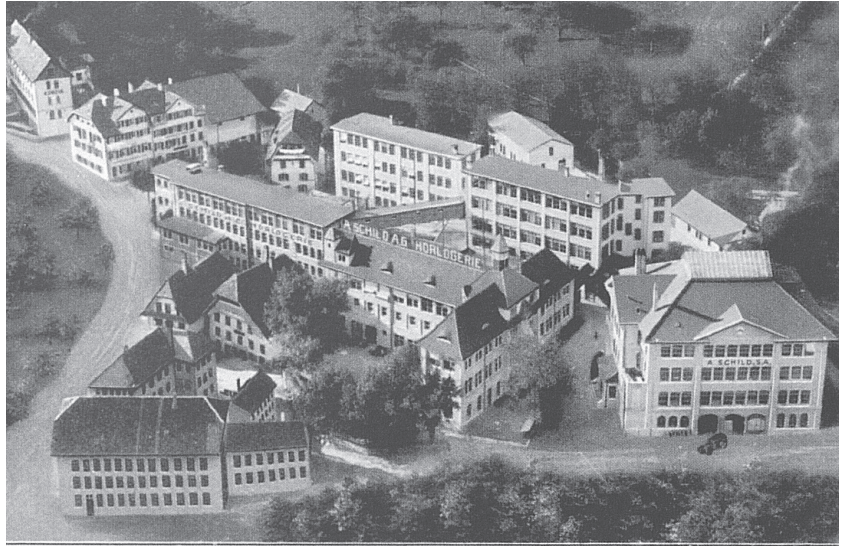


Fig. 52 Complex of A. Schild SA, Grenchen (La Classification Horlogère, 1936)



Fig. 53 Interior on the second floor, view towards east



Fig. 54 Interior on the first floor, view towards west



3.11. Peseux

Rue de Neuchâtel 34, Peseux

Charles Berner, who was previously the technical director of a movement factory in Fleurier, founded his own company in Peseux in 1923. The company had 20 employees and produced 6'240 pieces. Already in 1932 it was affiliated to the Ebauches SA and held the name "Fabrique d'ébauches de Peseux". (Coulon, 1951)

The company specialised in the production of ultra-flat watches in the 1950s. In 1970, the company employed 146 people and produced one million units. In 1979, the "Fabrique d'ébauches de Peseux" was legally dissolved. However, their activities were taken over by the "Fabrique d'Horlogerie de Fontainemelon", which was later taken over by ETA SA Manufacture Horlogère Suisse. The Peseux site was closed in 1982 during the clock crisis. (Coulon, 1951)

The building is located on the main road of Peseux, directly on the communal border to Neuchâtel. Today the first floor of the building is used by a textile store, the other floors and the office annex are empty.

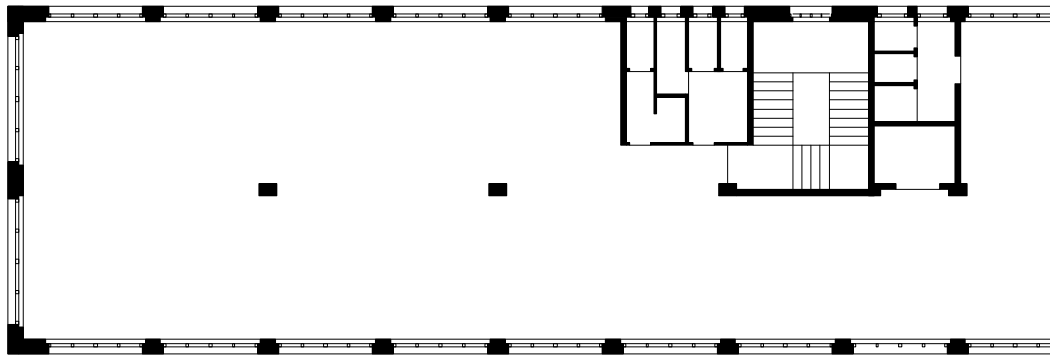
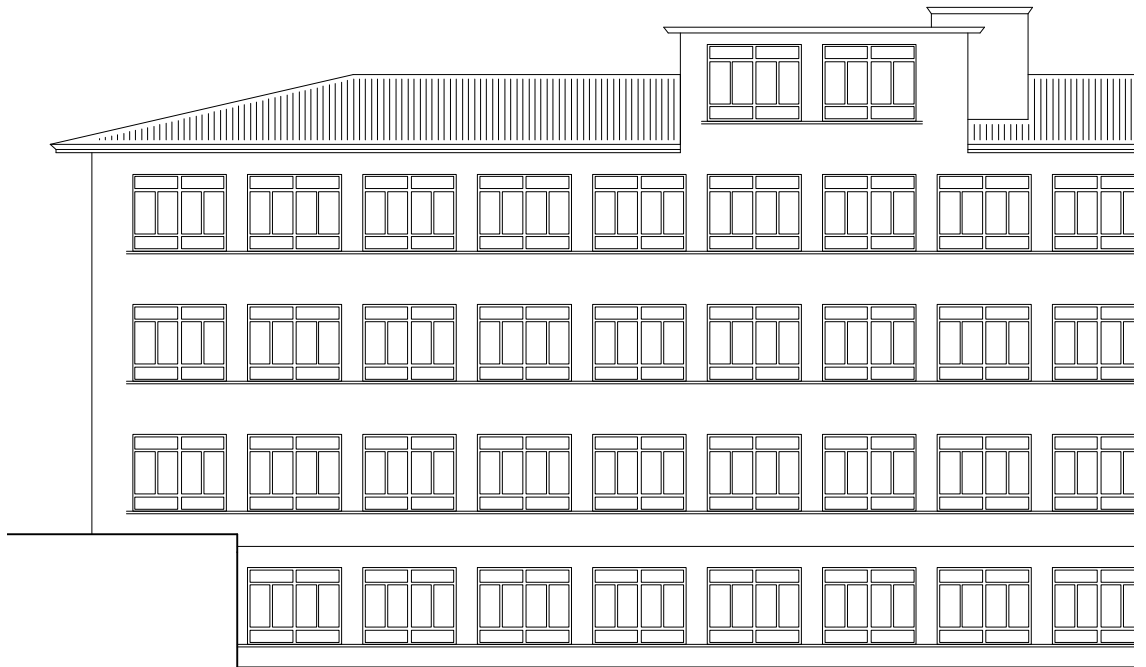
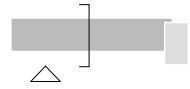
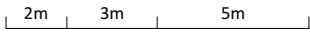
The first building was constructed in 1920 and later enlarged several times. While some constructions were added, some changes made it necessary to demolish the oldest parts. Due to the heavy modifications, the present construction does not explain the past. But with the support of old images the buildings history can be demonstrated.

Fig. 55 South facade of the former factory building

The original factory consisted of a long production tract, and a small annex building for office and counter. This separation of programs was clearly readable from outside. Firstly, the two volumes had different numbers of floors, and secondly also the shapes of the roofs and the arrangement of the facade were different. With the first extension additional production rooms were constructed next to the annex. Then a much wider enlargement took place in 1946. The building which was added to the west approximately doubled the dimension of the existing factory. The new construction contained production space, and another distribution area with staircase, elevator and sanitary rooms. During the last modifications in 1962 the initial factory building was destroyed and replaced by a building appearing similar to the previous extension. At this time, the middle and eastern tracts received flat roofs, instead of the originally pitched roofs.

Today the building consists of a 50 m long main tract with continuous production rooms, and a much smaller annex construction with offices and an apartment on the east side. The second volume is placed perpendicular to the factory. The main entrance is located at the east end of the main volume, and is oriented towards the main road passing on the northern side. The connected distribution zone with staircase and elevator creates a link between both building parts. The second staircase with another entrance is situated in the middle of the long factory part. The construction of the building is of the massive type. Skeleton and pillars are made out of reinforced concrete while the walls are made out of masonry. A passage in the building provides access to the backyard and the parking area.

1:250



The production area covers the whole length of the main volume and measures almost 50 m. Also, the structural system and the arrangement of the windows on the southern facade create a regular continuity over the whole distance. Because of the 10.50 m room width, additional structural support was needed. The row of concrete pillars is slightly displaced towards the south from the middle axis. On the northern side the generous space is interrupted by the distribution area with stairs and sanitary rooms. On the first floor the room was separated with lightweight walls into several ateliers for different production steps.

The large windows diffuse an optimal natural lighting for the whole room. They are subdivided into four lower vertical casements and two upper horizontal fields. Almost all windows on the first floor, where the textile store is located, are hidden behind moveable walls serving the presentation of merchandise. In contrast, the atmosphere on the empty second and third floor is impressive due to the natural light. As protection from direct sunlight horizontal plastic blinds were installed on the exterior.

The ceilings were covered with perforated panels. To heat the rooms, massive tubes were installed below the windows. The interior construction of the production space is functional and reduced to the minimum.



P E S E U X
(SUISSE)

Fig. 56 Illustration of the initial factory building (La Classification Horlogère, 1936)

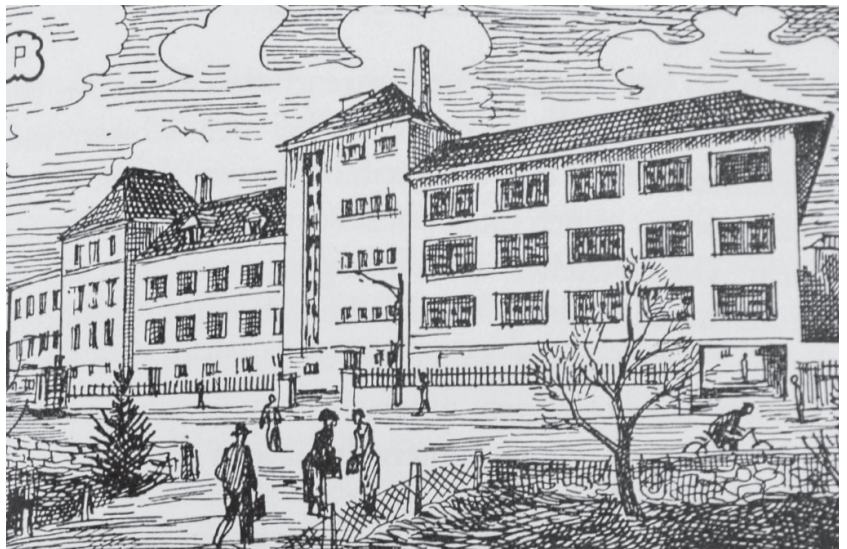


Fig. 57 Marcel North, Illustration of the building after the second extension (ETA, 1951)



Fig. 58 Empty interior on the second floor, view towards west



3.12. Longines

Rue des Noyettes 8, 2610 Saint-Imier

In 1833 Auguste Agassiz, Florian Morel and the watch dealer Henri Raiguel founded the company Raiguel Jeune & Co. In 1862 Ernest Francillon took over the manufacture from Agassiz and soon after, the company produced more than 20'000 watches annually. In order to convert the watchmaking process into serial production, the decision was made to build a new watch factory. Four years later Francillon acquired a piece of land outside the village of Saint-Imier in the meadows of Longines, where he built the first industrial production building. (Watch-Wiki, 2016b)

Already in 1879 the original factory was enlarged. (Watch-Wiki, 2016b) During the 20th century, several other buildings were added. Today the complex includes 14 buildings, with yet another one being under construction.

The company is part of Swatch Group, which consists of an extensive network of watchmaking factories. The Saint-Imier branch serves mainly the *assemblage* and logistics of Longines and Balmain watches. All watch components are produced in different locations. Some of the buildings on site were converted into offices and one hosts a museum.

The Longines branch is located in the south of Saint-Imier in the lowest area of the valley. The river passing through north of the complex, was originally running between the buildings and was used for the production of energy. The site lies outside the urban area and is surrounded by fields. All the buildings were constructed with their long facade facing south.

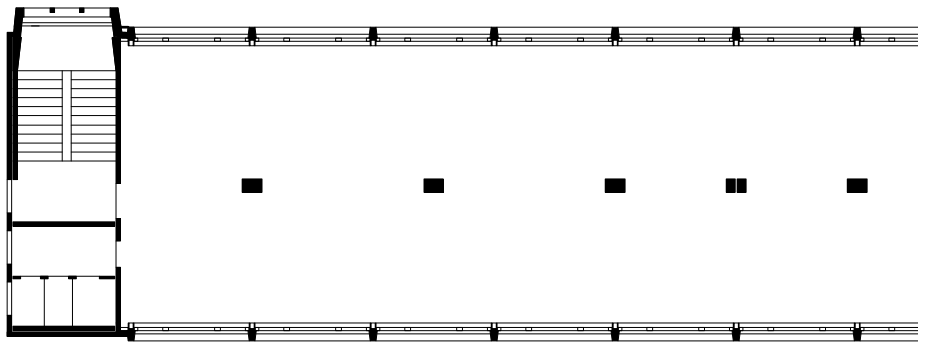
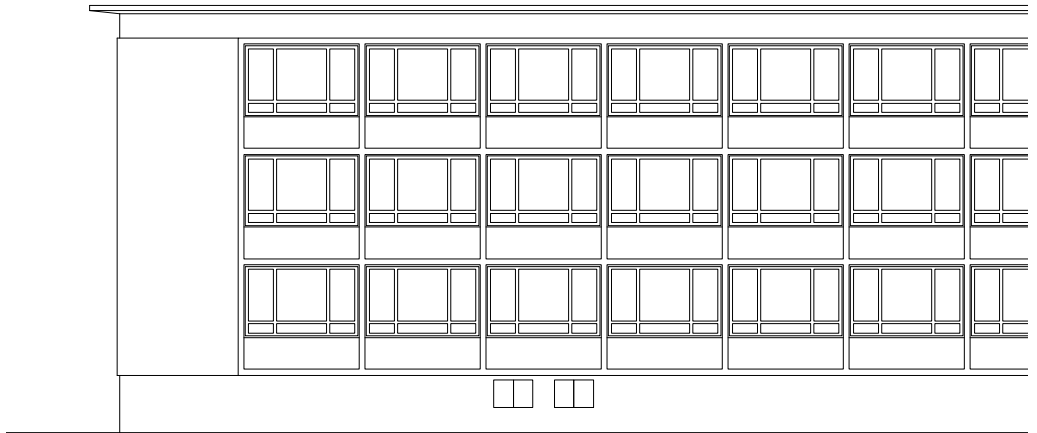
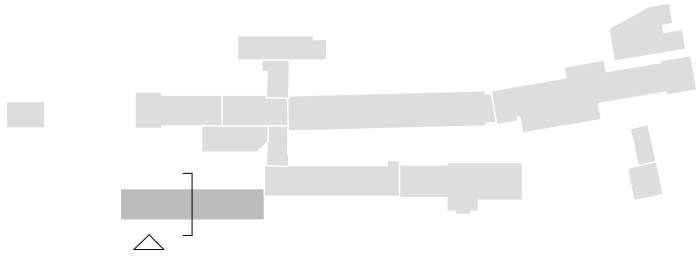
Fig. 59 Building complex of Longines on the valley bottom, view towards north

Building No. 13 was constructed in 1954. Located beside the river Suze and directly connected to the older buildings it creates the east end of the complex. Before extension in 1964 the building originally had only two upper floors. Today's dimensions are 47.70 m length, 10.40 m width and 14 m height, including the 3rd floor, which was added later.

The floor plan is based on a structural grid, consisting of 12 rows of 4.00 m distance. While the columns of the facade follow the system consequently, the middle row of pillars sometimes has exceptional distances of up to 6.00 m, creating an irregular pattern. Originally the production hall consisted of 10 rows of the grid, the two rows on both ends serving secondary uses, such as restrooms and a staircase on the east end. The actual room partitioning has only changed slightly since. To create additional rooms a couple of lightweight walls were installed. These rooms are used for changing, offices, a meeting room as well as a representation room for visitors.

The regular concrete structure of the building is clearly readable on the facade. The external appearance represents the internal organisation. Windows are located in the sector of the production rooms. The window zone is clearly framed and the arrangement follows the structural grid. Besides the windows the facade consists of a plain concrete wall. The simple flat roof goes beyond the facade line. The timeless simplicity of the building is impressive.

1:250 2m 3m 5m



The here presented production room stretches over seven rows of the structural grid and has a total length of 28 m. The area provides around 32 work places which are orientated in a right angle to the main facade. The watchmakers are no longer sitting directly in front of the windows, due to the harm direct sunlight can cause to the human eye. The tables are all constructed to serve the needs of watchmakers. They are higher than regular tables and equipped armrests, which are fixed on the table to guarantee a steady hand.

Each window is divided by a horizontal and two vertical bars. The natural light functions as a background lighting of the space. As soon as the sunlight reaches the interior the installed slat blinds close automatically. Lamps hanging from the ceiling ensure a constant basic lighting over the whole depth of the building. The work places are equipped with additional lamps to support the precise working processes. All artificial lights provide a natural light temperature.

Due to the fact that Longines no longer produces components in house, the rooms are not used for rough crafts anymore. The *assemblage* which is completed in this building nowadays requires a proper work environment. The building can only be entered through a changing room with an adhesive floor. Each work space is equipped with compressed air and vacuum cleaners, which are connected to the building installations. The air-conditioning is automatic, but does not have enough power to cool down the room during summer. Due to the limited diameter of piles, the wind flow would be too strong. So, an additional cooling systems with freezer panels had to be installed.

For an ideal acoustic environment, panels were attached to the ceilings. Because of the ongoing construction on a nearby building vibrations became a problem for the workers.



Fig. 60 Historic Longines complex, view towards north, photo undated (Memoire d'ici, 2017)

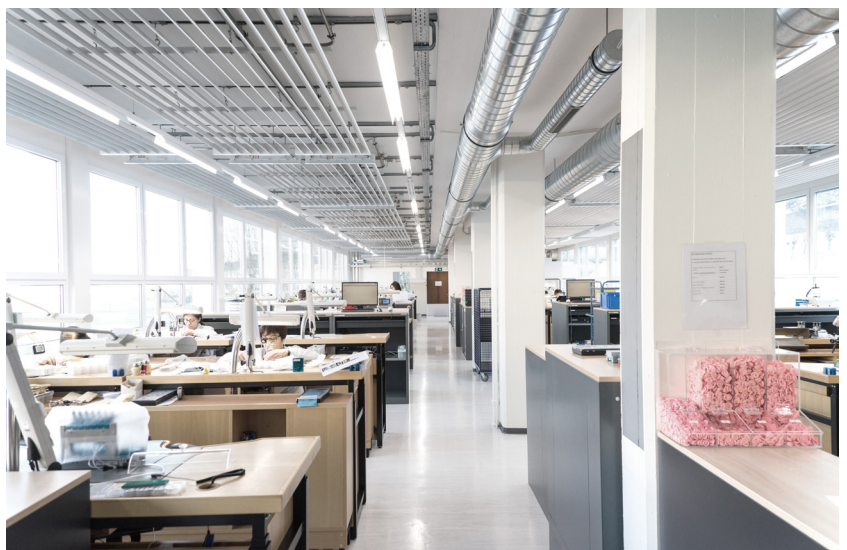


Fig. 61 Atelier on the second floor, view towards east

4. Conclusion

4.1. Architectural Characteristics

The previous documentation contains watch factories of various types. The buildings are different in shape and size, but also in organisation and appearance. Each of the documented factory buildings was constructed in a different location and for a different company. Due to the various requirements of the companies, a large number of solutions emerged. Each architect answered the needs with another design. Although there are various differences, some general architectural characteristics can be determined. The profound analysis of the buildings reveals five essential similarities. This present section demonstrates these qualities, explains their importance and qualifies them as architectural characteristics of watchmaking factories.

Orientation and Location of Buildings

Many of the documented buildings are located on a northern slope. Even during winter months these sites benefit from direct sunlight. However, there are several exceptions, mostly with buildings that are not in the mountains. Other exceptions are the factory of Tissot, which is located on the southern slope of Le Locle, and the Longines factory built on the bottom of the valley. In the latter case the passing river proved more important than direct sunlight, as it was used for the production of electricity. For the choice of location, it also was important that sufficient labour force was available in close proximity to the site.

A clear and often appearing architectural characteristic is the orientation of the longitudinal facade towards the south. This results in a good illumination of the production spaces. In addition, the construction volumes of many factories are also aligned with the urban road network.

It can therefore be stated that watch factories are not always located on a northern slope and the choice of location may well have other important reasons than optimal light conditions. However, the orientation of the longitudinal facade to the south must definitely be considered as an architectural characteristic, as this specific quality can be recognised without exception in all documented buildings.

Modularity of Building Volumes

All documented constructions are either extensions of pre-existing factory buildings, or they are initial factory buildings which later were enlarged by another extension. The rapid development and transformations of the industry required buildings with the strong ability of adaption. Often, extension possibilities were already explored before the construction of an initial building and therefore included in the planning process. For example, the design for the Alpina factory contained an asymmetric placement of volumes to provide the possibility for a later extension. Several other construction plans, which were considered during this research, contained also propositions for the future development of a site. However, another reason for this could be, that architects wanted to acquire new orders in the future.

In summary, the documented buildings do certainly not demonstrate modularity in the contemporary sense. The intention of the architect and the company during the initial construction phase does also stay uncertain. But the consideration of the historical development allows to consider modularity as specific architectural characteristic of these buildings.

Room Organisation in Relation to the Program

In addition to the production room, almost all of the documented buildings also have office spaces, a distribution zone with a staircase and several secondary rooms. Often the staircase, together with sanitary and changing rooms, is located on the northern side. Offices are either arranged separately on the ground floor, or spread over several floors and directly connected to the distribution zone. Only very few of the buildings have a separate supplier entrance. Most of the original buildings also had no elevators, although some of them installed them later. The products of the watch industry are small, which makes large logistic spaces unnecessary. The room organisation of the buildings is simple and hierarchical, this serves an optimised production process. The clear connection between program and spatial organisation is an obvious architectural characteristic of these buildings.

Structural System with Regular Aligned Grid

Most of the analysed buildings are separated into a production part and an office area. The presently discussed attribute primarily relates to the production spaces. The constructions were built mainly out of reinforced concrete slabs and columns. However, additional cast iron columns were placed in some of the buildings. Windows or masonry walls were installed between the columns. The simple structural grid supported the important illumination of rooms from two facades and allowed the internal organisation to be highly flexible. The room height was generous, which supported the distribution of natural light and also allowed the installation of equipment on the ceilings. The regular structural grid, together with the low building depth are architectural qualities that are specific for production rooms in the watchmaking industry.

Regular Facade with Large Windows

All buildings have facades that follow the alignment of the structural grid. The facades appear simple and clearly organised. The large windows contribute significantly to this appearance. Furthermore, the facades reflect the use of the interior. Through the size of the windows it becomes directly visible which parts of the building were built as production rooms. When comparing the facades of buildings with different years of construction, a clear development is visible. The later a building was built, the simpler and more reduced the facade was designed. At the beginning of the 20th century, many ornaments were still in use, but by 1920 they became increasingly rare. Also, the use of natural stone was still common at the beginning and then decreased quickly. The application of ornaments and the use of materials are very different in the analysed buildings and therefore not specific for watch factories. However, the simple and regular facades containing large windows are an architectural characteristic that undoubtedly belongs to these buildings.

4.2. Renovations and Modifications

Many of the documented buildings were abandoned by the watchmaking industry. The history demonstrates how the watchmaking sector went through several difficult phases, which provoked changes not only for certain participants, but often for the whole region. Obviously also the built structure, containing an enormous amount of factory buildings, was not spared from these changes. Companies moved out of their original factories because of economic reasons or strategic decisions, such as relocation or the merger with other factories. There are many reasons for a company to leave a certain building, but all of them name in common, that the built structure did not meet the transformed requirements anymore.

Adapt the Building to Serve New Requirements

The qualities discovered in the previous chapter helped the watch companies to improve their production process of watches during the phase of mechanisation. The analysed buildings offer a highly particular view on the architectural heritage of the industry. The described characteristics emerged during the interesting period, where the human work force received support by machines. Today machines support several individual operations of watchmakers. For some production stages, human labour forces were even completely replaced by machines. Consequently, these transformations demanded new requirements of the factory buildings. Although the production changed greatly, the craft of watchmakers still exists and with it of course their workplace.

Some of the analysed buildings demonstrate how the workplaces of watchmakers are equipped today. The natural light became much less important than it once was. On the contrary, direct sunlight can even be harmful to the watchmakers' eyes. Therefore, work tables are no longer located along the windows, but perpendicular to the facade or in the centre of the room. The production room has become a highly automatised area. Features such as flexible lighting, air conditioning, compressed air for each workplace, automatic sun protection and the equipment of entrances with special dirt-trapping flooring nowadays belong to the standards of established enterprises.

In some of the here presented buildings, the companies achieved to install such highly equipped rooms in older already existing buildings. But many of the large companies constructed contemporary factory buildings. The research showed, that these factories are highly secured and not accessible to visitors, making a detailed comparison impossible.

Changing the Program

For the reasons explained in the previous paragraph, many of the documented buildings are no longer used by a watch company. Although these former factory buildings do no longer serve as production areas, the previously demonstrated characteristics of the architecture are still present and visible. Moreover, the several qualities which were designed for a specific program, certainly still affect the present use.

Today, several of the transformed buildings are used for commercial purposes. The examples are miscellaneous and reach from simple office rooms, to a textile store, or rooms for physiotherapy and even a culture centre. With some exceptions, the actual programs benefit from the architectural characteristics such as the good lighting.

The two examples which were transformed into residential buildings, implemented contradictory solutions. While the apartments in the former Bulova factory are preserving the generous quality of space, the transformed Tavannes building contains small dwellings.

4.3. Learning from the Watchmaking Factory

The five developed characteristics are very specific to the construction of watchmaking factories. The question arises why all these buildings have the same architectural qualities. Of course, the general progress in the architectural world during this time brought new concepts, and also the improvements in construction technology opened other possibilities. It is obvious that these factors contributed to the architecture of the watchmaking industry. These conditions may influence the architectural expression and the used technologies. But they do not explain the

existence of common characteristics. The detected characteristics are the direct consequence of the buildings purpose. In conclusion, the architects design was influenced by the specific requirements of the companies. The watch companies must have seen architecture as a chance to improve the production process. And the architect then developed the building, always regarding the exact program and processes. Only this argumentation answers why all these building have similar characteristics.

Validation of the Thesis

The initial objective was to demonstrate that architects could learn from the specific qualities appearing in the watchmaking industry. As mentioned before the architects which were in charge of planning a watch factory, had to understand how these buildings should work and would be used. The knowledge of the industry was as important as the knowledge of architecture and construction issues. So, the first lesson that architects can learn from these buildings is that architecture often has to be viewed in connection with another special field. And it is obvious that the architect can only produce an environmentally good design by understanding the other sector and its processes.

The second lesson that architects can learn from the buildings of the watchmaking industry, is directly linked to the above presented characteristics of the documented buildings. The fact that these former factories survived many years is proof that the demonstrated characteristics were not only useful for the industry, but also for other purposes. The large windows for example create a unique quality, but also the discovered modularity of these buildings was important for their survival.

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Mapping

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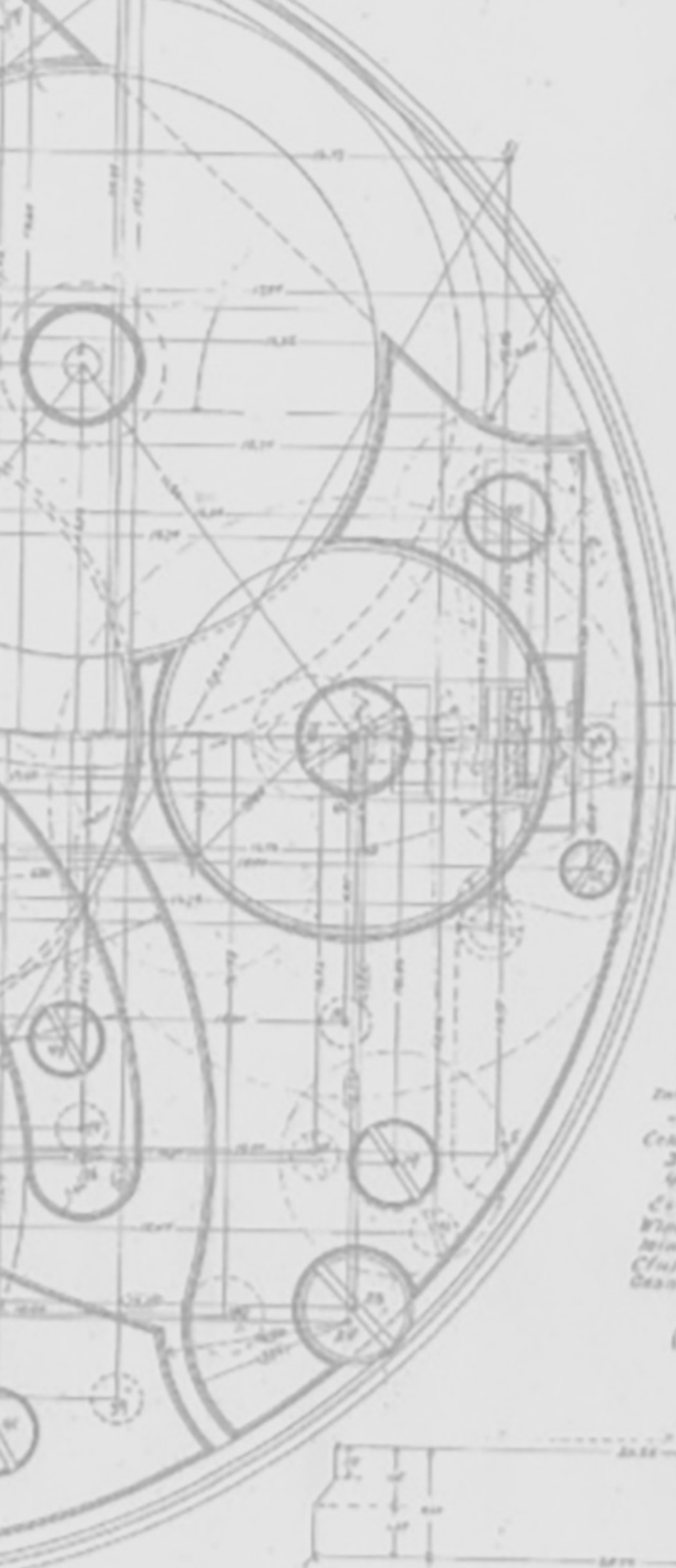
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	Tooth	mm
Balance Wheel	20	15.00
Barrel	20	15.50
Center Wheel	80	12.00
3rd	10	11.00
4th	80	10.00
Escape	15	7.00
Halfset	63	18.00
Crown	60	8.00
Hour	60	2.70
Minute	40	2.20
Enter set wheel	20	5.75
" - - (small)	16	2.65
Center Pinion	14	3.50
3rd	12	2.25
4th	10	1.50
Escape	8	1.15
Winding	16	8.00
Minute	10	2.00
Clutch (both ends)	13	2.50
Center Pinion	14	3.50

(G. E. DeLong)



