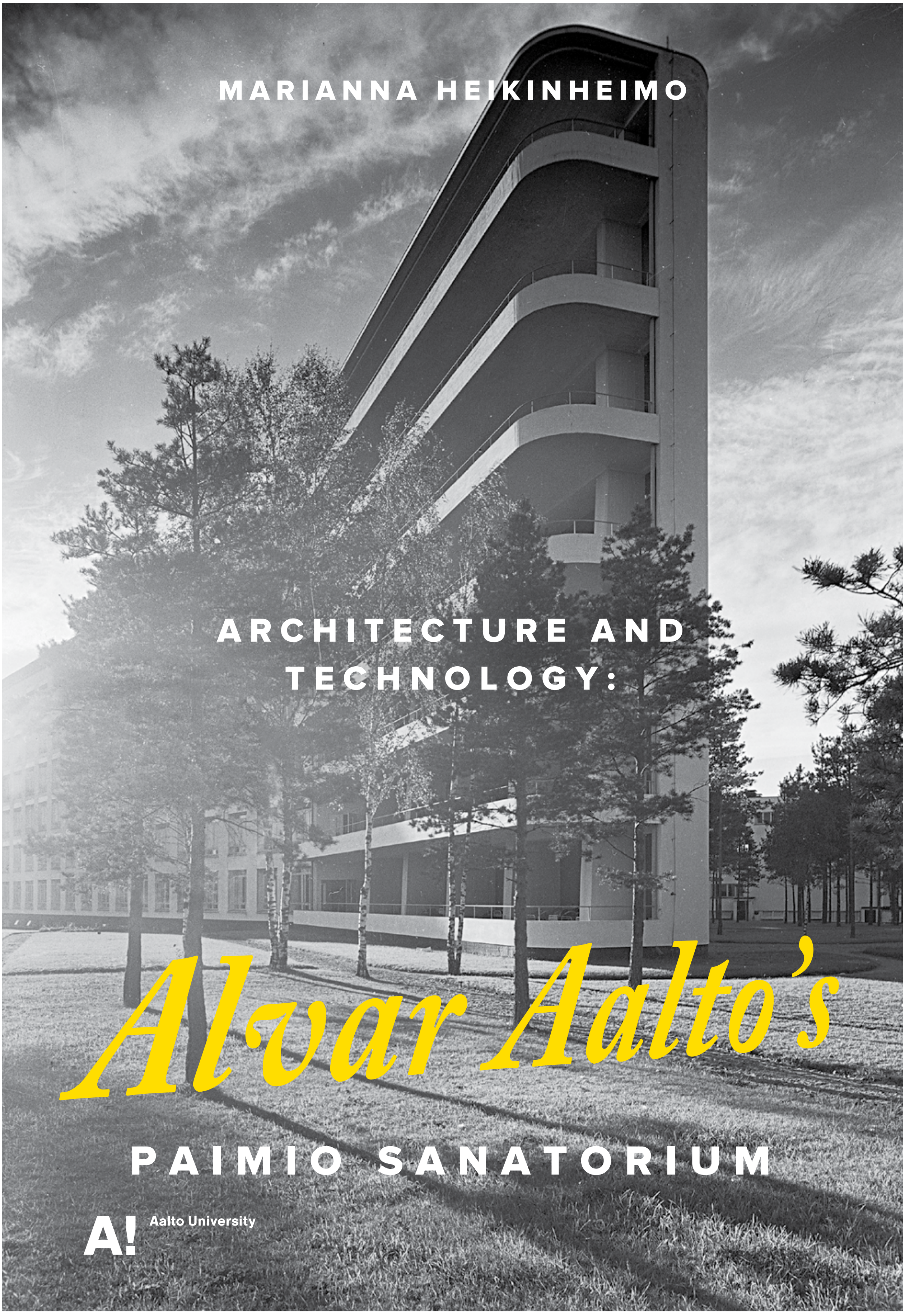

MARIANNA HEIKINHEIMO

ARCHITECTURE AND TECHNOLOGY: *Alvar Aalto's* PAIMIO SANATORIUM

Aalto University

ARCHITECTURE AND TECHNOLOGY:

Alvar Aalto's Paimio Sanatorium

TIIVISTELMÄ

Arkkitehti, kuvataiteen maisteri Marianna Heikinheimon arkkitehtuurin historian alaan kuuluva väitöskirja *Architecture and Technology: Alvar Aalto's Paimio Sanatorium* tarkastelee arkkitehtuurin ja teknologian suhdetta suomalaisen mestariarkkitehdin Alvar Aallon suunnittelemassa Paimion parantolassa (1928–1933). Teosta pidetään Aallon uran käännekohtana ja yhtenä maailmansotien välisen modernismin kansainvälisesti keskeisimpänä teoksena. Eurooppalainen arkkitehtuuri koki tuolloin valtavan ideologisen muutoksen pyrkiessään vastaamaan yhä nopeammin teollistuvan ja kaupungistuvan yhteiskunnan haasteisiin. Aalto tuli kosketuksiin avantgardistiarkkitehtien kanssa Congrès internationaux d'architecture moderne -järjestön piirissä vuodesta 1929 alkaen. Hän pyrki Paimion parantolassa, siihenastisen uransa haastavimmassa työssä, soveltamaan uutta näkemystään arkkitehtuurista.

Työn teoreettisena näkökulmana on ranskalaisen sosiologin Bruno Latourin (1947–) aktiivisesti kehittämä toimijaverkkoteoria, joka korostaa paitsi sosiaalisten, myös materiaalisten tekijöiden osuutta teknologisten järjestelmien muotoutumisessa. Teorian mukaan sosiaalisten ja materiaalisten toimijoiden välinen suhde ei ole yksisuuntainen, mikä huomio avaa kiinnostavia näkökulmia arkkitehtuuritutkimuksen kannalta. Olen ymmärtänyt arkkitehtuurin symbolisen ilmaisun järjestelmäksi, jolla on oma logiikkansa ja toisaalta rakentamisen teknologiseksi järjestelmäksi, jonka puitteissa rakentamisen käytännön ongelmat ratkaistaan. Brittiläisen arkkitehtuuriteoreetikon Alan Colquhounin mukaan symbolinen esittäminen ja empiirinen rakentaminen ovat samanaikaisia järjestelmiä. Symbolinen esittäminen perustuu tosiasioihin ja arkkitehtuuri on aina sidottu tiettyyn sosiaaliseen, teknologiseen ja taloudelliseen tilanteeseen.[1] Olen käsittänyt rakennuksen luonteeltaan monimuotoiseksi ihmisten, organisaatioiden ja materiaalisten toimijoiden yhdessä muodostamaksi teknologiseksi järjestelmäksi. Tapaustutkimus käsittelee arkkitehdin ja muiden osapuolten välistä vuorovaikutusta yhden rakennushankkeen mittakaavassa. Aalto voitti avoimen arkkitehtuurikilpailun 1929 ja pääsi vaikuttamaan rakennuksen suunnitteluratkaisuihin kokonaisvaltaisella tavalla jo hankkeen alusta alkaen.

Tutkimuskysymykseksi muodostui, miten Aalto onnistui sovittamaan yhteen kansainvälisen ideologian ja paikallisen rakentamisen kulttuurin suuresta lamasta kärsivässä maassa, jonka rakennusteollisuuden teollistumisen aste oli verrattain vähäinen. Erityisen huomion kohteena olivat ajankohdan uudet ratkaisut, kuten lämmitys-, ilmanvaihto-, viemäröinti- ja sähköjärjestelmät: ketkä osasivat soveltaa niitä ja mitkä olivat kriittisiä kysymyksiä niihin liittyvien ratkaisujen muotoutumisessa; olivatko järjestelmät niin valmiita, että niitä oli mahdollista soveltaa sellaisenaan vai osallistuivatko hankkeen arkkitehti tai muut toimijat niiden kehittämiseen; onko taloteknilliset järjestelmät luontevaa ymmärtää osaksi Aallon arkkitehtuurin tektonista ratkaisua vastaavalla tavalla kuin parantolan tunnettu betonirunko?

1 Colquhoun 1962, s. 508.

Avainsanat: Alvar Aalto, modernismi, Paimion parantola, Suomi, CIAM, hygienia, rationalismi, rationalisointi, standardit, teknologia, Bruno Latour, toimijaverkkoteoria, rakentamisen historia, sairaala, parantola

ABSTRACT

The doctoral dissertation of Marianna Heikinheimo, Master of Science in Architecture, Master of Fine Arts, in the field of architectural history *Architecture and Technology: Alvar Aalto's Paimio Sanatorium* discusses the relationship between architecture and technology in Paimio Sanatorium (1928–1933), designed by the renowned Finnish master architect, Alvar Aalto. The building is considered the turning point in Aalto's career and one of the most significant works of international Modernism in the inter-war period. In the face of increasingly rapid industrialisation and urbanisation, European architecture was at the time undergoing a dramatic ideological shift. Aalto came into contact with avant-garde architects through the organisation Congrès Internationaux d'Architecture Moderne (CIAM) from 1929 onwards. Aalto's aim with the design for Paimio Sanatorium, the most challenging assignment of his career so far, was to apply the new approach to architecture.

The theoretical underpinning for the study is the actor-network theory developed by the French sociologist Bruno Latour (1947). Besides the social theory, it also assigns a role for material factors in the evolution of technological systems. In this theory, the relationship between social and material actants is reciprocal, an observation which opens up interesting angles into architectural research. For the purpose of this dissertation, I understand symbolic expression in architecture as a system with its own logic and, in contrast, construction as a technological system forming the framework within which the practical problems of building are resolved. According to the British architect and scholar Alan Colquhoun, symbolic representation and empirical building are parallel systems. Symbolic representation is based on facts while architecture is bound to a given social, technological or economic situation in time.[2] A building with all its qualities and features has, in the present study, been understood as a technological system formed by people, organisations and material actors. The case study deals with the interaction between the architect and the other stakeholders within the scope of one building project. Aalto won the open architectural competition in 1929 and was able to influence the overall design solutions of the building from the very beginning of the project.

This study investigates how Aalto managed to reconcile international ideology and local building culture in a country where the degree of industrialisation in the building sector was relatively low. Specific attention has been given to the solutions that were new at the time, such as the heating, ventilation, sewage and electrical systems: who knew how to implement them and what were the critical points to consider in developing the solutions; were the systems sufficiently ready to be used as such, or did the architect or other project stakeholders contribute to their development; is it plausible to understand them as being part of Aalto's tectonic approach in a way similar to the well-known concrete frame of the sanatorium?

2 Colquhoun 1962, p. 508.

Key words: Alvar Aalto, Modernism, Paimio Sanatorium, Finland, CIAM, hygiene, rationalism, rationalisation, standards, technology, Bruno Latour, actor-network theory, construction history, hospitals, TB sanatorium

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FOREWORD

Paimio Sanatorium (1928–1933) is considered a key work by Alvar Aalto (1898–1976), who enjoys the unmitigated status of a national hero in Finland. The inter-war period, and particularly this building has been widely discussed within architectural research in Finland. Why, then, is it necessary to devote any further scientific attention to a building about which we already know so much?

Conducting research into a central work by a legendary architect is inevitably challenging because it is difficult to question the premise of such a work. Alvar Aalto is regarded as a doyen of form-giving and a master of different scales. Even my *alma mater* carries the name of Aalto. While we are well aware of and familiar with the buildings, chairs and vases he designed, we are far less knowledgeable about his partner networks, motives, doubts or the crossroads at which he found himself, when there was no obvious solution for bringing the idea to its realisation. I was particularly interested in the situations, in which he had to use his persuasive skills to convince other stakeholders involved in the project of the superiority of his solutions. I was keen to learn, how he operated and what his objectives were. Although there is a wealth of literature available on Aalto's oeuvre, so far only one other doctoral thesis has been completed in Finland on his architecture: Markku Norvasuo's dissertation *Taivaskattoinen huone* (A Room with a Sky Ceiling). During the early stages of writing the present dissertation, I received valuable encouragement from my then supervisor, Professor Vilhem Helander, who assured me that even the smallest addition of new knowledge on and insight into Paimio Sanatorium would be a valuable outcome. I have naturally availed myself of earlier key research in order to understand how the building has so far been discussed and what we know of Aalto's architecture. I find that Aalto as the mythical hero of Finnish architecture merits critical research based on primary sources.

I decided to focus on Paimio Sanatorium and so my work gradually evolved into the present case study. I gained first-hand experience of Aalto's architecture in my capacity as the project architect for the restoration of Vyborg City Library in 1997 and 1998, part of the centenary of Aalto's birth, with funding from the Ministry of Education and Culture. I had also trained as an architect and worked in buildings designed by Aalto. When designing the restoration work on the flat roof of the Vyborg City Library lecture hall wing, I studied Aalto's eaves structure detailing and came to understand on a very practical level, how he resolved the application of a new structure in our specific climate and found an architectural expression for it. Initially, I set out to compare the technical systems of the Vyborg City Library and Paimio Sanatorium. I abandoned the comparative element, with the Vyborg City Library and any other of Aalto's designs, in the course of my work as my understanding of the nature of technical systems deepened and my theoretical perspective sharpened: the study of technical systems matured into the study of technological systems. For the purposes of the present dissertation, I have approached technological systems as heterogeneous entities shaped by human, organisational and material factors.[3] With technical systems, I have referred to the mechanical or material dimension of technological systems. Comparing Paimio Sanatorium with another building had become redundant for my chosen theoretical perspective, which directed me towards an anthropological approach and guided me to concentrate on a single project. After launching my study on Paimio Sanatorium, in 2000, the National Board on Antiquities commissioned a historical building survey on Paimio Sanatorium from me and my team working on a consultancy basis.[4] This gave me the opportunity to study the building at close range on site and to form an informed opinion.[5] Furthermore, there are large amounts of source material on this architecturally ambitious, major institution and its construction and the architect himself was a prolific writer – all of which allowed me to pursue my elected approach to Paimio Sanatorium.

I launched into my dissertation research in 1999 at the national graduate school, in architecture. The first version of my dissertation, which I completed towards the end of graduate school was unsatisfactory in my own opinion. I had digressed into studying Aalto's patents and Finnish steel windows of the 1930s.[6] I put active research work on hold to pursue my other professional interests, until 2010, when I revived my research project. My topic remained the same, only now my focus had shifted more significantly towards discussing Aalto's architectural theories, and I chose Bruno Latour's actor-network theory as the major theoretical framework for my study and a tool for analysing the evolution of the technological solutions adopted at Paimio Sanatorium. A well-known subject matter demands a fresh angle for the study to be of any interest, and immersing oneself into the subject matter and interpreting the findings requires a great deal of work.

My dissertation studies were supervised by Professor Kimmo Lapintie, PhD, Aalto University, and instructed by Renja Suominen-Kokkonen, PhD, adjunct professor, Department of Philosophy, History, Culture and Art Studies, University of Helsinki. In the early stages of the work, my instructor was Professor Vilhelm Helander, followed for a short period by Professor Aino Niskanen, PhD. I would like to thank all my instructors, and especially Renja Suominen-Kokkonen, for their encouraging and challenging comments and persistent pedagogical work. The preliminary examiners of my work, Professor Emeritus Claes Caldenby, PhD, from Chalmers University of Technology,

3 See e.g. Hughes 1989, pp. 184–185.

4 The author's team compiled a report on Paimio Sanatorium commissioned by the National Board of Antiquities, the City of Paimio and Turku University Central Hospital. The report was completed in 2000 and formed the basis for the Ministry of Education and Culture's submission to the UNESCO World Heritage Sites. Heikinheimo et al., Ark-byroo architects 2000.

5 Wang 2002, p. 161.

6 My study on Aalto's patents was published in a brief article in *Ptah magazine* in 2004 and a separate study on steel windows in the Helsinki University of Technology publication series in 2002. See Heikinheimo 2004 and Heikinheimo 2002.

Gothenburg, and Professor Annemarie Adams, PhD, from McGill University, Montreal, provided invaluable comments and suggestions, for which I am grateful.

A decisive factor for me being able to carry out research was being selected as a research student to the national graduate school in architecture between 1999 and 2002 at Helsinki University of Technology. I was also able to attend the research seminar in art history for a year at the University of Helsinki, thanks to the kind permission of Professor Emerita Riitta Nikula, PhD, as well as the study circles on the history of technology run by Karl-Eric Michelsen, PhD, and Ilkka Herlin, PhD. My work was also funded at its initial stage by the Finnish Cultural Foundation with a one-year grant and the Wihuri Foundation with a grant that allowed me to participate on a course on the conservation of modern architecture.[7] Thanks to the travel grant awarded by HUT, I was able to visit and study Zonnestraal Sanatorium in Hilversum, the Netherlands, and to attend the docomomo seminar on colour in architecture held in Belgium. Since 2010, I have funded my research work myself. I have received support for the translation and publication of my dissertation from Aalto University School of Arts, Design and Architecture. Without the encouraging support of external funding, carrying out this work would have been immeasurably more difficult.

I would like to express my sincere thanks to all those who have provided valuable commentary on my work at the numerous seminars at the Department of Architecture of the Aalto University, the Department of Architecture of the Oulu University of Technology, Department of Architecture of the Tampere University of Technology, the Nordic architectural researcher seminar in Oslo, Department of Philosophy of the University of Gothenburg, Department of Art History of the University of Jyväskylä, Department of Art History of the University of Helsinki, and the seminars of the Aalto researcher network in 2011 and 2012.[8] Translator Tytti Laine has translated a major part of the Finnish-language manuscript into English, and the English language revision was conducted by Keith Baddeley. Architect Franz Betcke and translator Rosemary McKenzie have also translated parts of my work over the years. Editor Sanna Tyyri-Pohjonen has managed my publication at Aalto ARTS Books publishers, and graphic artist Annina Kivikari has created the visual design for my work. I would like to thank my language professionals, editor and graphic artist for their valuable contribution to the completion of my work. Any inaccuracies or errors are my own.

The encouragement from my close friends has helped me keep the research project alive alongside my other duties. I would like to express my special gratitude to my mother Maija-Liisa Leppänen and my husband Sami Heikinheimo as well as my whole family for all their material and mental support and their help in daily life. I dedicate my dissertation to my children Juuso and Jenny.

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7 Conservation of Modern Architecture MARC 99, organised in Helsinki in 1999 by ICCROM, docomomo and HUT.

8 The first seminar, held in Helsinki in 2011, was attended by Finnish Aalto scholars, while the second seminar, which took place in Seinäjoki in 2012, was international. The seminars were organised on the initiative of Susanna Pettersson, PhD, art historian and then Director of the Aalto Foundation.

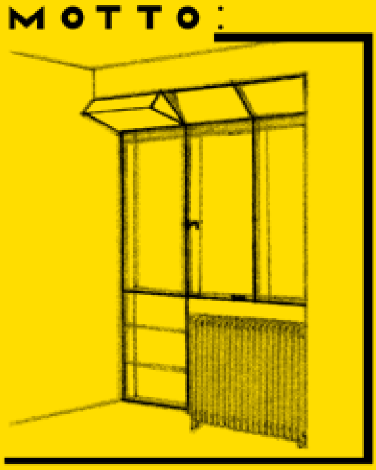

Fig. 1a. The vignette image for the competition-stage design depicts the patient room window. Detail of drawing No. 50-655, the drawing has been edited. AAM.

1 2 3 4

Introduction

In the face of increasingly rapid industrialisation and urbanisation, European architecture underwent a dramatic ideological shift in the inter-war period. The question was not only about the synthesis of rational technological applications and construction methods but also about the creation of a great narrative.[9] According to the British Professor John Gold, the first-generation historians did not see their own contribution to the evolution of the architectural theory of the time in anyway problematic, although it was simultaneously the object of their research.[10] He maintains that these historians paid attention to rationalist phenomena while emphasising the idea of *Zeitgeist* (Spirit of the Age) developed by romantic philosophers, and pushed other, concurrent phenomena to the side. One representative of this generation was the Swiss art historian Sigfried Giedion (1888–1968), who was also a friend of Alvar Aalto. The two men first met while Giedion was serving as CIAM's[11] secretary general, and they became family friends and eventually business partners[12]. The next-generation informants have since studied a host of other factors that united the movement and opened up a new perspective into the history of the Modernist movement.[13] The main work by Reyner Banham (1922–1988), who represented the younger generation of researchers, from 1960, entitled *Theory and Design in the First Machine Age*, is widely known among the architectural profession and has also been used in the training of architects at Finnish universities. Both theoreticians are considered central to the investigation into Modernism in the inter-war period and, in particular, to the relationship between architecture and technology.

Sigfried Giedion was invited to Harvard in 1938 and published a book in 1941 entitled *Space, Time and Architecture* based on his lectures given in the United States in the late 1930s and early 1940s. In this work, he discussed the idea of modern architecture as a kind of fusion of time and space. According to Sokratis Georgiadis, who has studied the life and career of Giedion, Giedion approached modern architecture as an image of reality in which intellect and emotional sensitivity converged. The concept of space was central to Giedion's thinking and he saw architecture as providing a solution to the problem of space. Giedion's views on architecture were also influenced by the intellectual climate of the time as well as the changing social conditions and the available construction techniques, which were particularly evident in the concept of Zeitgeist. Giedion understood that the changes in the way space was perceived were the result of the shift in the surrounding philosophical attitudes.[14] For Giedion, industrialisation

9 Gold 1997, pp. 2–3.

10 According to Gold's interpretation, this period was represented by Henry Russel-Hitchcock, Nicolaus Pevsner and Sigfried Giedion. Gold 1997, pp. 2–3.

11 The French name of the CIAM organization was Congrès Internationaux d'Architecture Moderne, and the German name was Die Internationale Kongresse für Neues Bauen.

12 Giedion's company, Wohnbedarf, began selling furniture designed by Aalto in the early 1930s. Rüegg, A. 1998, pp. 119–133.

13 This period was dominated by Reyner Banham, Charles Jenks and Alfredo Tafuri. Scholars who developed a new reading of the history of Modernism included cultural historians, building and design historians and feminist historians. Gold 1997, pp. 7–8.

14 Giedion 1949 [1941], pp. 2–28; Georgiadis 1993, pp. 148–149.

was a precondition to the architecture of the new age.[15] He traced the foundations for the development in the 1900s to the previous century.[16] Georgiadis has criticised Giedion's historical interpretations for being selective.[17] Giedion shared Le Corbusier's (1887–1965) view that the new century and the *Machine Age* were an awakening for the architect.[18] Giedion had emphasised the importance of social responsibility while operating within the sphere of influence of CIAM, in his publication of 1941, he rephrased his opinion and merely expected morality from Modernism.[19]

In his doctoral dissertation, *Theory and Design in the First Machine Age*, Banham highlighted the impact of Futurists as the true pioneers of Modernism and emphasised the symbolic value of the Modernism of the first few decades of the 1900s, and also conducted a critical study of Le Corbusier's writings.[20] Banham's relationship with Le Corbusier's literary output is remarkably different from that of Giedion. *Vers une Architecture* (Towards a New Architecture) was in Banham's view a collection of loosely linked texts, with the author attempting to create some sense of cohesion between them simply by including them in the same publication. Banham divided the chapters in Le Corbusier's book into those with an academic underpinning and those discussing mechanistic topics. As he pointed out, these themes varied throughout the book. Banham also paid attention to the fact that Le Corbusier used illustrations to create both historical and aesthetic oppositions.[21]

Banham understood the relationship between early 20th century avant-garde and technological progress from the perspective of philosophy. He argued that Mies van der Rohe's Barcelona Pavilion's (1929) extensive and rich use of modern materials alongside traditional marble was an example of juxtaposing the artistic and the non-artistic. He saw that such an approach came from Dadaism, Futurism and the *papier collé* works of the Cubists. In the final Chapter of his dissertation, "Architecture and Technology", Banham praises the material and immaterial illusionism of Le Corbusier's Villa Les Heures Claires (Villa Savoye) and refers to the building as a home of a "fully motorised post-Futurist family". In Banham's view, no single criterion would ever suffice to explain the architecture of these buildings.[22]

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15 Giedion 1944 [1941], p. 116; Georgiadis 1993, p. 102.
16 Giedion 1949 [1941], Chapter III pp. 97–224, especially pp. 146–152.
17 Giedion ignored, for example, many 19th century phenomena, such as style imitations. Georgiadis 1993, pp. 103–105.
18 Giedion refers to Le Corbusier in *L'Esprit Nouveau* (Paris 1924), No. 25. Giedion 1944 [1941], p. 152.
19 Giedion 1949 [1941], pp. 645–652; Georgiadis 1993, p. 107.
20 Banham's *Design and Theory in the First Machine Age* is divided into five Chapters, the first of which discusses academic and rationalistic writers from the period 1900–1914. Chapter 2 discusses the Italian Futurist manifestos and projects, Chapter 3 the Netherlands and de Stijl movement in 1917–1925, Chapter 4 Paris and Chapter 5 Germany and Bauhaus. Banham, p. 1999 [1960].
21 Banham, p. 1999 [1960], pp. 220–246.
22 Banham 1999 [1960], pp. 321–325.

Banham made an interesting observation that the machine-romantic features disappeared from the architecture of the decade before World War II: machines inspired architects as long as their mechanisms were in full view, and only a few actually understood how they worked.[23] Banham argued that Modernists betrayed their vision of the future of the Machine Age by remaining loyal to the academic canon. In his opinion, an in-depth study of the first quarter of the 20th century would bring out the real movers and shakers whose concept of technology was overshadowed by romanticising tradition. Banham maintained that the Futurists had a decisive impact in the Modernist ideology, as their imagery was not symbolic like Le Corbusier's.[24]

In my view, Banham overlooked the possibility that the relationship between architects and technology may have been different in the 1920s and 1930s. Many such technological systems that were developed as part of military industry had been introduced into the lives of consumers, at least the more wealthy ones, a decade later. Cases in point are the radio and the airplane. By the 1930s, architects had stopped associating technological systems with similar futuristic expectations and replaced this with a hope that technology could help bring about an easier life for the masses. The attitude of architects towards technology appeared to have become more optimistic.

According to Banham, many 1930s proponents of modern architecture rejected symbolism because they came from outside the pioneering countries and therefore joined the movement at a later stage, after the creative debates and confrontations that determined the direction of the movement had already dissipated. Banham sees the prevailing ethos in society as another contributing factor for the disinterest in symbolism: in the early 1930s, a style could only be justified on logical and economic grounds, and any aesthetic or symbolistic values would only have been met with sheer hostility.[25]

Banham believed that technology based on science could change our traditional ways of thinking and thereby architecture. Indeed, in his own work he attempted to expand our view on the relationship between architecture and technology, but was sceptical of whether the early 1960s architectural thinking and new knowledge about technology could ever be reconciled.[26] Anthony Vidler, who has studied the historical enquiry into Modernism, has argued that Banham's aim was to free the mechanistic from the hegemony of the academic, and he embraced science and technology in a way that superseded the symbolism of the modern movement.[27]

In his work published in 1969, Banham praised the fact that the previous generation of architectural historians had brought structures and materials into the narrative of modern architecture. However, architects themselves had, in his view, failed to integrate technological systems into their artistic expression. To the chagrin of architects,

23 Banham 1999 [1960], p. 328.

24 Banham 1999 [1960], pp. 99–138; Vidler 2005, pp. 116–117.

25 The international style was outlawed in Germany and Russia, while in France it lacked financial resources to flourish, in fascist Italy its supporters were few, in the UK people had no interest in the aesthetic and the United States was in depression. Banham 1999 [1960], pp. 320–321.

26 Banham 1999 [1960], p. 329; Vidler 2005, pp. 131–132.

27 Vidler 2005, pp. 155–156.

technological matters were governed by other professionals, ranging from plumbers to consulting engineers. According to Banham, the technological systems had also been more or less completely forgotten in architectural history.[28]

According to Göran Schildt (1917–2009), Alvar Aalto, belonged to those who optimistically sought to develop architecture into an objective science complying with the new ideology, and focused on the rational analysis of component functions in the problematic of architecture since the latter part of the 1920s.[29] Beginning in 1926, Aalto's personal friendship with his Swedish colleagues, Gunnar Asplund (1885–1940) and Sven Markelius (1889–1972), linked him to the circle of socially and technically progressive architects in Sweden, who were in touch with Walter Gropius (1883–1969) and the German Bauhaus school, the architects of the Dutch De Stilj group, and Le Corbusier (1887–1965) in France.[30] In 1929, Markelius and Aalto both participated in CIAM's second conference. The organisation provided a forum for seminars, exhibitions and personal connections and, as a whole, formed the basis for the development of Aalto's thinking, architecture and international network at the time.

The Paimio Sanatorium project, an extensive institutional complex, dates back to those years. Critics have canonised Paimio Sanatorium (1928–1933) as an internationally recognised masterpiece of modern architecture, and considered it, along with the Turun Sanomat Newspaper Building (1928–1930) and the Vyborg City Library (1927–1935), to be the breakthrough work of Alvar Aalto. Numerous architectural magazines published the project outside Finland in the 1930s and The Museum of Modern Art in New York displayed it at the Alvar Aalto: Architecture and Furniture exhibition in 1938, along with the other two buildings mentioned above.[31] Sigfried Giedion recapitulated the architectural development of the pre-war years in *Space, Time and Architecture*. With the second extended edition, published in 1949,[32] he considered Paimio Sanatorium to be one of the three most important institutional buildings associated with the rise of contemporary architecture, the other two being the Bauhaus at Dessau by Walter Gropius (1926) and the project for the League of Nations Palace at Geneva by Le Corbusier (1927), the latter of which was never constructed.[33] Paimio Sanatorium has been praised for crystallising functionalistic architecture[34] and for being a building in which Aalto developed a special architectural solution for the specific needs of a tuberculosis sanatorium, while fulfilling the general Modernist requirement of "light, air and sun" and achieving high hygiene standards that were in line with state-of-the-art tuberculosis treatment at that time.[35]

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28 Banham 1984 [1969], p. 9–14.
29 Schildt 1985, pp. 14–18.
30 Schildt 1997a, p. 58; Schildt 1997b, p. 58.
31 Riley 1998, p. 14.
32 Giedion 1949 [1941], p. 463; Schildt 1985, p. 64; Jokinen 2014, p. 41.
33 In Chapter VI of the original edition, "Space-time in Art, Architecture and Construction", he discussed the work of Walter Gropius and Le Corbusier only. In later editions, he extended his scope to include works by Mies van der Rohe, Alvar Aalto and Jørn Utzon. See Giedion 1944 [1941] and 1949 [1941].
34 Heinonen 1986, p. 242; Saarikangas 2002, p. 92.
35 Heinonen 1986, p. 242.

There was an acute demand for sanatoria in Finland, as tuberculosis was the country's most pressing national health issue of the time. [36] Eradicating tuberculosis became a national endeavour in the first few decades of the 20th century. The disease was not confined to urban areas but spread in rural areas to a similar degree. Preventive measures played a major role in this effort. Population-wide screening was introduced in the 1930s with the aid of portable x-ray equipment. [37] Local authorities assumed increasing responsibility for the care of tuberculosis patients from the 1910s onwards, and in the 1920s a whole movement for the prevention of the disease emerged. Collaboration between municipalities became an established practice with the 1929 Act on State Aid for tuberculosis hospitals and the 1932 Amendment to the Municipalities Act regarding Municipal Federations.[38] Eight new, large hospitals were built in Finland, adding 2,500 new hospital beds for tuberculosis patients. The daily care routine included rest, fresh air and a healthy diet, which often helped alleviate the symptoms of the disease. [39]

Aalto won the design commission for Southwestern Finland Tuberculosis Sanatorium, known as Paimio Sanatorium through an open architectural competition held between 1928 and 1929. When he won the competition in January 1929, the young architect was faced with an unprecedented task. His previous experience in hospital design was modest[40] and, through his then uncompleted projects, he was only starting to learn how to manage a large-scale project.[41] The Building Board steering the sanatorium project was strongly committed to go through with the work for three reasons. Firstly, the state considered lung tuberculosis the greatest threat to public health;[42] secondly, the Parliament legislated financing with the new Act on state aid to hospitals for tuberculosis passed in May 1929;[43] and thirdly the Building Board considered Aalto's architectural solution convincing[44]. Aalto and his architectural practice started work on the design in 1929, and the construction work started in 1930. The design work continued into 1932 and the Building Board completed the construction work in 1933. Aalto wanted to incorporate his Modernist ideas into the work. He found himself having to convince the other stakeholders of the feasibility of his ideas in order to win the mandate to execute

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36 The tuberculosis mortality rate was close to two per thousand incidents in Finland during the 1930s. Forsius 2000b.

37 Forsius 2000a.

38 Forsius 2000b.

39 The medical treatments used in Finland in the inter-war period included the pneumothorax and plombage technique, which means inserting air or an inert substance such as oil into the pleural space, collapsing the lung to allow it to rest and heal. Other methods included thoracoplasty and phrenic nerve crush. See e.g. Forsius 2000a.

40 In 1924, Aalto had designed a log-framed, classicist hospital building with four patient rooms, a special ward, an operating theatre, a nurses' room and an office, built in a remote village of Alajärvi in southern Ostrobothnia. The hospital was altered during its construction as per instructions of the master builder Eeli Ojala, whose opinion Aalto dutifully respected. Schildt 1995, 67; Aalto also participated in the invited competition for the Central Finland tuberculosis sanatorium in 1927 without success. Raija Heinonen studied Aalto's hospital designs from 1927–1931. Heinonen 1986, p. 235.

41 The Southwest Finland Agricultural Cooperative Building project took place in 1927–1929, the Turun Sanomat Newspaper Building in 1928–1930 and the Defense Corps Building in Jyväskylä in 1926–1929. Heporauta 1999, pp. 10–25.

42 Tuberculosis mortality rate in Finland in the late 1920s and early 1930s was approximately two in one thousand. New cases were detected at the rate of two to three in one thousand, and the number of registered cases was eight to nine in one thousand with four to six in one thousand placed in hospital care. Forsius 2000b.

43 Valtionapua koskeva laki 269/1929 ja asetus 207/1929. (Act No. 269/1929 and Decree No. 270/1929 on the State Aid).

44 The jury considered Aalto's proposal architecturally interesting and the disposition of functions generally successful. Some measurements were, however, criticised. Anon, 1929b, pp. 42–46.

them. This was particularly challenging in Finland, which was, at the time, highly agricultural as a society and struggling under the great economic depression.

For the purpose of this dissertation, I understand symbolic expression in architecture as a system with its own logic and, in contrast, construction as a system forming the framework within which the practical problems of building are resolved. According to the British architect and scholar Alan Colquhoun, symbolic representation and empirical building are parallel systems. Symbolic representation is based on facts, while architecture is bound to a given social, technological or economic situation in time.[45] In my opinion, a case study enables the appropriate level of accuracy in studying the interaction between the architect's world of ideas and other builders. The locality of architecture, in other words, the encounter of an international ideology and a local reality as illustrated by one project, is at the core of the present study. Aalto held a central role in Paimio Sanatorium project from the very beginning, which allowed him to influence the entire scope of design solutions.

The objective of this research was to examine how the relationship between architecture and technology was resolved locally in Paimio Sanatorium. When a building is constructed, ideas gain a material manifestation and the architect learns from the process of building through interaction with other stakeholders. I have elaborated on the ideas of Modernist architects and the role of the architect in the execution phase, working together with a number of different stakeholders. My observations have focused on subsystems derived from the ideological points of departure or paradigms of the era, including the reinforced concrete frame, windows and the environment for human activities within the frame, more precisely in the patient room. I have studied the significance of the many discourses that the architect engaged in as part of the design process of the building as well as its construction, and analysed Alvar Aalto's concept of technology.

45 Colquhoun 1962, p. 508.

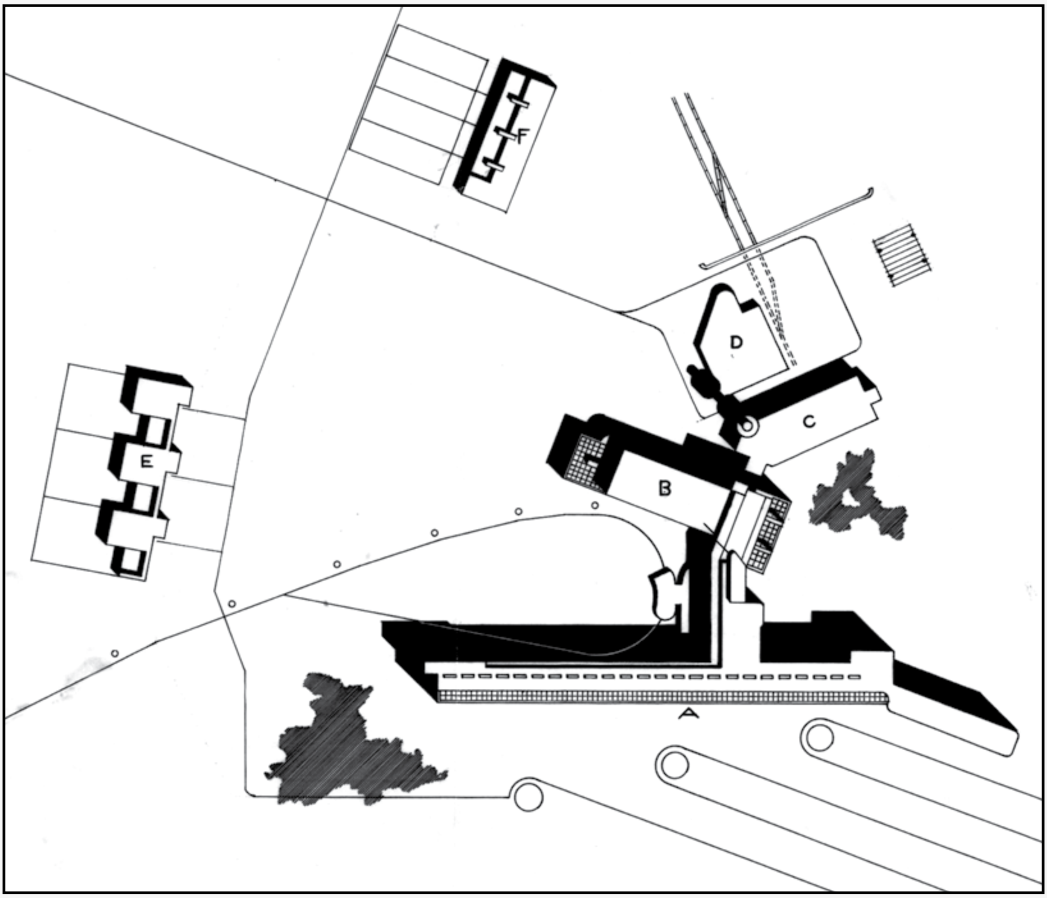

Fig. 1b. Site plan of the completed hospital showing the main building and its wings A–D, the Junior Physicians' and Administrative Director's terraced house facing the hospital entrance and workers' apartment building. Detail of drawing No. 50-759, the drawing has been edited. AAM.

PAIMIO SANATORIUM

A wing	Patients' wing and nurses apartments
B wing	Reception, operating theatre, phototherapy treatment, dining hall, library, workshops and staff dormitory
C wing	Staff dormitory, kitchen and laundry
D wing	District heating plant
E	Junior Physicians' and Administrative Director's terraced house
F	Workers' apartment building

Fig. 1.1a. The general view of the *cour d'honneur* between wings B and A is asymmetrical. Photographer Gustav Welin, 1932. Photo No. 50-003-157. AAM.

Fig. 1.1b. View towards the hospital from the east. Photographer Gustav Welin, 1933. Photo No. 50-003-303. AAM.

Fig. 1.1c. Junior Physicians and the Administrative Director were built a modern terraced house. Photo No. 50-003-448, from the 1930s. AAM.

Fig. 1.1d. In the foreground the Medical Director's villa, which was situated further away from the hospital. Photo No. 50-003-465, from the 1930s. AAM.

Fig. 1.1e. Alvar Aalto on the roof of Paimio Sanatorium. Photographer Gunnar Asplund, 1932. Photo No. 50-003-108. AAM.

Fig.1.1f. The sundeck. Photographer Gustav Welin, 1933. Photo No. 50-003-265 AAM.

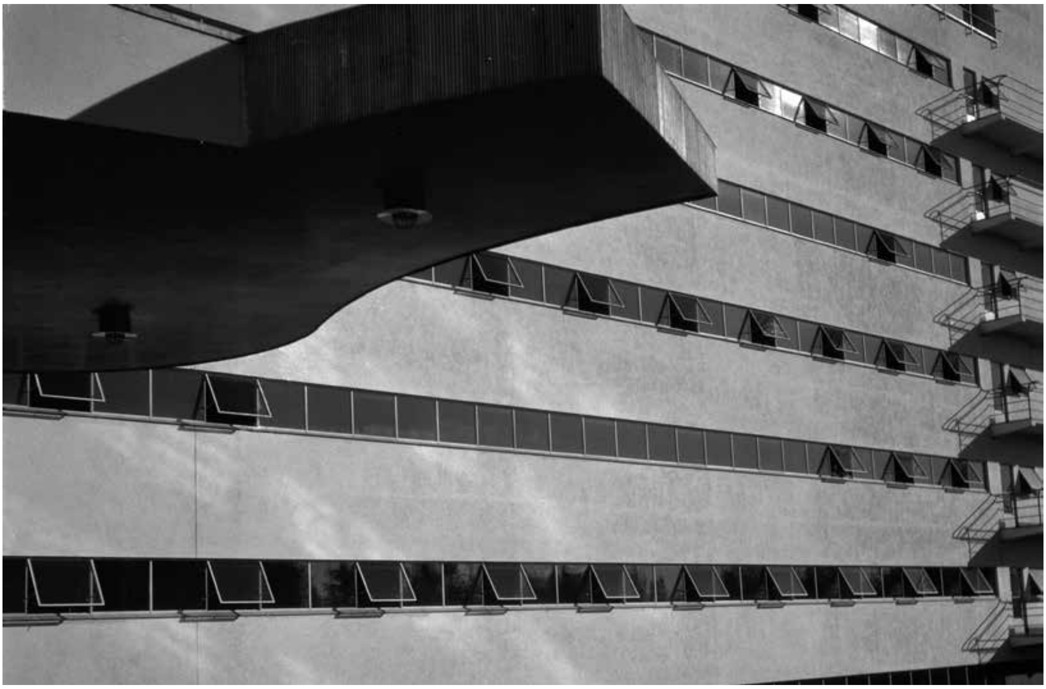

Fig. 1.1g. The canopy covering the main entrance evolved during construction and became asymmetrical. In the background, the ribbon windows of patient corridors. Photographer Aino Marsio-Aalto, 1932. Photo No. 50-003-162. AAM.

Fig. 1.1h Patients taking fresh air. The sun decks had plant containers with mountain pines and the garden had geometrically arranged footpaths for patients' outdoor walks. Photographer Gustav Welin, 1932. Photo No. 50-003-266. AAM.

1.1 THE RESEARCH QUESTION

A new architectural ideology was championed in the Europe of the interbellum period by architects active in CIAM, who embraced in their professional discourse the rationalistic management techniques developed in the United States. This discourse involved exhibitions and other events, articles, architectural publications, unrealised designs and completed building projects. The central theoreticians of Modernism, Walter Gropius and Le Corbusier, failed to acknowledge the culture-bound dimensions of buildings.[46] Their avant-gardist discourse was a deliberate departure from the past.

Aalto drew influences from culturally radical Modernistic discourse and applied new thoughts to his work. He felt that architecture should respond to the demands of the age, that is, modernisation. Although Modernism ignored the significance of local culture in building, buildings are inevitably tied both to time and place. The main research question became: How did Aalto manage to reconcile international ideology and local building culture in a country where the degree of industrialisation in the building sector was relatively low? This research also analysed the ways in which international discourse was translated into practical solutions in Paimio Sanatorium project in 1928–1933.

The general question subsumed several related questions: How was technology perceived in the architectural discourse of the time, by the main ideologists acting in CIAM; and how did Aalto reflect these ideas and discuss technology in his writings in 1928–1933? In this research, the architecture of Paimio Sanatorium and Aalto's texts were discussed in relation to the international discourse. It also examined how Aalto used mass media to construct images.

Special attention was paid to finding out which building parts of the sanatorium Aalto was most interested in. The number and quality of design documents drawn revealed which parts of the project he chose to design himself and when he would use prefabricated parts available on the market instead of a special design. Were these building parts to which he paid special attention the same as those that were highlighted in the international discourse? And again, to which technological systems did he pay only little attention?

The systems for heating, ventilation, sewage and electrical installations developed rapidly in the early decades of the 20th century and the demand to incorporate them into the architectural overall design became paramount. Who knew how to implement these new systems and what were the critical points to consider in developing the solutions? Were the systems ready to be used as such or did the architect or other project stakeholders contribute to their development? Furthermore, is it plausible to understand them as being part of Aalto's tectonic approach?

The subject matter of this research was to study in what ways specific architectural solutions were developed in interaction between different players in the heterogeneous

46 Hartoonian 1997, p. 38.

process of building, comprising both human and mechanical factors: Who and what influenced the technological solutions and systems of Paimio Sanatorium, in what way did these players influence the process and how did the process affect them? This research attempted to bring out the interplay, especially between the architect, the client, the engineers, the builders and the material world.

The study started with the notion that the architectural solutions implementing new ideas of organisation, constructional techniques or other techniques in Paimio Sanatorium, such as the reinforced concrete skeleton or heating systems, developed remarkably from the competition entry in 1929 to the finalised building. Something kept happening between the drawing desk and the assembly.[47] It is quite natural, however, that architectural design, especially the detailing, develops through the design process. Special attention was paid to the architect's role, whose aim was to convince all the other stakeholders of the superiority of his solutions: How did he express his ideas, justify his views and act to reach his goals? The working hypothesis was that the architectural solutions were influenced by the process of materialising the building. The focus of this study was on the process of design and building rather than on the end product.

I approached the relationship between the architecture and technology of Paimio Sanatorium through the perspective of the French sociologist Bruno Latour's actor-network theory. I have discussed the design and the construction of the building as an innovation process. According to Latour, a new *hybrid*, which in the present study was represented by a building, acquires its shape simultaneously as a social, subjective and material entity. According to Latour, the success of architecture, or any other technological hybrid, depends on how strongly interlinked the network of actors representing different ontological categories is, in this case that of designers, builders and material outcome. Below, I have applied Latour's theory in a critical discussion of the delimitation of the research object and the nature of the groups affecting decision-making.[48] My aim was to reveal the interrelations within the technological systems at Paimio Sanatorium.

Based on information available on the portal compiled and maintained by Bruno Latour himself[49] and on the portal of the Lancaster University, Action Network Theory Resource: Thematic List [50], the present dissertation is among the few studies in the field of architectural history to have used the actor-network theory as the theoretical framework. Bruno Latour and Albena Yaneva, Professor in Architectural Theory at the Manchester University, have published an article dealing with actor-network theory's view on architecture, which proved highly relevant to my own work.[51]

47 Latour has also drawn focus on the unpredictability of technological processes. See e.g. Latour and Yaneva 2008.

48 In his work *Reassembling the Social*, Latour argues that, instead of preconceived theories and methods, researchers ought to pay attention to oppositions and uncertainties, the five most salient of which according to Latour are the nature of groups, action, objects, knowledge and sociological research. Latour 2007 [2005], passim and especially pp. 21–22.

49 Bruno Latour's home page related to his scientific work http://www.bruno-latour.fr. Latour 2011.

50 Unfortunately, the useful resource has not been updated since 2000. Lancaster University 2000.

51 Latour and Yaneva 2008.

1.2 BRUNO LATOUR'S ACTOR-NETWORK THEORY

In the past few decades, the history of technology has been productively studied from the perspective of social sciences, sociology in particular. Most studies have attempted to distance themselves from technological determinism, according to which man cannot intervene in the inner logic of technology. Many historians of technology have, therefore, endeavoured to focus on the formation of a technological solution, as a process. Instead of treating "technology" per se as the locus of historical agency, the "soft determinists" locate it in a far more complex social, economic, political and cultural matrix.[52] Understanding the past of technology requires that we see it at the same time as a phenomenon that shapes society and one that is shaped by different actors. Thus defined, technology is part of society and technological change is part of social change.[53] One exponent of this line of architectural research is Thomas Markus, who has emphasised the nature of buildings as social objects, as processes in constant transition and as tools of power and classification.[54]

The idea of reciprocity of the social and the material lends particular interest to the actor-network theory developed by the French sociologist Bruno Latour from the specific perspective of interpreting architecture, as he provides tools for tackling the interplay between social networks and the material reality in a technology process, which an architectural process can be classified as.

In their 2008 article "'Give Me a Gun and I Will Make all Buildings Move': An ANT's View of Architecture", Bruno Latour and Albena Yaneva discuss the application of actor-network theory in architecture. The authors hold that while buildings appear static, they are in fact under constant transformation. However, it is all but impossible to observe buildings as series of transformations or a contest of different forces.[55]

Latour and Yaneva see perspective drawing (3D modeling), which is based on Euclidian geometry, as reductive. It falls short, for example, of representing various social demands affecting the building process. Furthermore, the materiality of a building cannot be presented through Euclidian models. Latour and Yaneva take a critical view of geometrical and mathematical models created by engineers being understood as exhaustive representations of the "material" world. According to the authors, materiality cannot be reduced to "objectivity". For them, Euclidian geometry ultimately offers a relatively subjective, human-centred or at least knowledge-centred approach, which does not do any justice to the way humans and things exist.[56]

52 Marx and Smith 1998 [1994], p. xiii.
53 MacKenzeit & Wajcman 1987, pp. 3–6, cited in Michelsen 2000, p. 73.
54 See Markus 1993, especially Chapter 1.
55 Ibidem.
56 Latour and Yaneva 2008, p. 84.

Latour and Yaneva further state that architects need to utilise different manners of representation and materials in order to reconcile all the different demands targeted at the design during the construction process. Drawings and models constitute no immediate means of translating ideas into material reality, but rather serve as tools for the architect to develop these ideas and to explore different options.[57] I agree with the authors in that architectural drawings do not, as such, equal material realisation, as the process of realisation involves many other factors besides the nature of the material, the production method, the executors of the design and the various demands on the material and labour, such as low price or hygienic standards.

The article by Latour and Yaneva is philosophical in its angle and they distance themselves from architectural praxis fairly substantially. This fact is manifest in, for example, their specific discussion on geometric projections as a way of representation. In a real building project, architects use other channels of communication in addition to their drawings, including work specifications, negotiation with other designers, the client and the authorities, and overseeing the building project and attending meetings. Moreover, some of the working drawings will be made by others. Architects extend their influence on drawings made by others through their role as the coordinator of the design process. While the present study is partly based on Aalto's drawing documentation, his "other" actions become especially interesting from the perspective of analysing how the architect manages to influence and redirect other actors' objectives to better align with those of his own.

Latour and Yaneva ask what the advantage of such a method of representation that communicates a building as continuation of transformations could be. In their view, such a method would erase the gap between the "subjective" and "objective". [58] It would also pay more attention to the material side of things, and the multidimensionality of material would no longer be reduced to 3D models. Since architectural design covers a vast spectrum of factors, which theory seldom succeeds in emcompassing, they propose a new type of model: "We should finally be able to picture a building as a navigation through a controversial datascape: as an animated series of projects, successful and failing, as a changing and crisscrossing trajectory of unstable definitions and expertise, of recalcitrant materials and building technologies, of flip-flopping users' concerns and communities' appraisals. That is, we should finally be able to picture a building as a moving modulator regulating different intensities of engagement, redirecting users' attention, mixing and putting people together, concentrating flows of actors and distributing them so as to compose a productive force in time-space…Only by generating earthly accounts of buildings and design processes, tracing pluralities of concrete entities in the specific spaces and times of their co-existence, instead of referring to abstract

57 Ibidem.
58 They argue that phenomenologists are upholding the Descartian notion of res extensa. Latour and Yaneva 2008, pp. 82–84 and p. 86.

theoretical frameworks outside architecture, will architectural theory become a relevant field for architects, for end users, for promoters, and for builders."[59]

At the core of my research is accepting the challenge presented by Latour and Yaneva and tackling it on an empirical level so as to make visible the multitude of forces affecting the Paimio Sanatorium project.

According to Finnish Professor Petri Ylikoski, there are three salient themes that run through Latour's later work. Firstly, Latour pays attention to the material aspects of scientific enquiry and aims to incorporate the fields of objects and non-human actors in his social research. His second major theme is the locality of knowledge and management. Scientific knowledge is valid only in the special conditions of a laboratory and when analysing any given piece of knowledge, it is essential to know where, how and by whom it was produced. Thirdly, Latour has no intention of sharing the understanding of scientific activity held by his object of study and uses his own set of concepts instead of those of the latter, as in his view, the understanding held by the object of study is something to be explained, not an explanatory resource.[60]

Rather than "actors", the actor-network theory, developed by Latour and his colleagues, talks about *actants* that are *heterogeneous* in scope. Actants have been attributed the ability to act. This attribution can be the result of a proposition, a technical artefact or another actant through *trials* of strength. An actant is ultimately defined by its strength. Actants can be companies, civic movements or individuals. They form heterogeneous networks, in other words, they involve actants from many different ontological categories, and the strength of the *collective* thus formed depends on the strength of the hybrid that these actants have managed to constitute.[61] Action is something that takes place between people and things. Latour urges the researcher to observe the details in view and map out the chain of events. His example directs our attention to what networks reflect of themselves to the outside world.[62] The aim in the present work was to adhere to this type of anthropological approach of the construction process of Paimio Sanatorium and focus on the specific chains of events at the construction stage that somehow proved critical and divided the opinions of the relevant stakeholders.

Using Latour's set of concepts, the research looked into the hybrids of architecture, both material and social at once. From Aalto's perspective, the aspects of ideological importance were, among others, windows, the reinforced concrete frame, the patient rooms and the district systems. For the client, in contrast, economy and the standard of care were major considerations. The analysis has been limited to the design and construction phases, and excluded the analysis of the social impact of the completed building, as this would have involved a completely different network of actants. From the perspective of architectural history, my research design is conventional, as it is

59 Latour and Yaneva 2008, p. 88.

60 Ylikoski refers to works following the seminal 1979 work *Laboratory Life*, which Latour co-wrote with Steve Woolgar. Ylikoski 2000, pp. 297–298.

61 Latour 1988, p. 252; Latour 1999, pp. 303–304; Ylikoski 2000, p. 300.

62 Lehtonen 2000, p. 291.

limited to the birth of the building with an emphasis on the architect's own intentions. The central role of the architect is explained through the theoretical framework of work research. Latour is interested in technological and scientific systems, the development of which depends on innovation. In Latour's terms, the inventor or scientist is the *innovator* of a project. When a building is analysed as a technological system, the role of the innovator falls on the architect. In the light of the present study, allocating the innovator's role to the architect seems natural and self-evident, although this might not be the case for other projects at other times. However, Latour does not see the innovator as a self-sufficient genius and he emphasises the importance of the collective. Although the innovator of the network, who initiates the formation of the cluster, is in a key position, success is primarily determined by the quality and quantity of the tools of cognition rather than, for example, the superior mental abilities of the innovator.[63]

However, what is original about this research is indeed the analysis between different actors and the *trials* the architect underwent in the course of the projects, in both the social and material context. The actor-network theory is interested in the processes within which actants mutually build and modify their respective operative situations and objectives. The mobilisation and persuasion of actants and the *translation* of their motives so that their inclusion in the network becomes a necessity is essential, according to the actor-network theory. Latour uses the term translation for the conversion of other actants' interests.[64]

Another methodological principle of the actor-network theory is the principle of generalised symmetry, which attributes equal footing to both human and non-human actants, assigning the same explanatory weight to both. Latour aimed to erase the distinction between the subject and the object, or the society and the nature. He sees the object as an active entity participating in a construct as well as with a serious pursuit to investigate the significance of objects in human activity. The effect is not one-directional.[65]

Finnish sociologist Reijo Miettinen has identified three problems in applying the principle of generalised symmetry in innovation studies. Firstly, limiting a network of entities to serve empirical analysis is difficult. Secondly, Miettinen argues, the theory relies on a one-dimensional view of human activity.[66] Latour, however, treats his innovator as a collective and not as a historical personage.[67] Thirdly, Latour's assumption of each actant's ability to speak has also been considered problematic.[68]

Notwithstanding the criticism presented by Miettinen and other scholars, Latour's theory has been considered a viable point of departure in this work. By applying Latour's approach, Aalto has been given a voice, a chance to "speak for himself" about where his interests lay in the design task of Paimio Sanatorium, which

63 Latour 1988; Ylikoski 2000, p. 303.
64 See e.g. Latour 1999 [1987], Chapter 3; Ylikoski 2000, p. 303.
65 Latour and Yaneva 2008, pp. 82–83 and 88.
66 Miettinen 1998, pp. 30–31.
67 Ylikoski 2000, p. 298.
68 Miettinen 1998, p. 31; Lehtonen 2000, p. 292.

has informed the choice in the angle of approach. Furthermore, understanding the master of design as a collective emphasised the nature of design and building as a collaborative process. Latour's theory also emphasises the locality of processes, which is highly relevant in architecture. The design solutions were shaped in the course of the project, as the ideas of the architect underwent trials. The impact of the collective on the architectural solution was particularly interesting in the case of a building that holds a canonised status. When discussing Aalto's buildings, we often fail to either see or understand the input of other designers. This is the very aspect into which the anthropological approach provided useful insight. By following the research methods suggested by Latour it was possible to make the architectural hybrid "speak". The reciprocity between the social and the inanimate becomes apparent in, for example, the aesthetically inspired use of material, low production costs or the qualities attributed by the material to the hybrid of which it is part, by way of fire-resistance or heat-insulation qualities. The scientific investigation of the architect's work included communication with other designers, the client, the builder and product manufacturers during the process of design and construction, in addition to the actual design work. The American architect and sociologist Dana Cuff has referred to the architectural praxis, as described in the present research, as the social dimension of architecture. While she does not emphasise material action to the same degree as Latour, her work offers a good description of the social challenges embedded in architectural praxis.[69]

Latour's observations on descriptions of innovation and the intertwining of forces as events that do not lend themselves to generalised concepts supports the approach of this study to focus on one project only. Paimio Sanatorium project was not compared with any other project since, no other building projects has been studied with similar methodology and level of detail. This would render any such comparison impossible. Similarly, comparing the findings of the present study regarding the architectural hybrid of Paimio Sanatorium to his later writings on technology would be equally futile, as they represent his later thinking.

As a general aim, this study attempted to link architectural research with recent theories of the history of technology and, to open up a softer, non-deterministic perspective on the relationship between architecture and technology.

69 Cuff's book *Architecture: The Story of Practice* concerns architectural offices in 1980s United States. She observed their operations through anthropological and ethnographic methods. See Cuff 1991.

1.3 THE RESEARCH CONTEXT

This section discusses the various perspectives from which the technological challenge in the inter-war years has been approached in the architectural research of the past few decades. The material analysed has expanded the epistemic base of this thesis, as well as helped to position its approach in relation to earlier research.

The technological challenge of the early 1900s has been understood in architectural research as a part of larger social modernisation, in other words, social development which was marked by technological advancement, industrialisation, urbanisation, the growth of population, the greater importance of administration, the mass media, democratisation and the expanding, capitalist global market.[70] In agreement with concepts defined by Hilde Heynen, in this particular study *Modernism* in architecture was used to refer to the manner in which architects applied their theoretical and artistic ideas about *modernisation* in order to produce architecture that would help people face up to the social changes in their living environment.[71]

Many researchers hold vital the impact of rationalistic working methods, and more specifically, that of *Taylorism* and *Fordism*, on the theory of Modernism. Europeans admired the efficient industrial production methods of the United States, which were based on rationalisation and the utilisation of standards and created wealth. The car and the airplane were symbols of advanced production methods that could also lend themselves to construction and architecture. With the rationalisation of work architects became interested in developing industrial standards.[72]

Europe witnessed a wave of industrialisation and urbanisation in the early 20th century. The First World War was followed by a desperate housing shortage. Social housing and public-sector building were acutely needed particular in post-World War I Germany.[73] Improving the quality of life for the masses became a central goal for architecture, shifting the focus from the status-driven grandeur serving a much broader social class. Ernst May (1886–1970), Le Corbusier and Walter Gropius, among others, found it necessary to make use of the rationalised industrial production methods in solving the problem of workers' housing. Many architects also believed that the problems created by urbanisation could be resolved by means of architecture alone. Urban planning became a topic *du jour* in the discourse space of architecture as early as the early 1900s

70 Modernisation refers to the process of social development, the main features of which are technological advances and industrialisation, urbanisation and population explosion, the rise of bureaucracy and increasingly powerful national states, an enormous expansion of mass communication systems, democratisation, and an expanding (capitalist) world market. Heynen 2001, p. 10.

71 Heynen's definition of *modernity*, modernisation and Modernism is based on Marshall Berman's work *All That Is Solid Melts Into Air: The Experience of Modernity*. Heynen 2001, pp. 12–14; Berman 1988 [1982], p. 15.

72 Standard project drawings, the use of which became more common particularly in the 19th century, can also be treated as standards for building types.

73 Miller Lane 1985 [1968], pp. 87–124; Georgiadis 1993, p. 81; Mohr 2011, pp. 51–68.

and particularly so in the sphere of the CIAM movement.[74] Division between the town and the country was associated with the enlightenment philosophy. On the one hand, the moral and aesthetic philosophy of the enlightenment directed the attention towards nature, while on the other hand, it led towards the rationalistic organisation of industrial production. This dualism, about which Aalto also wrote, has been seen as the substratum for 20th century design[75].

In Henry Ford's theory, the workers were also to benefit from the rationalisation of work. Affording more attention to working conditions would be rewarded in increased productivity and higher wages. Industrialisation brought in its wake the mass markets, as it made consumer commodities available to larger sections of population than ever before. Mass media and mass production developed hand in hand. The role of the press, film and radio was becoming central, as they represented new technologies and modernity. Women entered the world of work, started to earn their own income and the power balance within the family changed as women became more emancipated. The change in social structures also led to the development of new spatial formats, for example, in housing architecture, with collective houses as good examples. Although in reality, collective houses were never built to a major degree in Sweden and there were even fewer built in Finland, they had a distinct bearing on the shift in the role of housing design. Social change also reflected on the paradigm shift in hospital building in the 1920s.[76]

Industrialisation led to occupational differentiation and the importance of professional expertise grew. Construction firms required a wider range of competences and the design process became more collective. Engineers and technicians of different disciplines contributed their scientific knowledge and practical skills. The introduction of reinforced concrete structures required the ability to conduct structural calculations, while the feasibility of the plumbing, sewage, heating, ventilation and electrical installations needed to be verified at the design stage. In Finland, the architect would be heading the public-sector construction project at the time, collaborating with an increasing number of specialists and experts. The role of the architect was, however, changing. Private consultancies were a fairly new phenomenon,[77] there was competition between occupational groups. Also the first women entered the design profession.

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74 In his article in issue 5/1935 of *Neue Zürcher Zeitung* of June 24, 1935, Sigfried Giedion divided the Neues Bauen movement into four stages: typical of the first stage were the use of new materials, in particular, reinforced concrete; the second stage centred on the aesthetic and spatial concept inspired by Cubism; the third stage concentrated on the question of social housing with little concern for the aesthetics; and the fourth stage focused on urban and community planning. Georgiadis 1993, p. 73; For the situation in Sweden, see Eriksson 2001 and Hall 2009.

75 Porphyrios 1982, p. 83.

76 The Canadian architectural historian Annemarie Adams has compared the pavilion-style hospital typical of the period before World War I to multi-storey block hospitals, which gained ground in the inter-war period. Her primary research interests were hospitals in the United States and Canada. The change was brought about not only by the increase in the number of storeys and the changing floor plan but also by the changing objective of medical treatment, which moved away from preventive care to curing diseases, and hospitals were built with private rooms instead of large wards to serve paying customers. Adams 2008, pp. xvii–xviii.

77 See e.g. Viljo 1985, pp. 9–13.

Industrial production methods, new materials and rationalistic design methods placed architects in a situation where problems had to be resolved on the level of both form and aesthetics. Art-historical research into architecture emphasises the new concept of space that emerged in the inter-war period as well as the symbolic values it embodied and how different trends gained ground. Another aspect of interest for art historians has been to consider how new building materials and techniques were reflected in the architectural form and spatial formats, and in the evolution of new building types. However, art historical inquiry has not paid similar attention to electrical, plumbing, sewage, ventilation and heating systems, which developed in leaps and bounds in the early 1900s, as part of the tectonic solution as it has paid to materials and structure.[78] The American scholar Kenneth Frampton has discussed why the concept of space has been given such priority over both constructional and structural modes, which are the means by which spaces are created. As Frampton has pointed out, a building comes into existence through a constant interplay of three factors: the *topos*, the *typos* and the *tectonic*. Since the tectonic is not necessarily bound by any particular style, together with the topos and typos, it serves the current tendency of architecture to legitimate itself based on some other discourse.[79] Here, Frampton referred to a situation in the 1990s. Architectural research into the significance of rationalistic management systems in inter-war Modernism, which will be discussed in more detail in the next section, would indicate that even then architecture was, in fact, legitimising itself through another discourse. Frampton did not include any in-depth discussion in his text on the role that highly-developed technological systems, such as ventilation, played as objects that were assigned architectural meaning. Rather, he concentrated in a more conventional vein on the meaning of structure and material as part of architectural expression. Anne Beim, a Danish scholar who has studied tectonics in architecture, wanted to expand the scope of architectural meaning assignment. She argued that construction technology and practices contribute to the process of architectural meaning assignment if they are treated in a conscious manner.[80] Beim pointed out that construction technology and practices cannot be neutral, and architecture is never value-free.[81]

78 In the Finnish context, inter-war Modernism has been studied from the perspective of aesthetics, spatial conception and symbolism by, among others, Raija-Liisa Heinonen in her study *Funktionalismin läpimurto Suomessa* (The Breakthrough of Functionalism in Finland) and Teppo Jokinen in his doctoral dissertation *Erkki Huttunen liikelaitosten ja yhteisöjen arkkitehtinä 1928–1939* (Architect Erkki Huttunen as a Designer of Business and Community Buildings 1928–1939). See Heinonen 1986 and Jokinen 1992.

79 Frampton 1996 [1995], p. 2.

80 Beim 2004, p. 52.

81 Beim 2004, p. 168. See particularly the definition of ethics, which is a quote of “Postscript” in *VIA* 10/1990.

1.3.1 RATIONAL MANAGEMENT METHODS

The significance of rational management methods, more specifically the methods developed by Winslow Frederick Taylor[82] and Henry Ford[83] in the United States between 1895 and 1915, in the research into the history of architecture have rarely been approached in any systematic manner, although the impact of their "scientific" management theories on architecture is widely acknowledged.

The English architectural historian Adrian Forty has drawn attention to five aspects of Taylorism. Firstly, it was assumed that the Taylor's theories could serve to narrow down the chasm between the capitalist and the working classes. Secondly, Taylorism had scientific status; it was considered an objective approach. Thirdly, the advocates of Taylorism represented a new professional group, the middle-class technocrats who applied rationalist thinking to gain greater efficiency. Fourthly, Taylorist practice robbed the traditional craftsmen of the power to organise the manufacturing process for themselves. Fifthly, Taylorism was not fully grasped as a complete theory but was instead known for isolated slogans, such as "The one best way", and its symbols, including the time chart, stop watch, and certain pieces of equipment such as the office desk.[84] Henry Ford applied his consumer-centred ideas boldly in different fields of life, for example, hospital construction and the development of the hospital organisations.[85] However rationalist management methods were first applied in factories, which have subsequently been the primary points of interest in the study of the impact of rationalist management methods on architecture.[86] A study by the Swedish architect Lisa Brunnström, *Den rationella fabriken* (The Rational Factory) from 1990, is a pioneering work on the topic in the Nordic context. Brunnström's study discusses the rationalisation of the

82 The American Frederick W. Taylor (1856–1915) was a pioneer of rationalised work methods. His best known work is *The Principles of Scientific Management,* from 1911, which was soon translated into Swedish by a Finn, Johan Sederholm. Taylor emphasised the application of scientific method both in the recruitment and training of new workers and in the work itself. A new job title was introduced to the industry, that of the production planner. Taylor developed his ideas into twelve tenets that would promote efficiency, minimisation, differentiation of tasks, standardisation, systematisation, control, supervision and discipline. Taylor's theses were to do with management, organisation and performance but not the production building as such. Taylor's work soon gained international acclaim and his theories were adopted after the First World War in the automotive industry in France as well as in Russia. The Germans had already embraced Tayloristic principles prior to that with the publication of the German edition of the book in 1913 and developed their own methods on the basis of it. In Sweden, the employer organisation Sveriges Industriförbund was a keen proponent of Taylor's system. Brunnström 1990, pp. 55–57.

83 Henry Ford (1863–1947) developed the idea of mass production. His approach was less programmatic than that of Taylor. His goal was to produce cars at a low cost so that his employees could afford to buy them. The most decisive invention was the conveyor belt. Ford applied Taylor's theories to a degree. According to Ford, the purpose of industry was to serve the community and not to manufacture at a low cost and sell for a high price. He was calling for a situation where the company, its employees and the consumer would all be winners. Ford's proposed method was a departure from Taylor's theory. Ford maintained that bureaucracy needed to be reduced to a minimum. He also saw the role of the physical buildings as significant in rational production. Brunnström 1990, pp. 54–55; See also Nye 2013.

84 Forty 1986, p. 74.

85 Ford and Crowther [1922], pp. 214–219.; Henttonen 2009, pp. 221–224.

86 The factory buildings designed by architect Albert Kahn for the Ford Corporation have been studied by Frederico Bucci, while Ingrid Osterman has investigated early 20th century factory buildings in Germany and the Netherlands specifically within the context of rationalisation. Lisa Brunnström studied Swedish factory buildings of the same period. See Bucci 1999 and 2002, Osterman 2006 and Brunnström 1990.

factory building in Sweden during the period 1900–1930. She looks at the factory as a complete entity and extends her enquiry beyond the external building. Using three planning organisations[87] as examples, she infers how the rationalist principles were applied and how the architectural expression in factory buildings evolved. According to Brunnström, the roots of Functionalism were in rationalist dogma and Taylorism employed the essential theoretical design principles of Modernism – programme study, function separation, standardisation and minimisation – 20 years prior to the Stockholm Exhibition.[88] She also emphasises the importance of Behren's designs created for AEG as models and the role of Bauhaus as the conveyor of rationalist principles to the Swedish body of architects. The Swedish federation of consumer co-operatives, Kooperativa Förbundet (KF), in particular, adopted the teachings of Bauhaus on the importance of design in industrial production and the idea that it was part of the architect's remit to design the general corporate image for manufacturers.[89] Brunnström's other study *Det svenska folkhemsbygget. Om Kooperativa Förbundets arkitektkontor* (Building the Swedish Welfare State. Regarding the Swedish Co-operative Union and Wholesales Societies' Architectural Office) details the history and introduces the projects of the largest design organisation in the Nordic countries.[90] These influences were introduced through Sweden to Finland, where the activities of the KF co-operative had attracted widespread interest.[91]

Finnish art historian Maarit Henttonen researched the impact of rationalist management methods on the specialist hospitals in Finland in the inter-war period through case studies on three women's and children's health-care institutions as architectural, medical and social design tasks.[92] She was interested, among other things, in how efficiency ideals and the scientific and systematic organisation of work were incorporated into hospital construction and the gender system.[93] Henttonen approached the hospital building as a synthesis arising from the cross pressures of multiple discourses. In her opinion, the proposed option for the central design method to be applied in hospital architecture was the engineer-centred design method, in which problems were accurately defined and subsequently resolved. She maintained that hospital architects

87 Brunnström used three design institutes as examples of the application of the new design methods: Industribyrå, ASEA and Kooperativa Förbundet. Brunnström 1990.

88 Brunnström 1990, pp. 216–217.

89 The building design projects included buildings from factories, offices, shops, restaurants and schools to leisure centres. KF also designed exhibitions, furniture, light fittings, packaging and advertising. Brunnström 2004.

90 Established in 1924, the architectural practice of KF grew into the largest practice in the Nordic countries by 1930. Brunnström's interpretation was based on several primary sources. Brunnström 2004, p. 43.

91 Similar Finnish co-operative design organisations, such as those within SOK (Finnish Cooperative Wholesale Society) and KK (Central Union of Consumer Cooperatives), kept a close eye on the operations and production of KF. Jokinen 1992, p. 25 and pp. 28–29; Niskanen 2005, p. 54.

92 She has referred to the idea developed by the French sociologist Michel Foucault of power as a network encompassing social life, with power relations crisscrossing each other and sometimes pulling in completely opposite directions. Therefore, it would follow that, rather than focus on the discourses of the architect alone, it was essential to analyse those of other actors involved in the process and the interrelations of these discourses. Henttonen 2009, pp. 319–320.

93 Henttonen 2009, p. 53.

clearly adopted this new systematic approach in their work.[94] According to Henttonen, another imprint that Taylorism and Fordism left on hospital design was the new focus on the work processes taking place in the building. As a result, the number of treatment rooms was increased and their importance was brought to the fore. Henttonen argued that rationalisation had a strong impact on hospital building in the early 1900s, and it gave rise to a new, centralised idea of space and hospital type, the block hospital. The older pavilion-hospital did not, however, disappear altogether, instead it was incorporated into the new type.[95]

Despite the fact that Henttonen's study discussed the specialist hospital of the same period as the present dissertation, the research questions were markedly different. Henttonen's point of departure was a certain building type, while the present study was focused on the relationship between architecture and technology within one project. Her research context was hospital buildings, while the context for the present study was technology in construction. Henttonen studied social networks and discourse taking place within them, while in this study material entities were included alongside social relations in the analysis of networks. Henttonen's findings regarding women's and children's hospitals were not all directly applicable to a specialist hospital of a different kind, such as a sanatorium, because the patients and forms of therapies were significantly different. The treatment in a pulmonary tuberculosis sanatorium was more passive and was based primarily on rest, diet and physical exercise.[96]

Many other monographs on Finnish architecture of this period have also touched upon the impact of rationalist management methods on architecture, but in these works rationalisation has not been put forward per se as a determining factor in the research problem as it was for Henttonen.[97] For example, Finnish art historian Anne Mäkinen has highlighted in her study *Suomen valkoinen sotilasarkkitehtuuri 1926–1939* (White Military Architecture in Finland, 1926–1939) both the older, more conventional, and the new, rationalist design principles adopted in the construction of the defence

94 Henttonen has paid attention to the different, sometimes conflicting and contradictory pursuits of the doctors, state institutions or private owners and the architect. She found that drawing a clear boundary between the architect and doctor was difficult in hospital design. Doctors were the ones to draw up the room programme and they had their own ideas of a rationally organised workspace. In Henttonen's interpretation, translating ideas into spaces and designing the elevations was left to the architect. Henttonen 2009, p. 321.

95 Henttonen 2009, pp. 321–322.

96 See e.g. Forsius 2002a and 2002b.

97 For example, Henrik Wager discussed the increased efficiency of work in his doctoral dissertation on Bertel Liljeqvist's production facilities. Wager 2009; Aino Niskanen's analysis built on modernity as architect Väinö Vähäkallio's personal project and on the influences of modernisation on the remit and networks of the architect. In Niskanen's study, rationalist principles were only one factor among many. Niskanen 2005.

administration buildings in the 1930s.[98] Mäkinen has also made numerous observations on the application of rationalist design principles in the different building projects of the defence forces, such as hospitals,[99] but she did not draw any direct parallels between the tenets of Taylorism and the building designs of the defence administration.[100]

Interestingly, the Canadian architectural historian Annemarie Adams has adopted a completely opposing approach to the influence of medicine on inter-war hospital architecture in the United States and Canada, asking whether hospital design acted as the catalyst for medical advances and not the other way around.[101] She argued that the hospitals of the inter-war period were not only therapeutic institutions but also agents and producers of medical practices on general and social levels, rather than merely on a symbolic level. Adams saw architecture and medicine as reciprocating systems that jointly produced the 20th century hospital type.[102] Architects drew influences from other building types and adapted them to hospitals, such as industrial buildings and hotels.[103] The 1920s hospitals in North America were modern on the inside, but conservative on the outside: technological fetishism coupled with social conservatism. Fire safety of materials, noise abatement and reinventing the patient room were typical considerations in the design of these buildings. According to Adams, American architects were sceptical towards standards, as they feared they would make the architect redundant. For example, according to the well-known American hospital architect Edward Fletcher Stevens (1860–1946)[104], hospital equipment could well be standardised but not the floor plan, as each hospital required a unique solution. Stevens set great store by a flexible use of space in hospitals. He understood flexibility as an opportunity to completely alter the use of a building. Adams also made several observations on the increasing use

98 Anne Mäkinen discussed the design principles applied in the barracks as described by Niilo Niemi, an architect from the Ministry of Defence Building Department, in his articles of 1934 and 1935. The objectives in the barrack design included, among other things, using uniform measurements and standardised fixtures in the interior. Niemi's descriptions reveal, for example, that in the 1930s barracks type each floor accommodated one company, divided into rooms sleeping 18 men. The designated space per person was four square metres or thirteen square metres, as stipulated in the 1919 Act on military quarters. Niemi discussed in his instructions different floor plan options for the barracks (side corridor, partial side corridor, centre corridor with extensions opening on the window wall, central corridor) from the perspective of health and economic considerations. The side corridor was the best solution on health grounds while the central corridor was the most economical alternative. The function of the corridor was to stage line-up and formation exercises during bad weather and as a common space. Therefore the spaces needed to be bright, airy, spacious and easy to air. Mäkinen also paid attention to how similar the floor plan types were compared to other institutional buildings, such as those used in sanatoria. Mäkinen 2000, pp. 88–89.

99 At the Russarö barracks, designed by architect Ragnar Ypyä and completed in 1931, different functions were separated from each other both spatially and with regard to massing. In the book *Suomen armeija* (The Finnish Army) the defence forces boasted about the comfort, tidiness and cleanliness in the barracks as well as their modern kitchen; in the Helsinki Motor Transport Company building by Martta Martikainen-Ypyä the efficient straightforward floorplan was based on a rational idea of the typical pathways of motor vehicles and human beings. Separation of functions was typical in the hospital design of the 1930s. Mäkinen 2000, pp. 93–112.

100 Mäkinen mentioned Taylorism and Fordism only briefly in conjunction of one building, Martta Martikanen-Ypyä's Helsinki Motor Transport Company building. Mäkinen 2000, p. 98.

101 Adams 2008, p. xvii.

102 Adams 2008, p. xx.

103 Adams 2008, pp. xx–xxi.

104 Specialist in hospital design, Stevens was also a prolific writer. His best-known work is *The American Hospital of the Twentieth Century*, which was first published in 1918 and as a revised edition in 1928. He ran the architectural firm Stevens & Lee with architect Frederick Clare Lee, specialising in hospital architecture, from 1912 until 1933. Adams 2008, pp. 90–108.

of non-medical technology, such as central clock systems, paging systems and modern machinery, in hospitals. Adams also highlighted an interesting contradiction: while the aim was to build flexible hospitals, the certain aesthetic hygiene that informed the design work, extending to cover the tiniest of details, worked exactly to the opposite end.[105] This notion questioned the role of hospital architecture.

Adrian Forty studied the application of Taylorism in furniture design. In his view, design is a mediator of social relations between people, and the discourse on these relations is an essential part of design and understanding a design object. His example, the rethinking of the office desk around 1900s in the United States, is an illustrative case in point. Although Taylorists reformed the desk, their interest lay ultimately in designing tools rather than furnishings.[106] The principle of division of labour, which was elemental to Taylorism, led to the differentiation of tasks and consequently to differentiated furniture.[107] The transformation of the office desk was a result of the reorganisation of work and the changed relationship between employees and ranks. The new desk became a driver and symbol of a new order.[108] Forty criticised understanding material culture singularly from the perspective of the aesthetics or idealised concepts.[109] Both Forty and Adams have concluded that the relationship between architecture, design and the material world is complex, which is also the approach adhered to in this study.

Standardisation was one of the key tenets of Taylorism and Fordism. Finnish art historian Elina Standertskjöld's articles "Alvar Aalto and Standardisation" and "Alvar Aalto's Standard Drawings" discuss the ideological background of Aalto's standard drawings between 1929 and 1932, most of which are related to the Turun Sanomat Newspaper Building, the Minimum Apartment Exhibition in Helsinki and the Paimio Sanatorium. According to Standertskjöld, Aalto's views on standardisation were fully in line with those voiced by the leading modernists at the same time, in particular Le Corbusier and Pierre Jeanneret.[110] Aalto drew up a vast array of standard drawings for different building parts[111] and aimed to use them as a way of introducing his furniture into industrial production. Furniture design was, therefore, a major object of Standertskjöld's analysis.[112] She gave valuable insight into understanding Aalto's professional strategies. One of Aalto's objectives was to introduce his tubular steel frame furniture into industrial production as early as in 1930.[113] While Standertskjöld's study described Aalto's standard designs, it did not

105 Adams 2008, pp. 120–121.
106 For scientific management experts, the conventional desk epitomised inefficiency. When archiving and writing were separated into two different tasks, as based on Taylorist analysis, a clerk no longer needed numerous pigeon-holes in the desk. Desks were transformed into clean surfaces with drawers for keeping writing equipment. The employees were now in the manager's unobstructed supervision and view. Forty 1986, pp. 76–77.
107 Forty 1986, pp. 79–80.
108 Forty 1986, p. 81.
109 Forty 1986, p. 81.
110 Standertskjöld 1992a, p. 85.
111 Aalto's standards included those for doors, windows, light fittings, chairs, beds, sofas, tables, kitchen fittings, clothes racks, shelves, wardrobes and fixtures. Standertskjöld 1992b, pp. 89–111.
112 Aalto's furniture and the professional associations related to their design have been studied by, among others, Pekka Suhonen in Finland and Arthur Rüegg in Switzerland. See Suhonen 1985 and Rüegg 1998.
113 Standertskjöld 1992b, p. 99.

reveal whether the standard parts were eventually produced on an industrial basis and, if so, in which format. Therefore, I find that a closer investigation of Paimio Sanatorium's realisation will bring added insight into this ideologically essential theme, the role of the standards as part of the design and its execution.

My earlier research discussed Alvar Aalto's patents.[114] Aalto began to file for patents for his inventions from the 1930s onwards. Like many other designers, Aalto aimed to protect his immaterial rights and economic interests through patents. Even if only a small number of European designers of the 1920s and 1930s were successful in protecting their innovation from financial exploitation,[115] Aalto was one of these few. He worked on his first patent applications in the early 1930s in collaboration with the furniture manufacturer Otto Korhonen (1883–1935), who had a wealth of experience in this field and was knowledgeable about the critical questions in his industry and the patent procedures.[116] Otto Korhonen knew from experience how to instruct Aalto specifically on patent methods to ensure that the patent would secure as extensive protection for Aalto's innovation as possible. The collaboration was based on the two men's mutual interests. Aalto wanted to develop serial manufacturing methods and make financial gains as a furniture designer. Korhonen, in turn, saw an interesting business opportunity in the collaboration, and he was prepared to dispense his knowledge for the purpose.[117]

Scientific management methods have been seen in architectural discourse as a manifestation of *Americanisation*, in other words, changing European and other cultures to follow American and Canadian models. Many European architects were, for example, inspired by North-American building types, such as skyscrapers, industrial buildings and hotels.[118]

Architectural historian Mary McLeod from the United States studied Le Corbusier's views on modern industrial production methods as drivers of social change. In the 1920s, Le Corbusier, as well as many of his German colleagues, regarded Taylorism and the serial production method as tools for social change. Industrial efficiency made it possible to approach architecture as a social medium. Le Corbusier believed that only modern production could facilitate the production of architecture at a cost that would be affordable to all.[119] Le Corbusier's *Vers Une Architecture* proclaimed that changes in building design and production would bring such social advances that a revolution could thus be avoided.[120] According to McLeod, Le Corbusier's future-oriented urban plans were, however, socially segregated. A new class division predicted power based

114 "Innovative Aalto" was an exhibition held at the Finnish Patent and Registration Office and based on the author's then unpublished manuscript and research material that was compiled on Aalto's patents. The exhibition was open from the end of 2002 until March 2003 at the Finnish Patent and Registration Office premises. *Innovative Aalto* exhibition publication on the Finnish Patent and Registration Office website. See Nikkanen et al. eds. 2002.

115 Benton 1979, p. 13; Heikinheimo 2004, p. 16.

116 Heikinheimo 2004, pp. 10–11.

117 Heikinheimo 2004, pp. 9–16.

118 See e.g. Cohen 1995.

119 McLeod 1983, pp. 135–136.

120 Le Corbusier 1986 [1923]; See e.g. Forty 1986, p. 80, and Banham 1999 [1960], pp. 220–246.

on capacity and expertise: engineers, captains of industry, bankers and artists would live in the centre of the city, while other actors were housed on the periphery of the town. McLeod pointed out that in Taylorism it was the pursuit of efficiency rather than equality that paved the way for social reform.[121]

Taylorism and Fordism resonated widely in the architectural circuit in Germany. Rationalist management methods were adopted in German architecture and construction before they gained a foothold in the Nordic countries.[122] In 1925, Ernst May, the director of Frankfurt am Main's Municipal Building Department, assembled a multi-professional team of architects, sociologists, engineers and manufacturers to realise May's massive social housing programme. May aimed to industrialise the building process by using pre-fabricated building parts, and extensive studies were carried out on his initiative to investigate how residential houses were used. As a result of this strategy, innovations such as the *Frankfurter Küche* (the Frankfurt Kitchen)[123] were conceived, with which Aalto was able to familiarise himself when attending the CIAM conference in October 1929. Gropius' experimental housing projects during and after his Bauhaus period were also mostly inspired by Fordism. He wanted to develop housing design so that dwellings could be produced with light-weight parts and at a low cost, just like in the automotive industry.[124] Gropius also made building site organisation schemes.[125] The generation of architects who were interested in the rational use of buildings could not avoid applying Taylorist ideas, which promised savings in both space and time. Adopting the new method led to the development of new spatial formats. Movement within a space became a central factor in design. Architects, who designed and organised action, acquired new kinds of tools for designing production.[126] While Le Corbusier's dedication to scientific management methods was reflected in a wide circle of urban planners, architects and urban planners only adopted the new thinking for the exclusive purpose of creating efficient floor plans and ignored the aspect of mass production.[127]

Elina Standertskjöld's book *The Dream of the New World* contributed to the debate on Americanisation in the Nordic countries and, in particular, Finland of the early 1900s. Taylor's two works were translated into Finnish as early as the 1910s[128] and Henry

121 McLeod 1983, pp. 138–139.
122 See Pehnt 2011, pp. 99–109.
123 The model was mainly created by Grete Schütte-Lihotzky, who applied Lillian Gilbrecht's and Christine Frederick's studies in her work. The kitchen was based on ergonomic movement paths and standardised furniture and equipment. Cohen 1995, p. 78.
124 See e.g. Cohen 1995, pp. 78–79.
125 See e.g. Gropius 1976 [1926].
126 Cohen 1995, pp. 78–79.
127 McLeod 1983, p. 137.
128 *Suomen Teollisuuslehti* (The Finnish Industrial Journal) featured Taylor's methods for the first time in 1903 and *Rakennustaito* (The Finnish Construction Magazine) discussed Frank Gilbreth's methods in 1909. Between 1913 and 1914 *Rakennustaito* published a series of articles written by the Finnish J.J. Sederholm entitled "Scientific management – American innovation in the field of management". A year later, *Rakennustaito* introduced Taylor's *Principles of Scientific Management*, which had been translated into Finnish by Jalmari Kekkonen. In 1915, another work presenting Taylor's ideas was Sederholm's *Työn tiede* (The Science of Work), which was also reviewed in *Rakennustaito*. The work by Theodor Anton Bergen, a Swedish proponent of rationalisation and a designer of factories, *Industribyggnader* (Industrial Buildings) gained wide publicity at the 1919 Building Forum in Helsinki, where it was presented. Standertskjöld 2010, pp. 43–45.

Ford's seminal *My Life and Work* was translated into Finnish in the late 1920s. The Finnish historian Karl-Erik Michelsen described the campaign for rationalisation and standardisation undertaken by *Suomen Teollisuuslehti* (The Finnish Industrial Journal) in the early 1930s.[129] Nordic architects adopted rationalist influences via Continental, and more specifically German, architectural discourse, whereas many engineers and master builders absorbed the ideas directly from the United States.[130]

1.3.2 MODERN ARCHITECTURE AND MASS MEDIA

Spanish art historian based in the United States Beatriz Colomina's ground-breaking study *Privacy and Publicity* discussed modern architecture as a form of mass media. She argued that, in the 20th century, the production of architecture shifted from the building site to the immaterial domain of the media: architectural publications, exhibitions and journals.[131] She went on to maintain that architecture can be modern and become industrialised only through a particular media relationship.[132] For Le Corbusier, media was not merely a space for disseminating culture, but also an autonomous domain for producing culture.[133] For him the location and the materialisation of the building were secondary. Architecture was something to be negotiated purely in the domain of ideas. When architecture is translated into a building, it becomes entangled with different phenomena and loses its purity. When a completed, three-dimensional building is discussed in two-dimensional media, such as the press, it re-enters the domain of ideas. Colomina wrote: "Photography and layout construct another architecture in the space of the page. Conception, execution, and reproduction are separate, consecutive moments in a traditional process of creation."[134] The interest in the present study was precisely in this "contamination" of ideas, and their execution. I saw conceptualisation as something more than simply a phase prior to the execution; it is a continuum that takes new directions at the execution stage. Similarly, Colomina described Le Corbusier's tactic of creating new associations by juxtaposing image and text. Le Corbusier's images did not only illustrate the text, they built new meanings.[135] According to Colomina, Le Corbusier also understood the potential of modern, targeted[136] advertising: when

129 The campaign targeted at policy-makers voiced fears about the efficiency demands on human labour and the loss of jobs, but the problems were seen as transitory. Taylorism and Fordism were described as methods that were not against workers' interests and, in fact, created opportunities for the ongoing development of work. Many sectors of society endorsed these ideas. Increased resources were allocated to teaching rationalisation methods to engineering students at Helsinki University of Technology, and Suomen Rationalisoimistyön Edistämisyhdistys (Finnish Association for the Promotion of Rationalisation) was established in 1930 and the construction industry established a permanent exhibition of building materials. Michelsen 1999, pp. 287–292.

130 Brunnström 1990, p. 202; Standertskjöld 2010, p. 48.

131 Colomina 1998 [1994], pp. 14–15.

132 Ibidem, pp. 14 and 107.

133 Ibidem, p. 104.

134 Colomina 1998 [1994], p. 114; See also von Moos 1983 [1979], p. 299.

135 Colomina 1998 [1994], pp. 119, 148 and 153.

136 Modernity, from the 1920s onwards, has been considered the era of targeted advertising. Colomina referred to Daniel Pope's work *The Making of Modern Advertisement*. Colomina 1998 [1994], p. 190.

Le Corbusier sold advertising space in his journal, the readers' attention was actually the product he sold to the advertisers. He alone was in charge of creating the advertisements. His other tactic was to present his own works in advertisements. The copy was coupled with the same imagery as the advertisement. In some cases, the company in question had been involved in building the project referred to, which clearly supported the above observation, that the advertisements were targeted towards a certain group. The target group for *L'Esprit Nouveau* (The New Spirit) were architects.[137]

According to Colomina, modern architecture became a commodity, which was particularly evident in a 1932 exhibition held in New York and the related publication edited by Philip Johnson and Henry-Russell Hitchcock, *The International Style: Architecture since 1922*.[138] Colomina wrote: "The curators established a dichotomy between art and life, artwork and everyday objects, by maintaining a hierarchy between architecture and building, between 'the aesthetic' and 'the technical or sociological'".[139] The American cultural philosopher and architect Lewis Mumford (1895–1990), who curated the housing architecture section of the above exhibition, was, however, more critical than his peers towards the architectural phenomena of his time.[140]

I argued, that Alvar Aalto also saw mass media as a space for creating architecture, even during the construction phase. For this dissertation, I have investigated whether Aalto was as deeply aware of the potential of using the media as Le Corbusier was and how he utilised communicative tools in his three articles on Paimio Sanatorium between 1932 and 1933.

1.3.3 ARCHITECTS AND ENGINEERS

Industrialisation also entailed a differentiation in the professions and job descriptions in the field of construction. When analysing the collaboration between technology professionals, in this case architects and engineers, it is vital to understand their respective starting points determined by their professional education. The Swiss architect Ulrich Pfammater's study *The Making of the Modern Architect and Engineer* explored the history of polytechnic education since the late 1700s.[141] According to Pfammater, industrialisation required that the education system be taken in a more practical and applied direction.[142] The French and German training systems were reflected in those elsewhere in Europe, and therefore make for a more interesting research topic. Training in a polytechnic institute was based on gradual learning through problem-solving tasks, encouraging students to approach building design tasks systematically and methodically.

137 Colomina 1998 [1994], p. 190.
138 Johnson & Hitchcock 1995 [1932]; Colomina 1998 [1994], p. 195.
139 Colomina 1998 [1994], p. 203; Riley 1992, p. 25.
140 See e.g. Riley 1992 passim, p. 32 and pp. 83–84.
141 Pfammater 2000.
142 Pfammater 2000, pp. 8–10.

From the mid-19th century onwards, Polytechnic institutions established new options for specialising in engineering sciences, in which the emphasis remained nonetheless on general knowledge. The French École des Beaux-Arts represented a different approach, with its tuition based on models and learning through imitation. Pfammater argues that, in this sense, Bauhaus also represented the Beaux-Arts method although its subjects were industrially oriented.[143] In Finland, technical schools were based on the German polytechnic model.[144] Furthermore, students and young architects worked as apprentices at the beginning of their careers.

The professional atmosphere during Aalto's student days, between 1919 and 1923 at the Department of Architecture at Helsinki University of Technology, and his early career was marked by both professional and political[145] change. Architectural training was modernised in the late 1910s.[146] Engineer training began in industrial schools in 1912 and it was intended specifically to serve the field of building construction. The university civil engineers of that time were mainly employed by public-sector agencies for their land and waterway construction or in industrial construction projects.[147] In the wake of urbanisation, local authorities began to establish positions for technical professions in the early 1900s.[148]Architects and engineers also began to run private practices. Architectural competitions were a major channel for architects to win assignments. At the beginning of the 20th century, architects aimed to monopolise artistry as the element that distinguished them from the other technical professions. Expertise in artistic values helped architects create symbolic power in the domain in which they operated.[149] The first Finnish engineering firms specialised in designing and building demanding reinforced concrete structures. By the early 1920s, private engineering firms and construction businesses had become significant employers for engineers.[150] The history of Finnish architectural offices has yet to be written, except for monographs on architects or architectural teams, which tend to be very design or personality-oriented.[151]

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143 Pfammater 2000, pp. 302–307.

144 Architectural training began in Finland in 1863 at Helsingin teknillinen reaalikoulu (Helsinki Technical School). In 1872, the name of the school was changed to Polyteknillinen koulu (Polytechnic School), in 1879 to Polyteknillinen opisto (Polytechnic Institute), and in 1908 to Suomen teknillinen korkeakoulu (University of Technology). Härö 1992, pp. 211–214.

145 Finland became an independent republic in 1917, when it broke away from Russia. Shortly after this, in 1918, a Civil War broke out, in which Alvar Aalto fought on the side of the Whites. Heporauta 1998, p. 6; Schildt 1981, pp. 93–95.

146 The new challenges included urban planning, heating, ventilation and electrical systems, new industrially produced materials and structural designs. Härö 1992, p. 216.

147 Rantamo 2009, pp. 41–43.

148 As members of the local administration, architects headed town planning and public building construction operations. In larger towns architects and engineers were jointly in charge of building inspection while master builders served as project managers. Rantamo 2009, pp. 84–85.

149 Suominen-Kokkonen 2001, p. 122.

150 Construction firms offer design and contracting services as well as cost calculation and project management services. The operations of major construction firms focused largely on house and industrial building construction but also to some degree on land and water construction. Rantamo 2009, pp. 91–98.

151 Other research would greatly benefit from understanding who established architectural offices and how they acquired their clients, what the projects were like and what their charges were based on. It would appear that it was typical in Finland from the very early days of architectural training for architects to combine a public-sector job and private practice.

Construction history, which is based on empirical inquiry, is quite young among research traditions, but has gained a fairly established foothold in some European countries, including Spain, Italy, Germany and the UK. It is, however, lesser known in the Nordic countries.[152] In Finland, this tradition is represented by a series of studies on the construction of blocks of flats authored by architects Petri Neuvonen, Erkki Mäkiö and Maarit Malinen and Panu Kaila's works on construction methods.[153] Research carried out within this tradition has emphasised the contribution of other parties besides architects, especially by engineers and constructors, as well as the material essence of buildings and the skill of building. Therefore it is quite natural to see the present research as part of the continuum in this tradition, and it will potentially open up new perspectives into construction, which is simultaneously a social and material process.

1.3.4 AALTO RESEARCH

In this section, previous research into Alvar Aalto's oeuvre and the personality behind his work is introduced. Furthermore, the significance of these interpretations for the present work is highlighted. This section will also give an overview of monographs on Finnish and Swedish architects who were part of Aalto's sphere of influence.

Finnish art historian Raija-Liisa Heinonen's licentiate dissertation *Funktionalismin läpimurto Suomessa* (The Breakthrough of Functionalism in Finland)[154] has long served as the founding for other readings of the architecture in that period.[155] In Heinonen's interpretation, Alvar Aalto's Turun Sanomat Newspaper Building, Paimio Sanatorium and Vyborg City Library were such seminal works in Finnish and international architecture that they in fact epitomise the general development and establishment of "Functionalism".[156] Heinonen's study included a fairly comprehensive analysis of Aalto's four hospital designs created for competitions between 1927 and 1931, three of which were for Finnish tuberculosis sanatoria. The proposal for Paimio Sanatorium was second in order, and the only one that was ever built.[157] Heinonen traced the design solutions for Paimio Sanatorium back to the international influences and formal motifs

152 Becchi and Carvais 2015, pp. 9–17; Caldenby 2015, pp. 263–271.
153 See e.g. Neuvonen et al. 2002 and Kaila 1997.
154 The Museum of Finnish Architecture published the study, which had been completed in 1976, posthumously in 1986.
155 Scholar David Pearson from the United States collaborated with Heinonen; his study, *Alvar Aalto and the International Style*, was published in 1978.
156 Heinonen 1986, p. 281.
157 The architectural competition for the Central Finland Sanatorium, or Kinkomaa Sanatorium, in Muurame was carried out in 1927; for the Tuberculosis Sanatorium of Southwest Finland, or Paimio Sanatorium, in 1928–1929; for Central Ostrobothnia, or Kälviä Sanatorium in early 1929; and for the Zagreb University Hospital in Yugoslavia in 1930. Heinonen 1986, p. 235.

that inspired them.[158] She found similarities between the sanatorium and the spatial structures of Soviet communal houses and passenger ships.[159] Heinonen does not even attempt to explain the formal motifs with interaction between different stakeholders during the building project, the qualities or availability of materials or the production method; in her reading, the architect was incorporating ideas he had adopted from international discourse. She understood form as essentially symbolic and, moreover, her thorough investigation was limited to theoretical questions in architecture.

The second volume in Göran Schildt's three-volume biography of Alvar Aalto, *Alvar Aalto. The Decisive Years*, concentrates on the architect's life in the period between 1927 and 1939.[160] Schildt and Aalto became friends only later, and the biography was published some 10 years after Aalto's death, in the 1980s. Owing to his personal friendship with Aalto, Schildt had a special advantage as a researcher because he was privy to the kind of background information on and insight into Aalto's life that other researchers could never access. On the other hand, he was in a completely different position from Giedion, who was an active participant in the phenomenon that was also his object of research. Schildt had no presence in Aalto's life during the period in time under review. I see Schildt as a kind of mouthpiece for Aalto.

According to Schildt, Aalto pursued not only serial housing production but also modern building types, of which Paimio Sanatorium is one example. Schildt suggests that Aalto may have reiterated the ideas he saw at Duiker's Zonnestraal Sanatorium in resolving the design problems of his own type sanatorium.[161] Aalto was undoubtedly interested in serial production as well as the standardisation of individual building parts and accessories. Shortly thereafter, he also embarked on developing type houses. The idea of a type sanatorium may, however, represent Schildt's or Aalto's own, later interpretation of the Paimio project.

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158 She pointed out that organising spaces into wings was typical in the new architecture of Continental Europe. This had been the choice solution at Zonnestraal Sanatorium, which according to Heinonen served as a model for both Aalto's and Erik Bryggman's entry for the Paimio Sanatorium competition. The wings at Zonnestraal are in free angle towards each other, while the overall composition is symmetrical. Heinonen held the view that the spiral staircase and the smokestack in the service building at Paimio were directly influenced by Zonnestraal. Heinonen likened the canopy covering the main entrance of Paimio Sanatorium to the small pavilion behind the Palace of the League of Nations assembly hall, which was raised on pillars. She also found that the tall dining hall at Paimio Sanatorium is a reference to works jointly designed by Le Corbusier and Pierre Jeanneret. On the other hand, the workshop wing at the Bauhaus school and Van Nelle tobacco factory housed an uninterrupted window wall spanning several floors. Heinonen also saw parallels between Aalto's design of a window reaching to the floor, which still existed at the competition stage, and André Lurçat's tourist hotel in the Mediterranean (1927), and argued that the plant windows at Paimio Sanatorium were inspired by the refurbished Palmgarten restaurant in Frankfurt am Main (1929), designed by Ernst May, Martin Elsasser and Werner Hebebrand. Heinonen 1986, pp. 239–241.

159 In a communal house, small flats or rooms were situated alongside long corridors in their own wings, while the common spaces had been placed in a separate connected block. Of the Soviet examples, Heinonen mentioned Ivan Nikolaev's student and communal house and The Narkomfin collective apartment block by Moisei Ginzburg and Ignaty Milinis. In a passenger ship, the cabins were placed alongside corridors and communal dining rooms and lounges were similar to those in the sanatorium. In addition, the sundecks at the sanatorium were, in Heinonen's view, reminiscent of open ship decks. She also drew attention to the pragmatic and minimised use of space, pruning out of all superfluous elements and the optimisation of the tiniest details, principles that were identical to those applied at Paimio Sanatorium. Heinonen 1986, pp. 242–243.

160 The second volume of the biography was first published in Swedish in 1985 entitled *Moderna tider*. The Finnish translation by Raija Mattila was published the same year. The English-language edition, *Alvar Aalto. The Decisive Years*, was published in 1986. See Schildt 1985 and 1986.

161 Schildt 1985, pp. 212–215.

Alvar Aalto in His Own Words[162] is a collection of Aalto's articles and speeches edited by Göran Schildt and the only collection of Aalto's output of this kind. It contains some 15 percent of Aalto's texts with which Schildt was familiar. The collection emphasises the architect's image as a thinking, interactive artist. While the texts are selected and edited by Schildt, and he has written short introductions to each one of them, the collection is a key work in the canon of Aalto literature, as he was well-known for being a talented speaker and a skilful writer. Researchers must, however, be careful not to confuse Aalto and Schildt with each other.

Aalto's works have often been interpreted as being humanistic. According to Schildt, for example, from 1932 onwards, Aalto shifted from a "non-synthetic" architectural design methods towards looking for models from nature.[163] Finnish Professor Juhani Pallasmaa paid particular attention to Aalto's concept of the expanded understanding of rationality that Aalto employed from 1935 onwards.[164] The architect's activities in the late 1920s and early 1930s have sometimes been erroneously interpreted on the basis of his later writings without taking into consideration that it was precisely the time when his architectural theory was undergoing a major shift.[165]

Some writers have directed their attention to Aalto's personality.[166] This study, rather than analysing his personal traits, aims to understand his ability to build networks and to act. In her doctoral dissertation *Empathetic Affinities: Alvar Aalto and His Milieus*, the Finnish-American architect Eeva Pelkonen employed the idea of travel as an allegory of modernity and a means by which Aalto became a modern individual.[167] Pelkonen proposed that, for Aalto, modernity meant mobility, travel, reading international periodicals and befriending with people from abroad. She saw Aalto as a "chameleon-like" person who adapted to the international circuit and fluid situations, despite his relatively isolated background. In her view, Aalto made for a fascinating example of how an architect aimed to incorporate intellectual culture into his professional domain.[168] Pelkonen also maintained that Aalto entered the international architectural debate when the Modernist movement already existed.[169] Her interpretation of Aalto is interestingly in line with Banham's suggestion of the young apostles of Modernism, who denied symbolism because they themselves joined the Modernist architectural movement from outside the pioneering countries at a later stage.[170]

Pelkonen's other work, *Alvar Aalto, Architecture, Modernity and Geopolitics*, continued in the same thematic vein as her dissertation, although the political aspect of Aalto's

162 The collection, *Näin puhui Alvar Aalto*, was published in Finnish in 1997, and the English translation by Timothy Binham, *Alvar Aalto in his Own words*, later that same year. See Schildt 1997a and 1997b.
163 Schildt 1997a, p. 86; Schildt 1997b, p. 86.
164 Pallasmaa 1998, p. 31.
165 See e.g. Rattray 2007, p. 70.
166 For example, Kirmo Mikkola has stated that theoretical speculation was an equally foreign concept for Aalto as dogmatism. Mikkola also argued that, despite his sceptical basic attitude, his world view was vitalistic. Mikkola 1976, pp. 20–21.
167 Ibidem, p. 207.
168 Pelkonen 2003, p. 9.
169 Ibidem, p. 7.
170 Banham 1999 [1960], pp. 320–321.

life and career, particularly the geopolitics, was given more prominence.[171] Pelkonen disregarded the impact of the CIAM meetings on Aalto's thought, although these were the instances, particularly the meeting in Frankfurt am Main, where he built and maintained his professional networks. Another point of importance was that the movement itself became more politicised during the early 1930s. Pelkonen also afforded little attention to the role and presence of Aino Marsio-Aalto (1894–1949) as the architect's conversation partner and sounding board.

During the inter-war period, the body of architects was predominantly male. Finnish art historian Renja Suominen-Kokkonen emphasised in her research the role of women in architecture. In her doctoral dissertation, she described Aino Marsio-Aalto as an architect who successfully combined her marriage and career.[172] She highlighted Aino Marsio-Aalto's role as a furniture and interior designer in joint projects with her husband and in Artek, the furniture and design marketing business, which was established in 1935. Suominen-Kokkonen's research has made visible an aspect of Aalto's work that had previously remained hidden and emphasised the collective nature of design.

Finnish Professor Pekka Korvenmaa has written about Aalto's clients, particularly the forest industry companies, which was the wealthiest sector in Finnish industry in the 1930s. Korvenmaa drew attention to the differentiation of roles in factory building design. The remit of the architect was limited to the design of the external envelope of the building, which was, nonetheless, of great importance and interest to the client.[173] Korvenmaa also examined Aalto's role as the advocate of Bauhaus Modernism, which in the 1930s was largely seen as left-wing. Regardless of his radical ideas, Aalto was able to convince his industry clients of the feasibility of modern formal idiom.[174] In his article "A Bridge of Wood: Aalto, American House Production and Finland", Korvenmaa explained that the way Aalto embraced internationalisation and built contacts with American counterparts in the late 1930s was a practice that had already been established by the previous generation. Korvenmaa went on to add that while Germany was on many levels the primary model in technological and cultural development, the individualistic model of democracy prevailing in the United States, combined with social and technological modernity, became the ideal for many.[175] Although the situation described by Korvenmaa is highly interesting from the perspective of the present research, particularly in terms of technology transfer, his study focused on a later period than the one of this enquiry.

Aalto's light fittings and lighting designs have been widely covered by architectural research because, even in his early career, he was a prolific lighting designer and showed

171 *Alvar Aalto und die Schweitz* (Alvar Aalto and Switzerland); *Aalto and America*; and *Alvar Aalto i Sverige* (Alvar Aalto in Sweden) also shed light on Aalto's rich encounters and relationships with certain cultural areas. See Jokinen and Maurer eds. 1998b; Anderson et al. eds. 2012; and Rudberg 2005.

172 Aino Marsio-Aalto is one the three "invisible" woman architects whom Suominen-Kokkonen has brought into focus in her doctoral dissertation, *The Fringe of a Profession*, which covers the period from the 1890s to the 1950s. Suominen-Kokkonen 1992.

173 Aalto 1931c, pp. 188–193; Korvenmaa 1998, p. 74.

174 Korvenmaa 1998, passim.

175 Korvenmaa 2012, p. 101.

great interest in using natural light in innovative ways and, in particular, in creating architectural solutions that took into account the existing light conditions.[176] Markku Norvasuo's doctoral dissertation *Taivaskattoinen huone* (A Room with a Sky Ceiling) discussed the role of scientific and technological knowledge of lighting in Alvar Aalto's architecture between 1927 and 1956. He specifically studied the importance of the 1920s and 1930s lighting technology and theories for Aalto. Norvasuo defined lighting technology as a discipline that covers both the technology of producing light and the theory of lighting and light sources. Norvasuo did not see the application of light-technological theories in the analysis of architectural form as a relevant object of study.[177] He maintained that technological principles were not apparent in a pure form in Aalto's thinking, which in his opinion was understandable as Aalto was, after all, an architect, not a technology professional.[178] According to Norvasuo's interpretation, lighting technology and theory represent a discipline separate from architecture.

Knowledge about electrophysics and the function of electrical equipment was essential for a lighting designer. Norvasuo has emphasised the importance of the Finnish engineer Helge Kjäldman and the Danish designer Poul Henningsen for Aalto. Apart from the influences they apparently drew from the work of these two, the Aaltos were in a privileged position in terms of accumulating and absorbing knowledge about electricity, as Aino's brother and Alvar's brother-in-law, Aksel Marsio, was one of the first pioneers of electrification in Finland.[179] At the time of the Paimio Sanatorium project, he was heading the Helsinki Electricity Works and chairing the Lighting Economy Agency of the Finnish Electricity Association. The remit of the agency was to provide information and advice in all matters regarding electricity.[180] Aksel Marsio's expertise must have had a crucial influence in Aalto's knowledge about lighting and electrical systems.

The monographs of Aalto's contemporary architects given this research insight into how the professional scope and the position and relations within the different networks of an architect were understood in 1920s and 1930s Finland. Elina Standertskjöld's monograph on P.E. Blomstedt (1900–1935), who was more theoretical in his approach to architecture than Aalto and one of the architects featured at the Helsinki Minimum Apartment Exhibition as well as a prolific writer, serves as an important benchmark.[181] Erik Bryggman, who collaborated with Aalto, has been studied by art historian and Professor Emerita Riitta Nikula[182] and art historian Helena Soiri-Snellman, whose thorough study into Erik Bryggman's Turku period also provided a wealth of information

176 For example Kaarina Mikonranta has studied Aalto's light fittings and Markku Norvasuo his use of light. See Mikonranta 2002a and Norvasuo 2009.

177 He draws attention to how light and the shape of the space have usually been linked together when studying lighting. The shape becomes salient when observing the geometry of lighting, in other words, how light is reflected in a space. However, the effects of the reflection of light are complex in a deeper analysis of a space. Norvasuo 2009, p. 21.

178 Norvasuo 2009, p. 25.

179 Renja Suominen-Kokkonen in personal conversation, March 18, 2015.

180 Kjäldman 1930, pp. 56–58; Norvasuo 2009, p. 35.

181 Standertskjöld 1995.

182 Nikula 1991, pp. 9–79.

on Aalto's networks.[183] Soiri-Snellman's studies would suggest that it was Erik Bryggman who introduced Aalto to many influential people in the Turku construction business, such as Arvi Ahti (1888–1940), and Emil Henriksson (1894–1970), who came to play major roles in the Paimio Sanatorium project. Finnish architectural historian Aino Niskanen's monograph on Väinö Vähäkallio and his architectural office[184] was relevant because Vähäkallio was a member of the architectural competition jury for Paimio Sanatorium. The other architect member of the jury, Jussi Paatela (1886–1962) has so far not been studied to a similar degree.[185] The Women's Hospital of his design has been discussed by Finnish art historian Petra Havu in her master's thesis and by art historian Maarit Henttonen as part of her doctoral dissertation on women's and children's hospitals.[186] Aalto's Swedish colleagues, Sven Markelius and Uno Åhrén, who were active proponents of modern architecture and engaged in CIAM's activities, have been topics of monographs written by Swedish architectural historian Eva Rudberg. Rudberg also studied the 1930 Stockholm Exhibition and Aalto's architectural projects and personal relations in Sweden.[187] Unfortunately, for the purposes of the present study, Rudberg never carried out any detailed enquiry into the friendship between Aalto and Markelius, a topic that remains a largely unknown territory.

1.3.5 PAIMIO SANATORIUM

There are at least six previous studies and publications on the Paimio Sanatorium building, all very different from each other. Finnish historian Sirkka-Liisa Törrönen's study on the history of the Tuberculosis Sanatorium of Southwest Finland, from 1984, represents basic research on the different stages of the construction of the hospital and its first 50 years of operation.[188] It served as the primary guide when familiarising with the research object. *El Sanatorio de Paimio, 1929–1933: Alvar Aalto, la arquitectura entre la naturaleza y la máquina* (The Paimio Sanatorium, 1929–1933. Architecture Between Nature and Machine) from 1991 is authored by three writers, who have attempted to develop a poetic discourse on what they consider one of the most central works of Modernism. The school of architecture at Universitat Politècnica de Catalunya had a pedagogic objective although the publication is not an academic dissertation as such. Alfred Linares' article "Alvar Aalto y la Modernidad" (Alvar Aalto and Modernity)

183 Soiri-Snellman 2010.
184 See Niskanen 2005.
185 Architect Mikael Paatela, who continued his family profession and business, studied the hospital designs of Paatela's practice in his work *Sairaalarakennuksen kehitys* (The Development of the Hospital Building). Paatela 2003; Art historian Petra Havu studied the Paatela practice in another book published by Paatela & co. Architects Ltd, *Piirrä, piirrä, piirrä... Paatelan arkkitehtisuunnittelun 80 vuotta.* (Draw, Draw, Draw... 80 Years of Paatela Architects). Havu 2001.
186 Havu 1996 and Henttonen 2009.
187 See Rudberg 1981, 1989a, 1999 and 2005.
188 See Törrönen 1984.

focused on Aalto's influences.[189] Linares saw the sanatorium as a dualistic work that can, on the one hand, be interpreted superficially as a repetition of Modernist motifs and, on the other hand, as a synthesis of those and of Aalto's own architectural training which was deeply anchored in local values and attitudes.[190] Mateo Closa's article "El Sanatorio de Paimio entre la mímesis y la invención" (The Paimio Sanatorium Between Mimesis and Invention) discussed the architectural composition of the sanatorium.[191] He was interested in, for example, the manifestations of *machine romanticism*. F. Javier Biurrun's article "D'ailleurs c'est toujours les autres qui meurent" (Besides, It's Always the Others Who Die)[192] draws parallels between Paimio Sanatorium and the art of its time. The special feature in this article is the composition diagrams.[193]

Finnish art historian Minnamaria Koskela's master's thesis *Paimion parantola – rakennus kuin "lääketieteellinen instrumentti"* (Paimio Sanatorium – A Building Like a "Medical Instrument") concentrated on how doctors and the nursing staff contributed to the design of the sanatorium. Koskela showed that the design work was not solely based on science and rationalism as it was also influenced by the common perceptions and beliefs associated with tuberculosis.[194]

The historic building survey that Ark-byroo Architects carried out in 2000 covered the history of the construction from 1928 to 2000, including a room inventory, photographic documentation, and a colour and surface material analysis.[195] The work was commissioned for the purpose of building protection. In 2005, based on this survey, the National Board of Antiquities drew up a proposal for the nomination of Paimio Sanatorium to the UNESCO World Heritage List.[196] A seminar publication by ICOMOS on Paimio Sanatorium on its protection values also exists.[197] The author of the present work together with Ark-byroo Architects launched a website aimed at the general public in 2014 introducing the architectural solutions of Paimio Sanatorium.[198] Later that same year, the Alvar Aalto Academy and Building Information organisation published a monograph on Paimio Sanatorium, containing several short articles on the topic.

The book by the French architect Jean-Paul Cremnitzer, *Architecture et santé* (Architecture and Health) discussed the typology of European sanatoria of the 1920s and 1930s.[199] The typology of sanatoria, different national situations and individual

189 Linares 1991, pp. 59–79.
190 Linares 1991, pp. 62–63.
191 Closa 1991, pp. 81–105.
192 Biurrun 1991, pp. 107–131.
193 In these diagrams, Biurrun compared the solutions employed in Paimio Sanatorium to the designs of Villa Snellman, Zonnestraal Sanatorium, Bauhaus Main Building in Dessau and the competition entries of the Kinkomaa Sanatorium and the Zagreb Hospital of Aalto. He also compared Paimio Sanatorium to the other proposals submitted to the competition. Biurrun 1991, pp. 114–131.
194 Koskela 1998, p. 86.
195 Heikinheimo et al., Ark-byroo Architects 2000.
196 Ehrström et al. eds. 2005.
197 Salastie 2010.
198 The content of the website www.paimiosanatorium.fi is based on the first stage of the author's doctoral disertation conducted in 1999–2002.
199 Cremnitzer 2005.

sanatoria have also been researched by a number of other scholars.[200] Similar, comprehensive studies on Finnish sanatoria have not been made, despite the fact that they were quite notable as a phenomenon in the 1930s. From the perspective of this study, a work of great importance is Annemarie Adams' research into North American and Canadian hospital architecture, *Medicine by Design, The Architect and The Modern Hospital, 1893–1943*.[201] An in-depth monograph on the history and repair of Zonnestraal Sanatorium has been published only recently.[202] Similarly, Adrian Forty's study on the social and medical ambitions behind hospital architecture has inspired many other researchers, including myself. According to Forty, there is no clear causal relationship between medicine and hospital construction and, when studying hospital architecture, it is advisable to devote attention to the motives of the different stakeholders contributing to the hospital design.[203]

200 See e.g. Åman 1976, Tavares 2005, Ruiloba Quecedo 2013b and Châtelet 2014.

201 See Adams 2008.

202 The publication *Sanatorium Zonnestraal* concentrates mainly on the restoration of the building designed in 1926 and it was authored by a team of writers. Meurs and van Thoor eds. 2010.

203 Forty 1984, p. 61; Adams 2008, p. xviii.

1.4 THE RESEARCH METHODS AND MATERIALS

This chapter explains the methods employed when carrying out the study. The approach was anthropological. The actors that were focused were allowed to lead this study to the salient perspectives and discourses. The material products of culture were seen as parts of a larger immanent discourse, and, in view of the adopted strategy, any historical assessment of architecture was by its nature an assessment of the social and cultural discourse as well.[204]

Moreover, the architectural discourse relating to the technological system was seen as part of the reality of the research object and of the architect in particular. Besides written sources and archive material, the building itself served as evidence. Professor David Wang from the United States has classified evidence of interpretive-historical research into four categories: determinative, contextual, inferential and recollective evidence. Different tactics were used as regards evidence; for example, the minutes of the Building Board and the Building Committee, important source material, were considered both as determinative and as inferential evidence, and the contemporary literature as contextual evidence.[205]

The primary context of the research was the development of the building, the interplay between the stakeholders and their decision-making process. The time frame of the building project extended from 1928, when the decision to build Paimio Sanatorium was made by the Federation of Municipalities of Southwest Finland and the architectural competition, open to Finnish architects, was launched, until 1933, when the sanatorium was inaugurated.[206]

1.4.1 MATERIALS

Texts written by influential architectural ideologists of the 1920s and 1930s were primary sources. In this research, the closer study of the international discourse was limited to the printed presentations of Le Corbusier and Walter Gropius from two CIAM seminars. The selection of Aalto's texts was based on the publishing period and the information value. The selection and the analysis of this empiristic material is explained in Chapter 2, "Alvar Aalto's Professional Networks". To build a solid body of background information, publications on hospital architecture of the time, as referred to in research literature, were also familiarised.[207]

204 Wang 2002, p. 151.

205 Wang 2002, pp. 154–158.

206 The building was inaugurated on June 18, 1933. Törrönen 1984, p. 46.

207 Publications on the hospital architecture of the time included e.g. the conference publication of the 1931 Vienna hospital conference *Rationeller Krankenhausbau* (The Rational Hospital Building), Richard Döcker's *Terassen Typ* (The Terrace Type), a 1928 theme issue of *Die Baugilden* (The Construction Journal) on hospital architecture, the Swedish architect Gustav Birch-Lindgren's doctoral dissertation *Svenska lasarettsbyggnader: modern lasarettsbyggnadskonst i teori och praktik* (Swedish Hospital Buildings: The Theory and Practice in Modern Hospital Architecture) from 1934. See e.g. Distel 1932, Döcker 1929 and Birch-Lindgren 1934.

From the perspective of the execution of hospital designs, one of the two archives of major importance was the archive of the hospital itself.[208] The minutes of the Building Committee and the Building Board were records of decision making during the building process, most of which have been preserved for posterity. The hospital archive also contained contracts, as well as the drawings and specifications by the engineers and companies responsible for executing different parts of the building, including the constructional drawings of Emil Henriksson. In both of these administrative bodies, the Board and the Committee, Mr Ilmo Kalkas, acted as the secretary. Most of the minutes were typed, and some were hand written. In each document there were several sections, each dealing with one subject matter only. The style of the documents was objective, the texts were short, and most often only the decisions were recorded. In the minutes of the executive body, the Building Committee, the discussion of alternatives and the grounds for decisions was mostly omitted. Exceptions were made in certain cases such as the filling of the supervising doctor's position[209], and in the selection process of the plumbing contractor, in which Aalto wanted his divergent opinion to be recorded in the minutes[210]. A few decisions were discussed at length over several meetings. In the minutes of the Building Committee, there were often appendices, such as contractors' and suppliers' tenders. In the minutes of the Building Board, the flow of decision making and the decisions themselves were described in more detail.

Aalto's drawings, photographs from the construction period and of the finished building, as well as his correspondence, are kept in the Alvar Aalto Museum archive, which was one of the two principal sources of information for this study. The archive also contains certain other documents, such as engineers' drawings and product catalogues, in addition to those produced by the architects. The drawings and photographs and the letters from the Aalto archive have been selected following an examination of the archive. The archivists also made available reports on Aalto's library database, and correspondence.

According to the classification system of the Alvar Aalto Museum, the architectural drawings of Paimio Sanatorium belong to class 50 – hospitals, sanatoriums, rehabilitation centres – and there are nearly 600 items dated between 1929 and 1932.[211] The Paimio drawings included sketches, the competition entry, the master plan, working drawings, and details. Some of the drawings were designated as standards by the architect.[212]

208 Turku University Central Hospital's Paimio Hospital archives (PSA), which were investigated in the Paimio hospital building itself, have since been gradually incorporated into main archives in the 2010s.

209 Building Committee May 17, 1932. PSA.

210 Building Committee April 7, 1931. PSA.

211 According to the ledger of AAM the drawings related to Paimio Sanatorium, dated 1929–1932, belonged to class 50 and were numbered 24–35, 54–486, 636–766, 949–956, and 977–978. Besides these, some drawings, such as Nos. 50-534, 50-555, and 50-1038 were copies or drawings classified under other projects or marked with later timing.

212 These were designs of building components, such as doors, windows, light fittings, chairs, a metal tube sofa, a handrail and furnishings of the patient room, including the wardrobe, a glass shelf, a washing bowl and a spitting bowl. Standertskjöld 1992b, pp. 89–111.

The historic building survey of Paimio Sanatorium Ark-byroo Architects carried out as a consulting project in 2000,[213] and the researcher's earlier work as the project architect of the Vyborg City Library (1927–1935) restoration project helped to achieve familiarity with the site and Aalto's architecture of the period. This was essential in order to arrive at conjectures that, in the completed narrative, have the weight of informed opinion. Other projects designed by Alvar Aalto from the same period were inspected visually in order to understand Aalto's architectural approach, and the similarities, differences and repetitive elements in them.[214] Also inspected on site visits were works by other architects such as the Zonnestraal Sanatorium in Hilversum designed by Johannes Duiker, Bernard Bijvoet and Jan Gerko Wiebenga, a building referred to as the model for Paimio Sanatorium,[215] the Bauhaus Dessau by Walter Gropius, a number of Le Corbusier's and André Lurçat's works in Paris,[216] the Weissenhof Siedlung (Weissenhof Housing Scheme) in Stuttgart, and in addition certain other Finnish sanatoria.[217]

1.4.2 THE ANALYSIS

The empirical section on the construction process in this dissertation could be described as a "close reading": I have aimed at a highly detailed chronology of certain chains of events by juxtaposing various design and construction documents and drawing comparisons between them. The purpose of this method was to identify the critical points of the process. The general research question was approached through different methods of data analysis.

The interaction between different actors has mainly been studied by cross-referencing the minutes of decision-making bodies, correspondence and drawings. The only representative of the architectural practice mentioned in the minutes was Alvar Aalto. The letters were mainly signed by Alvar Aalto, but other employees of his office also participated in acquisitions. In terms of the drawings, their authorship of each drawing has been validated based on signatures and initials.

213 Heikinheimo et al., Ark-byroo architects 2000.
214 These included his own house in Helsinki (1934–1936), Villa Mairea in Noormarkku (1938–1939), the Sunila Pulp Mill (1937–1938) and its housing area (partly from the 1930s) in Kotka, the Turun Sanomat Newspaper Building in Turku (1928–1930), the Standard Apartment Building in Turku (1927–1929) and the Southwest Finland Agricultural Cooperative Building in Turku (1927–1929).
215 See e.g. Heinonen 1986, p. 239.
216 I refer to Le Corbusier's works from the late 1920s and early 1930s such as Atelier Ozenfant, Maison La Roche-Jeanneret, Villa Savoye, the Salvation Army and the Swiss Pavilion.
217 An on-site visual inspection was executed at Satalinna Sanatorium in Harjavalta (architect Onni Tarjanne 1925, and Jussi Paatela 1927), Kinkomaa Sanatorium in Muurame (architects Jussi and Toivo Paatela 1927–1930, and Jussi Paatela 1937–1938), Ahvenisto Sanatorium (architects Jussi and Toivo Paatela 1930–1932), the Tuberculosis Hospital of the City of Helsinki (architect Eino Forsman 1929), Women's Hospital (architect Jussi Paatela 1932–1934), Tilkka Military Hospital (architect Olavi Sortta 1934–1936), Kiljavannummi Sanatorium (architect Jussi Paatela 1938), Tarinaharju sanatorium in Siilinjärvi (architect Eino Forsman 1930) and Keski-Häme Sanatorium in Kangasala (architect Eino Forsman 1932).

DATA TYPE	ANALYSIS METHOD	ASPECT OF ANALYSIS
Texts by Alvar Aalto	Identifying ideas on the relationship between architecture and technology and identifying influences from Le Corbusier and Walter Gropius. Discussion on the target audience. Analysing the visual elements in relation to the text.	Primary sources were interpreted as parts of the reality of the research object, providing the researcher with information on the intellectual sphere. Also the visual elements of Aalto's articles were problematised.
Architectural designs	Preparing a database of all preserved architectural drawings. Listing the documents in chronological order, considering the content, grouping the drawings, comparing them to other sources. Some of the original architectural drawings held at the Aalto Museum were in such poor condition that the researcher was not allowed to access them and no copies of them were available.	Design documents were interpreted as parts of the reality of the research object, providing the researcher with information on how the technological issues were dealt with. The drawings also provided the researcher with information on what was considered worth designing and how the designs changed.
Constructional working drawings, specifications and workshop drawings	Preparing a database of all known construc-tional drawings. Listing the documents in chronological order, considering the content, and comparing them to other sources.	Design documents were interpreted as parts of the reality of the research object, providing the research information on how the technological issues were dealt with.
Minutes of the Building Board and the Building Committee	Indexing the subject matter in chronological order, constructing a narrative, discussing the decision making process, and comparing the content to other sources.	Firstly, the material was taken as fact, and secondly, it was taken as parts of the reality of the research object.
Contracts	Comparing the content to other sources. Considering the relations of the different stakeholders.	Firstly, material was taken as fact, and secondly, it was taken as parts of the reality of the research object.
Photographs from the building period	Comparing the content to other sources.	Photographs were taken both as fact and as parts of the reality of the research object, providing the researcher with information on what was considered worth photographing.
Texts by ideologically influential architects at conferences and exhibition catalogues	What kind of technology-related content did the writer highlight in the text and the illustrations.	Published articles were interpreted as parts of the reality of the research object.
The building itself and other related buildings	Historical survey and familiarity with the site.	Material was taken as fact.

Table. 1.4.2a. Methods and aspects of analysis of different data types.

The text analysis, covering the primary sources, was done by identifying ideas or ways to understand the relationship between the architecture and technology of the period. It focused on the strategies of the writer, and tactics dealing with the topical focal points of this research, such as construction, electrical installations, water supply and sewage, windows, and the functions of the architect and the engineer. Aalto's own texts were analysed the same way as those of Le Corbusier and Gropius. The target audience, to whom the text was addressed, was also discussed.

A robust narration of each building component or technological system was first compiled on the basis of the minutes of the Building Board and the Building Committee, the written contracts and the inspection records, which were arranged in chronological order. On the one hand, these documents were considered factual documentation of the course of events. This narrative of each building part was compared with other source materials, such as drawings, specifications and the building itself. On the other hand, the minutes formed part of the reality of the research object, displaying the social interaction of the decision making process. The minutes revealed, among other things, the intentions of different parties, and they also answered questions, such as who proposed what, whether someone objected to something, whether the administrative bodies altered the plans, in what way the solutions and decisions evolved, and who was entitled to act as the representative of these bodies in different situations. The matters that were not discussed in these meetings also revealed characteristics of the process. In addition to the course of actions, the minutes revealed what was important for the body to record and how decisions were recorded.

Architectural drawings and other design documents[218] were grouped into categories to match the topical focal points of this research, such as the designs relating to the windows. The categories included drawings from the competition phase to working drawings, and from elevation drawings to the smallest details and standards drawings. Within each group, the drawings were arranged in chronological order. This method was useful for understanding the ways in which the design was altered and which solutions were abandoned. These considerations were then juxtaposed against the analysis of the minutes and the workshop drawings. Through this method, I was able to trace which building parts were afforded the most design effort and who participated in the process. Prior to this analysis, I compiled a database of the entire drawing material, which I would use as support for my analysis and which enabled me to carry out image searches.

Architectural drawings served two purposes. In the case of certain solutions, such as the patient room window, the drawings together with other documentation shed light on the developments of the design process. Similarly, examining the metamorphosis of the patient room wardrobe became possible with this method. However, some drawings were undated and putting them in chronological order was more challenging. For certain features, no drawings had been preserved or possibly none had ever been made. This was the case with some of the light fittings, the patient room bedside table and the circular concrete structures

218 The original drawings and specifications are located in the AAM.

used in the water treatment facility. It may well be that the drawing of the bedside table has disappeared or that the architect paid a visit to the workshop and directly instructed the manufacturers. In addition, the architectural drawing of the patient room light fitting does not correspond to the actual one made. There is, however, a modest pencil sketch that is very close to the actual light fitting design. The drawings, in other words, do not fully reveal how certain features came into being. Some of the drawings, such as the detailed working drawings for the steel windows were created at the drawing department of the subcontractor, Crichton-Vulcan. The series of engineer's drawings in the Paimio Hospital Archive is incomplete. Only part of the series of structural drawings that were used at the building site of the main building has been preserved. These drawings had markings that were made on site, including dates, which provided a great deal of new information and enabled their comparison to architectural drawings and decision-making documents. Some drawings were missing, such as the overall structural drawing of the sundeck wing, which the engineer most likely drew. Similarly, drawings were missing from water and sewage piping plans, such as the interim-stage drawings indicating space requirements for the sewage system for the patient room. Drawings on the biological treatment plant were also missing. Owing to the gaps in the drawings, I was obliged to rely on other, mainly written documents, as sources.

The architectural drawings included standard drawings, which were idealised presentations of a feature and which were not as such reliable sources for establishing the developments during the construction process, but which were interpreted as more general expressions of the architect's intents.

Aalto was highly aware of the power of mass media and he exploited it to communicate his ideas, as prescribed by CIAM's mission. The visuality of Aalto's articles on Paimio in the Swedish journal *Byggmästaren* (The Master Builder), the Finnish journal *Arkkitehti* (The Finnish Architectural Journal) and the publication *Varsinais-Suomen tuberkuloosiparantola* (The Tuberculosis Sanatorium of Southwest Finland) was analysed. Special attention was paid to which characteristics he highlighted, and which aspects he gave no attention to. This visual material revealed which characteristics Aalto considered worth presenting, and is discussed in Chapter 2. Photographs of Paimio Sanatorium from Aalto's office, including photos taken by Aino Marsio-Aalto and Gustaf Welin, have been used as factual evidence on how a part of the building was constructed.

Emil Henriksson's working drawings on the reinforced concrete skeleton[219] were arranged in chronological order according to their date. When drawings were organised in this way and compared to the minutes, the drawings revealed, among other things, the steps and the approximate schedule according to which the reinforced concrete skeleton was built. In this study the architectural drawings and the constructional designs were set side by side in order to visualise interaction.

219 Copies of the original working drawings are located in the PSA. The selection is, however, incomplete. Some of the Paimio Hospital archive (PSA) was transferred to the Turku University Central Hospital main archive between 2013 and 2014.

1.5 THE SCOPE AND THE CONCEPTS

1.5.1 HOSPITAL ARCHITECTURE

According to the Argentinian architectural theorist Juan Pablo Bonta, the analysis of expressive systems in architecture can only be made in terms of classes, such as functional and formal typologies. Different types of meanings will be conducive to different expressive systems. Each expressive system will selectively highlight some meanings while obscuring others.[220] The class referred to in this study was based on technological solutions in architecture within a certain historical context.[221] For example hospital architecture, Finnish architecture of the 1930s, or Aalto's oeuvre on the whole remained outside the scope of this examination, although some buildings belonging to these classes have been referred to. For example, the mechanical air conditioning systems in contemporary hospitals that were introduced in *Arkkitehti* (The Finnish Architectural Journal) were referred to in articles written by the engineers and architects working on these other projects.[222]

Despite the fact that tuberculosis was the worst public health problem in Finland in the early decades of the 20th century[223], and the task of designing the public sanatorium in Paimio offered the architect a social point of departure for developing new forms, this dissertation does not deal with the socio-historical significance of the hospital project.[224] This is not a study on Finnish sanatorium architecture either, a subject which is still to be addressed.[225] Despite the fact that the hospital as a building type had evolved for centuries, the sanatorium was a relatively recent building

220 Bonta 1979, passim pp. 125–129.

221 See also, e.g., Raija-Liisa Heinonen, according to whom the architecture of Paimio Sanatorium appeared to have been influenced by other building types than just hospital architecture. Heinonen 1986, passim., especially p. 237 and pp. 239–243.

222 See, e.g., engineer G. Huber's article on the City of Helsinki Tuberculosis Hospital and architect Jussi Paatela's article on the Red Cross Hospital. Huber 1929 and Paatela 1933.

223 The question of establishing tuberculosis sanatoria had become topical in Finland at the turn of the century. The first large public sanatorium built in Finland was the Satalinna Tuberculosis Sanatorium, opened in 1925. The Finnish Defence Forces fought the "white plague" in the 1920s by raising the standard of hygiene in barracks. The first actual military sanatorium was opened in 1929 in the municipality of Uusikirkko in the province of Vyborg. A real turning point in the founding of public sanatoria was in 1930, when the Act on State Aid came into force. See Pesonen 1980, passim, and Mäkinen 2000, passim.

224 Maarit Henttonen's dissertation on women's and children's hospitals brought out the social underpinnings and models in hospital building in Finland at the time. Henttonen 2009.

225 Finnish sanatoria, a substantial phenomenon, from the 1930s have not been studied albeit Finnish hospital architecture has been studied in dissertations (Henttonen 2009, Mäkinen 2000 and Kjisik 2009), in a Licentiate thesis (Paatela 2003), and in Master's theses (e.g. Holma 1993, Havu 1996 and Koskela 1998). Many studies on architectural history have also dealt with hospitals and sanatoria.

type[226], and as such was less dependent on established models.[227] On a more generalised level, Finnish hospital design developed to the international level in the 1930s. Besides Paimio Sanatorium, the Women's Hospital designed by Jussi Paatela[228] was held up as a model of hospital design, both in Finland and internationally.[229]

Paimio Sanatorium, like other modern 1930s hospitals, made use of medical technology such as the x-ray equipment used for mass screening of patients, operating theatres with instruments and the equipment needed for phototherapy. This study does not, however, deal with the development of medical science, technology or treatment methods.[230] In the 1930s in Finland, despite equipment, the treatment of tuberculosis was mainly based on improvement of the patient's general physical condition and on making the patients lie in large open-air wards for several hours a day.[231] In Finnish legislation, hospital buildings were considered to be medical instruments, as the Act on State Aid which came into force in 1930 laid down many of the physical features applying to sanatorium buildings.[232] Adrian Forty has argued that the change in the hospital type [233] cannot be explained by scientific development alone, and that changes in the typology of hospital buildings reflect the ambition of physicians to exercise power.[234] The research of Stephen Verderber and David J. Fine *Healthcare Architecture in an Era of Radical Transformation* deals with huge hospital complexes of the late 20th century as social, technological and architectural entities. They divided the historical development of hospitals into six waves. Juxtaposed to their classification Paimio Sanatorium resembles the "Minimalist Megahospital", which became common only in the decades following World War II. The researchers characterised this type of Modernist hospitals as perfect architectural expressions of high-tech medicine, which were reduced to their structural essence and became sheer containers of volumetric machines to be healed. The hospital became more specialised and there were zones for different functions. The hospital grew in size

226 The sanatorium as a building type existed for about half a century until the 1960s in Sweden and the 1970s in Finland. Åman 1976, p. 269; Pesonen 1980, passim, especially p. 479.

227 In the 1920s, architecturally new types of institutions had been developed in Europe, such as the Zonnestraal Sanatorium, with its freely orientated wings but still part of an entirely symmetrical composition, designed by B. Bivojet and J. Duicker and the Weiblingen Sanatorium, a terraced building, designed by R. Döcker, which had become known to the architects participating in the open architectural competition for Paimio Sanatorium through publications, exhibitions and visits, and from which they had drawn influences. Heinonen 1986, p. 237 and pp. 239–240.

228 Architect Jussi Paatela worked as a specialist with the Hospital Department of the State Medical Board during the planning of Paimio Sanatorium. Henttonen 2009, pp. 141–148.

229 Henttonen 2009, p. 320.

230 Medical treatment methods included pneumothorax treatment, thoracoplasty (plastic surgery of the thorax) severing of the phrenic nerve and oleothorax treatment. Forsius 2000a.

231 Forsius 2000a.

232 In addition to the plan for establishing a sanatorium, a description of the location, site and intended buildings of the institution and a site plan showing the organisation of the buildings in relation to one another, the drawings of the hospital buildings proper, showing floor plans and height of rooms, the number of beds to be placed in the various wards, the structure of windows, lighting, heating and ventilation equipment and cost calculations, were to be appended to the application for state aid for the costs of establishment. Asetus valtionavusta 270/1929, pykälä 3. (Decree on State Aid 270 /1929, Section 3).

233 The hospital type changed in the 18th century from a manor-like castle to a pavilion-type hospital and then to a block-type hospital building in the 20th century. Forty 1984, p. 61.

234 Forty 1984, pp. 61–93.

and spatial complexity. The structural systems developed, as well as the heating, ventilation and mechanical air conditioning systems. The typology evolved from earlier pavilions to block hospitals.[235]

Tuberculosis sanatoria were built for one purpose only and had spaces designated for the necessary activities, such as ward rooms and sundecks. As the disease is contagious, isolation was one of the guiding principles in the design of these specialist hospitals. At Paimio as well as the other Finnish sanatoria, the isolation principle is evident in the selection of the hospital site.[236] Favouring separate small patient rooms instead of large Nightingale wards was also a means to isolate patients.[237] The national movement to organise treatment and care for tuberculosis patients and Modernism emerged concurrently. The modernist formal idiom and solutions, such as flat roofs, balconies and roof gardens became popular even in northern climates such as in Finland. These themes catered to the trendy tastes of the affluent upper classes but also more pragmatic considerations, such as treating tuberculosis. The sanatoria became models for housing construction.[238] According to an article by the Canadian architectural historian Margaret Campbell, "What Tuberculosis Did for Modernism: The Influence of a Curative Environment on Modernist Design and Architecture", architecture, therapies and physical recuperation were believed to be integrally linked up until the development of efficient antibiotics in the 1950s.[239] Another research group, in an article titled "Collapse and Expand: Architecture and Tuberculosis Therapy in Montreal, 1909, 1933, 1954", has looked into how different tuberculosis treatment methods have overlapped, how old methods were replaced by new ones and how different therapies have co-existed over a period of time. According to the article, architecture was seen a method of treatment and one that developed hand in hand with other treatments.[240] In earlier research, the tuberculosis sanatorium has been seen as a tool for healing and research has been undertaken specifically into the interaction and discourse between medical experts and architects. In this study, the role of the experts of the State Medical Board has been discussed in a separate chapter, and the actions of authorities and norms become evident as part of the building process.

235 Verderber & Fine 2000, Chapter 1 "The Six Waves of Health Architecture", pp. 3–16.
236 See Koskela 1998.
237 Adams et al. 2008, p. 915.
238 Campbell 2005, pp. 1–3/15.
239 Campbell 2005, p. 10/15.
240 Adams et al. 2008, pp. 908–942.

1.5.2 HYGIENE

Hygiene is a relative concept; a hundred years ago, it involved areas that currently are understood to fall under the domain of social policy, health care, elderly care, food safety and personal hygiene.[241] In the inter-war period, the pursuit of hygiene included major public information campaigns in Europe. Similarly, in architecture, the progressive aesthetic ideas of the first few decades of the 20th century were to do with hygiene, light and transparency.[242] Kirsi Saarikangas, a Finnish art historian who has studied housing architecture, concluded that, at that time, in the approach to hygiene in housing, the focus was on the home as the benchmark and instrument for hygiene, social and aesthetic education and improvement.[243] A sanatorium and a laboratory, however, were central symbols of the new society and citizens, setting the standards for housing. Alongside population density, cleanliness and healthiness, which had been the cornerstones of hygiene in the home, new notions entered the discourse in the inter-war period, namely the design of details, a pragmatic spatial organisation and the relation between different rooms.[244] Saarikangas also made a sharp observation regarding the "vulgarisation of bacteriology". With the confusion of miasma theory and bacteriology in public health education and housing-related debate in the press, the aim of creating a clean living environment became a type of vulgarised form of bacteriology. At the same time, popularising bacteriological findings became an objective for the discipline and the prevention of disease a moral virtue. As bacteria are invisible to the eye, ordinary people had to make do with removing visible signs, that is, dirt, and with creating spaces that looked, smelled and felt clean.[245] In terms of lighting, hygienic standards referred to the elimination of glare, avoiding tiring the eyes, the reduced capacity to work and sensory irritation.[246] Physical privacy and cleanliness were emphasised as a hygienic strategy. This showed in the architecture of dwellings, schools, barracks, hospitals and other public institutions, where physical privacy and the private space were assigned more importance. In the debate on hygiene and housing, emphasis was placed on the impact of the environment on personal health and morals. The entire debate was marked with a belief in the power of architecture to change people's lives.[247]

According to Maarit Henttonen, hygienic considerations in conjunction with hospital architecture also included the notion of aesthetic hygiene. Simple, downtoned architecture was perceived as hygienic and so this aesthetic hygiene was extended in hospitals to the level of specific details, both inside and outside.[248]According to Annemarie Adams, hospitals in the United States and Canada aspired towards impeccable

241 Henttonen 2009, p. 55.
242 See Overy 2007, pp. 52–57.
243 Saarikangas 2002, p. 44; Gold 1997, pp. 57–64.
244 Saarikangas 2002, pp. 45–50.
245 Saarikangas 2002, pp. 51–53.
246 Norvasuo 2009, p. 79.
247 Saarikangas 2002, pp. 59–61.
248 Henttonen 2009, p. 324.

cleanliness, with the priority in design on hygienic surfaces, medical applications and financially and ideologically motivated solutions. She argued that, in the case of inter-war period hospitals, it was difficult to differentiate whether a certain solution stemmed from an attempt to create and maintain an image of cleanliness or to prevent the transmission of diseases.[249] She maintained that, in addition to the countless cleaning devices, there were numerous design details for fitting doors, windows, wall foundations, medicine cabinets, lavatories and even ventilators seamlessly onto the wall surface.[250] Hygiene may also have a symbolic representation, such as the white walls favoured by modernists. The New Zealand-born architectural scholar Mark Wigley's study, *White Walls, Designer Dresses*, explored the aesthetic of white walls. He argued that white walls incorporate racial and gender-related and sexual meaning, and are by no means neutral or innocent.[251]

249 Adams 2008, p. 126.
250 Adams 2008, p. 126.
251 Wigley 1995, p. 359; The Finnish art historian Anne Mäkinen has also studied the symbolism of white walls in military hospitals in the inter-war period. Mäkinen 2000.

1.5.3 TECHNOLOGY

The relationship between architecture and technology was not stable even in ancient Greece. In ancient Greece, architecture was understood as a marriage of thought and action, represented by the Greek concept *techné,* technology in the sense of 'the art of making'.[252] In ancient Greece the concept of techné, as generally understood, covered not only manual work but also fields requiring knowledge and skill, such as building, sculpture, acting and rhetoric. Plato defined knowledge, *episteme*, as a true belief that has a basis or an explanation. The knowledge of a craftsman was also such knowledge. Aristotle, on the other hand, distinguished between theoretical knowledge, practical knowledge and productive crafts. He defined craft as "a state of rational ability to create", which in an interesting way highlights the knowledge that lies at the basis of techné. As a heritage of antiquity, knowledge and craft, or skill, were kept strictly apart.[253] The Greek word *tekton*, in turn, referred to a carpenter or builder. The concept expanded in the fifth century BC, and it was considered to encompass the dimension of *poïesis*, or creativity. This concept led to the emergence of the concepts of master builder and *architecton.*[254]

The relationship between architecture and technology changed in the wake of industrialisation so that art and construction became separate. The German architect and scholar Gottfried Semper (1803–1879) suggested in his 1851 work, *The Four Elements of Architecture,* that a primitive dwelling could be divided into four basic elements: the heart, the earthwork, the roof and the enclosure.[255] According to the Australian Professor Gevork Hartoonian, who studied the ontology of structure, Gottfried Semper radicalised the question on the origin of architecture and overhauled the anthropocentric discourse by arguing that architecture was based on four crafts. According to Hartoonian, Semper's discourse undermined the metaphysical content of techné and the tectonic while emphasising the automatisation of values and experience.[256]

Albeit the etymology of "technology" is passed down to us from antiquity, the concept needs to be discussed in connection to industrialisation and science. Industrialisation started in the mid-18th century and proceeded rapidly during the next century. The context of this study is modern technology, which differs from the technology of the previous times in its relation to scientific knowledge. Beginning in the late 19th century, people developing technological systems started to apply scientific knowledge to them. However, the modern technological systems are not about scientific knowledge alone. Historian Thomas Hughes from the United States has defined technological systems as such that use whatever means available and appropriate to solve problems or fulfil goals.

252 "Techné" is the Greek word for technology; it means "the art of making". Hartoonian 1997, pp. 1–2.
253 Niiniluoto 2000, p. 17.
254 Frampton 1996, pp. 3–4.
255 On the basis of this taxonomy Semper classifies the building crafts into the tectonics of the frame, in which linear lightweight components are assembled so as to encompass a spatial matrix, and the streotomics of the earthwork, wherein mass and volume are conjointly formed through the repetitious piling up of heavyweight elements. Frampton 1996, p. 5.
256 Hartoonian 1997, p. 1.

For Hughes the problem solving is usually concerned with reordering of the material world to make it more productive of goods and services. He has also paid attention to the special ability of technological systems to postdate the problem to the emergence of a system as a solution.[257] In the context of the present work, technology is understood as a heterogeneous system comprising of inanimate or physical artefacts and humans, including people, organisations, norms, economics, and architectural theory. Furthermore, here a building has been understood as a technological system, in which the building with all its aspects and subsystems is the artefact.

The researcher must of course question the concepts he or she uses. As the meaning of the concept of technology in 1930s Finland very obviously differs from its meaning in the researcher's culture, there is the risk of anachronism, i.e. that the researcher examines the phenomenon using the concepts of an alien culture. For example, the use of the term "technology" in its modern sense only became more common in the USA after World War I, and was established there after the Great Depression of the 1930s.[258] According to Finnish Professor Jorma Kalela, the historian must aim at a true and just description of the object of research and must assess it according to the premises of the research, meaning the questions that the researcher's social position and cultural environment have caused him or her to ask, in the same way as the object of historical research, in order better to control his or her own cultural limitations.[259] I have gone through the factors influencing my research framework in the Foreword and Chapter 1 "Introduction". As regards the concept of technology, the most significant difference between the culture of the object of study and of the researcher is probably that nowadays researchers explain technology as being heterogeneous, and our general understanding of the concept of technology prevailing in the 1930s is that it leaned towards the mechanical. However, in my research I question the premise that Alvar Aalto's conception of technology in the 1930s was purely mechanical, basing my reservations on the expressions he used in his articles and his methods of working.

257 Hughes 1997 [1987], p. 53.
258 Marx 1998 [1994], pp. 247–248.
259 Kalela 2000, p. 87.

1.5.4 MODERNISM

The everyday living environment in the completed Paimio Sanatorium was certainly of a higher standard than most patients were accustomed to in their own homes. The modernity of the hospital, and how it was experienced by the individuals, was an important ideological standpoint for the architect: Aalto was aiming to create a physiological dwelling[260] and was interested in psychologically varied interiors for patient use. However, this research is not concerned with how the users personally experienced the new kind of environment. Hence, the research deals with the dialectics between modernisation and modern architecture, that is, Modernism. Many scholars have discussed the complexity of the concept of modern architecture and, today, it is understood as a whole closely linked with wider cultural modernisation. Furthermore, Modernism is not considered a style.[261] In the present dissertation, the term 'Modernism' has been used to denote inter-war period architecture and, in some contexts, to the Modernism of the period when Paimio Sanatorium was being built. Each instance shows which denotation was referred. The use of the term "Functionalism" was avoided except in citations. In Finland, "Functionalism" as a concept is typically associated with Modernism in the decade before and the one after World War II. Nowadays, attitudes are critical towards using the concept of "Functionalism".[262] Aalto did not himself use the term in relation to Paimio Sanatorium, or his other works in the early 1930s – and in this sense there is no justification for using it. He used varied terminology during the building of Paimio Sanatorium, such as "new realism". However, in 1940, Aalto stated that the term *rationalism* is used in connection with modern architecture almost as often as "Functionalism".[263] Finnish architects such as P.E. Blomstedt and Aalto, and their Swedish modernist colleagues, rejected the idea of seeing the new direction as an architectural style; for them defining a movement as a style was superficial.[264]

According to Adrian Forty, the success of architectural metaphors depends on the difference of phenomena rather than their similarity.[265] Following that science became the predominant discourse of the 20th century, many architectural metaphors, such as circulation, mechanical methaphors, both fluid and static, originated from science.[266] He writes: "… The success of the word 'functional' relies upon a commonly accepted agreement that architecture is different from biology and from mathematics. And furthermore, the scientific metaphors employed in architecture are drawn from such a

260 In his article "Asuntomme probleemina" (The Dwelling as a Design Problem), from the year 1930, Aalto nevertheless stressed the physiological needs common to human beings rather than the experience of the individual. Aalto 1930e, pp. 176–189; Schildt 1997a, pp. 76–84; Schildt 1997b, pp. 76–84.

261 Banham 1982 [1962], pp. 9–10; Colqohoun 1994 [1989], pp. 74–75; Heinonen 1986, pp. 4–5 and p. 8; Niskanen 2005, pp. 19–22 and Lahti 2006, p. 31.

262 Heinonen has explained the terms as used in the period under research. Heinonen 1986, pp. 4–9.

263 "The Humanising of Architecture" is an article published in *The Technological Review* in 1940, and quoted in Schildt 1997, pp. 102–107. Aalto 1997 [1940].

264 See, e.g., Aalto 1930b, Aalto 1930e, Åhrén 1929 and Blomstedt 1928.

265 Forty 2000, p. 100.

266 Forty 2000, pp. 87–101 passim.

diversity of scientific fields, from natural sciences as well as physical sciences and mathematics, the cumulative effect is to suggest the unlikeness of architecture to science in general".[267] According to Banham, architectural theoreticians accepted the term "Functional" into general use from the 1930s onwards, used in the sense that Le Corbusier intended, to replace the term "Rational". It was not, however, Le Corbusier's intention to replace the idea behind the latter. Both Le Corbusier and Gropius rejected the 19th century meaning of the concept Functionalism, which had deterministic undertones.[268]

The concept of rationalism is associated with technological systems and it also has a long tradition in the philosophy of architecture. A building must satisfy pragmatic and constructional criteria, which circumscribe the field within which the imagination of the architect works.[269] According to Alan Colquhoun, the definition of the rational in architecture has not remained constant but depends on changes in ideology, and it cannot be considered independently of either economic and social factors or philosophical ideas. It never exists in isolation and it is one side of a complex system that can be expressed only in terms of a series of more or less homologous oppositions.[270]

267 Forty 2000, p. 100.
268 Banham 1999 [1960], p. 320.
269 Colquhoun 1994 [1989], p. 57.
270 ...such as reason/feeling, order/disorder, necessity/freedom, universal/particular, and so on. Colquhoun 1994 [1989], pp. 57–58.

1.6 THE STRUCTURE OF THIS DISSERTATION

The first Chapter served as an introduction to the study, presenting the background and the theoretical frame, stating the research problem, making a review of existing research, and explaining the context, methods, delimitations and the key concepts.

Chapter 2, "Alvar Aalto's Professional Networks", focused on the ideological influences, writings, social networks and professional development of the architect during the years of Paimio Sanatorium completion, between 1928 and 1933. In this chapter, Aalto's writings have been analysed with reflection on the international intellectual influences that he absorbed, with specific attention paid to thoughts and concepts regarding technology. Aalto's writings echoed the influences he adopted and revealed his personal interpretations thereof. The chapter also explained how Aalto himself discussed the Paimio Sanatorium project in publicity during its construction. Discussing the architect's later interpretations of his design for the sanatorium, were deliberately avoided, as his ideas may have evolved over the years.

Chapter 3 "The Building of Paimio Sanatorium" concentrated on the construction of Paimio Sanatorium from the initial architectural competition to its inauguration. At the time of the realisation of his design, Aalto collaborated with numerous stakeholders, each with their own motives and interests to guard.[271] Besides Aalto himself as a person who headed the design team and the construction project, the design created by Aalto was another factor directing the execution process. The design work and the realisation partly overlapped. Approaching the realisation process from certain ideologically determined perspectives revealed the intentions of the different stakeholders as well as the perspectives that mattered the most to the architect. The findings of the empirical research were linked to Latour's set of concepts at the end of all four sections in which the processes of design and construction were discussed. The first section introduced the project organisation, the process and the format that the project took. The second section explained how the economic depression in Finland affected construction and the funding of the sanatorium project. In the sections focusing on the technological systems, the solutions, designers, contractors, manufacturers, methods and, most importantly, the critical stages in their interaction at each given topic were described. In Chapter 4 "Conclusions", the research question for the present study study, the findings and the professional significance thereof were discussed. In the final section, Latour's key concepts were mobilised.

271 In addition to the Federation of the Municipalities of Southwest Finland, the competition organisers, the architects, the engineers and the state authorities, there were many other stakeholder groups involved in the construction stage: building supervisors, medical doctors as specialists representing the state and the user, specialists in different engineering disciplines, construction contractors, subcontractors, workers and product suppliers. Each player contributed to decisions made. As the users of the building, in other words the patients and the staff, were absent from the design and execution phase, they were represented indirectly by specialists, such as doctors, institutes, and architects, who made decisions for them.

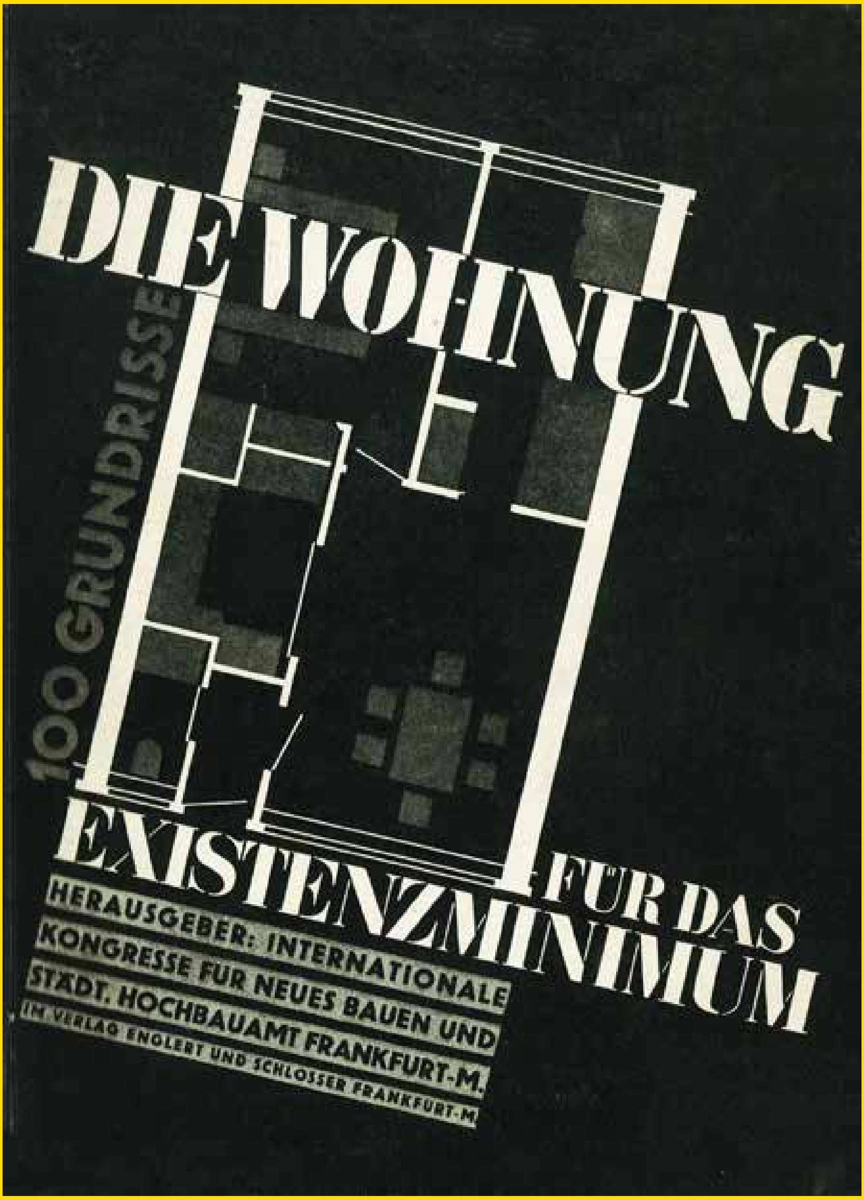


Fig. 2a. The cover page of the CIAM seminar publication *Die Wohnung für das Existenzminimum* (The Dwelling for Minimum Existence), Giedion 1930a.

1 2 3 4

Alvar Aalto's Professional Networks

Alvar Aalto joined CIAM in 1929. The establishment of the organisation and its early years coincided with the design and construction of Paimio. CIAM, and more importantly CIRPAC,[272] CIAM's preparatory meeting, which had at least one representative from each member country, opened up a diverse forum for Aalto to engage in the international discourse at the time when he was working on the Paimio project. CIAM was an exclusive set; membership could be acquired through invitation only.[273] Le Corbusier and Walter Gropius[274] were central figures at CIAM and in Finland they are generally hailed as the forefathers of modern architecture.[275] Gropius gained fame in the Nordic countries as the founder and head of the Bauhaus art school between 1919 and 1928, and Le Corbusier through his publications and exhibitions. Furthermore, Gropius and Aalto became good family friends.

Aalto also regarded maintaining good relations with Swedish architects as highly important from the very beginning of his career.[276] Aalto's relationship with Sven Markelius, whom he had met in 1926,[277] grew closer towards the end of the 1920s. Markelius was appointed in absentia as Sweden's representative at CIRPAC in June 1928 at the founding meeting of the organisation held at La Sarraz Castle. In February 1929, CIAM's Chairman Karl Moser invited Markelius to propose members from other Nordic countries. It was thanks to his proposal that Aalto was invited to become a member.[278] Aalto attended two CIAM conferences and at least two CIRPAC meetings during the Paimio years.[279]

272 C.I.R.P.A.C. Comité International pour la Réalisation des Problèmes d'Architecture Contemporaine = Internationaler Ausschuß für Neues Bauen = International Committee for the Resolution of Problems in Contemporary Architecture. Giedion ed. 1931c, p. 210.

273 Le Corbusier, 1964a [1933], p. 187.

274 Walter Gropius (1883–1969) was an ideologist, a strategist, a designing architect and an educator. It is exceptionally true of Gropius to say that his thinking found true expression through interacting with people, in his architecture and in his writing, and he set great store by cooperation. Research and methodology were also of central importance to his work. Gropius served as the director of Bauhaus between 1919 and 1929 in Weimar and Dessau, after which he dedicated his time to housing design and, for example, CIAM.

275 Järventaus 1967, p. 433.

276 Aalto had made his first trip to Sweden in 1920 while still a student. His visits to Sweden became increasingly frequent and the trip from Turku was even shorter than from Helsinki or Jyväskylä. His friends Gunnar Asplund and Sven Markelius introduced Aalto around 1926 to a circle of architects who were interested in social and technological questions in architecture and were aiming to change Sweden into a welfare state. They also had direct contacts with Bauhaus, the Dutch De Stilj group and Le Corbusier in France. Schildt 1997a, p. 58 and Schildt 1997b, p. 58; Eva Rudberg has also described each individual relationship Aalto had with his Swedish colleagues in a book *Alvar Aalto i Sverige* (Alvar Aalto in Sweden). Rudberg 2005.

277 Heporauta 1999, p. 15.

278 Göran Schildt described the process of Aalto gaining membership in CIAM following a suggestion by Markelius. In addition to Aalto, Markelius also proposed membership for the Danish designer Poul Henningsen. Schildt 1985, p. 60; See also Rudberg 1989a, p. 50.

279 Aalto attended a meeting in Frankfurt am Main on September 25, 1930, preparing for the 1930 Brussels conference. Heinonen 1978, p. 241; He also included a visit to Zurich in the trip. Alvar Aalto's letter to Giedion, November 9, 1930. AAM; Aalto attended the "special congress" in Berlin in June 1931. Schildt 1985, p. 71.

CIAM demanded that architects had to be able to practise their profession observing the needs as well as the opportunities of their time. In CIAM's La Sarraz founding declaration, the founders expressed their refusal to rely on the methods of the past and proclaimed the necessity to redefine the concept of architecture to accommodate the changed ideological and material reality. The progressive architects recognised the profound impact of the Machine Age in social structures and the need to respond to the new situation by means of architecture. The members also called for reform in the training of architects.[280] The goal of CIAM was to actively introduce modern architecture to technological, economic and social decision-makers.[281] CIAM's representatives were instructed to seek collaboration with those who adopted the sense of the movement and not to rely exclusively on the existing architectural associations in their work. CIAM worked towards changing and challenging old power structures. Exhibitions and writing in trade publications as much as in the general press were key methods for the members to promote the movement.[282] CIAM had a clear publicity strategy.

CIAM convened for the second time in October 1929 in Frankfurt, followed by a conference in Brussels in November 1930, and for the fourth time as late as July–August 1933, by which time Paimio Sanatorium had already been completed, on the cruise ship *Patris II* sailing from Marseilles to Athens. In between these main conferences, CIRPAC convened on a number of occasions. In 1933, when the political atmosphere in Germany and in the Soviet Union changed, CIAM's scope of activity became increasingly restricted. The National Socialist government in Germany launched its campaign against modern art and architecture,[283] and in 1933, the Bauhaus school was closed down.[284] The school building, designed by Gropius, was designated to a Nazi party school and a pitched roof was constructed on top of its original flat roof.[285] An exception to the prevailing political situation was represented by architect Ernst Neufert, who had adopted the rationalist tenets of the

280 See the Declaration of La Sarraz, June 28, 1928. Le Corbusier 1964a [1933]. p. 28.

281 Giedion, the newly appointed secretary of CIAM to the Dutch architect and town planner van Eesteren in a letter dated June 10, 1928, quoted in Mumford 2002, p. 10.

282 Mumford 2002, pp. 24–27; Le Corbusier 1964a [1933], p. 28.

283 Barbara Miller Lane described how the National Socialist government leveraged the views of those who had been relegated to the opposition in the recent architectural debate on modern architecture: since new architecture found support both in capitalist and communist camps, it followed that architects representing the movement had to be "Bolsheviks" and "cut-throat capitalists"; on the other hand, the sociological and cultural critique of "industrial" buildings was associated with national and racist architectural theory that was to serve as an apology for historical architecture. Miller Lane 1985 [1968], pp. 136, p. 141 and p. 145.

284 Modern design was considered among German conservatives as "Bolshevist" and "left-wing". Bauhaus, the symbol of modern design, became a pawn in political conflict as early as 1924, before its relocation to Dessau. Gropius adamantly denied from the very beginning that the issue was in any way political. When Gropius resigned as the Director of Bauhaus Dessau in 1928, he was succeeded by the Swiss architect Hans Meyer, who changed the teaching content of the school radically in a more industrial direction and was a supporter of communism. He was dismissed in 1930, and replaced by the German architect Mies van der Rohe. Van der Rohe strived to defuse the politically charged situation by expelling students who were known to be left-wing. The school was forced to move from Dessau to Berlin in 1932 under duress from the National Socialists, continuing its operations in the new location until 1933, when the school was finally closed down. Droste 1991, pp. 113–114, p. 120, pp. 161–163, pp. 166–167, pp. 204–209 and pp. 227–236.

285 Mumford 2002, p. 76.

Bauhaus school and who was still able to continue his career despite changes both in the political climate during the Nazi regime and in postwar West Germany.[286] In the Soviet Union, Josif Stalin came to power and raised neo-classical architecture as the new ideal. Through such measures, Germany and the Soviet Union effectively politicised architectural expressions.

Incidentally, the completion of Paimio Sanatorium coincided with the end of the era conducive to rationalist architecture in the wider international context. Yet it must be pointed out that, in the Finnish context, modern architecture was never associated with political meanings to the degree that was the case in Germany and the Soviet Union. Modernism was, however, linked with left-wing sympathies even in Finland, as witnessed by an incident between architect Bertel Jung and Aalto at the Nordic Building Forum in 1932.[287] Jung had taken a cautiously positive view on Modernism two years earlier in his comment entitled "Functionalismi" (Functionalism), published in *Arkkitehti* (The Finnish Architectural Journal).[288] This would indicate that Jung's view on architecture became more politicised during the early 1930s. Jung enjoyed an established position and to mark his 60th birthday in July 1932, *Arkkitehti* published a short article praising his life's work particularly in the field of town planning, immediately after the episode at the Nordic Building Forum.[289] The editorial desk at *Arkkitehti* strived to strike a balance between the traditional and the modern and to avoid politicising architecture. Therefore, to counterbalance its earlier support shown for Jung, it published an article on urban development in the Soviet Union in its next December issue, written by Hans Schmidt,[290] who was Aalto's friend and had visited Helsinki in the autumn of 1932.[291] Schmidt was at that time the Director of the Moscow town planning offices in the Soviet Union.

I have analysed the talks[292] given by CIAM's two main ideologists, Le Corbusier and Walter Gropius at CIAM conferences in Frankfurt and Brussels alongside Aalto's correspondence with the Sigfried Giedion, the General Secretary of CIAM. Giedion never gave his own talks at CIAM conferences, but delivered Walter Gropius' papers, edited the conference publications and published articles on CIAM's activities in many other publications.[293] The talks have been analysed as published in the seminar

286 His book *Bauentwurfslehre* (Architect's Data), which for decades became a handbook for architects all over the world, was first published in Germany in 1936. There is a summary on Neufert's career in the first pages. Neufert 1980 [1936].

287 The issue was discussed by the Board of the Finnish Association of Architects and the association's court of honour. A reconciliation between the two was mediated by architect Carolus Lindberg. Schildt 1985, pp. 85–88.

288 Jung 1930, p. 59.

289 Brunila 1932, p. 25.

290 Schildt 1985, pp. 87–88.

291 Schmidt 1932, pp. 191–194.

292 Aalto did not hear the talks on the outward journey, and only participated in the meeting on the return trip. I have assumed that the talks referred to were discussed during the return trip.

293 Giedion's articles were published at least in the German *Bauwelt* (The Building Magazine) in addition through other channels that CIAM regularly used. Giedion also published books other than those related to CIAM's activities, including *Befreites Wohnen* (Freed Dwelling), Giedion 1929, which was published shortly before the Frankfurt conference.

publication of the conference. The Athens conference was held after Paimio Sanatorium had been completed, for which reason its role has been given secondary importance in the present analysis. I have, however, included a discussion of the Athens conference, because, firstly, it reflects the tense political atmosphere of the time, and secondly, I wanted to point out Aalto's approach to the situation. Although Aalto only attended the Frankfurt conference and part of the conference on-board *Patris II*, in addition to the CIRPAC meeting in Berlin in 1931, he received information through discussions, correspondence and publications. CIAM's main languages of communication were German and French. The speakers held their talks in either language.[294] In addition to his first languages Swedish and Finnish, Aalto was also fluent in German, but by all accounts his French[295] was quite poor, which may have affected his choice of personal contacts and which presentations he was able to understand.

This Chapter discusses Aalto's interaction with his peers during the sanatorium project and it has been organised by themes that were central to Aalto.

294 The researcher has no knowledge of whether the talks were interpreted. Both in the Frankfurt and Brussels conference publications, some of the texts were translated into English.

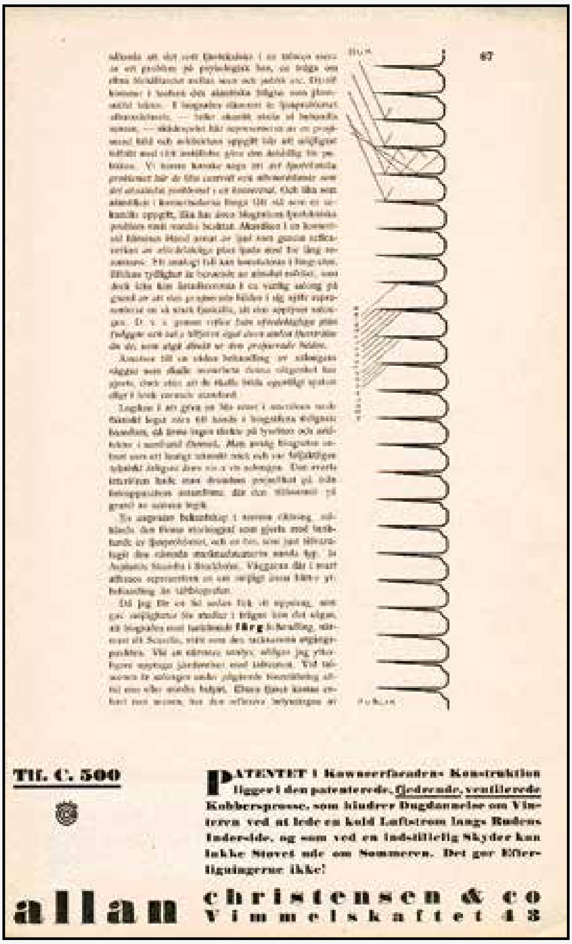
295 Aalto had taken only a few courses in French at school. He read Le Corbusier in German. See Schildt 1985, p. 57 and p. 62.

2.1 AALTO'S LITERARY OUTPUT

Aalto was a prolific writer even before CIAM's mandate. The articles of his that were included in the present study were selected based on their publication date and information content. In each of the selected articles, Aalto discussed the interface between architecture and technology from a different angle. Some of the articles have helped form a picture of his career and ideas in the years of the Paimio project. The project presentations published in *Arkkitehti* (The Finnish Architectural Journal) that he himself wrote, introducing all his designs from his Turku period were also included in this study. The volume *Alvar Aalto in his Own Words*, edited by Göran Schildt, and more specifically the articles he selected for the chapter "The Rationalist Utopia", have served as a key guide in the the selection of relevant articles for closer study. [296] The original texts have also been used and referred to as sources. The first of the articles, "Uusimmista virtauksista rakennustaiteen alalla" (The Latest Trends in Architecture) was published on New Year's Day 1928, in a Turku newspaper *Uusi Aura* (The New Dawn). In the present study, this article represented Aalto's career in the period before his CIAM memberships and is philosophical in its approach. The second article, "Asuntomme probleemina" (The Dwelling as a Design Problem),[297] which was published in 1930 in *Domus* magazine, was thematically linked with the 1929 CIAM conference Die Wohnung für das Existenzminimum (The Dwelling for Minimum Existence), the 1930 exhibition in Stockholm and the Minimum Apartment Exhibition curated by Alvar Aalto and Aino Marsio-Aalto in Helsinki in 1930. The focus of the article was on the home and the central theme was standardisation. In 1932, Sven Markelius invited Aalto to write an article for a special *Arkitektur och samhälle* (Architecture and Society) issue of the *Spektrum* magazine, which he edited together with Uno Åhrén. Aalto's article "Bostadsfrågans geografi" (The Geography of the Housing Problem) discussed technological systems in the context of town planning. The project descriptions on Paimio Sanatorium published in *Byggmästaren* (The Master Builder), *Arkkitehti* and the publication *Varsinais-Suomen tuberkuloosiparantola* (Southwestern Finland Tuberculosis Sanatorium) revealed how the architect wished to present the building to his peers. Observations on the evolution of Aalto's thought processes, the ideas expressed by the writings and the way their writer justified these ideas, were made. The concepts he used were focused, and how he considered them in relation to the conference talks given by Le Corbusier and Gropius. A further point of interest were the communicative strategies that Aalto employed in the three articles on Paimio Sanatorium, which were studied by analysing the target audience, illustrations and the combined impact of the imagery and text.

296 Schildt wrote an introduction to each chapter as well as individual article, shedding light on his own reading of the texts. The introductions debate, among other things, at whom the articles were targeted. Schildt also provided valuable insight into Aalto's exceptional methods: he might, for example, use the format of an interview in which he wrote both the questions and the answers. Schildt 1997a, p. 58, and Schildt 1997b, p. 58.

297 In my opinion, Schildt's translation, (The Housing Problem), of the original title "Asuntomme probleemina" is not accurate, as the article focuses on only a single apartment and its design. I have translated it as "The Dwelling as a Design Problem".



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Tlf. C. 500

PATENTET i Kawneerfacadens Konstruktion ligger i den patenterede, fjedrende, ventilerede Kobberspresse, som hindrer Dugdannelse om Vinteren ved at lede en kold Luftstrøm langs Rudens Inderside, og som ved en indstillelig Skyder kan lukke Støvet ude om Sommeren. Det gør Efterligningerne ikke!

allan christensen & co
Vimmelskaftet 43

Fig. 2.1a. A page of Aalto's article "Rationel biograf" (Rational Cinema), was published in the Danish *Kritisk Revy* (The Critical Journal). Aalto's diagram of sound absorbing wallpanels shows the reflections of sound waves. Aalto 1928d, p. 67.

With reference to international influences, the talks given by Gropius and Le Corbusier at the Frankfurt and Brussels seminars were analysed as well as the content of the exhibitions organised in conjunction with the seminars, as based on the original seminar publications.[298] I used Erich Mumford's *The CIAM Disclosure on Urbanism 1928–1960* as an introduction to the history of CIAM. I have also studied, as additional background material, a number of works and articles published by Le Corbusier, Walter Gropius and Sigfried Giedion, restricting my selection of material to those that Aalto was familiar with. Aalto's correspondence provided me with a deeper understanding of his relationship with certain people, such as Sigfried Giedion and Sven Markelius. Elected the General Secretary of CIAM in 1929, Sigfried Giedion was responsible for communication with CIRPAC. The communication mainly took place through circular letters. Giedion appears to have been highly proactive in fulfilling his role under the CIAM mandate. Correspondence between Aalto and Giedion was at its most prolific between 1930 and 1932.[299] Eva Rudberg's monographs on Sven Markelius and Uno Åhrén guided me to the central literary output of the two Swedish CIAM representatives and opinion-leaders.[300] Regarding Aalto's contacts with his Swedish peers, the focus in the present study was on the relationship between Aalto and Markelius.

298 Here, I am referring specifically to the 1929 and 1930 CIAM conference publications. See Giedion 1930a and 1931c.
299 The messages sent by Giedion to Aalto have survived and are included in Aalto's letter collection; the oldest of Giedion's letters dates back to summer 1930. AAM.
300 Mumford 2002, pp. 61–62.

2.2 THE SPHERE OF AVANT-GARDIST INFLUENCES

Alvar Aalto and Aino Marsio-Aalto's family and office moved from Jyväskylä to Turku in 1927. At that time, Turku was a dynamic, cultured city where people experienced and interpreted the new modern in many different ways.[301] Renja Suominen-Kokkonen has described the architect couple's relocation as an intellectual journey into the sphere of genuinely significant avant-gardist architects.[302]

Aalto had already earlier become friends with the Turku-based colleague Erik Bryggman, who had engaged himself in the architectural discourse of Germany and France and accumulated a collection of topical publications.[303] Bryggman visited the Weissenhof Exhibition, which was part of the Die Wohnung Exhibition, organised by the German Werkbund together with the City of Stuttgart, and familiarised himself with Bauhaus together with architect Ilmari Ahonen in 1928.[304] The programme of Deutscher Werkbund and Hermann Muthesius had become familiar for Finns through Heinrich Tessenow's book from 1916, *Hausbau und Dergleichen* (House Building and Such Things). Erik Bryggman was one of the conductors and interpreters of Tessenow's ideas. In the 1920s, Finnish professionals also absorbed ideas from Italy, and German influences were not adopted directly as such.[305] Aalto's library also included several international publications, such as *Bau und Wohnung* (Building and Dwelling), the exhibition catalogue of the Weissenhof Siedlung exhibition;[306] *Innenräume* (Interiors), which introduced the interiors, furniture and light fittings featured in the exhibition; and the German-language edition of Le Corbusier's *Vers une Architecture, Der kommende Baukunst*. Aalto probably acquired the latter publication in 1926 after having been introduced to Le Corbusier's ideas through Sven Markelius.[307] Further evidence supporting this timing is Aalto's article "Porraskiveltä arkihuoneeseen" (From the Stairway to the Living Room), which was published in *Aitta* (Granary) magazine in 1926 and shows clear influences adopted from Le Corbusier.[308]

301 See e.g. Mäkikalli and Grägg 2004, pp. 8–9.
302 Suominen-Kokkonen 2004, pp. 84–106.
303 Soiri-Snellman 2010, p. 63 and p. 68.
304 Suominen-Kokkonen 2007, pp. 68–69; Heinonen 1978, p. 96.
305 Heinonen 1986, pp. 50–53.
306 Held in 1927, the exhibition featured 31 permanent homes, designed by 17 architects from five different countries. The designers included Walter Gropius, Hans Scharoun and Peter Behrens as members of the German Werkbund as well as Le Corbusier, Pierre Jeanneret, J.J. P. Oud and Mart Stam. Joedicke ed. 1992 [1927]; Gold 1997, pp. 53–56.
307 Aalto met Sven Markelius in 1926. Suominen-Kokkonen 2007, p. 68.
308 Aalto 1926; Heinonen 1986, p. 277; See also Schildt 1997a, pp. 50–55, particularly p. 52, and Schildt 1997b, pp. 50–55, particularly p. 52.

Fig. 2.2a. Villa Stein-de Monzie in Vancresson designed by Le Corbusier and Pierre Jeanneret and built 1926–1927. Photographer Aino Aalto, 1928. Photo No. 106600. AAM.

Bau und Wohnung included Le Corbusier's German-language article "Fünf Punkte auf einer Neuen Architektur" (Five Points of New Architecture), which introduced the architectural and structural principles of his exhibition buildings Nos. 13 and 14: the columns, roof gardens, open plan spaces, the ribbon window and curtain walls.[309] Gropius' article was at least equally interesting. "Wege zur Fabrikatorischen Hausherstellung" (Ways to Industrial House Production) introduced building No. 16, which had been built using a semi-dry method, and building No. 17 which had been built using the fully dry method purely by installing prefabricated elements.[310] The special value of these articles lies in their practical approach, discussing real buildings, instead of focusing purely on theory. The illustrations include high-quality photographs both from the inside and the outside and clearly presented drawings. In my understanding, it was precisely this type of high-standard material that guided Aalto's theory formation and work.

309 Le Corbusier 1992 [1927], pp. 27–37.

310 Walter Gropius explained the principles of prefabricated houses in conjunction with the buildings he designed for the Weissenhof Siedlung exhibition. The house installed using the dry method was constructed in situ without any casting work. With a semi-dry method, Gropius referred to a method in which some of the construction work, mainly casting, was carried out in situ. Gropius 1992 [1927], pp. 59–67.

Fig. 2.2b. Alvar Aalto, Sven Markelius' wife Viola Wahlstedt, Sven Markelius and an unknown person. Photo No. 106265. AAM.

The exhibition publication *Innenräume*, introducing the interiors featured in the Weissenhof Siedlung Exhibition, includes a picture supplement of more than a hundred pages, in which the interiors have been grouped into series, illustrating types of spaces and furnishings as well as light fittings. The second part, consisting of short articles, begins with Le Corbusier's article "Die Innenausstellung unserer Häuser am Weissenhof" (Our Houses at Weissenhof). He asks, "Was heisst Möblierung?"(What is Furnishing?) Le Corbusier called for more functional and inexpensive furniture and spoke in favour of standardisation. For example, by combining standard-size tables, even a small flat could accommodate a large dining table, when necessary. Chairs and the new concepts of seating were clearly of great interest to Le Corbusier. In his opinion he was able to improve the furnishability of the experimental houses he designed by using pocket doors and integrated cupboards. The Stuttgart Exhibition represented a continuation of the themes that Le Corbusier had exhibited at his 1925 Pavillon de l'Esprit Nouveau in Paris. He felt that the innovation in furniture design was primarily founded on a new spirit and shared optimism, and only then on handmade prototypes, followed by industrial production.[311]

311 Le Corbusier 1928a, pp. 122–125.

Aalto studied the Bauhaus school initially through publications and experiences recounted by his friends. The objective of the school was to bridge the gap between different disciplines of visual arts and industrial production methods. Established in 1919, the slogan of the school was initially "art and craft", changed in 1922 into "art into industry". Bauhaus wanted to develop housing in a way appropriate to the times, its scale ranging from simple household items to a complete house. The school adopted the method of systematic experiments on form, technology and economics. Architecture gained an increasingly central role in the school's teaching in the wake of the establishment of its architecture department in 1927. It was first headed by the Swiss architect Hannes Meyer, who also served as the Director of the school. Under the leadership of the openly left-wing Meyer (1927–1930), the teaching became politicised and he was eventually dismissed from his post.[312] His successor, Mies van der Rohe, strived to relieve the pressures created by the increasingly tense political climate in Germany and to develop Bauhaus as a politically neutral school of architecture and applied arts.[313] Some of the ideas of Bauhaus were conveyed to Aalto by László Moholy-Nagy, who taught at the school, was a close collaborator of Gropius and visited the Aaltos in Finland with his partner during their trip to the Nordic countries in summer 1931.[314]

Bauhausbücher, the Bauhaus book series, discussing artistic, social and scientific issues from topical perspectives, began to be published in 1925.[315] The first volume to be published was Walter Gropius' *Internationale Architektur* (International Architecture). According to Gropius, new architecture was about combining architecture and technology and about penetrating to the very essence of phenomena. Designs, whether for a piece of furniture or an entire house, had to be functional. In his view, examining the problematics of a building was always linked with mechanics, statics, optics, acoustics and the world of interrelations. For him, matter and structure embodied interrelations in the way that the designer had intended. The aim of modern architecture, as far as Gropius was concerned, was to move away from personal and national towards objectivity.[316]

The books included a magnificent series of images on topical architecture from one-family homes to cities. The main focus was on residential buildings (42), factories (20) and offices (12). The designs for blocks of flats incorporated the ideal of social responsibility. The frame designed by Marcel Breuer, introduced in *Internationale Architektur,* was in terms of basic structural concept and rhythm reminiscent of the frame of A wing at Paimio Sanatorium.[317] The featured one-family houses included homes for the wealthy as well as studies on houses that could be serially produced. The

312 Droste 1991, pp. 190 and 196–200.

313 Droste 1991, pp. 204–238.

314 Göran Schildt has described Moholy-Nagy's and Aalto's friendhip. Schildt 1985, pp. 70–78.

315 Hahn 1981 [1925], p. II.

316 Gropius 1981 [1925], p. 7.

317 The projects had such titles as "Entwurf zu einem Miethausblock", "Entwurf zu einem Grossen Miethaus" or "Modell zu einem Etagenhaus für Kleinwohnungen" (Sketch for an Apartment Building; Sketch for a Large Apartment Building; or Model for a Block of Flats). Gropius 1981 [1925], especially p. 90.

captions were short, and typically listed the materials used. Reinforced concrete was the dominant material in the featured buildings.[318] The images in the book included photographs of completed projects as well as models and drawings. The photographs usually showed a general view, the front façade of the building, the building from an angle, a street view or even an aerial view.[319] Some images highlighted the concrete structure.[320] Gropius' Master's Houses and Le Corbusier and Pierre Jeanneret's Pessac housing development were photographed from a completely new, low angle that drew attention to the experience of an individual.[321] In addition to photographs, the images included axonometric, elevation and perspective drawings. Some of the projects illustrated had not been completed.[322]

Gropius' choice of images showed that he placed great importance on unfinished projects as being indicative of the direction of development. By juxtaposing photographs and drawings, unrealised projects began to seem more real in the mind of the reader. *Internationale Architektur* was forward-looking and did not merely settle on reporting past development. The typology of the featured buildings also revealed what type of functions Gropius considered topical. Housing was the most important theme, and the selection of works highly international. The dominant building material, reinforced concrete, was at the core of the book's message.

In the architectural view held by Bauhaus, rationality was linked with the material side of architecture, its structuralism and pursuit of economical solutions. Gropius maintained, however, that the task of architecture was also to give aesthetic pleasure to the human soul. For him, the new method of building allowed for a new kind of spatial thinking. While construction was a question of method and materials, architecture was spatial art.[323]

Aalto's reportage "Uusimmista virtauksista rakennustaiteen alalla" (On the Latest Trends in the Field of Architecture)[324] was published on New Year's Day 1928 in the most widely distributed newspaper of Southwest Finland, *Uusi Aura* (The New Dawn), which was an organ of the National Coalition Party. Aalto's aim with the article was to demonstrate to people of influence in Turku his stature, level of knowledge and international contacts. In 1928, the economic outlook was still positive and there was optimism and expectation in the air. The article was built on clever, emotionally charged

318 The steel structure is mentioned for 17 and glass for 13 images. Brick was used in load-bearing structures in at least 13 projects, while only one had a timber frame. At least two projects had a hybrid frame combining several materials. Gropius 1981 [1925].

319 The books show aerial photographs the Bauhaus Building in Dessau, Fiat factory in Turin, wooden market stalls designed for Moscow by K.S. Melnikov and Manhattan Island. Gropius 1981 [1925].

320 These included, among others, images of Freysinnet's airship hangar and E. Norwert's power plant in Moscow. Large interior spaces and their arches were also featured in the photographs, including P. Berlage's Amsterdam Stock Exchange, Brothers Perret's H. Esders atelier in Paris, and Bruno Taut's carrle auction hall in Magdeburg. Gropius 1981 [1925].

321 Gropius 1981 [1925], p. 63 and p. 84.

322 Gropius 1981 [1925].

323 *The New Architecture and the Bauhaus* by Gropius sheds light on the reasons for establishing Bauhaus and the fundaments of its approach to teaching. It was published in English originally as early as in 1935. Gropius 1998 [1935], p. 24.

324 Aalto 1928a, p. 11.

juxtaposition of text and images, which was likely to arouse interest in new architecture as well as the writer of the article himself – Aalto's intention was to stand out to his advantage and win new customers. Aalto masked the article as an interview with a busy architect of high professional calibre explaining key questions of modern architecture.

Aalto used the dialogue between traditional and new realism as an effect that created intriguing tension and symbolised this with the image of scales. In the illustration used for the article, he likened classical columns to the products of the Machine Age. Representatives of the new "sober European architecture" included his own design for the Vyborg Library, Gunnar Asplund's design for the Stockholm Public Library, which was under construction at the time, and Erik Bryggman's Atrium Apartment Building in Turku. Images of a turbine and the bomber Goliath were borrowed from Le Corbusier's work *Vers Une Architecture*. Aalto included in his illustrations only examples that he considered to hold merit – his style was provocative, but always positive. "New realism" represented Zeitgeist and a typology-generating process for Aalto. He also spoke about "neo-monumentalism" when introducing Bryggman's work, although he refrained from explaining the term. He understood architecture as a process, a dynamic movement. New form required new content.

Structure could also prove to be an architectural challenge that invited the designer to create a new form, type or concept, even if the building was for a traditional use. In his view, Modern art, however, was only possible once both the function and social content are new. The article also contained a moral message: a socially and technologically progressive environment offered the biggest potential for architecture that expressed the essence of the period. Aalto understood "industrialism" as cultural change and an inevitable development path, and expected it to take the position of a harmonious cultural factor. According to Aalto, architecture should be constant with the times. From a European perspective, *Vers Une Architecture* was no longer a new publication in 1928, when Aalto published his own article reflecting on the thoughts and mode of communication adopted by Le Corbusier, but in Finland, the aspects as discussed by Aalto were still interesting to the general public.

2.3 "MY LATEST BUILDINGS WILL BE BUILT EXCLUSIVELY FROM CONCRETE"

The quotation in the heading is from Aalto's interview for the *Sisä-Suomi* (Inner Finland) newspaper, which the architect had edited himself.[325] Alvar Aalto was successful in architectural competitions in the late 1920s and, as a result Turku became the main geographical focus of his work and concrete one of the central challenges in all his projects. As a break of the past years, the main material of his new building designs at the time was reinforced concrete. Aalto's career experienced a new boost when he won the architectural competition for Southwest Finland Agricultural Cooperative Building in spring 1927 and for Vyborg City Library at the end of the same year.[326] Alongside his competition work, in November 1927Aalto was also commissioned by factory owner Juho Tapani to design an apartment building in Turku.[327] In 1928 he got a commission from a local newspaper owner Arvo Ketonen to design the Turun Sanomat Newspaper Building. The Aaltos understood that they had an unprecedented opportunity to apply their avant-gardist views in these projects. Adopting new expression and an innovative method of execution took courage, which the architects Aino and Alvar bolstered by familiarising themselves with topical buildings built on the Continent.

In early summer 1928, the Aaltos made a long study trip to Denmark, the Netherlands and France. On their trip, they met Poul Henningsen, Alfred Roth, Le Corbusier[328], André Lurçat and Johannes Duiker.[329] They studied topical buildings, such as the Zonnestraal Sanatorium in Hilversum,[330] completed in the same year. In Paris the couple was hosted by the French Modernist André Lurçat. Their visit was timed only days before the CIAM founding meeting, which was attended by both Le Corbusier and Lurçat.[331] They likely had the opportunity to visit La Villa Seurat artist community, designed by Lurçat and consisting of Modernist, three-storey private homes built along a cul-de-sac in Paris.[332] Since one of the houses was designed by Lurçat for his brother, one may assume that he had a personal relationship with the customers in the community, and the Aaltos would probably have been allowed to see the inside of some of the houses as well. Amédée Ozenfant's studio (1922–1924), designed by Le Corbusier, is located close to the La Villa Seurat, and a visit there was probably part the day's programme.

325 Aalto 1928c, p. 3.

326 Simo Paavilainen and Kristiina Nivari have described the different sketching stages of the Vyborg City Library in their articles. The building of the library was delayed by several years, being eventually built on the basis of a master drawing dated as late as 1933. The design of the Vyborg City Library took place, in other words, after the completion of Paimio Sanatorium and is therefore excluded from the present discussion. Paavilainen 1990, pp. 9–18; Nivari 1990, pp. 19–34.

327 Aalto 1929d, pp. 96–97.

328 According to Renja Suominen-Kokkonen, the Aaltos may have met Le Corbusier in Paris in June 1928, unlike Schildt had previously asserted. Suominen-Kokkonen 2007, pp. 70–71.

329 Heporauta 1999, p. 18.

330 Heinonen 1986, p. 239–240.

331 Schildt 1985, p. 55 and p. 58.

332 Maison Jean Lurçat (1924–1925), Maison Goerg et Gromaire (1925), Maison Pierre Bertrand (1925), Maison Madame Bertrand (1925), Maison Quillé (1925), Maison Townshend (1926), Maison Arnold Huggler (1926) are designed André Lurçat. Cohen 1995, pp. 30–40 and 287.

Fig. 2.3a. Aalto applied all the five points of new architecture defined by Le Corbusier to his design of the Turun Sanomat Newspaper Building. Photographer Gustaf Welin, around 1929. Photo No. 62-005-040. AAM.

Fig. 2.3b. Turun Sanomat Newspaper Building roof terrace. Photographer Gustaf Welin, around 1929. Photo No. 62-005-083. AAM.

Fig. 2.3c. Turun Sanomat Newspaper Building printing hall and its asymmetrical columns. Photographer Gustaf Welin, around 1929. Photo No. 62-005-103. AAM.

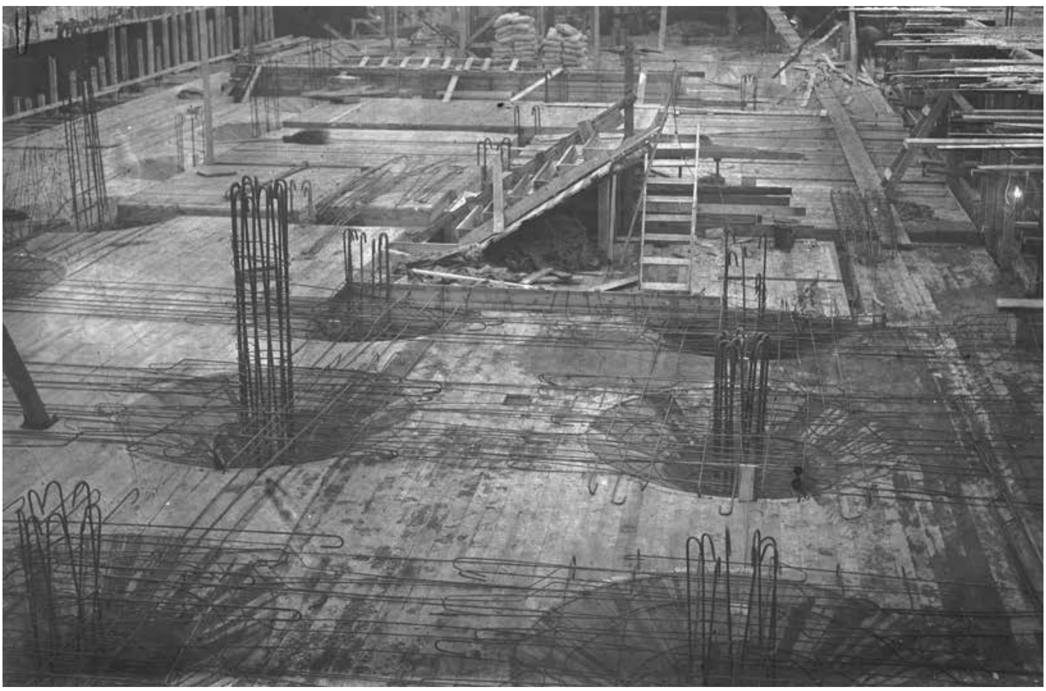

Fig. 2.3d. Casting the beamless reinforced concrete ceiling of the Turun Sanomat Newspaper Building. TS.

Alvar Aalto and Aino Marsio-Aalto visited the interior of Villa Jeanneret-Raaf (1923–1925) and saw Villa La Roche from the outside.[333] Aino Marsio-Aalto took photographs of Villa Stein De Monzie (1927–1928), which they also visited.[334] In Paris, the Aaltos met Le Corbusier.[335] Aalto also saw Lurçat's sketches of a hotel he had designed for the Mediterranean coast, and its asymmetrical windows made such an impression on Aalto that he reiterated the idea in his competition entry for Paimio Sanatorium.[336]

Renja Suominen-Kokkonen has emphasised the influence of the trip to Paris and Le Corbusier's work on the design of Turun Sanomat Newspaper Building.[337] The master drawings of the Turku project were completed in October 1928 immediately after the trip, but the building permit was issued only in late April 1929. Since the building was technically extremely modern, it may be assumed that the authorities required structural calculations before granting the permit. These calculations are not, however, housed in the city archives.[338]

The 700th Anniversary Exhibition of the City of Turku, designed jointly by Alvar Aalto and Erik Bryggman, was open to the public in 1929 for one week only.[339] Other Turku projects were completed in rapid succession and Aalto presented the Southwest Finland Agricultural Cooperative and the Standard Apartment Building as well as the Turku 700th Anniversary Exhibition design in *Arkkitehti* (The Finnish Architectural Journal) in summer 1929.[340]

Aalto expressed regret in the project description for the Southwest Finland Agricultural Cooperative Building that the internal "heterogeneity" impeded his design work, as the theatre hall was also to be used as a conference space. The dilemma troubled the architect, as he could not clearly define the design problem. Aalto recounted that he designed the interiors only for some of the spaces. He introduced his team,[341] the most important contractors and the building material manufacturers,[342] but left, for example, the structural engineer Emil Henriksson uncredited. Henriksson had drawn up the structural design for the Agricultural Cooperative in July–December 1927, partly overlapping with the design of the master drawings.[343] Aalto reported having used as many standard parts in the interior as possible and having designed a few standard pieces in the course of the work, including the letter and advertisement system, the lit concrete

333 Suominen–Kokkonen 2007, pp. 70–71.
334 See e.g. Schildt 1985, pp. 57.
335 Suominen-Kokkonen 2007, p. 63.
336 Cohen 1995, pp. 112–113; Schildt 1986, p. 57.
337 Suominen-Kokkonen 2007, p. 63.
338 Building permit documents. Archive reference VI-4-4. TKA.
339 The exhibition was open June 15–23, 1929. Soiri-Snellman 2010, pp. 66–67.
340 See Aalto 1929a, Aalto 1929d and Aalto 1929c.
341 At Aalto's office, the design work was contributed to Aino Marsio-Aalto, Harald Wildhagen, Erling Bjertnæs, Kerttu Tamminen, Erkki Beckström and Totti Strömberg. Aalto 1929a, pp. 83–88.
342 The main contractor was Juho Tapani and the site supervisor was master builder Axel Löfström. The windows and doors were made of the Dutch Crittal-Braat steel profiles with bronze fittings and with partly single, partly double glazing. The buildings were installed with light fittings by Poul Henningsen as well as by light fittings from the Taito, Kaune and Koristamo factories. The restaurant interiors were partly manufactured by Huonekalu- ja Puutyötehdas in Turku. Aalto 1929a, pp. 83–88.
343 Building permit documents for the Southwest Finland Agricultural Cooperative. Archive Reference VII-20-4. TKA.

Fig. 2.3e. Standard Apartment Building. Photographer Aino Marsio-Aalto, 1928. Photo No. 82-001-003. AAM.

Fig. 2.3f. Southwest Finland Agricultural Cooperative Building. Photographer Gustaf Welin, 1928. Photo No. 46-008-022. AAM.

stairs, a handrail detail, corridor lighting, a café table and a door handle.[344] Aalto's holistic approach shows Continental influences.

In the project description of the Standard Apartment Building[345] Aalto reported having been commissioned by a Turku based businessman and innovator Juho Tapani to investigate the feasibility of the patented Tapani concrete slab in the construction of the standard apartment house.[346] There was a great deal of scepticism with regard to the use of concrete structures in building. It was feared that they made for humid and cold buildings. The inventor was compelled to build an apartment building himself to be able to prove the feasibility of his system.[347]

The technologically innovative building frame was based on Tapani's patented concrete brick and intermediate floor slabs.[348] Presumably, the hollow concrete brick used in the load-bearing vertical structures was the same one that Juho Tapani patented in 1931.[349] These load-bearing walls also served as ventilation ducts and risers for piping. Aalto described how sound insulation had been achieved using cork, and emphasised the method of breaking up the design tasks into smaller sub-projects as prescribed by his new design method: "The dampening of the echo has been approached as a separate function, as is natural in the case of a concrete building."[350]

The architect chose the apartment as his basic unit in the floor plan and aimed to develop the unit of one or several rooms into a standard that could be repeated. He placed the bedroom on the sunny side of the building and assigned the central part of the dwelling as a shared family space. The larger flats had a room for the maid, which was still in line with the social order of the time. One of the flats in the Standard Apartment Building was finished and decorated as a showroom for the Turku Fair. Aalto described it as a design experiment with the purpose of showing that decorating and furnishing a home need not be costly. Aalto also introduced his team and the foreman Väinö Tähtinen in his article.[351] Tähtinen became later one of the clerk of works at the Paimio Sanatorium building site.

The Standard Apartment Building, which was owned and built by Tapani and whose structures were scaled by Henriksson, has a load-bearing frame that was completely

344 Aalto 1929a, pp. 83–88.

345 Aalto 1929d, pp. 96–97.

346 Juho Tapani was an inventor who had patented reinforced concrete structures and related structural systems mainly in the early 1910s, including the Finnish Patents of a concrete bridge No. FI6911, a reinforced concrete loading vessel No. FI1501, a reinforced concrete oven No. FI4962, a concrete door or window frame No. FI4906, a concrete building slab No. FI4775, an additional Patent to the latter No. FI4775, a concrete brick No. FI14093, and a reinforced concrete roof No. FI4992. Patent documents. NA.

347 The first apartment house was in Horttokuja 1. Later projects included Maariankatu 12 and Aurakatu 22, which was the largest apartment building in Turku in the 1920s. The latter two projects were housing companies established by Tapani in his role as a developer. Kankaanpää 1997, p. 71.

348 Aalto 1929d, pp. 96–97.

349 Concrete brick patent No. FI14093 was issued in 1931, while the other patents for Tapani's designs were issued much earlier. Many of the patents carried the name Tapani: Tapani bridge, Tapani reinforced concrete vessel, Tapani oven etc. Patent documents. NA.

350 Aalto 1929d, pp. 96–97.

351 The construction work was carried out by master builder Väinö Tähtinen, paid for by Juho Tapani. In addition to Aalto, the work and its management were participated by Aino Marsio-Aalto, Harald Wildhagen and Erkki Backström. Aalto 1929d, pp. 96–97.

Fig. 2.3g. The huge auditorium with a flat ceiling of the Southwest Finland Agricultural Cooperative Building. Photographer Gustaf Welin, 1928. Photo No. 46-008-046. AAM.

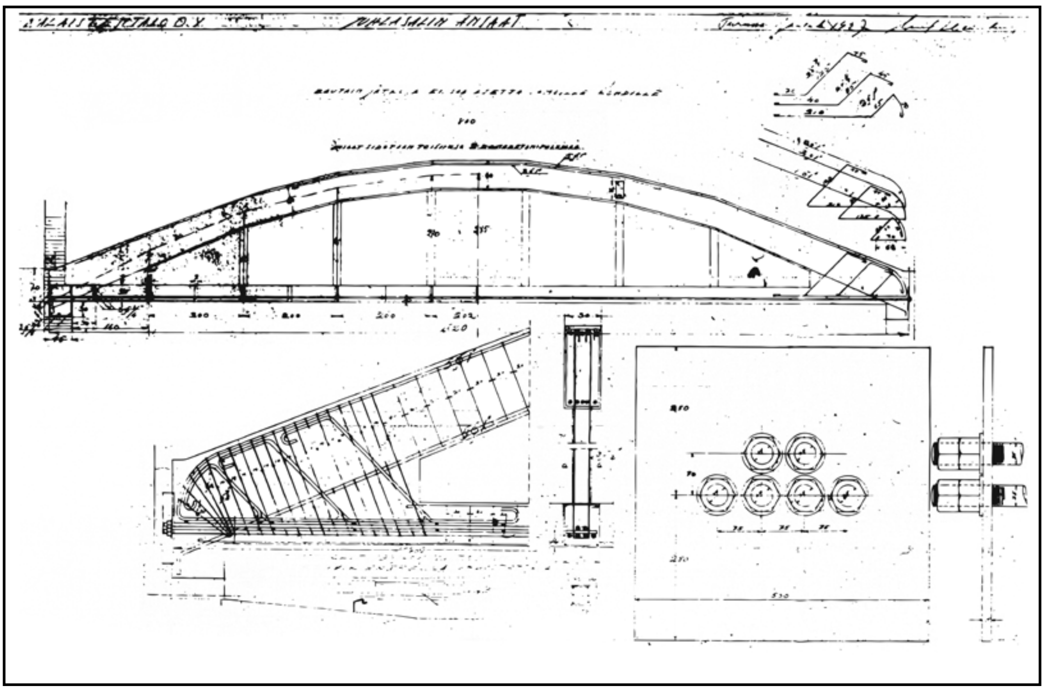

Fig. 2.3h. The Roof truss structures of the auditorium of the Southwest Finland Agricultural Cooperative Building made the flat ceiling possible. Emil Henriksson's structural drawing. The drawing has been edited. TKA.

separate from the heat-insulating structure. The load-bearing transverse partition walls were made of prefabricated Tapani slabs, which supported the longitudinal intermediate floor beams. The external wall only served the function of heat insulation. Aalto wrote in *Rakennustaito* (The Finnish Construction Magazine): "The façade of the building, a light-weight wall supported entirely by beams, is to be completed only after the building has been waterproofed with the roof. Part of the façade is formed by the outer beam on each floor, while the remaining sections beneath the windows are made of cored brick laid on top of the beam. This means that the question of heat insulation on the external wall is treated completely separately from the load-bearing question. It was treated merely as a matter of insulation. The insulation of the external wall was partly based on the air contained in the cored tiles and the expanded cork covering the whole of the inner surface of the external wall."[352]

The innovators of concrete bricks had long been trying to resolve the question of load-bearing, heat-insulation and waterproofing with one single structure. Achieving an adequate level of heat-insulation had proved a difficult challenge. Aalto's solution for the Standard Apartment Building, which he developed together with Henriksson, was based on a completely different approach. He treated the functions of insulation and load-bearing as separate, from which it followed that the thermal conductivity of reinforced concrete no longer presented a problem. In terms of the material qualities, the Standard Apartment Building is all but optimal.[353] The structure of the Tapani concrete slab was designed to prevent the conduction of heat from the inside to the outside. Since the load-bearing structure in the Standard Apartment Building remained mainly inside the frame, its only function was to stand as the supporting structure and its conductivity qualities became irrelevant. As Finnish historian Jari Kankaanpää pointed out, the Standard Apartment House put an end to the Tapani concrete slab in the design-philosophical sense.[354]

The name of the building project was a rhetorical statement from Aalto, who used the title to emphasise the modern building typology and topical international architectural ideology it represented. He also probably wanted to avoid the use of the "Tapani" epithet. Discussing the aspects of standardisation, construction technology and acoustics showed how central the technological questions were from the point of view of design. Juho Tapani hired Aalto as the designer because he believed Aalto to be a person qualified to resolve technology issues but also to explain them to the public. This strategy was crucial for Tapani, as the success of his Tapani bricks and their popularity as a building material had crumbled because of their poor heat insulation qualities. He was, in other words, keen to boost the sales of his own products. However, Aalto resolved the structural problem of the Standard Apartment Building by separating the load-bearing and insulating structures, which meant that the improved insulation qualities of the Tapani

352 Aalto 1928b, p. 76.
353 Kankaanpää 1997, p. 80.
354 Kankaanpää 1997, pp. 80–81.

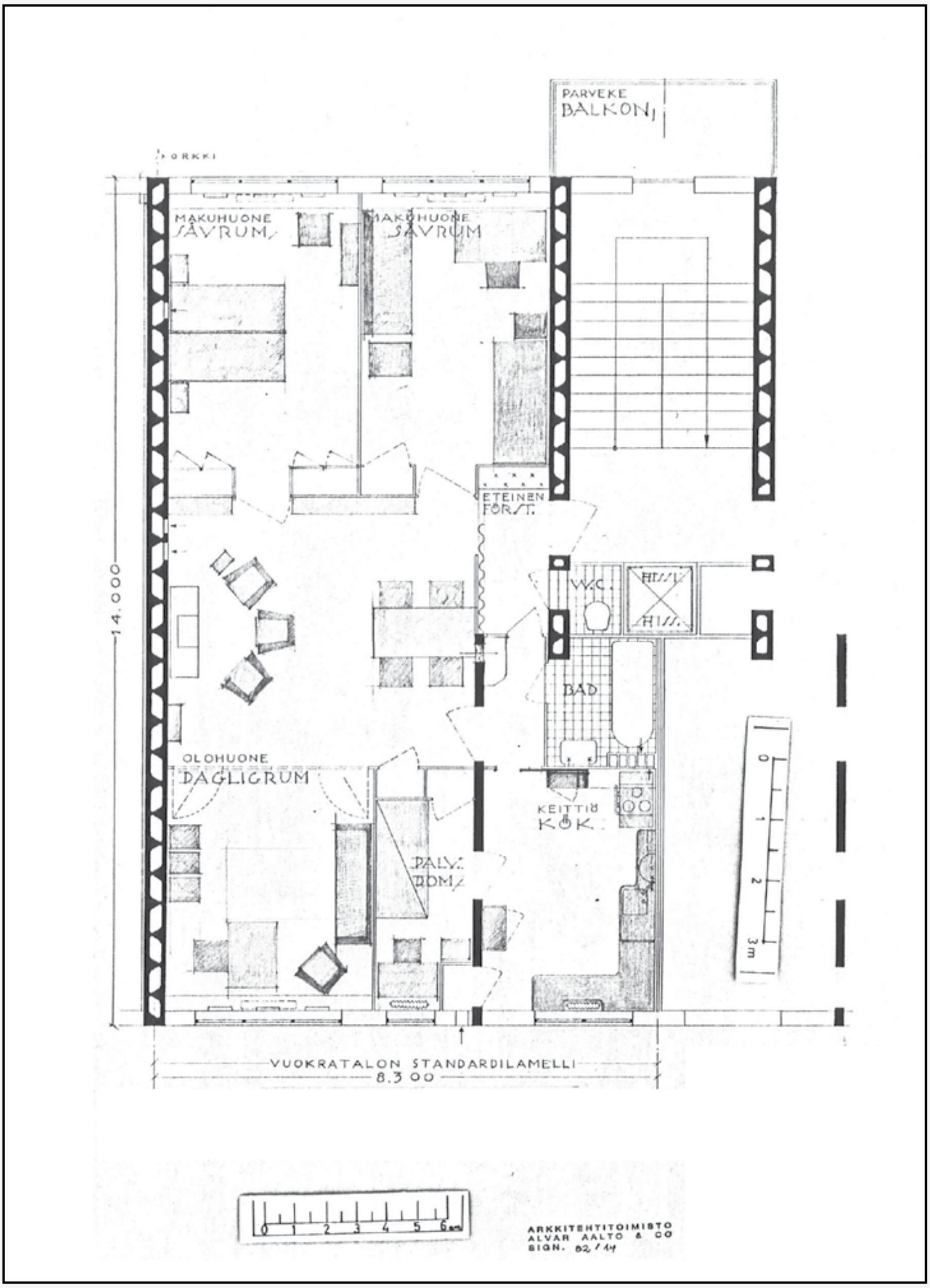

Fig. 2.3i. The Aaltos organised a showcase apartment from the Standard Apartment Building as part of the Turku Fair. They aimed to furnish the apartment with serially produced furniture at as low a cost as possible. The floor plan of the exhibition apartment. Drawing No. 82-14. The drawing has been edited. AAM.

brick were now redundant as the product was used merely for load-bearing structures. Aalto did, however, make use of the cavities inside the bricks for pipes to legitimise the use of the product. In the case of Standard Apartment Building, Aalto was not, in other words, loyal to the commercial pursuits of his customer, giving priority to solving the structural question and following his own ambitions. It is obvious that this damaged the relationship between Juho Tapani and Alvar Aalto. Although Emil Henriksson served as the structural engineer in the Standard Apartment Building project, Aalto never credited him as a member of his team in the project description in *Arkkitehti* (The Finnish Architectural Journal). Such selective use of information bolstered Aalto's image as an expert in concrete structures. These roles became evident from the building permit documents, which did not include structural drawings.[355]

The industrial art trade show, Suomen Messut (Finnish Fair), continued the series of events to mark Turku's 700th anniversary in 1929. Aalto wrote that the designers, Erik Bryggman and himself, had mainly aimed to develop a building system that would be both economical and individual. Aalto compared the trade fair structures to row houses, explaining that as many stands as necessary could be added. The contract offers had, according to the architect, been requested for a running metre of structural units. In Aalto's view, organising the actual trade show was a simple matter of assembling prefabricated elements. The architect's task was to design the overall composition for the space. He praised the cost savings afforded by the use of standardised elements.[356] The master plan for the area was originally created by Bryggman. Elina Standertskjöld has argued that Bryggman's staggered exhibition stands were modelled after Ernst May's terraced houses, and that the graphic expression of the architect had been influenced by Bauhaus books, *Das Neue Frankfurt* (The New Frankfurt) magazine and the Danish publication *Kritisk Revy* (The Critical Journal).[357]

In the project description of the 700th anniversary exhibition published in *Arkkitehti*, Aalto used several expressions that were foreign to the Finnish language or difficult to grasp, such as "panoramic overall composition", "row pavilion", "added publicity", "function", "terminal" and "standard". The use of these terms reveals the architect's intention of creating an impression of his work being scientifically sound. By introducing the exhibition structures, he emphasised the rationality of developing a flexible, serial system instead of building new, individual exhibitions from scratch. He argued that such a system would be economical but did not specify further whether savings were actually achieved.[358]

The following summer in 1930, Aalto introduced the Turun Sanomat Newspaper Building to his Finnish peers in *Arkkitehti*. Aalto wrote that the challenge had been to design a building with good lighting and communication arrangements on a narrow but deep plot. Upon its completion, the building housed the newspaper printing presses, the

355 Archive reference VII-30-3. TKA.
356 Aalto 1929c, pp. 99–100.
357 Standertskjöld 1991, pp. 112–114.
358 Aalto 1929c, pp. 99–100.

stereotype room,[359] offices, the editorial offices and retail, office and residential spaces for let. Aalto wrote about the "dualism" of the building, referring to the division between the spaces occupied by the newspaper and the spaces that were let to outsiders. He drew particular attention to the seven-metre-tall window, onto which the image of a newspaper was projected, a façade within façade. He also introduced the structural system of the reinforced concrete building that had a flat roof with a roof garden, mentioning especially the ventilation, advertising technology, wiring routes and iron windows. Emil Henriksson carried out the structural calculations and Harald Wildhagen from Aalto's office was in charge of the drawings and supervision. Other contributors to the project were Aino Marsio-Aalto and Erling Bjertnæs.[360]

Schildt had the opportunity to interview Harald Wildhagen and Erling Bjertnæs, the Norwegian architects who worked at Aalto's office during the Turku period. According to Schildt, the collaboration between the architect and engineer was governed by the Staplemohrian model: the engineer set the boundary conditions within which the artist-architects would realise their instincts. In Schildt's view, the columns of the printing hall of the Turun Sanomat Newspaper Building were the result of collaboration between Emil Henriksson, Harald Wildhagen and Alvar Aalto.[361] Here, Schildt followed the general approach in art-historical research to the tectonics in architecture: structures were not considered from the perspective of execution or, for example, the difficulty of the novel realisation process, but from that of ideas and formal motifs.

During his Turku years, Aalto also formed a collaborative network with local professionals and companies who shared his approach and who contributed to his projects to varying degrees. It was likely that Aalto was introduced to Turku-based builder circles by Erik Bryggman, as some of them, such as master builder Arvi Ahti[362] and engineer Emil Henriksson, who had previously worked with Bryggman, would later participate in projects with Aalto as the architect. Architect colleague Ilmari Sutinen from Turku, contributed to the creation of CIAM exhibition sheets with Aalto. Aalto's collaborative network during his Turku period included other notable businessmen and companies, such as the furniture manufacturer Otto Korhonen and his company Huonekalu- ja Rakennustyötehdas (Furniture and Building Work Factory), the Turku shipyard Crichton-Vulcan,[363] factory owner and contractor Juho Tapani and lighting designer Paavo Tynell and his manufacturing company, Taito Oy.[364]

359 The stereotype room was a space were printed matter using metal or wooden printing plates was produced. For example, some of the special typefaces and symbols were printed with plates. Personal conversation with Päivi Hovi-Wasastjerna on December 23, 2011.

360 Aalto 1930c, pp. 82–90.

361 Schildt was referring to an article on the expressive potential of concrete architecture, published in 1927 in *Byggmästaren*. Schildt 1985, pp. 45–46; Stapelmohr, O. von. 1927, pp. 75–80.

362 Arvi Ahti (Fagerroos) was born in 1888. He trained as a master builder at Turku Industrial School graduating in 1911 and made study trips to Sweden, Denmark, Germany, France and the Netherlands. Ahti worked as a building contractor from 1916 onwards. He was a member of the committee in the Finnish Association of Master Builders between 1928 and 1933, the member of the board of its Turku division and its chairman from 1923 onwards. Talvitie 1936, p. 28.

363 Suominen-Kokkonen 2007, pp. 51–52.

364 The first mention of Taito Oy in Aalto's materials appears in the project description of the Southwest Finland Agricultural Cooperative Building. See Aalto 1929a, p. 85. Poutasuo has argued that the collaboration between the two began only with Paimio Sanatorium. Poutasuo 2005, pp. 28–30.

2.4 THE DWELLING FOR MINIMUM EXISTENCE

All of Aalto's significant designs from his Turku period were underway before he came into direct contact with CIAM, in other words, before the 1929 conference in Frankfurt am Main, and some were even completed before this. Both Aalto and Markelius attended the second CIAM conference, Die Wohnung für das Existenzminimum, which was held in Frankfurt am Main October 24–26, 1929 with "Minimum Apartment" as its theme. The conference was attended by 130 architects from 18 countries. The Nordic countries were represented by seven delegates.[365] The New York Stock Exchange crashed on the first day of the CIAM conference. The timing most likely also caused personal difficulties for Aalto, as he was to finalise the master drawings for Paimio Sanatorium by the beginning of December. Yet the timing was also most opportune from the perspective of developing the carrying themes in the Paimio Sanatorium designs.

Frankfurt had been selected as the CIAM conference location owing to its exceptionally progressive housing policy, which had been put into action since 1925 under the leadership of architect Ernst May.[366] The seminar programme included an excursion to the new Frankfurt residential developments of Höhenblick, Praunheim, Römerstadt, Bornheimer Hang and Niederrad, which were based on serial production.[367] May succeeded in engaging many different stakeholders and institutions with either a direct or indirect interest in aesthetic design. He extended his reformist programme to include interiors, furniture and home fittings as well as marketing, communications and typography relating to the dwellings.[368] The homes were well-appointed and the costs incurred by the conveniences were deliberately compensated with efficient spatial design.

The international exhibition which was held in conjunction with the conference on the minimum apartment exhibited some one hundred floor plans from different countries, designed to the same format. These were also introduced in *Die Wohnung für das Existenzminimum* conference publication, with examples grouped by typology into detached, semi-detached, multi-family houses and special cases. Each example had their floor area, volume and window area specified. The conference publication also included English summaries of the key papers given in French or German. The exhibition then went on tour in several European cities following the conference.[369] Finland

365 Edvard Heiberg and Poul Henningsen (1894–1967) for Denmark; Aalto for Finland; Lars Backer (1892–1930) and Fritjof Stoud Platou (1903–1980) for Norway; Sven Markelius (1889–1972) and Gunnar Sundbärg (1900–1978) for Sweden. Giedion 1930a, p. 40.

366 The Mayor of Frankfurt, Ludwig Landmann, had invited architect Ernst May to work as the City Architect and to lead the housing programme. In the numerous suburbs designed and executed by May and his staff during the latter half of the 1920s, much attention was devoted to the natural setting, the creation of hygienic living spaces, proximity to work places, and industrial mass production of housing. Curtis 1996 [1982], p. 249; See also Mohr 2011, pp. 51–67.

367 Nina Blum's email to the author, December 6, 2011.

368 Barr and May 2011, pp. 91–97.

369 Giedion 1930a, p. 42.

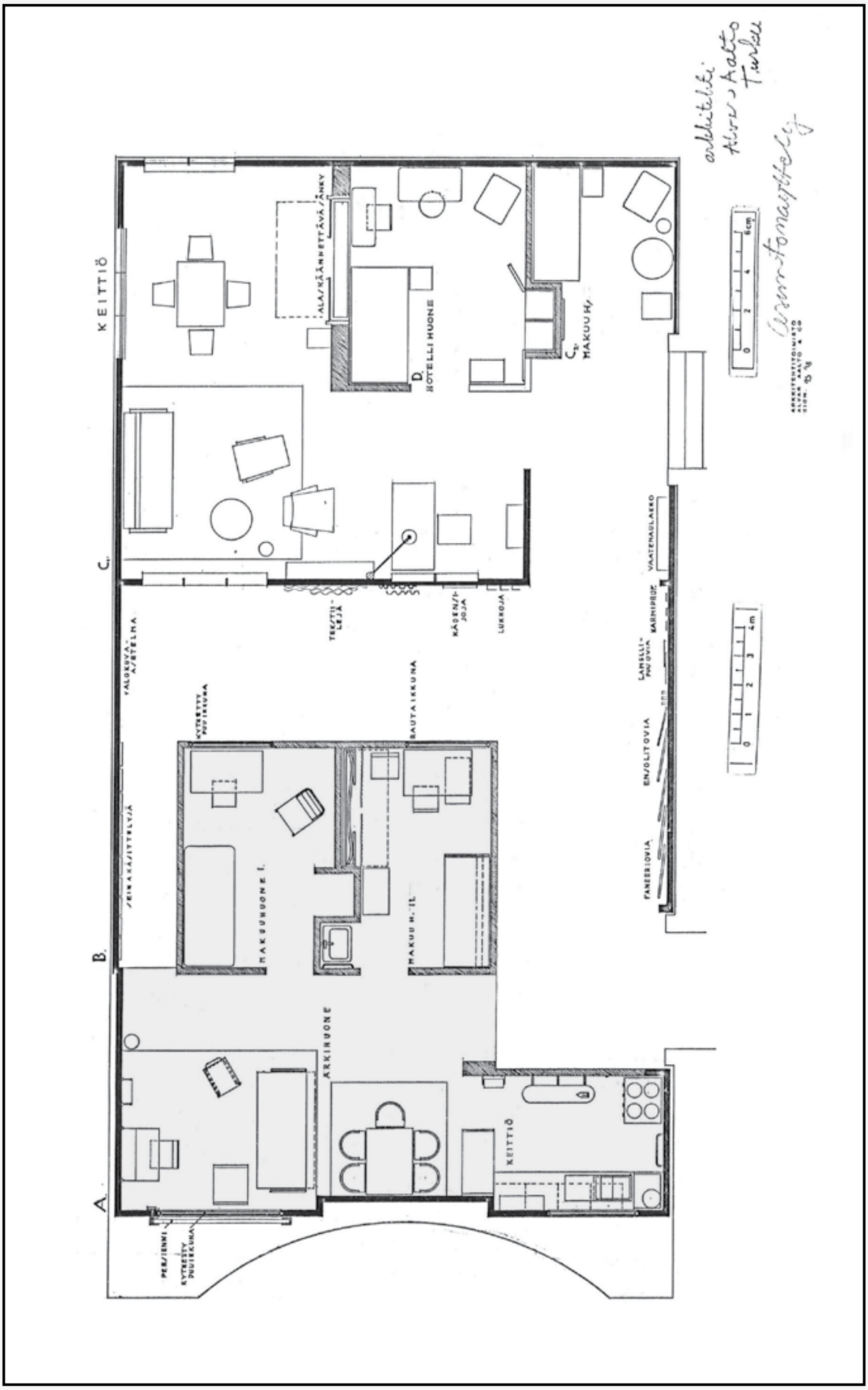

Fig. 2.4a. The Aaltos' exhibition dwelling at the Minimum Apartment Exhibition in Helsinki was a 50–60 square metre flat. The grey shading marks the parts designed by Alvar Aalto and Aino Marsio-Aalto. Drawing No. 82-14. The drawing has been edited. AAM.

did not feature on the exhibition tour. The systematic and to-the-point presentation of exhibition sheets must have made an impression on Aalto. The hotel rooms that were also presented at the Frankfurt am Main conference were inspiring for the designers, who strived to utilise space to maximum capacity.[370]

Pierre Jeanneret delivered Le Corbusier's paper "Analyse des elements fondamentaux du problème de la maison minimum" (Analysis of the Basic Elements of the Design Problem of the Minimum Dwelling), as the latter was on a lecturing tour in South America.[371] Le Corbusier's paper was published unabridged in the conference publication in French alongside an English summary.[372] A longer English-language version was published only in 1964 in the English edition of *La Ville Radieuse*, *The Radiant City*.[373] Le Corbusier's paper has been discussed quite thoroughly in the present thesis, as it was considered a particularly influential impulse to Aalto's thinking. Similarly attention has been devoted to Gropius' paper, as it was elemental in awakening Aalto's social conscience.

Le Corbusier's point of departure was the observation that living was a biological phenomenon, while the circumstance, such as structure, site and space, were essentially static. In his view, living in and building a house ought to be seen as separate pursuits for the problem to be solved. Living, or using a dwelling, was in Le Corbusier's thinking based on the regular actions of a human being, which when placed in a sequence required movement within the home. These actions demanded various spaces, the minimum requirements for which could be determined in great detail. These economised measurements were what he called standards. According to Le Corbusier, the sequence of actions was based on biological needs and could be presented in a linear fashion. In this way, the functions of the home could be placed in their assigned places in the floor plan. In addition to the standardised and optimised living space, the home also needed ample natural daylight, which was received through external walls. Partitions delimiting spaces were in his thinking simply thin membranes.[374]

In Le Corbusier's system, the floor plan emerged independent of the elevation, and it was the architect's task to operate within the boundaries set by the open floor and ceiling space and the practical requirements of movement as well as daylight. Le Corbusier found reinforced concrete suitable for large-scale houses and steel for houses assembled in situ. If the industrial method proved more expensive than the traditional method, the industrial method needed reorganisation. Le Corbusier maintained that in the case of the minimum apartment, the architectural problem was to do with the equipment of the home: "According to the data (space available), the social standing and the quality of the occupier (style of life), the equipment architect will be able to invent biological groupings within a static frame."[375]

370 Standertskjöld has analysed the floor plans featured in the publication, edited by Giedion. Giedion 1930a, p. 56 and p. 207; Standertskjöld 1992a, p. 86.

371 Mumford 2002, p. 39.

372 See Le Corbusier and Jeanneret 1930a, pp. 2–5 and Le Corbusier and Jeanneret 1930b, pp. 20–29.

373 I have used the English version as reference material in translating the original text. Le Corbusier 1964a [1933], pp. 29–34.

374 See Le Corbusier and Jeanneret 1930a, pp. 2–5; Le Corbusier and Jeanneret 1930b, pp. 20–29.

375 Ibidem.

Le Corbusier drew parallels between biological living and architecture, saying that focus could be directed to the architectural side, by which he meant human action within the static frame. Towards the end of the article, Le Corbusier developed the idea of houses supported on columns, resolving the problem of traffic in cities, and also incorporating roof gardens. He believed that consistency and thorough actualisation of ideas would result in a new architectural attitude. Le Corbusier warned against opportunism when building minimum apartments.[376]

Gropius discussed how architecture should respond to the social change in an industrialised society. His paper, "Die soziologischen Grundlagen der Minimalwohnung für die städtische Bevölkerung" (The Sociological Foundations of the Minimum Apartment) made a deep impact on Aalto. The paper was delivered on Gropius' behalf by Sigfried Giedion.[377] Gropius approached his topic by describing the social changes taking place in society: employment mainly took place outside the home and people's mobility had increased. The family lost its meaning as a unit of production. The number of small households, those of single or divorced people, increased. This created a demand for small dwellings.

Responding to changing social conditions and biological needs required the design of a standardised minimum apartment. Every adult in a household was entitled to their own room, even if a small one. Gropius was aware of the emancipation of women, which gave rise to a new need for shared spaces and communality. He thought it ill-advised to calibrate the minimum apartment programme based on the most dire of living conditions.[378]

Ernst May, who hosted the conference, spoke about the characteristics of and demand for minimum apartments and called for public investments in the construction thereof. In May's opinion, attention should have been directed towards people's biological and sociological needs instead of theories. Victor Bourgeois emphasised the scientific method in architecture, the ventilation and daylight requirements of the minimum apartment as well as the use of machines in the home and the introduction of air conditioning units in dwellings. Hans Smidt discussed the minimum apartment in relation to building regulations.[379]

The talks delivered by Le Corbusier in South America in 1929 were published in 1930.[380] The ideas presented in this book, *Précisions sur un état présent de l'architecture et de l'urbanisme* (Precisions on the Present State of Architecture and City Planning), for example, those on furniture and interiors, reached the awareness of architectural circles through Le Corbusier's other activities. The title of the paper he delivered in

376 Ibidem.

377 The English translation of the German-language paper, "Die soziologischen Grundlagen der Minimalwohnung für die städtische Bevölkerung"(The Sociological Foundations of the Minimum Apartment), was published in Walter Gropius' 1955 book *The Scope of Total Architecture*. I have used both the German version and its English translation as my sources. See Gropius 1930a, 1930b and 1955a [1929].

378 Gropius 1930a; Gropius 1930b.

379 See the English summaries. Giedion 1930a, pp. 2–16.

380 The book originally appeared in French under the title *Précisions sur un état présent de l'architecture et de l'urbanisme* in 1930. It was reprinted in 1960, and the English version *Precisions* only appeared in 1991. Le Corbusier, 1991 [1930].

Buenos Aires was "Techniques Are the Very Basis of Poetry. They Open a New Cycle in Architecture." Here, Le Corbusier explained his views on the relationship between architecture and technology. Firstly, he saw "technique" in terms of resistance of materials, physics and chemistry. Secondly, sociology meant for him a new type of dwelling and a city that met the needs of the new era. Thirdly, economy equalled standardisation, mass production and efficiency. All these three aspects merged together to become architecture through poetry, that is, through a unique act of creation. Drama and pathos were eternal values for Le Corbusier whereas "technique" was transitory.[381] In his paper, he also discussed structures and the scale of cities, as well as ventilation systems, and presented diagrams of their operating principles.[382] Le Corbusier did not take into account in his technology-driven optimism a scenario in which the technocrats would take over and sideline the human need for drama and pathos.

The impact of the Frankfurt conference was also evident in the Stockholm Exhibition of summer 1930, with the significant manifestation of Modernism in the Nordic countries. The exhibition committee for the Stockholm Exhibition was appointed in 1928 and its chief architect was Gunnar Asplund. For Gregor Paulsson, who was the organizer of the Stockholm Exhibition in 1930, the Weissenhof Exhibition, consisting of a housing district, was clearly a model.[383] The Stockholm Exhibition featured a whole urban environment with restaurants bordering the main street Corso. The main theme of the exhibition was housing, and an architectural competition for the model dwellings was organised prior to it. The competition was also motivated by the strong programme that was based on teamwork and a systematic approach to resolving the housing problem.[384] Besides new architectural thinking, the debate in Sweden also focused on city planning.[385]

The Swedish press and architects voiced opinions both for and against the radical exhibition. Many socialist newspapers branded it as propaganda for Swedish capitalism, while the conservative press regarded it as un-Swedish, opposing mass production.[386] Aalto had had the opportunity to follow the planning of the exhibition on the drawing tables of his Swedish friends.[387] Aalto's article in the *Åbo Underrättelser* (Turku News) newspaper emphasised how in new architecture, design evolved from inside out, rather

381 Le Corbusier 1991 [1930], pp. 35–37.
382 Ibidem, pp. 65.
383 Rudberg 1999, pp. 20–22, p. 27 and pp. 35–37.
384 Rudberg 1981, pp. 67–73.
385 Major town-planning competitions in the districts of Gärdet and Kungsholmen were held in the late 1920s. Swedish architects' increasing interest in open block structures oriented according to cardinal points was evident in the proposals and was reflected in the public debate. Architect Arvid Stille's proposal for Gärdet partly represented a more traditional urban planning. The first prize for the Kungsholmen competition was shared by two proposals, which were completely different from each other. One of the designs was created by Sven Markelius and it followed the new town-planning principles of the time. The visions of many radical architects were canonised in the early 1930s when the Social Democrats came to power. Eriksson 2001, pp. 427–435; Hall 2009, pp. 83–90.
386 Rudberg 1999, pp. 187–193.
387 Schildt 1985, pp. 62–63.

than the opposite, as had been the convention before.[388] In his article in *Arkkitehti* (The Finnish Architectural Journal), Aalto defended the significance of the exhibitions as a way of social education, as prescribed by the CIAM agenda. In his opinion, the Stockholm Exhibition was the first in which the questions of the minimum apartment had been consciously tackled. He inferred that the smaller the home, the greater the number of everyday activities that would be carried out in shared spaces. However, Aalto saw that this collective aspect had not been adequately addressed in the exhibition. He also criticised the methodology: "The shortcut of quickly designing a comfortable home has hindered many, by pushing aside an exact analysis of 'each object separately' in the innumerable situations and details, which now remain completely obscure." Aalto stated that it takes a radical touch not to settle for superficial comfort.[389]

Giedion had asked Aalto in March 1930 to cover the Frankfurt conference in the Finnish press.[390] The debate on the minimum apartment eventually reached Finland when Aalto's article "Asuntomme probleemina" (The Dwelling as a Design Problem) was published in *Domus* magazine,[391] which focused on interiors, industrial art, fine art and sculpture. It was related to the Minimum Apartment Exhibition that opened in Kunsthalle Helsinki in late November 1930 and that, as an experiment, was organised in conjunction with an industrial art exhibition, with Aalto as the main exhibition architect. The exhibition aimed at shedding light on the question of rationalising living conditions. Featured in the exhibition were the four-to-five-member family homes designed by Alvar Aalto and Aino Marsio-Aalto, Erik Bryggman's living room and a bedroom and hotel room arranged by architects P.E. and Märta Blomstedt.[392] The exhibition also featured the folding iron bed designed by Erik Bryggman, which had a patent pending.[393]

At the beginning of his article, Aalto critically discussed the concept of a room and defended the concept of the traditional Finnish open-plan kitchen-living room, *tupa*, which, before its decline, had been akin to the concept of a room. Unfortunately, he did not develop this highly interesting juxtaposition – that of tupa and the multipurpose living room – any further. Aalto led the reader to the idea of a versatile, flexible living space: no family with children could live in one or even two rooms, but living with a similar floor area in a space that was designed for the different activities of the family members, could instead be possible for any family. Aalto understood the dwelling to mean a sheltered space where one ate, slept, worked and played. These needs, which he coined as "biodynamic needs", were to inform the entire internal order of the dwelling, instead of formal rules of composition.[394]

388 Aalto 1930b, p. 1.
389 Aalto 1930d, pp. 119–120.
390 Giedion's letter to Aalto dated on March 15, 1930. Signum 10809, correspondence. AAM.
391 *Domus* was published by Taideteollisuusyhdistys (The Finnish Association of Industrial Arts) between 1930 and 1933.
392 Blomstedt 1930, pp. 190–194.
393 The innovation was called "Teräspatja" (Steel mattress). The patent had been applied for in 1929. Finnish Patent No. FI13642 (A), granted on June 19, 1931. Bryggman 1929.
394 Aalto 1930e, pp. 176–189.

This line of thought echoes Le Corbusier's paper delivered at the Frankfurt am Main conference. For Aalto, biological equalled dynamic, as it was the polar opposite of the static, more precisely the static frame. He used the phrase "biodynamic". Aalto explained that families were more mobile than before and the mechanical qualities of objects reflected this new reality. Aalto was referring to the feeling of experiencing the modern environment, the modernity. Aalto declared that a large-sized dwelling was not an advantage but a disadvantage. He studied the concept of the minimum dwelling by adding to its functional features. This led him to the concept of "general dwelling", which was functionally superior to an "inorganic", unfeasible entity. By organic, he was referring to a well-functioning environment. Aalto maintained that in a functional, comfortable home moving from one task to the next could happen without difficulty and disruption as the acoustic qualities and lighting in the space were good. A scientifically designed apartment was to be neutral and non-discriminatory.[395]

Next, Aalto explained the concept of culture using an ocean liner as an allegory. For example, a mechanical engineer and his working environment with all the machinery formed an organic entity. The engineer was probably oblivious to the style of his bed, as long as it was comfortable. Aalto argued that housing had become a problem because the values on which housing was based, had changed. Aalto called for a scientific solution to the housing problem. He felt that housing at the minimum income level should be studied to determine the parameters for a standard dwelling in a classless society. He thought that research should be targeted at the criteria that a dwelling should meet to offer a balanced setting for social life.[396]

Aalto's text was substantially similar in its analysis regarding the arrangement of the dwelling to Le Corbusier's paper for the Frankfurt am Main conference. Le Corbusier had emphasised the importance of the right research questions: selecting the appropriate problems was crucial. This thinking showed in Aalto's article. Aalto supported his theoretical ideas with his own empirical observations and images such as a resident doing his morning exercise in a small apartment. Aalto's text is fluent and readable. His request for research methods on the minimum apartment and "social positivity" were in turn direct loans from Gropius. Aalto returned in his article to the necessities of "biological" human existence: air, light and the sun. Air was a question of ventilation to him, and its quality was a matter of great importance. Deliberating on the role of light and the sun led him to criticise planning practices. Aalto argued that in a dwelling of 50 square metres there was no room for chance, and each angle in which light fell on the dwelling had to be studied and carefully designed. He would address the need for fresh air in the apartments of a block of flats collectively instead of resorting to the concept of the garden city, which he found "sentimental". Collective arrangements were suitable for families, too, if the mother worked outside the home.[397]

395 Ibidem.
396 Ibidem.
397 Ibidem.

Aalto asked what the scientific criteria should be that could serve as standards, physiological or otherwise, to the internal division of space in a dwelling and the tectonic choices. Finally, he brought to the fore a number of issues that Gropius had mentioned in his paper, such as the dramatic change in women's societal position and the need of each family member for privacy.[398]

Aalto's article discussing the novel ideas for living ran across seven spreads of *Domus* magazine. Typical of the layout style of the time, the illustrations and the copy did not progress concurrently. Aalto was not in charge of the illustrations for the article and *Domus* did not make full use of visual means of communication.[399] Alvar Aalto and Aino Marsio-Aalto's exhibition department received more column space in *Domus* than the others. Finnish colleague Rafael Blomstedt considered Aalto's kitchen organisation more interesting than their other room designs, as it contained all imaginable kitchen machinery. He only regretted that the machines were not Finnish-made. He also pointed out that small kitchens divided opinion: Some experts had been scathingly critical of the small kitchen, while some had commended them for the economical use of space. Blomstedt applauded the pulp paper wallpaper, designed by architect Uno Ullberg for Enso Gutzeit, as a durable, easy to paint and smooth-surfaced material but complained about its strong smell.[400] This sound absorbing wall paper was later used in the Pamio Sanatorium patient room. The Aaltos' exhibition dwelling had two iron windows and two coupled wooden windows.[401]

According to Elina Standertskjöld, Aalto applied ideas that he had adopted at the Stockholm Exhibition in the Kunsthalle Helsinki exhibition of minimum apartments. The Aaltos' exhibition dwelling was a 50–60 square-metre flat, which was approximately the size of the minimum apartments exhibited at the Frankfurt exhibition. The minimum apartment exhibition also included a technical display of building types. In his address in the exhibition publication entitled "Minimum Apartment?", Aalto borrowed directly from ideas presented in the Die Wohnung für das Existenzminimum conference, while the ideas presented in P.E. Blomstedt's piece "Old and New Industrial Art" in the exhibition catalogue were very close to those introduced by Sven Markelius in the 1928 architecture conference in Turku, Finland.[402]

398 Ibidem.
399 The first five spreads of the article "Asuntomme probleemina" (The Dwelling as a Design Problem) contains pictures of church textiles, photographs of Bryggman's Parainen Chapel, Teuvo Church following its renovation, the following five spreads of church art and Bryggman's Emanuel Church and Hospitals. For a researcher of today, this seems highly paradoxical. Aalto had specifically stated in his article published on New Year's Day in 1928 that the church did not constitute a design task the social substance of which would offer any other choice of expression except the traditionally artistic one. Ibidem.
400 Blomstedt 1930, p. 191.
401 Drawing No. 93-18. AAM.
402 Standertskjöld 1992a, p. 87.

The new ideas at the Stockholm Exhibition provoked public debate as late as 1931, when the apologist publication for the new movement, *acceptera* [sic] (To Accept), was published. It was edited by six architects and critics, Gregor Paulsson, Eskil Sundahl, Gunnar Asplund, Wolter Gahn, Uno Åhrén and Sven Markelius, collectively.[403] According to Rudberg, Åhrén was responsible for the highly polemic layout, with its collages, journalistic formats and choice of photographs reminiscent of the Danish *Kritisk Revy* (The Critical Journal, published in 1926–1928), Ernst May's German publication *Das Neue Frankfurt* and Le Corbusier's writings. *Acceptera* was optimistic. Architecture should respond to its time culturally, socially and technologically. For the writers, hand-made and industrial production were complementary and they needed not to be treated as opposites. Democratic development and the change in women's status were major cultural challenges to which architecture was expected to react.[404]

Uno Åhrén was an active writer and served as the editor-in-chief for *Byggmästaren* in 1929–1932. He was Sweden's other representative alongside Sven Markelius in CIRPAC, the preparatory committee for CIAM, from 1930 onwards,[405] where his role also included the work of the press committee. In his article "Brytningar" (Breakages) from 1925, Åhrén described Le Corbusier's inspiring take on architecture based on the latter's books *Vers Une Architecture* and *Urbanisme* (The City of Tomorrow).[406] Åhrén went on to become a major advocate of architecture in Sweden and wrote reviews on the major late 1920s architectural exhibitions, such as Weissenhof Siedlung in Stuttgart 1927.[407] According to Swedish Professor of Art History Thomas Hall, who has conducted in-depth research into the urban structure of Stockholm, Uno Åhrén, who backed the idea of an open urban structure and opposed closed city blocks, was one of Sweden's leading theoreticians and proponents of urban planning at the turn of the 1920s and 1930s.[408] Åhrén was also involved in launching radical study circles[409] discussing architectural and social issues, some of which were also attended by Sven Markelius[410]. Although Åhrén and Markelius' professional paths thus frequently crossed, Åhrén and Aalto had probably not built a close friendship. *Arkkitehti* (The Finnish Architectural Journal) published Aalto's critique on the Swedish *Acceptera* publication. He used the opportunity to remind readers that architects formed a body of scientists, whose unquestionable duty was to create flexible and organic culture.[411]

403 Asplund et al 1931.
404 Asplund et al 1931; Rudberg 1981, pp. 74–78.
405 Rudberg 1981, p. 54.
406 *Urbanisme* by Le Corbusier was first published in French in 1924. Le Corbusier 1998 [1924].
407 Åhrén 1927, pp. 253–261.
408 Hall 2009, pp. 87–89.
409 Examples of such groups were Fritt forum (The Free Forum), a group established in 1924 that dedicated itself to philosophical and social questions; a group formed by architects in 1928 to discuss economic matters; Trettonklubben (The Club of the Thirteen), established in the early 1930s by architects and cultural luminaries; and Clarté (Clarity), also established in the early 1930s by radical architects. Activists in all these groups, including Åhrén, were prolific writers. Rudberg 1981, pp. 81–83.
410 Rudberg 1989, pp. 75–76.
411 Aalto 1930d, pp. 119–120.

Fig. 2.4b. The Stockholm Exhibition featured a whole urban environment with restaurants bordering the main street Corso. Photo No. 1976-107-0480. ArkDes.

2.5 ON THE RELATIONSHIP BETWEEN SVEN MARKELIUS AND ALVAR AALTO

Sven Markelius and Alvar Aalto met in 1926 and soon became family friends.[412] Markelius and Aalto engaged in a close exchange of ideas up until the early 1930s. Both modernists' interests extended to the design of objects, buildings, urban planning and influencing public opinion through the media.

With a grant from Kammarkollegiet (The Swedish Legal, Financial and Administrative Services Agency), Markelius went on a six-week European tour in summer 1927 to study new airports. On this trip, he also met Gropius and visited the new Bauhaus school and Törten housing estate in Dessau, both designed by Gropius. Markelius also visited the Weissenhof Siedlung exhibition in Stuttgart that summer.[413] On his return, Markelius wrote a piece in *Byggmästaren* (The Master Builder) about the Dessau-Törten housing estate, which he admired greatly and in the project management of which Gropius had applied Ford's conveyor belt method.[414] Markelius suggested that a more systematic method of housing construction could bring savings and improve the quality of housing also in Sweden.[415] In Markelius' opinion, the main obstacle for serial housing production in Sweden was prejudice against standardisation.[416] The developers of the Dessau-Törten housing estate had open-mindedly applied typological thinking[417] and the building process had been carefully planned beforehand.[418] Local materials were used whenever possible, which considerably reduced transport costs.[419] All parts had been designed to be light enough for one man to lift. Work had been divided into stages, each of which was carried out by the same worker throughout the site. A group of eight houses had been built simultaneously, after which a team moved on to the next stage.[420] Markelius' social responsibility shows in the detail in which he analysed the low building costs at Dessau-Törten and how these low costs benefited the consumer.[421]

The following spring he had the honour of delivering a paper at Turun Seurahuone Hotel during the meeting of the Finnish Association of Architects in Turku.[422] His article "Rationalisointipyrkimykset nykyaikaisessa huoneenrakennustaiteessa" (Rationalisation in Modern Building Construction) was published in *Arkkitehti* (The Finnish Architectural

412 Schildt 1985, pp. 46–54.
413 Rudberg 1989a, pp. 48–50.
414 Markelius 1927, p. 242.
415 Markelius 1927, p. 236.
416 Ibidem, p. 238.
417 Since most people have similar needs, it is only natural that these are treated en masse. Building individually was a waste of resources and a misplaced emphasis on the personal. Ibidem, p. 236.
418 Ibidem, p. 238.
419 Ibidem, p. 238 and p. 242.
420 Ibidem, p. 242.
421 Markelius 1927, 243; See also Wager 2009, p. 66.
422 Raija-Liisa Heinonen and David Pearson interviewed Hilding Ekelund, who joined *Arkkitehti* in 1930 as sub-editor. Ekelund argued that it was particularly this paper by Markelius that marked the breakthrough of "Functionalism" in Finland. Heinonen 1986, p. 13.

Fig. 2.5a. Alvar Aalto and Sven Markelius on Vierwaltstättersee in Switzerland around 1930. Photo No. 106593. The photograph has been cropped. AAM.

Journal) and gained nationwide attention.[423] Markelius demanded a modern approach to social, economic and technological issues. In his view, the democratic times called for appropriate addressing of genuine housing needs, high hygienic standards and economy. According to Markelius, technical execution, the task and intended use were the new starting points for design, and the machine had become a form-giving factor. Markelius warned his peers against formalism and urged them to use steel and reinforced concrete and respect the real nature of these materials. He argued that the shortage of housing could be alleviated by making use of new technology and rational solutions. He emphasised typification and standards as prerequisites for mechanical mass production and considered the emergence of types a sign of mature building culture.[424]

According to Rudberg, Markelius was inspired in his design particularly by Le Corbusier, while his ideological thinking was fuelled by Walter Gropius. Markelius' opinions against property speculation and short-sighted trade union policies mirrored those of Gropius. Like Gropius, Markelius emphasised the importance of curbing the rise of building costs and promoting new building materials and working methods. Markelius' paper delivered in Turku showed a clear line of thought. In addition, being invited by the Finnish Association of Architects helped establish Markelius' position as one of the most significant proponents of the new movement in his homeland.[425]

The Stockholm Exhibition of summer 1930 also featured a hospital unit, which was designed by Sven Markelius and his team of experts and has been given only passing attention in research. The unit, that represented the terraced hospital type, included an operating theatre and a ward. Also exhibited were hospital instruments, furniture, light fittings and floor and wall materials. Heating, ventilation and sanitary systems were given particular attention. According to Markelius, the aim of the design was to cast a look into the future rather than repeat previous achievements.[426] The ward was located on the top floor of the exhibition building and it incorporated a tea room and a lounge that were placed at opposite ends of a corridor, a four-bed patient room, a two-bed patient room and a combined wet room and lavatory in between the two. The wet room was placed in between the patient rooms, although in a real hospital it should be accessible to all patients and would be placed on the less prominent side of the building. The exhibition architect pointed out that, even if somewhat extravagant, placing the lavatory adjacent to the patient rooms improved the quality of the patient room and the hygiene standards in the hospital, and saved labour. A four-bed room was an attempt by the team to respond to the demand for more efficient hospital wards. The patient rooms received daylight through two ribbon windows, the upper ribbon near the ceiling and the lower one level with the door. Markelius aimed to maximise the amount of daylight without excessively increasing the window area. Both ribbons could be covered with

423 Markelius 1928, p. 71.
424 Ibidem, p. 71.
425 Rudberg 1989a, pp. 48–50.
426 Markelius 1930, pp. 173–176.

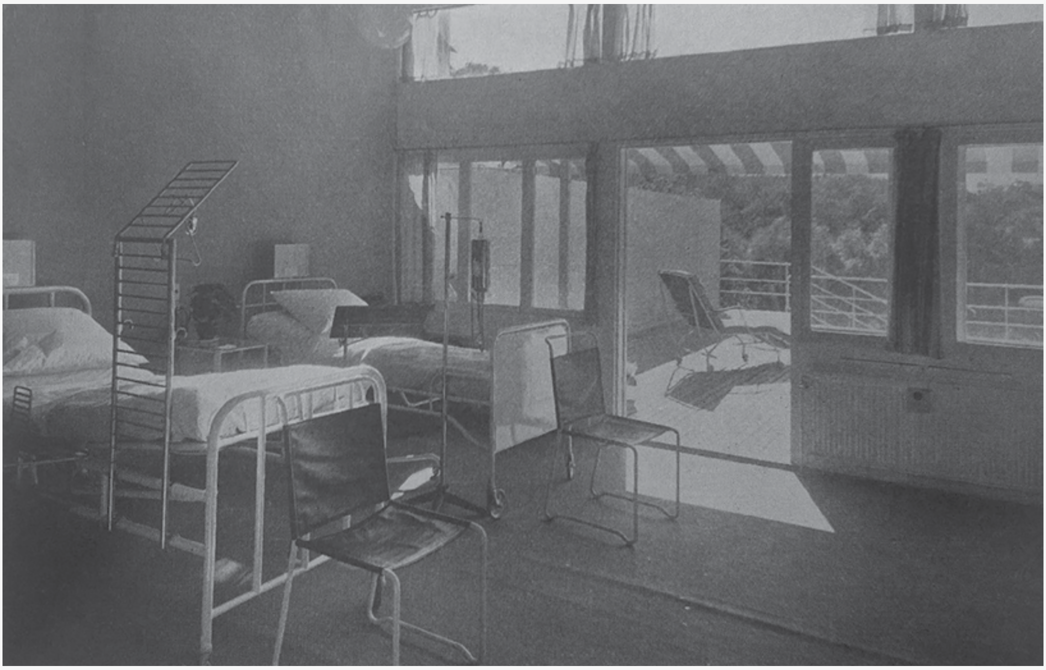

Fig. 2.5b. The patient room in Markelius' model hospital at the Stockholm Exhibition, summer 1930. Markelius 1930, pp. 173–176.

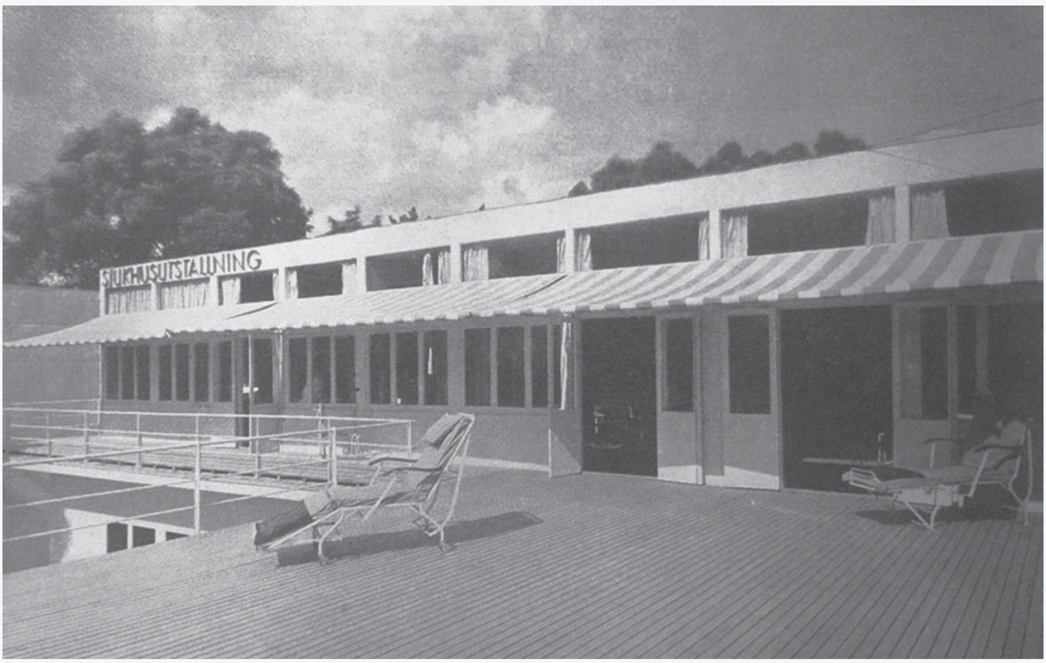

Fig. 2.5c. The model hospital designed by Markelius for the Stockholm Exhibition represented the terraced hospital type. Each room had an access to the terrace. Markelius 1930, pp. 173–176.

sunshades. The lower ribbon was also equipped with an awning, which would shade the faces of patients reclining outdoors on the terrace outside the window.

The terraced hospital type had a topical example in the Waiblingen Hospital near Stuttgart (1928), designed by Richard Döcker. According to Markelius, adding terraces was applicable only in fairly low, two to three, or at the very most four storey buildings located on low-density sites. In terraced hospitals, patients could benefit from fresh outdoor air for most of the year. The writer anticipated that the hospital building type would be popular among physicians, as it would speed up recovery.[427]

Interestingly, Aalto made no mention about Markelius' hospital ward in his critique of the Stockholm Exhibition in *Arkkitehti* (The Finnish Architectural Journal). However, it must have provided real and concrete solutions for a number of detailed design questions that Aalto was working on at that time. Markelius specifically stressed his attempt to freely experiment with new possibilities in hospital design rather than showcase existing solutions. The exhibition hospital ward focused on the floor plan of two key spaces, the patient room and the operating theatre, as well as hospital technology, furniture, interior arrangements and equipment.[428]

Both Markelius and Aalto were familiar with Henry Ford Hospital in Detroit, although neither mentions this in their articles. This particular hospital concept merits further discussion because Ford approached the problematics of a hospital from a completely new angle: the patient. This approach must have had a bearing in both Aalto's and Markelius' design ideology. Ford recounted the story of the Detroit hospital in his best-selling book *My Life and Work,* in the chapter "Why Charity?".[429] Ford had donated funds for the hospital, which was built as a charity project. As the project exceeded its original budget, Ford redeemed himself for the project by returning all donations to their origin. Ford regarded charity as passivating and humiliating for the beneficiary. He set out to develop a hospital concept aimed at middle-income population that would support itself. The idea was to produce a maximum volume of services with as low expenditure as possible, but the purpose of the hospital was not, in the end, to generate profit. Ford changed the plans for both the building and the hospital operations. Rooms were to be private and exactly identical. The hospital fee depended on the length of stay and the nature of treatments, which were priced in advance. According to Ford, it was difficult to say whether the hospitals of the day had been designed to benefit the doctors or the patients. To avoid misdiagnosis and the supremacy of doctors, each patient was given several, independent diagnoses. Doctors and nurses were on a monthly salary with one-year contracts, so the doctors were not tempted to order unnecessary treatments for patients to increase their own income. One nurse had no more than seven patients at one time. Ford called for a more constructive approach to organising public services and the inclusion of economics in general education.[430]

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427 Markelius 1930, pp. 173–176.
428 Ibidem, pp. 173–176.
429 The description of the hospital can be found in the Chapter "Why Charity?" Ford [1922], pp. 215–219.
430 Ibidem.

Fig. 2.5d. The main interior of Helsingborg Concert Hall, designed by Sven Markelius, has a similar spatial composition to the theatre auditorium of Aalto's Southwest Finland Agricultural Cooperative Building (see Fig. 2.3g), as acknowledged by Eva Rudberg. Photo No. 1962-101-0334a. ArkDes.

News coverage on the paper Aalto delivered in Oslo in 1931 reveals the Fordian influence in his hospital design philosophy. Aalto emphasised the role of the patient as the starting point for the design. Aalto maintained that architects should study human behaviour and human needs and translate the findings into design and the choice of materials: concrete, glass and linoleum. He held that, in a hospital project, physicians and architects should work together and also that the hygiene standards required for a hospital were equally appropriate when designing homes.[431]

In reality, Markelius was not in the process of designing a hospital and his exhibition ward elicited no reaction from Aalto, at least not publicly. The architectural intentions of Markelius were best manifested in his main work until then, the Helsingborg Concert Hall, completed in autumn 1932. The design had evolved from the classicist competition win from 1925 towards new rationalism, as Alvar Aalto's design for the Vyborg Library had similarly evolved after 1927. For its placement and design of the stairs, Eva Rudberg has also likened the Helsingborg Concert Hall to the theatre auditorium of the Southwest Finland Agricultural Cooperative Building.[432] It would seem plausible to assume that close colleagues would be aware of the progress of each other's ongoing projects and that they would discuss them.

431 Anon 1931, p. 6; See also Schildt 1985, p. 65.
432 Rudberg 1989a, p. 41.

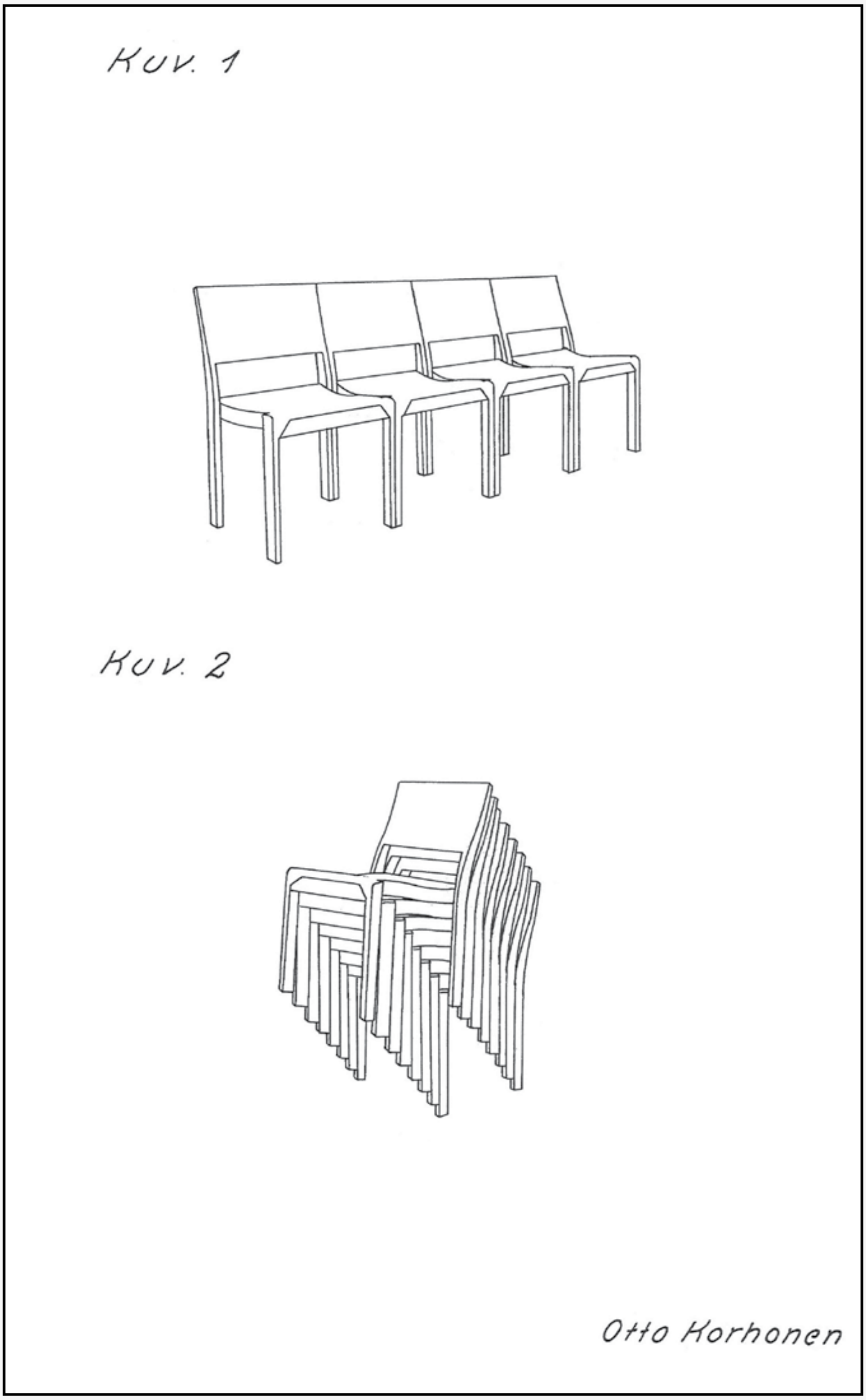

Fig. 2.5e. Otto Korhonen's patent for a stackable wooden chair, Finnish Patent FI14869 (A), was granted on December 30, 1932. The patent application was filed October 15, 1929, from which date the design was protected. PRH.

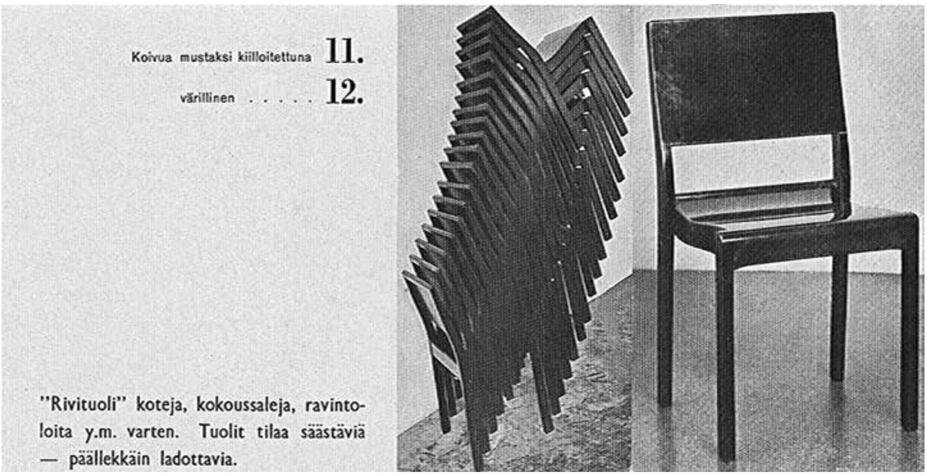

Fig. 2.5f. Aalto redesigned the chair Otto Korhonen had patented. Huonekalu- ja Rakennustyötehdas Oy, published on January 1, 1934, p. 7.

Shortly before the completion of Helsingborg Concert Hall, Markelius had voiced his concern that the stackable chair he had designed for the Concert Hall violated Aalto's copyright, as it resembled Aalto's design for a similar type of chair.[433] When Markelius queried this from Aalto, the latter had no objection. In fact, Aalto had himself modelled his stackable chair after Otto Korhonen's patented stackable chair with Korhonen's consent. In Korhonen's innovation, the stackability was the patented quality. Moreover, patents were national and the innovation was protected by a patent in Finland only.[434] Aalto never mentioned this aspect of his design to Markelius. Their correspondence does not reveal whether Markelius knew that what was being discussed was actually Korhonen's invention and whether Korhonen was ever aware that his idea was being plagiarised.[435]

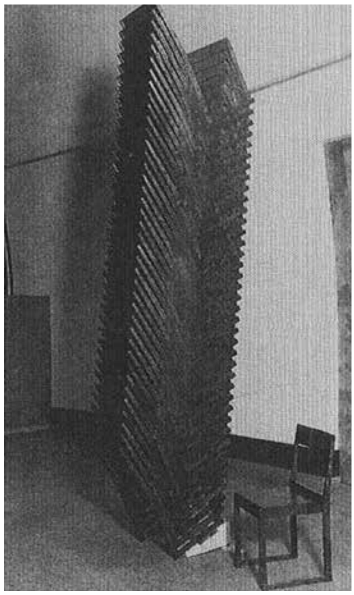

Fig. 2.5g. Stackable chair designed by Sven Markelius for Helsingborg Concert Hall. Rudberg 1989a, p. 41.

433 A letter from Markelius to Aalto dated September 17, 1932. Signum 10314, correspondence, AAM.

434 The protection of the patent started from the day of application, October 15, 1929. Finnish Patent Tuoli (Chair) No. FI14869. Patent documents. NA.

435 There is no correspondence between Otto Korhonen and Alvar Aalto in the archives of the AAM. As they both lived in Turku until 1933, they did not necessarily write letters to each other. In October 1933, Korhonen sent Aalto his biographic information upon request. Korhonen was born in Rautalampi in on June 11, 1884. He had studied two years at the Kuopio School for Carpenters, after which he had started working as a carpenter. In 1910, Korhonen established the company he was then managing, with three other colleagues. Otto Korhonen's letter to Aalto, October 25, 1933. KOR.

In August 1932, Sven Markelius had persuaded Aalto to write in the architectural October issue of the new *Spektrum* magazine, the theme of which was architecture and society. Markelius was himself planning to write about collective housing, Åhrén on functionalist form, and Poul Henningsen would also contribute as an editor. Markelius hoped that Aalto would submit an illustrated article, stating that "pages in high-grade paper can be added as necessary". The writer would be allowed to choose his own subject and a small financial compensation was also promised.[436] Aalto wrote back to Markelius saying that he would write on the differences between the city and the countryside from the perspective of rationalisation of housing design. Aalto decided to study housing design on a scale that was new to himself but highly topical at the time.

Aalto complained about lack of funds in the correspondence regarding the article, and he was to receive no further remuneration for Paimio Sanatorium. He used this as an excuse for not travelling to the opening of Helsingborg Concert Hall, to which Markelius had invited him in his previous letter.[437] It would appear that the friends were becoming more distant.

In October, Markelius sent Aalto a letter thanking him for the article and asking for illustrations for it.[438] In the next letter, he commented on Aalto's use of language. Markelius claimed that Aalto had used words that did not sound scientific. Since the article was aimed at the general public, certain expressions needed to be further explained, Markelius wrote, and continued: "In places, there are also differences in the ways we express ourselves on either side of the Bothnian Bay. I have added some comments in the margins where I think you ought to pay some attention to ensure the passage is comprehensible to ordinary people".[439] Aalto may have been offended by Markelius' comment, which explains why the correspondence became critical in its tone.

Aalto's article "Bostadsfrågans geografi" (The Geography of the Housing Problem) discusses geography and technological systems in the context of the housing question. According to Aalto, the metropolis and the countryside, the A and B Europe, were polar opposites in terms of lifestyle. Industrial development had to some degree levelled out the differences, as modern conveniences had reached rural areas. The beginning of the article is highly reminiscent of Gropius' paper for the Brussels conference, although Gropius did not use the terms "A and B Europe". The same terms had been used a year earlier in *Acceptera*, in the Chapter "Kultursituation" (Cultural Situation). *Acceptera* gave insight on the concept which originated in Francis Delais' work *Les deux Europes* (The Two Europes) published in 1929.[440]

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436 A letter from Markelius to Aalto August 25, 1932. Signum 10313, correspondence. AAM.
437 Aalto's letter to Markelius s.a. Correspondence, Signum 25530. AAM.
438 Markelius' letter to Aalto October 13, 1932. Signum 10316, correspondence. AAM.
439 Markelius' letter to Aalto October 19,1932. Signum 10317, correspondence. AAM.
440 Asplund et al. 1931 pp. 15–25; Pelkonen 2009, p. 106.

Aalto felt that traffic was too narrow a point of view for discussion on the geography of the housing problem because people's need for social contact also demanded attention. In his view, the radio was a centralising force because a log cabin was just a passive recipient. A telephone system, including the main line, the switchboard, and special lines branching out from it, was in his view close to the order of the natural biological system, or locally grouped cells: "There is not a tree in which the needles would grow directly from the stem, but from smaller branches."[441] The economy of the telephone would lead to an organic organisation that would allow for low-density planning which would require local concentration. The economic routing of roads and streets, and the organisation principles of the railway, telegraph and post, favoured local concentration instead of isolated cells. Aalto regarded industrialisation, the replacement of human labour with machines, and planned economy as equalising factors that levelled out development. Aalto promoted the use of technological systems and suggested that their operating principles should be acknowledged in the design of housing districts. [442]

Aalto called for consistency in housing development both in the urban and rural context, just like Gropius had done in Brussels and Åhrén at the Nordic Building Forum in 1932 in Helsinki.[443] He compared certain technological systems and human cultural needs with "nature's own biological system, the principle of locally grouped cells" and, in more practical terms, with the way a tree grows. The installation teams circulating on a building site, as described by Aalto, were a direct reflection of the way the prefabricated houses in Dessau-Törten had been built.[444]

The Swedish and Finnish CIAM members were also active in organising the Nordic Building Forum held in July 1932 in Helsinki. The event's Swedish organising committee was chaired by Sven Markelius, who regretted in his opening address the low number of Swedish participants, assuming it was the result of the recession.[445] An architectural exposition was organised in conjunction with the event. The dwelling designs of Alvar Aalto and Aino Marsio-Aalto highlighted industrial building methods and the problematics of a small apartment.[446] This event also presented an opportunity to promote Modernist ideology among peers.

441 Aalto 1932c, p. 88.
442 Aalto 1932c, pp. 90–91.
443 Gropius 1931, pp. 26–47; Åhrén 1932, pp. 26–30.
444 Gropius applied Tayloristic theories in building, as discussed by Sven Markelius in a 1927 issue of *Byggmästaren* (The Master Builder). Markelius 1927.
445 Markelius 1932a, p. 8.
446 "Rental apartment house, small dwellings of 35–91 square metres in size, Turku", or Standard Apartment Building and "Row house, small dwellings, Paimio", or the Paimio Sanatorium workers' building. The lower floor of the latter project was realised as a row house, in which the number of rooms in an apartment could vary from one to three. Anon 1933, p. 222.

2.6 THE HORIZONTAL SLIDING WINDOW

Giedion attempted to organise a construction technology exhibition in conjunction with the CIAM conference in Brussels, with the horizontal sliding window as its theme.[447] Giedion contacted Aalto for material for the exhibition. In September, Aalto sent a number of sketches on the structure of his sliding window designs.[448] In October, Giedion confirmed having received Aalto's drawings and asked for a physical model. In November, he queried again whether the windows that Aalto had promised him had already been dispatched. Eventually, the sliding window Aalto sent for the exhibition arrived too late.[449] Giedion's intended exhibition never finally materialised in Brussels, but it was later realised in Zurich.[450]

The exhibition, although not finalised as intended, nonetheless gave Aalto the impetus to develop steel window types. They were in demand, as steel windows had until then been available only as imports and Finnish manufacturers had recently started producing them.[451] In September 1930, Aalto sketched several versions of the metal-framed sliding window with German annotations.[452] The Aaltos' exhibit at the Helsinki Minimum Apartment Exhibition in 1930 included one iron window and it is possible that Aalto had only one sample window made, which he would prefer to showcase in Finland rather than Brussels.[453] It may be that the architect could not afford to have more than one sample window made and he knew that he would gain more attention for it in Finland than elsewhere.

The drawings of the horizontal sliding windows created for the Brussels exhibition were grouped with the Paimio Sanatorium drawings at the Alvar Aalto Museum. The sanatorium drawings included 13 window standard drawings in total, eight of which were numbered. Four drawings were undated. The oldest drawing was dated January 1929 and the last one October 1930. Standards Nos. 201–206 had German annotations and Standard 203 Finnish annotations, and they were all signed by Aalto. These were the same drawings that Aalto created for the sliding window exhibition. Standard drawings Nos. 201–206 had no window codes that refered to the sanatorium's window programme and, in terms of their solution, they paid no resemblance to any of the windows that were eventually realised at the hospital. Moreover, Standards Nos. 201–206 were dated October 1930, while the window acquisitions for the sanatorium took place much later, in spring of 1931. These standards were therefore not related to acquisitions for the sanatorium.

447 Giedion's letter to Aalto, which was probably written at the end of August 1930. Signum 10812, correspondence. AAM.
448 Aalto's letter to Giedion, September 10, 1930. Signum 25453, correspondence. AAM.
449 Giedion's letter to Aalto, January 13, 1931. Signum 10821, correspondence. AAM.
450 Mumford 2002, p. 78.
451 Heikinheimo 2002, pp. 88–89.
452 Elina Standerskjöld described these drawings. Standerskiöld 1992b, p. 91.
453 Elina Standerskiöld also arrived at the same conclusion. Standerskiöld 1992b, p. 90.

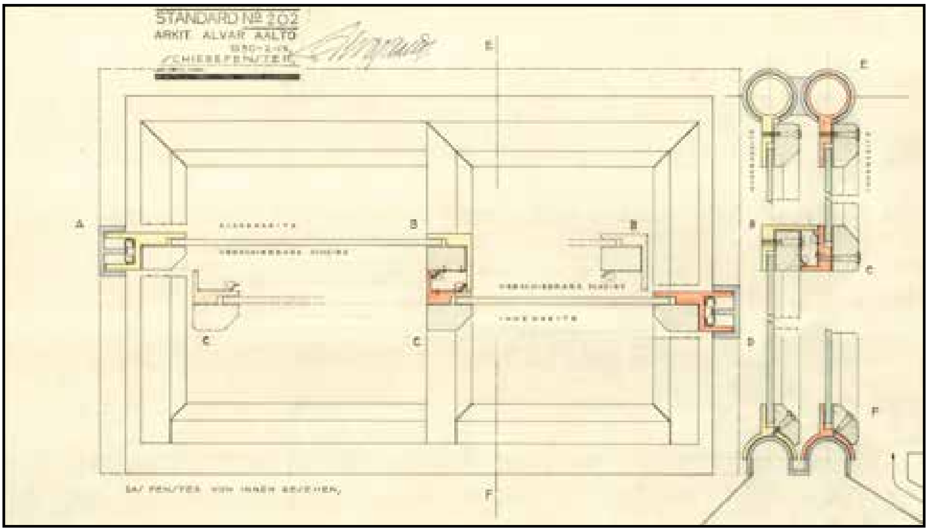

Fig. 2.6a. Standard No. 202 by Alvar Aalto presents a horizontal sliding steel window. It was dated September 2, 1930 and the texts were written in German. Drawing No. 50-170. AAM.

Standard No. 201 showed a timber-frame horizontal sliding window. The casements of the fixed panes are marked to be opened for cleaning only.[454] Standard No. 202 showed a steel-frame horizontal sliding window. The single-glazed window included a combination of a circular tube profile, a semi-circular profile and rectangular profiles. The tubular profiles slided one inside the other in a horizontal direction. Both the outer and inner casements were movable. The panes were fixed with wooden casings. The outer casement was marked yellow and the inner one red in the picture.[455] Standard No. 203 showed a timber-frame horizontal sliding window, with a fixed outer pane and a movable inner pane. Standard No. 204 was an iron-framed horizontal sliding window with tubular profiles at the top and the bottom that slided one inside the other. The inner pane was movable and the outer one fixed.[456] Standard No. 205 was a four-pane window, one of which was a vertically opening sash. The movable sash was flanked by two upright frames made from round tubular profiles. The panes were fixed with wooden casings.[457] Standard No. 206 was a steel-frame horizontal sliding window with nested round tubular profiles at the top and the bottom.[458] One of the unnumbered and undated window standards showed a four-pane steel window with two vertically opening casements and upright frames of tubular profiles[459] and the other the mechanism of the window.[460] These two pencil drawings were somewhat sketchy in comparison to standards Nos. 201–206.

454 Drawing No. 50-169. AAM.
455 Drawing No. 50-170. AAM.
456 Drawing No. 50-172. AAM.
457 Drawing No. 50-173. AAM.
458 Drawing No. 50-174. AAM.
459 Drawing No. 50-165. AAM.
460 Drawing No. 50-168. AAM.

Aalto had previously used the Dutch-made Crittal Braal system in the Turun Sanomat Newspaper Building, in the Southwest Finland Agricultural Cooperative Building and the Standard Apartment Building, which had consolidated his knowledge about the design problems related to steel windows and and doors.[461] Now he had the confidence to design windows and their details by himself and was ready to send his designs to be displayed at an international show. Aalto attempted to understand the mechanisms of one industrially manufactured building part and systematically created several variations of the windows, including details. Aalto considered window design an important task and the modernistic discourse was embodied in his design down to single building parts, in this case windows.

Le Corbusier had engaged in heated public debate in mid-1920s on fenestration with his former mentor, architect Auguste Perret (1874–1954). According to Perret, the primary function of windows was to add light to a space and he argued against Le Corbusier by claiming that the horizontal windows championed by the latter were overlooking this function. For Perret, windows were also linked with the proportions of the human body and how a person experiences a space. He was not interested in the panorama, which is the view that Le Corbusier's horizontal window afforded.[462] One result of this debate undoubtedly was that avant-garde architects were now conscious of the issue and that the theme of the exhibition held in conjunction with the third CIAM conference was indeed the horizontal sliding window, and not simply the sliding window. There are no records indicating whether Aalto was aware of the window dispute between the two architects. The drawings he prepared for the Brussels exhibition actually included one four-pane window in the shape of a horizontal rectangle, in which the bottom panes are pulled upwards.[463]

461 See Aalto 1930c, 1929a and 1929d.
462 See e.g. Colomina 1998 [1994], pp. 128–139, and Britton 2001, pp. 134–138.
463 Standard No. 205, drawing No. 50-173. AAM.

2.7 THE RATIONAL SITE PLANNING

Aalto was unable to attend the three-day seminar Rationelle Bebauungweisen (Rational Site Planning) held in Brussels as it coincided with the opening of the Minimum Apartment Exhibition in Helsinki.[464] Aalto had been informed beforehand about the main topics of the seminar, having received, for example, an abridged version of Gropius' paper to be presented at the seminar, sent out by Giedion to all CIAM representatives.[465] Aalto was fully involved in the Brussels event in spirit, proven by the fact that he had delivered materials from Finland to Brussels for the exhibition on sliding windows. Aalto also met Giedion in Zurich[466] and several CIAM members in Frankfurt am Main a month before the conference.[467] Papers presented at this conference also reflected on Aalto's own discourse.

In his paper "Le parcellement du sol des villes" (The Subdivision of Land in Cities), Le Corbusier noted that the themes of the conference were limited to living and that the topics also incorporated the question of mobility. He responded analytically by compartmentalising the problem into sub-themes: the dwelling was to secure privacy for the family, there should be enough daylight, the designers should pay attention to clean indoor air and ventilation, the living environment of a person working outside the home should be organised based on a 24-hour clock and the "human machine" should be maintained, for example, through exercise. Le Corbusier also recognised the need for visual drama and architectural expression.[468]

In Le Corbusier's opinion, a choice should be made between the garden city and dense urban concentration. He found the right alternative to be one that would not waste people's time, energy, money or land. He defended dense, high-rising developments and fantasised about houses based on internal access corridors, or "streets", with lifts transporting residents to their flats. In the test buildings erected in Moscow, the noise from the corridor had been considered a problem, which could, however, be solved through architectural means, according to Le Corbusier.[469] In Le Corbusier's vision, the housing problems could be solved by building and utilising technology.

Gropius' paper, "Flach-, Mittel- oder Hochbau?" (Low, Medium or High-rise?),[470] discussed the different heights of residential buildings. In his view, the problem was the opposition between the town and the country – a topic which was also touched upon by Aalto in his article "Bostadsfrågans geografi" (The Geography of the Housing Problem).

464 The third conference of CIAM was held in Brussels on November 27–29, 1930 and the Minimum Apartment Exhibition in Helsinki was opened November 29, 1930.

465 Aalto's letter to Giedion, November 8, 1930. Signum 10820, correspondence. AAM.

466 Aalto thanks Giedion for his hospitality in Zurich in his letter, November 9, 1930. Signum 25456, correspondence. AAM.

467 The CIRPAC meeting was held in Frankfurt am Main on September 20 but Aalto visited the city only on September 25, 1930 and met many of CIAM's representatives. Aalto apparently did not attend the CIRPAC meeting. See Giedion's letter to Aalto, August 25, 1930. Signum 10813, correspondence. AAM; Schildt 1985, p. 65.

468 Le Corbusier 1931, pp. 48–57.

469 Le Corbusier 1931, pp. 48–50; Le Corbusier 1964a [1933], p. 38–39.

470 Gropius 1955b [1931].

According to Gropius, technological development would soften the polarisation between the town and the country, as urban conveniences could be introduced to rural areas and the greenery of the countryside could be brought to the city. Gropius defended the *Zeilenbau* (row construction) principle, which refers to a rationalistic method of building parallel multi-storey residential buildings with several lamellas. He maintained that towns should be planned so that the volume of traffic would remain as low as possible. Gropius suggested that one or two storey houses be favoured on the outskirts and 10–12 storey buildings in the centre of cities. He dismissed blocks of flats of any intermediary scale as he found them socially, psychologically and economically inferior. Gropius' address emphasised the possibilities opened up by technology and the new social order as well as the spatial consequences of it, such as collective houses.[471]

The seminar publication of the Brussels conference, *Rationelle Bebauungsweisen*, compiled key papers delivered at the conference and examples of residential buildings from different countries. The examples were grouped according to the building type and were presented in an identical visual format. Among the 56 examples, three were from Turku. Projects Nos. 12 and 13 were grouped under "North–South-oriented low-rise buildings". Project No. 12 introduced an imaginary project at Vartiovuori area in Turku.[472] No floor plan of the project was presented. Project No. 13 was described as experimental in its social status.[473] The floor plan and photograph presented the workers' residential building at Paimio Sanatorium. The site plan, showing five identical parallel buildings, was not, however, true to the reality at Paimio. Aalto simply repeated his real design to appear to follow the Zeilenbau principle. Project No. 35 represented a series of parallel multi-storey residential buildings.[474] The buildings were three storeys high. The site plan shows two street types, a residential street and a main arterial street.[475] The floor plan was taken from the Standard Apartment Building. Raija-Liisa Heinonen argued that resorting to imaginary designs, compiled from different sources, was the only ticket to the international conference, because real projects such as these had not yet been completed in Finland.[476] It would appear that Aalto multiplied the number of residential buildings he had designed to attract interest in Continental Europe, although no such plan was ever going to be realised at Paimio. Aalto's conduct was not, however, dishonest, as his motivation was really to show to the international media that he was aware of the current international discourse. The exhibition publication also revealed that Finland's representatives in CIRPAC for 1930–1932 were Alvar Aalto and "Soutinen".[477] The misspelled name belonged to architect Eero Ilmari Sutinen (1892–1947), who served as a city planning architect in Turku from

471 Gropius 1955b [1931], pp. 119–133.

472 The sheets included in Heinonen's picture supplement were featured at the Brussels exhibition in 1930, and not at the one in Frankfurt am Main in 1929, as Heinonen mentions. Heinonen 1986, illustrations 124 a, b and c.

473 Experimental settlement. Giedion 1931c, p. 195.

474 Giedion 1931c, p. 204.

475 Heinonen compared Aalto's proposal with Ilmari Sutinen's site plan for the Makasiini plots from 1929. Heinonen 1986, illustration No. 125.

476 Heinonen 1986, p. 195.

477 Giedion 1931b, p. 210.

Fig. 2.7a. The photograph of the building site of the workers' apartment building at Paimio Sanatorium appeared in the *Rationelle Bebauungsweisen* (Rational Site Planning) publication and was shot in July 1930. Photo No. 50-003-512. AAM.

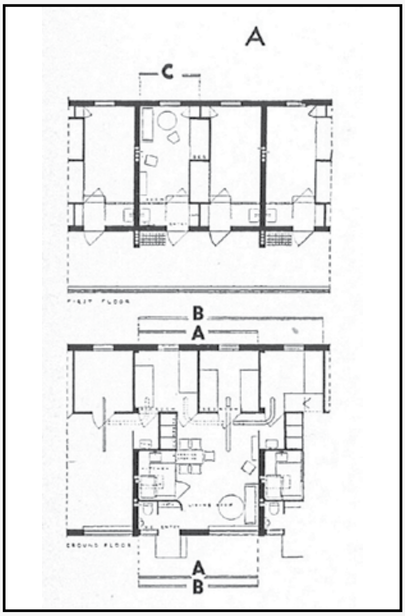

Fig. 2.7b. A diagram of the floor plan for the workers' apartment building at Paimio Sanatorium appeared in *Rationelle Bebauungsweisen* publication. Giedion 1931c, sheet 13.

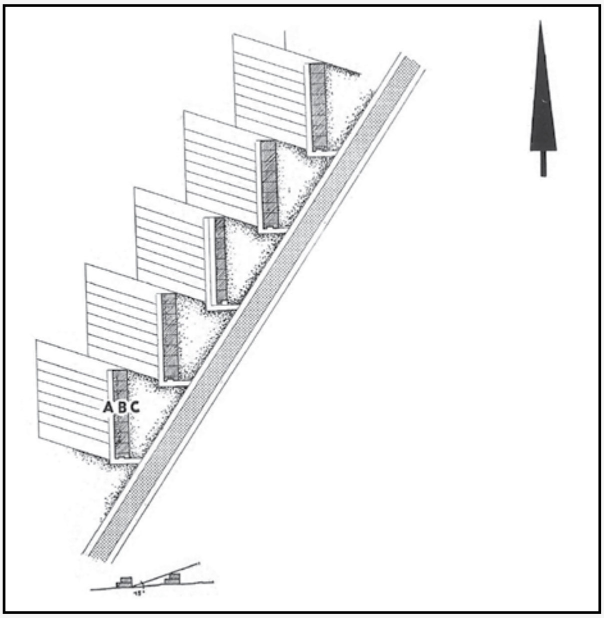

Fig. 2.7c. The site plan that appeared in *Rationelle Bebauungsweisen* showed five building blocks when only one was realised. Giedion 1931c, sheet 13.

Fig. 2.7d The workers' apartment building finished in 1932. Photo No. 50-003-432. AAM.

1925 onwards. It is likely that Aalto and Sutinen were jointly behind the three Finnish examples submitted to the Brussels exhibition. Sixteen sheets of Le Corbusier's "La Ville Radieuse" (The Radiant City) town plan were also featured at Brussels.

In spring 1931, Giedion and Aalto corresponded on the publication of an article on Finnish architecture and Aalto's projects in the German *Bauwelt* (The Building Magazine), which served as CIAM's publicity channel. Aalto's article "Ein Brief von Alvar Aalto" (A Letter from Alvar Aalto), the project description of the Turun Sanomat Newspaper Building and an overview of Finnish architecture, written by Giedion, were published in CIAM's country file on Finland.[478] Aalto's article had four key points: Finland was an agricultural society; the country grew vast quantities of wood; the questions of urban development had yet to be thoroughly discussed; and, while Finland had some urban development, in terms of organic building, construction and town planning, it had only weak architectural content.[479] The illustrations of the country file on Finland were dominated by nine high-quality photographs and drawings of the Turun Sanomat Newspaper Building and two photographs of the Minimun Apartment Exhibition. This marked Aalto's arrival on the international stage as a designer.

In May, Giedion sent Aalto the agenda of the Berlin special conference in advance. The conference would prepare the way for the 1932 CIAM conference to be held in Moscow, with "Functional City" as its theme. Giedion hoped that Nordic participants could attend the Berlin conference.[480] Aalto participated in the 1931 conference, which took place simultaneously with the Deutsche Bauaustellung (The German Building Exhibition), as did his Swedish colleagues Sven Markelius, Uno Åhrén and Eskil Sundahl.[481]

478 Giedion 1931a and 1931b.
479 Aalto 1931a, pp. 35–39; Schildt 1997a, pp. 85–86, and Schildt 1997b, pp. 85–86.
480 Giedion's letter to Aalto, May 11, 1931. Signum 10827, correspondence. AAM.
481 Mumford 2002, pp. 61–62.

2.8 BUILDING PAIMIO SANATORIUM IN THE MEDIA

Aalto's article on Paimio Sanatorium was published in *Byggmästaren* (The Master Builder) in late spring 1932 under the editorship of Uno Åhrén, a member of CIAM. The article was published in the architecture supplement[482] shortly before Helsinki hosted the Nordic Building Forum in July 1932. By publishing the arcticle, Aalto and his Swedish colleagues wanted to attract colleagues from the neighbouring countries to join an excursion to the Paimio Sanatorium building site. A group of Nordic delegates, including Gunnar Asplund, visited Paimio in conjunction with the event.[483]

The article runs across four pages and begins with text. The illustrations include 10 diagrams and one photograph with the caption: "Betongstomme till solarium" (Concrete Frame for the Sundeck). The image is dramatically simplified. The graphic presented the key elements of Aalto's design solution: the floor plan of the third floor and a site plan which acquired its final shape regarding the workers' residential building only after this. Sections of A, B, and C wings as well as the arrangement of the "standard patient room" were also presented. At this stage, the fixed desk in front of the patient room window was made of concrete. The diagram also explained the structure of the external corridor wall and the acoustic surface materials of the partition walls between patient rooms. The ideas of ceiling radiators in the patient room and the use of the ceiling surface for reflecting overhead light were introduced, but their solutions had yet to take on their final shape. The patient room wardrobes were also still work in progress and not finalised. The article in *Byggmästaren* also included a diagram of the curving wall and the eastern end of the patient wing, illustrating the acoustic control in the space, with the caption: "...The rounding transmits sound waves that travel longitudinally towards the wall section absorbing them (with blankets and fur sleeping bags hanging on the wall)". However, the corner of the corridor was not eventually built as a curve. This difference raises the question: what in fact was Aalto intending to build at that time and what message was he trying to convey? If Aalto knew that the corner was never going to be built as a curve, did he nonetheless wish to present this interior acoustic solution to his colleagues? If this was the case, he clearly considered the idea more important than the actual outcome. The press was used for creating a parallel reality to what was taking place on the building site. If Aalto, on the other hand, believed that the corner could be built as a curve, other documentation provides no clues as to the stage at which the designs were changed, why they were changed and on whose initiative. Since the rounded corner is only presented in the drawing of the article, it is likely that this was merely the architect's idea that he rejected or was compelled to reject for one reason or another.

482 Aalto 1932a.
483 Schildt 1985, p. 86.

Fig. 2.8a. Concrete frame for the sundeck balconies. This photo was published for the first time in Aalto's article in *Byggmästaren* (The Master Builder). Photo No. 50-003-091. AAM; Aalto 1932a, p. 83.

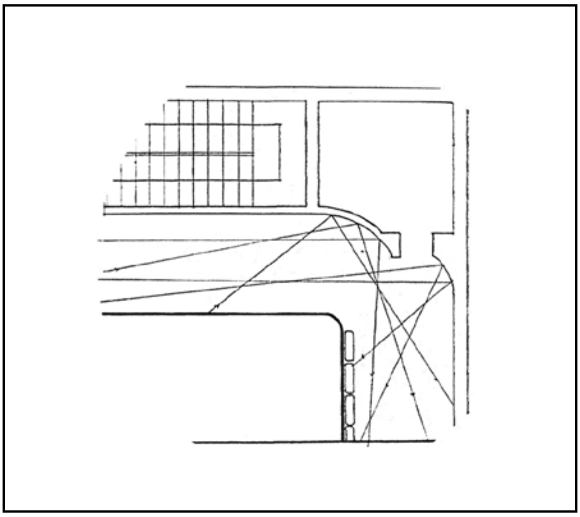

Fig. 2.8b. A diagram of the reflection of sound waves in the patient wing corridor. Aalto 1932a, p. 83.

Aalto participated in the international modernistic discourse by demonstrating his awareness of topical problems and his efforts to resolve the acoustic problem of the corridor in an aesthetically successful manner.

Photographs could not be used with the article, because the construction was ongoing and the architectural press was not in the habit of publishing pictures of unfinished sites, as these were of no interest for the editors of the architectural magazines. Aalto's ideas were illustrated with drawings and one photograph. The photograph shows, however, that the building was being constructed and that this was not only a theoretical exercise. Using image collage in illustrating the washbasins also gave a sense of realism to the article.

In his article in *Byggmästaren* (The Master Builder), he highlighted solutions that were of great interest from the perspective of international discourse. Since the Swedish architectural press was widely followed in Finland, Aalto succeeded in raising public expectations and bringing the highest-ranking leaders in the field of construction in Finland to inspect the building on its completion the following spring. Aalto adopted Le Corbusier's method of critically analysing design questions by breaking them down into parts, as evident in the description of the design solution for the patient room. It is also interesting to find that the solutions were not yet finalised. The architect was comfortable with the nature his work as a process. Aalto used publicity as his tool to clarify his thinking to himself, having to organise and verbalise his ideas.

The second description Aalto wrote about the architecture of Paimio Sanatorium was published in a publication entitled *Varsinais-Suomen tuberkuloosiparantola* (The Tuberculosis Sanatorium of Southwest Finland), which was published in 1933 by the Building Board and edited by Secretary of the Building Board Ilmo Kalkas, the former medical consultant, Medical Director of Paimio Sanatorium Markus Sukkinen and Alvar Aalto. This publication represented the official story of the project and it was aimed at policy-makers including the State Medical Board, architects and politicians. The book began with the Secretary and Ombudsman of the Finnish Association for the Prevention of Tuberculosis Severi Savonen's article on the prevalence of tuberculosis in Southwest Finland and Ilmo Kalkas' long article on the execution of the project. A shorter article on the architectural design was written by Alvar Aalto, who was also in charge of the graphic design and photo editing of the publication. He used Gustav Welin's general views and Aino Marsio-Aalto's detail photographs. This publication included only a few diagrams. Aalto treated the copy and photographs as separate elements throughout the publication. His own article ran across four spreads, followed by the introductions to the floor plans of the ground floor and first floor in the main wings. The photographic section began with large general views showing the concrete frame with the same abstract photograph that Aalto had used in *Byggmästaren* and the same images of the main building taken from the direction of approach that he would later use in his project description in *Arkkitehti* (The Finnish Architectural Journal). The captions indicated how the architect wanted viewers to look at the images, for example: "Western elevation. In the foreground, balconies of the nurses' apartments." This publication also included photographs of the wall structure taken during the construction stage, with the caption stating that the wall was insulated with brick and cork. Also included was a photograph of the armchair type. The chair was not placed in any specific room, only rows of serially produced bent wooden chairs were depicted. The image was not directly tied to the place. The *Varsinais-Suomen tuberkuloosiparantola* publication included more photographs than the article in *Arkkitehti*, including ones of the bakery, laundry, central heating pipes, boiler room and a number of interior views taken by Aino Marsio-Aalto from an angle that emphasised a personal experience.

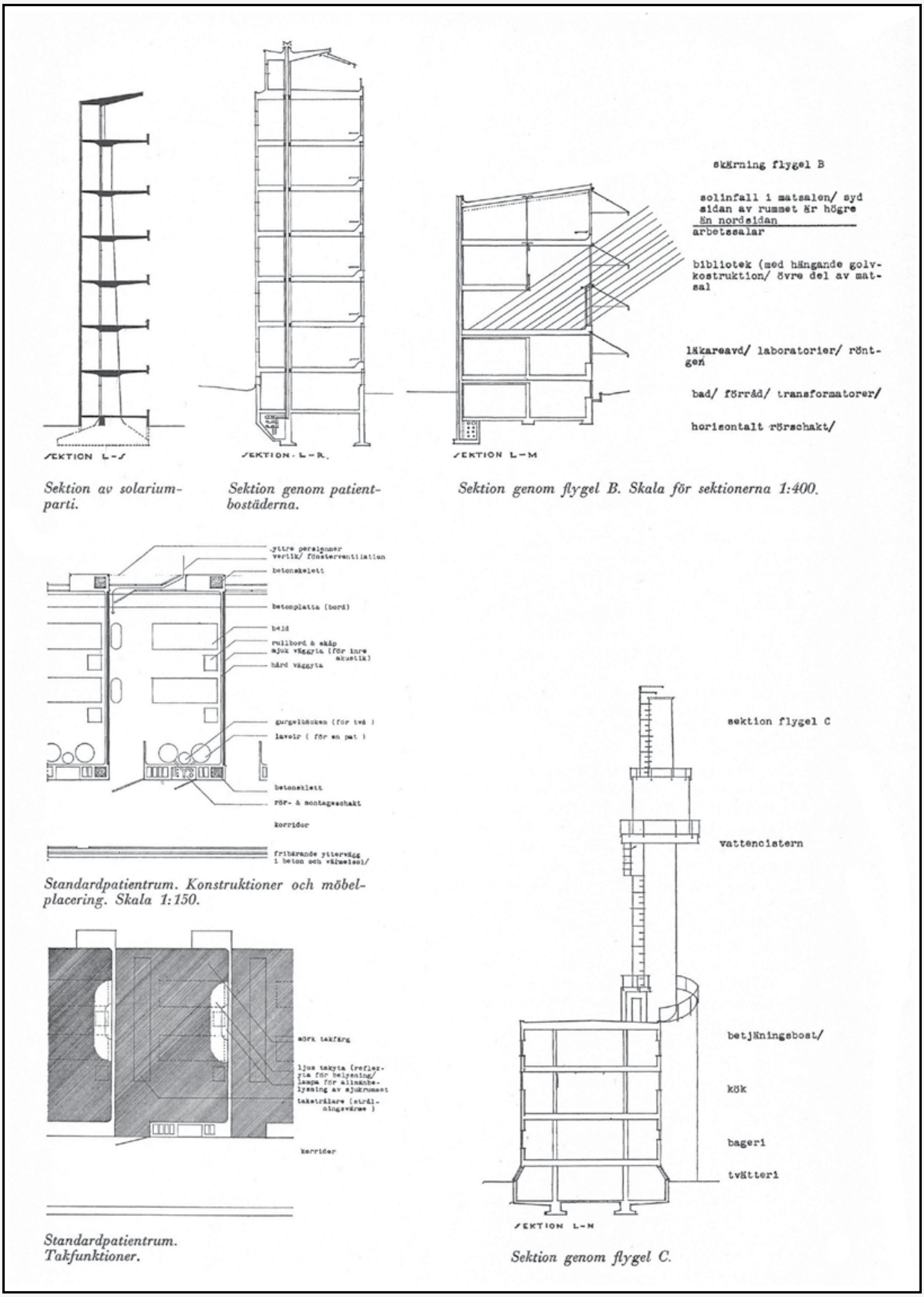

Fig. 2.8c. Diagrams presented by Aalto in his article for *Byggmästaren* (The Master Builder). Aalto 1932a, p. 82.

The three articles in the publication and the series of photographs accompanying Aalto's article were followed by numerous advertisements. The advertisers were the companies who had delivered materials for the sanatorium.[484] Aalto had also designed the advertisement's graphic layout, using mainly Aino Marsio-Aalto's photographs as imagery. This was a way for Aalto's practice to collect fees from the advertisers in the form of user rights for the photos. In the advertisements, the manufacturers highlighted their contribution to the sanatorium building projects, and the copy was for the most part descriptive and explanatory of the work process. The most interesting advertisement in terms of Aalto's ideas is the one of Huonekalu- ja Rakennustyötehdas (Furniture and Building Work Factory), which does not use images from the interior of Paimio Sanatorium but those of serially produced chair parts and one illustrating the stackability of the metal-legged chairs. By using photographs of Paimio Sanatorium in the advertisements, Aalto was able to give thorough coverage of his project. The advertisements would have had a very different look had the companies themselves decided on their design. Now, for example, the advertisement had no company logos or typeface, as Aalto had visually harmonised everything. In this way, Aalto was able to sell to the advertisers the attention of a specific target group, the progressively minded decision-makers with the power to commission building projects. An exception was Kolhon Saha (Kolho Sawmill), who was not featured among the advertisers as they had failed to complete their delivery to the specification. It is likely that Aalto deliberately excluded the company from the advertisement section. Kolhon Saha was, however, keen to use the project as their reference, and they did so in their brochure from 1938. In this brochure, the sawmill boasts having completed the majority of the carpentry work[485] for the sanatorium, which was an exaggeration. Aalto's publicity strategy was similar to Le Corbusier's.[486]

The third project description written by Aalto was targeted at Finnish architects. It was published immediately upon the inauguration of the hospital. The author explained that he had been fairly free to create the overall composition as the area was relatively isolated.

484 Luth & Rosén from Stockholm (ceiling and panel radiators); August Louhen Rautasänkytehdas ja Valimo from Turku (metal furniture), Suomen saviteollisuus (bricks); Oy Aage Havemanns Eft. Ab from Helsinki (x-ray and light treatment equipment); The Insulite Company of Finland Oy from Kymi (insulite sheets for thermal insulation), Turun Insinööritoimisto Oy from Turku (elevators); Turun asfalttitehdas from Turku (bitumen for the roofs and stair elements); Rakennustoimisto Oy Arvi Ahti from Turku (reinforced concrete skeleton); Marttisen Maalaus Oy (painting works); Suomen Gummitehdas Osakeyhtiö from Nokia (rubber flooring); Stockmann Department Store (medical set of furniture, service etc.); Vähäsillan paja from Paimio (lampposts); Turun Vanuliike from Turku (bedclothes, mattresses, towels, white coats and curtains); Hankkija sähköosasto (electric systems); Vesijohtoliike Onninen Oy from Turku (heating, water and sewage pipes); Enso-Gutzeit Osakeyhtiö from Enso (sound isolating wallpaper); Oy Taito (lamps); A. B. Crichton-Vulcan Oy (steel windows and doors); Tutun kaakelitehdas Oy from Turku (flooring tiles); Huonekalu- ja Rakennustyötehdas from Turku (furniture); Turun Rautakauppa Osakeyhtiö from Turku (steel tubes, steel stirrups and cement); Kaune from Turku (glass and glazing works); Oy. Metalliteos (kitchen equipment); Oy Wiklund from Turku (building materials and dishes); Lämmityslaite Oy from Helsinki (stoves of the private apartments); Oy. Turun Autohalli from Turku (Chevrolet lorry and van); Arabia (wash basins and sanitary fittings); Arthur Reimer from Helsinki (surfacing of the bathrooms); National Radiator Company from England represented by Bröderne Dahl, Willy Malmström in Helsinki (Rayard ceiling radiators). Sukkinen et al. 1933, the advertisements; Aalto 1933b, pp. 79–91.

485 Kolho Oy 1934, p. 110.

486 See Colomina 1998 [1994].

Fig. 2.8d. Aino Marsio-Aalto's photograph on mounting Enso wallpaper was used in an advertisement featured in the publication *Varsinais-Suomen tuberkuloosiparantola*. Photo No. 50-003-345. AAM.

The finalised group of buildings gave character to the landscape, a viewpoint that was further enhanced by a landscape picture showing the main building as taller than the surrounding woodland. The designer also explained how he had grouped different functions into separate wings in the main building, accessed through communication routes. The geographical orientation of the building had dictated the location of rooms. A wing was mainly based on a side corridor, B on both a central and a side corridor and C wing on a central corridor arrangement. Aalto stressed the significance of the patient room design, with the external wall and window systems being of primary importance. The orientation of the wing and the asymmetrical positioning of the window allowed morning light to flood the room. The room was equipped with many technological innovations, such as the ceiling radiator and the noiseless, specially manufactured washbasins. The designer emphasised his consideration of the acoustic and psychological impact of his room design. Here, Aalto did not discuss the furnishing of the patient room The wards gave access to 24-bed sundecks and the roof terrace of 120 beds for the healthier patients. The large sundeck had plant containers with mountain pines as the roof garden. The staff had also been provided with sunbathing canopies.

The separate volumes, C and B wings, were linked by a first floor corridor. C wing, the service building, housed rooms for handling raw materials and the kitchen on top of each other, connected by a lift. The kitchen and serving areas were located on the same level and storage had therefore been solved with "serial boxes with castors". Aalto also described the ventilation system in the kitchen.[487]

He recounted that the building was entirely built on a reinforced concrete frame, the external walls being non-load bearing and that there were vertical and horizontal channels running throughout the building for technical systems. The sundecks and the A wing staircase had cast concrete façades, while the other sections were rendered with a fluate[488] and lime paint coating. He also described the special structural system of the sundeck. All roofs were flat roofs. Aalto described the work process and introduced key partners, such as the site foreman, the chairman of the Building Board, the senior engineers, paintwork supervisors and the team at his own practice.[489]

Aalto did not explain in any detail the clinical spaces or methods or how the needs of clinical practice had been taken into account in the design. He overlooked explaining spaces relating to surgical operations and other active treatment forms, such phototherapy. If we compare the project description of Paimio Sanatorium to that of the Red Cross Hospital (1932)[490] and the Women's Hospital (1934)[491] in Helsinki, which were designed by Jussi Paatela, completed practically simultaneously, and published in the same magazine as the Paimio Sanatorium project, it is noticeable how Aalto completely omits discussing the design problems arising from medical treatment or the descriptions of electrical and ventilation systems or structural typification. The description of Paimio Sanatorium focused exclusively on the architect's insights and the architectural design of the sanatorium.

The 13-page in-depth article was rich in illustrations, with 22 photographs taken by Gustav Welin and 11 diagrams. The photographs were recently taken both outside and inside the sanatorium. Aalto used general views from three angles. The building was more than its main elevation; it was a spatial experience that could be approached from a number of different angles. The general view of the *cour d'honneur* between two wings was asymmetrical and emphasised a personal perception of the building. The photograph of the dining hall was taken from the lower section of the space towards to double-storey space. The cross-sections of the wings were the same as those used in 1932 in *Byggmästaren*. The section of B wing showed sunlight penetrating deep into the building, the principle which Aalto used to persuade decision-makers to allow him to keep his original design. The diagrams included a collage illustration of the structure of the washbasin and the projection of the patient room floor plan

487 Aalto 1933b, pp. 79–91.

488 Fluates were fluosilicates used as liquids to waterproof concrete and materials. The technique was commonplace in the 1920s and 1930s. Panu Kaila's email correspondence to the author, February 26, 2003.

489 Ibidem.

490 Paatela 1933, pp. 49–57.

491 Paatela 1934, pp. 141–150.

and ceiling. The diagrams of the patient room were now depicted in further detail than the similar diagrams published earlier in *Byggmästaren*. Only the collage image describing the principle of the washbasin was the same as the one used a year earlier. Aalto selected the photographs to emphasise the role of the reinforced concrete structure, the patient room, the transparency, hygienic detailing and the aesthetic of an industrial environment. The captions were short and factual while the copy provided a more in-depth explanation of the rationalistic principles adopted in the design. The article was aimed at architects and the photographs illustrated the theoretical underpinning to the design as discussed by Aalto in the article text. Here, the text and the illustration did not form a communicative tension of opposites, as in Le Corbusier's articles.

Aalto recycled the same visuals in the three articles on the main building of Paimio Sanatorium. In his article of 1932, aimed at his Swedish counterparts, he had included almost exclusively only drawings. In contrast, the 1933 publication *Varsinais-Suomen tuberkuloosiparantola* included mainly photographs. The 1933 article in *Arkkitehti* (The Finnish Architectural Journal) had twice as many photographs as drawings. Aalto did not set up any provocative juxtapositions in these articles; he rather aimed to direct, through his explanatory texts, how the photographs and diagrams ought to be interpreted. It is especially interesting to note the large number of advertisements in the *Varsinais-Suomen tuberkuloosiparantola* publication, in which Aalto used targeted advertising as a tactic in a similar way that Le Corbusier had done in the advertisements in *L'Esprit Nouveau* (The New Spirit).[492] The diagrams Aalto included in his article in *Byggmästaren* of the rounded corner indicate that Aalto used the media space to build architectural meaning, in a similar manner to Le Corbusier.[493]

492 Le Corbusier 1998 [1923, 1924 and 1925]; Colomina 1998 [1994], p. 190.
493 See Colomina 1998 [1994], pp. 104 and 114.

2.9 THE WIZARD OF THE NORTH

In January 1933, Giedion asked Aalto for a paper on the hospital for the summer's CIAM conference, focusing on the viewpoint of the physiological well-being of the patient. He was interested in images and drawings of Paimio Sanatorium for the purpose of publishing projects descriptions in *Cahier d'art* (The Art Journals) and *Bauwelt* (The Building Magazine) magazines.[494] In an undated letter sent prior to the conference, Giedion repeated his request to Aalto to deliver a paper in Athens on the sanatorium.[495] CIAM's fourth conference in August 1933 was eventually held on a cruise from Marseilles to Athens and back, instead of in Moscow, which had been the original plan. The theme of the event was "Functional City". Whilst on board the ship, the conference delegates introduced studies on the urban development of their respective countries. Following the same format, this type of study had already been prepared at the preparatory CIRPAC conference in Berlin beginning from June 1931.[496] Aalto joined the conference in Athens.[497] He did not give the paper requested by Giedion at the conference.

The other Finnish delegate at the conference, Nils Gustav Hahl, attended the whole conference. Göran Schildt has intepreted him as a representative and loyal intermediary of Aalto.[498] Hahl introduced the urban development of Stockholm on the journey out.[499] This probably happened because no Swedish delegates were present. This is an indication of the close and confidential relationships between the Swedish and Finnish architects involved in CIAM. The urban development of Stockholm was topical that year because of the competition on the planning of Nedre Norrmalm district,[500] in which Aalto was also participating.[501] Other Nordic delegates on the ship were Poul Hansen and Arno Sørenson from Denmark and the Norwegians Hermann Munthe-Kaas and Frithjof Reppen.[502] Gropius did not attend the conference and Aalto, again, missed Le Corbusier's paper, as this was given during the first part of the cruise.[503] Aalto had by this stage still never heard a paper given by Le Corbusier or Walter Gropius in person.

As the keynote speaker Le Corbusier stressed the nature of town planning as a three-dimensional science and tall building height as an essential characteristic. In his view, people's lives revolved around a 24-hour rhythm, which had a bearing in the relation between heights and distances. Town planning was about a choice between expansion and growing density. The latter led to the use of steel and reinforced steel structures to

494 The letter from Giedion from Aalto discussing matters relating Wohnbedarf and the additional personal message were dated January 26, 1933. Signums 10844 and 10845, correspondence. AAM.
495 Giedion's letter to Aalto on July 17, 1933. Signums 10846 and 10849, correspondence. AAM.
496 Le Corbusier 1964a [1933], pp. 187–189.
497 Aalto set out on his journey too late, and stopped on the way in Budapest. Schildt 1985, p. 90 and p. 95.
498 Schildt 1985, pp. 90–91.
499 Mumford 2002, p. 81.
500 See the backgrounds of the international Great Norrmalm Competition held between 1932 and 1933. See Hall 2009, pp. 117–121.
501 In the Great Norrmalm Competition, Aalto proposed replacing the existing structure with a monotonous open-block structure based on only a few different building types. Hall 2009, p. 120.
502 Mumford 2002, p. 77.
503 Le Corbusier held his presentation on July 30, 1933. Mumford 2002, p. 79.

allow city dwellers to enjoy the essentials of life – the sky, the trees, the light. Le Corbusier held that housing was the most important one of four life functions defined by CIAM (dwelling, work, recreation and transport). He criticised the garden city model for its lack of organisation. Cars and the railway had recalibrated the scale. The land in cities should be freed up to benefit the community and be allocated to a master plan.[504]

After the conference, Giedion was entrusted with compiling the proceedings of the conference. Architectural historian Erich Mumford from the United States described the correspondence between Giedion and Le Corbusier reflecting the change in the European political climate. In Giedion's opinion, CIAM was faced with the fundamental question whether to be a technological or political entity. In the given circumstances, Giedion felt that the former was the only option. If the latter role were adopted, they could achieve nothing, for as an active political actor, CIAM could only exert any influence in a socialist system.[505]

British Professor John Gold has described the difficult process that ensued after the Athens conference. The conference failed to release a public statement, although Giedion, among others, wanted to give the opposite impression. There had been tensions between German and French delegates throughout the early 1930s, and the members could not reach unanimity on the essence of the Athens conference. The first draft was further edited by the Swiss and Parisian members in autumn 1933. Eventually, in 1936, a decision was made to publish two publications, one for the general public entitled *Town Planning In Creation* and one, a more scientific one, entitled *The Functional City*. The editors were unable to find a publisher for either edition, and at the next CIAM conference of 1937, the responsibility for the publication fell on the Spanish colleague José Luis Sert, who soon went into exile in the United States due to the Spanish Civil War. The publication finally came out in 1942 under the title *Can Cities Survive?* As Gold points out, the work now served more like a source for current city planning and a retrospective on the situation 10 years earlier than a forward-looking manifesto.[506]

Le Corbusier formulated his own opinion in his 1933 book *La Ville Radieuse* (The Radiant City). He gave his description of the conference in the Chapter "Mobilisation of the Land". On the outward journey from Marseilles to Athens, the delegates had introduced their sheets and problematics that their respective cities were facing. On the inbound journey, the delegates had engaged in group work. Le Corbusier used this material in the Chapter "Plans", in which he attempted to summarise his views on the problems in the planning of certain cities, such as Stockholm, and his suggested solutions. He saw current city planning practices as a driver of inequality offering the wealthy a host of options, while millions were left unable to fulfil their basic needs at any point in their lives.[507] The conference limited its discussion to technical aspects of architecture and city planning.[508] Le Corbusier was

504 Mumford 2002, p. 79.
505 Ibidem, p. 87.
506 Gold 1997, pp. 56–77, particularly pp. 64–77.
507 Le Corbusier 1964a [1933], p. 187.
508 Ibidem, p. 188.

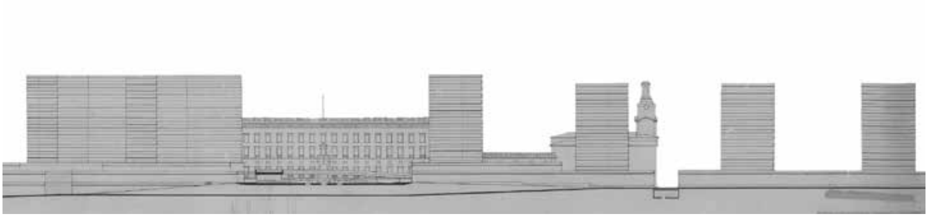

Fig 2.9a. Aalto's entry to or sketch for the Great Norrmalm Competition. The Royal Castle and the Storkyrkan church that dominate the landscape of the old town of Stockholm sink in the background of the enormous multi-storey blocks. Aalto proposed replacing the existing structure with an open-block structure. Drawing No. 13-8. The drawing has been cropped and edited. AAM.

disappointed with the outcomes of the conference. A group of experts had, based on their joint analysis, arrived at a statement saying that land was to be acquired for public use but also stating that the decision fell outside the professional remit of the architect.[509]

Why did Aalto refrain from giving a paper on Paimio Sanatorium to the group of international architects? One explanation may lie in the uncertainty of his attending the conference in the first place. However, a more likely explanation is his being intimidated by the politically delicate atmosphere and not considering CIAM the right forum for him. Aalto managed to avoid any political pitfalls by adopting this line of action. After the conference cruise, however, he sent copies of the *Varsinais-Suomen tuberkuloosiparantola* (The Southwestern Finland Tuberculosis Sanatorium) publication to his friends who were involved with CIAM.[510] Giedion responded at the end of that year, saying he was fascinated by Paimio Sanatorium based on the material received. He was curious to know whether it was Alvar or Aino who had left a stronger imprint in the smallest of details. Giedion called Aalto the Wizard of the North. He expressed his wish that Aalto should convey any materials on the building to the international press via CIAM and not directly.[511] After this, Giedion's correspondence with Aalto became less frequent, although it never completely ended.

Giedion had expressly wished that the sanatorium would be publicised through CIAM's publication channels. Publishing through the channels Giedion recommended would have helped to promote furniture Aalto had designed and the Wohnbedarf company was selling and producing.[512] Due to his involvement in the furniture trading of Wohnbedarf, Giedion had a personal interest in promoting Aalto's work. Aalto operated in the international circuit as an active communicator and unique interpreter of ideas who left his mark on the debate through his work. CIAM offered Aalto a path for gaining international publicity for his designs. His close relationship with Giedion, Sven Markelius and Walter Gropius has been widely discussed in earlier research. The situation in the Europe of the early 1930s was politically tense and economically difficult. Modernist architects, in their conscious promotion of new ideology, were easily branded as left-wing.

509 Le Corbusier 1964a [1933], p. 189.
510 See Jokinen and Maurer 1998a, p. 57.
511 Giedion's letter to Aalto on December 6, 1933. Signum 10851, correspondence. AAM.
512 Arthur Rüegg investigated the collaboration between Aalto and the Wohnbedarf company, represented by Giedion. Rüegg 1998, pp. 119–133.

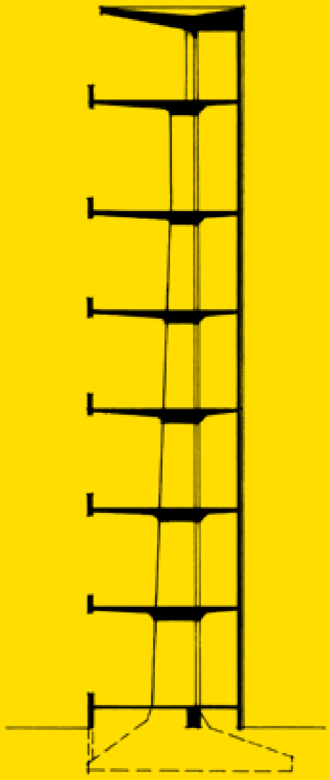

Fig. 3a. The image inked in for publication shows a simplified version of the seven-storey sundeck structure supported on one column row. Drawing No. 50-414. The drawing has been edited. AAM.

1 2 3 4

The Building of Paimio Sanatorium

This chapter is an empirical presentation of the organisation and parties that were involved in the building of Paimio Sanatorium and explains the general economic situation in Finland at that time, and how the project was funded and executed. I have selected the concrete frame, windows, patient room furnishings and installation technology as the specific focus for investigating the building process on the basis of Aalto's own writings and design documents.

For European modernist architects, the reinforced concrete frame represented a solution to the problems of urban development and, for Alvar Aalto, using the new type of structure was a welcome challenge as its application as a complete system in building construction at the turn of the 1930s was a novelty in Finland.[513] The use of concrete structures also required the ability to carry out structural calculations, a skill that many Finnish engineers acquired through studying and working abroad. "The Decision of the Council of State Concerning Instructions on Concrete and Reinforced Concrete Structures" from 1928 is an example of a new approach in construction. From now on the reinforced concrete structures were to be based on scientifically tested knowledge. Building firms became aware of the necessity of concrete building and many advertised their competence in this area, which they were indeed rapidly accumulating. The reinforced concrete frame of Paimio Sanatorium was designed in mutual collaboration between the architect and structural engineer.

Another key theme is the windows. The title of Aalto's competition entry, *Piirretty Ikkuna* (Drawn Window*)*, alone is an indication of the great importance of this element for the architect. Windows were crucial in the architectural ideology that emphasised the importance of sunlight and fresh air. The main building of Paimio Sanatorium was fitted with the more traditional wooden windows as well as metal windows and hybrids thereof. A further proof of the great importance of the window designs is the large number of architectural window drawings that remain.

In his article "Asuntomme probleemina" (The Dwelling as a Design Problem), Aalto discussed possibilities to increase the functionality of small dwellings, for which reason the furniture needed to be lightweight and movable. In the small apartments presented for CIAM, the spaces were well appointed despite their compact size. The apartment had a private space for each family member together with a versatile, modifiable shared space. The concept of a minimum dwelling was probably inspiring to Aalto when designing the patient room of Paimio Sanatorium, as the architectural drawings included a great number of details designed for the patient room. He seemed to approach the design

513 Hennebique's reinforced concrete construction system had gained popularity in the early 1900s, following the Paris Exposition Universelle. One of the largest and most significant early reinforced concrete buildings is Eliel Saarinen's Railway Station in Helsinki, which was based on a competition win and the reinforced concrete frame was designed by structural engineer Jalmar Castrén. Reinforced concrete structures were also used in industrial buildings, such as the new facilities for the City of Helsinki Gas and Electricity Company, which were jointly designed by Selim A. Lindqvist and Jalmar Castrén, warehouses and commercial buildings dating from the first few decades of the 1900s. One of the key examples of the latter is the Stockmann Department Store in Helsinki from 1930, designed by architect Sigurd Froserus. Putkonen 1991, pp. 21–76.

task through an exact analysis of 'each object separately', which he also demanded from his Swedish colleagues in his critique on the Stockholm Exhibition in 1930.[514]

Paimio Sanatorium was built in a rural landscape, some 30 kilometres east of Turku. Paimio was within easy reach by train. The distance from the station was approximately three kilometres, so the location was fairly isolated. The project included the building of a road, a regional electricity network, district heating network as well as a water supply and sewage system in a pristine, rural landscape. The early 1900s was a period of rapid development in infrastructural technologies, and the methods were yet to be established. The electrification of the countryside of Southwest Finland began as late as in the 1910s.[515] At the same time, a key objective for both hospital design and architectural ideology for that period was to achieve a high level of hygiene. Regional systems were interlinked with the sphere of urban planning, which was topical at the time, and which Aalto discussed in his article "Bostadsfrågans geografi" (The Geography of the Housing Problem).[516] The role of fresh air was also repeatedly debated at CIAM meetings. Le Corbusier, in particular, questioned the role of windows in ventilation and introduced the possibilities of mechanical ventilation as an option. The project team and designers had to take into account the installations[517] both as regional systems and, on a smaller scale, within the building.

514 Aalto 1930d, pp. 119–120.
515 See Haikala 1987, pp. 10–14.
516 See Aalto 1932c, pp. 86–92.
517 Martti Välikangas used the term 'installation technology' when explaining the heating, water, sewage, ventilation and electricity systems showcased at the 1931 Berlin Building Exposition. Välikangas 1931, pp. 106–108.

3.1 THE SOCIAL STAKEHOLDERS OF THE SANATORIUM BUILDING PROJECT

3.1.1 STATE MEDICAL BOARD HELD THE KEYS TO FUNDING

In 1929 the Finnish state promoted the founding and operation of public institutions for the treatment of tuberculosis by passing an Act[518] and a Decree[519] that provided the fundamental framework for building new institutions, and for repairing and maintaining old ones with state funding. Before the legislation came into effect, municipalities had formed federations, which had initiated the building of district sanatoria. The Tuberculosis Sanatorium of Southwest Finland, more commonly known as Paimio Sanatorium because of its location in the municipality of Paimio, was one of the large public sanatoria, whose building was financed and supervised by the state under the new legislation, and which was erected immediately after the new Act had entered into force in 1930.[520] These sanatoria represented a new type of public-sector institution and were indicative of social reform in Finland.

According to legislation, it fell within the remit of the State Medical Board to decide which institutions at a given time were to receive state aid for founding costs, as prescribed in the general plan approved by the Minister of the Interior based on the State Medical Board's proposal and within the limits of appropriations allocated in the state budget. In January 1930, the State Medical Board submitted its plan concerning tuberculosis sanatoria to the Ministry of the Interior for approval.[521] Prior to 1930, state aid had been granted to cover founding costs of six sanatoria.[522] These hospitals had from 150 to 200 beds and their budgets varied between FIM 15,100,000 to FIM 20,500,000, with the Tuberculosis Sanatorium of Southwest Finland being the most expensive.[523] The plan also included proposals for seven other sanatorium projects that met the criteria and that had yet to receive state aid.[524] The plan excluded sanatoria built by the larger municipalities, as in the opinion of the State Medical Board, their plans were mostly still at an early stage of planning. The only exception was the Vyborg Tuberculosis Sanatorium, which had been partly funded with donations.[525] However, the most important tuberculosis hospital at

518 Laki valtionavusta 269/1929. (Act on State Aid to Municipal Mental Hospitals and Hospitals for Tuberculosis Patients and for Promoting Work to Combat Tuberculosis 269/1929).

519 Asetus valtionavusta 270/1929. (Decree on the Implementation of the Act Given on the 31st Day of May, 1929, on State Aid to Municipal Mental Hospitals and Hospitals for Tuberculosis Patients and for Promoting Work to Combat Tuberculosis 270/1929).

520 The State Medical Board's proposal to the Minister of the Interior on the granting of state aid for tuberculosis sanatoria, dated January 8, 1930. Record No. 114:30 8/1 200 Y III. State Medical Board 1930 Da:7. NA.

521 Ibidem.

522 These were the sanatoria of Central Finland, Kontioniemi, the Swedish-speaking municipalities of Uusimaa Region, Northern Savonia (Tarinaharju), Oulu Region and Southwest Finland. Ibidem.

523 Ibidem.

524 These were the sanatoria of Satakunta, North Häme, Finnish-speaking municipalities of Uusimaa Region, South Häme, South Karelia (Rauha), Central Ostrobothnia (Oulainen and Swedish-speaking municipalities in Ostrobothnia). Ibidem.

525 Ibidem.

the time was the City of Helsinki's Tuberculosis Sanatorium in the district of Laakso, which could house 390 patients and was municipally funded.[526] The State Medical Board pointed out in its plan that, at the time of passing the legislation, it had been estimated that the appropriations allocated to tuberculosis sanatoria would total FIM 20,000,000 annually. Provided the appropriations remained at the same level, the proposed sanatorium building projects would be completed by the end of 1936.[527]

Building tuberculosis sanatoria was a major investment in public health. Similar hospitals were built throughout Europe and the United States. In 1931, the Vienna International Hospital Congress focused on discussing the building costs of hospitals, which was a concern widely shared by the international community.[528] In 1930, the Ministry of the Interior wanted to appoint a committee to find ways to reduce the founding costs of hospital building costs and it urged the State Medical Board to make a proposal on the matter. The State Medical Board had a special hospital department, the duties of which included reviewing the planning documents of sanatoria as well as monitoring the progress of the building projects and overseeing the state aid granting process. When reviewing the drawings, it targeted the costs specifically by reducing the cubic volume of the buildings as long as this did not compromise the operations of the sanatorium.[529] In conjunction with this, the State Medical Board had ensured that the hospitals would meet the criteria for modern medical establishments and that they would be able to operate with as few staff as possible. According to the opinion of the State Medical Board, the rising building costs of hospitals were due to the addition of radiology, surgical and outpatient departments, and the purchasing of new medical technology and equipment. In the State Medical Board's view, it was the duty of the Building Board appointed to oversee the building of a hospital in order to keep costs under control, and it was reluctant to propose a new committee specifically to find cost savings.[530] Such a committee would have removed power from the medical advisers of the State Medical Board, so it was not in the interest of the executive officials of the State Medical Board to establish such a body.

The application documentation required for state aid included a founding plan specifying the purpose of the institution and the number of beds, a description of the site, the intended buildings and a site plan. Also required were drawings of the actual hospital buildings, specifying the location and height of rooms, the number of beds to be placed in each room, the structure of windows, and lighting, heating and ventilation equipment, as well as cost estimates.[531] The compilation of the documentation was the first responsibility of the architect.

526 Heiniö 1968, pp. 453–512; Laurila and Tandefelt 1968, pp. 653–661.

527 The State Medical Board's proposal to the Minister of the Interior on the granting of state aid for tuberculosis sanatoria, dated 8 January 1930. Record No. 114:30 8/1 200 Y III. State Medical Board 1930 Da:7. NA.

528 Distel 1932.

529 Ibidem.

530 Records No. 58/11:28 K.D and No. 30/10 9777 III. State Medical Board 1930 Da:10. NA.

531 Asetus valtionavusta 270/1929, pykälä 3 (Decree on State Aid 270/1929, Section 3).

3.1.2 A COLLABORATION OF MULTIPLE MUNICIPALITIES

The project of building the Tuberculosis Sanatorium of Southwest Finland was launched by the Finnish speaking Members of Parliament of the area, and Bernhard Heikkilä[532] from municipality of Rusko was designated as initiator. Representatives of the 38 rural municipalities of the area had convened towards the end of 1927 and appointed a committee to prepare the matter under Heikkilä's leadership. Three months later, representatives of as many as 48 municipalities participated in the project and, in a meeting held on March 5, 1928 they made a decision on founding the Tuberculosis Sanatorium of Southwest Finland with 150 hospital beds, and on the appointment of a Building Board to receive and approve the municipalities' applications for their quotas of hospital beds.[533] The municipalities established a joint Federation of Municipalities to gain state funding. Since 1930, after Turku had joined, the association had 52 members[534]. By the competition stage the number of hospital beds had risen to 184 and it increased by a further hundred beds when Turku was included in the project. On completion, the hospital had a total capacity of 286 patients.[535]

The Building Board oversaw the building project from 1928 until 1934. The Board comprised of seven members and a secretary. The Building Board of the Tuberculosis Sanatorium of Southwest Finland officially convened 49 times in the years 1928–1934.[536] The first meeting, on March 5, 1928, held immediately after the meeting of representatives, was attended by all the seven members of the Board and its secretary. Heikkilä acted as the Board's Chairman and the other members included two Members of Parliament, two farmers, a labourer and a primary school teacher.[537] Two of the MPs represented the Rural League and one the National Coalition Party. All had a background in farming and two also served as bank managers.[538] After the City of

532 Bernhard Heikkilä (formerly Artig, 1882–1931) was a farmer, lay judge and MP for the National Coalition Party May 5, 1924–October 20, 1930. Parliament of Finland website.

533 Törrönen 1984, pp. 32–33.

534 The Building Board made a decision regarding a motion to the municipalities' meeting of representatives to accept Turku to the project under certain conditions. Building Board February 10, 1930, Section 1. PSA.

535 Markus Sukkinen, Medical Director of Paimio Sanatorium, reported to the State Medical Board that each unit of the sanatorium would have two four-bed rooms, 19 two-bed rooms and one private room, 47 beds per unit in total. The number of units was to be six, so the total number of beds in the units would be 282. In addition, the central unit would have two two-bed rooms for those requiring surgery and 11 beds in the special care unit. The total number of hospital beds was thus 297. As the beds in the special care unit were not included in the bed count, the State Medical Board confirmed the number of beds to be 286 and set the daily fee at FIM 20, provided that half of the beds would be free of charge. Record No. 339. The State Medical Board 1933 Ea:60. NA.

536 Minutes of the Building Board. PSA.

537 Chairman Bernhard Heikkilä from Rusko, Deputy Chairman Paavo Saarinen from Perniö and one of the ordinary members, Juho Pilppula form Laitila, were also MPs. The other ordinary members were labourer K. Hellberg from Halikko, primary school teacher Paavo Pyysalo from Vehmaa, farm owner Antti Raita from Naantali Rural Parish and farm owner Onni Rantasalo from Yläne. Törrönen 1984, p. 33.

538 Paavo Saarinen was a member of the Rural League parliamentary group between 1924 and 1933. Prior to the project, he had worked as a farmer and as a bank manager for Kansallis-Osake-Pankki (The National Bank) in Perniö between 1929 and 1932. Juho Pilppula was also a member of the Rural League parliamentary group between 1927 and 1948, and served as the Chairman of his parliamentary group. Before his parliamentary career, he had first worked as a farmer and then as a bank manager at Laitilan Säästöpankki (Laitila Savings Bank) from 1926. Parliament of Finland website.

Turku joined the project on February 15, 1930, Kaarlo Thomander[539], master builder, and Jaakko Ranta, Deputy Mayor of Turku, were appointed as new members to the Building Board.[540] After Heikkilä's death in December 1931, his work as Chairman of the Building Board of the Tuberculosis Sanatorium of Southwest Finland was continued by Antti Raita. Architect Aalto participated in the work of the Building Board from June 1929, when the Board made the decision to commission Aalto's office to design the Sanatorium.[541] Physician Markus Sukkinen[542] was appointed as the Board's medical consultant in December 1929,[543] after which he also attended the meetings of the Board. The Building Board chose Sukkinen as the Sanatorium's Medical Director in May 1932[544] based on his professional merits during the construction phase.[545] The Building Board did not convene at Paimio, and only made site visits on a needs basis.[546]

The Building Board was responsible for communication with the authorities, such as the State Medical Board, which, as the guardian of the state coffers approved the designs for the Sanatorium. The Head of the Hospitals Division of the State Medical Board, Senior Medical Officer Edward Johan Horelli's brother Medical Director Väinö Valpas Horelli,[547] influenced the project as a member of the Competition Committee. Väinö Horelli was then working on a PhD research dealing with surgical treatment of pulmonary tuberculosis.[548] The Building Board invited statements from specialist doctors on the location of the site and on Aalto's competition entry prior to ordering the architectural plans. During the construction phase, the State Medical Board provided statements on request. State aid was to be applied annually and, in conjunction, the Building Board was required to report on budget compliance and the progress of the work. The State Medical Board maintained constant control.

For the preparation and implementation of decisions, the Building Board appointed from among its members a Building Committee, operating under the authority of the Board, including three members and a secretary. The architect and the consulting

539 Kaarlo Esaias Thomander was born in Halikko in 1883 and graduated from the Turku Industrial School building construction department in 1906 and from the road and water construction department in 1907. He had also studied electrical engineering between 1904 and 1905. He began his career as a draughtsman at the Building Construction Unit of City of Turku Building Department. He was a partner at Veljekset Thomander (Thomander Bros.) drawing and construction office between 1909 and 1914. Thomander held several positions of trust in Turku City Council and served on a number of technical boards and committees in the 1920s. He also served as the joint director of Oy Radioala from 1927 onwards, as a member of the Board of Turun Suomalainen Säästöpankki (Turku Finnish Savings Bank) from 1923 onwards and as member of the Board for Turun Transito-Satama transit harbour from 1929 onwards. Tolonen 1930, p. 556.

540 Törrönen 1984, p. 42.

541 Building Board 27 June 1929, Section 2. PSA.

542 Born in 1891, Markus Martialis Sukkinen graduated as a physician in 1916 and served as a physician at Alavus Tuberculosis Sanatorium in 1920–1922, as a Junior Physician for a month in 1922, as the acting House Officer of Satakunta Sanatorium and the House Officer at Central Finland Sanatorium for a total of five months. Prior to the sanatorium project, he had made a study trip to Denmark in 1924 and Germany in 1928, where he paid a second visit to in 1930. He chaired the City of Turku Healthcare Board between 1932 and 1933. Soininen 1935, p. 510.

543 Building Board December 8, 1929, Section 1. PSA.

544 Building Board May 18, 1932, Section 3. PSA.

545 Building Committee May 17, 1932, Section 1. PSA.

546 For example Building Committee August 26, 1931, Section 1. PSA.

547 Soininen 1935, pp. 180–181.

548 Soininen 1935, pp. 180–181.

physician participated in the work of the Committee from its second meeting onwards, and civil engineer Kaarlo Albert Kilpi,[549] appointed as clerk of works, from the fourth meeting onwards. The Chairman and secretary were the same as the Board's. During the construction years of the Tuberculosis Sanatorium of Southwest Finland, between 1930 and 1933, the Building Committee convened a total of 58 times. Aalto took an active role in Board and Committee meetings, being present almost without exception, and absent only when the matters at hand did not require his presence. The contractors did not participate in these meetings, but separate meetings were held with them. Apparently, no site meetings, where all the parties involved would have been present, were held[550]. The organisation of the building project was strictly hierarchical.

The Committee's remit was practical and it carried out a great deal of preparatory work. The Building Board was not able to thoroughly familiarise itself with all decisions related to the construction and even major decisions, such as making contracts on water, sewage and heat piping and drawing up the budget, were entrusted to the Building Committee. The Committee, in turn, delegated purchasing decisions, including those on windows and doors, to Aalto. Aalto played an active role in many purchasing decisions, including selecting the suppliers for the reinforced concrete frame and radiant heaters, waste water treatment system and furniture.

The Building Board approved Aalto's motion on the scheduling of the building work partly on a cost-plus basis for the project organisation and partly as separate subcontracts.[551] The work was supervised by the Clerk of Works' Office of the Building Board.[552] In addition to clerk of works Kilpi, the site was supervised by another master builder, Väinö Tähtinen.[553] The Building Committee was authorised to invite contract tenders and to consider the extent of the first contract, i.e. the construction of the main building skeleton, and the sequence in which subsequent contracts would be performed.[554] The appendices of the minutes of the Building Board and Building

549 Kaarlo Albert Kilpi was born in Kaarina in 1885 and graduated from the Turku Industrial School building construction department in 1908. He worked at Wanadislunden's water tower construction site in Stockholm between 1912 and 1913 and studied at the Technical School of Sterlitz reinforced concrete engineering department in Germany between 1913 and 1914, graduating as a reinforced concrete engineer in 1922. Kilpi had made study trips to Germany, the Netherlands. Southern Sweden, Denmark and Belgium and worked in the 1920s as Technical Director for Turun Sementti Valimo Oy, owned by Juho Tapani, as a contractor in Turku together with master builder K.V. Lamminen between 1924 and 1929 and as an extraordinary draughtsman for Turku harbour construction office from 1929 onwards. Tolonen 1930, pp. 213–214.

550 There was no site meeting minutes book in the archives of PSA.

551 Workers housing, pump room, garages and the mortuary would be implemented as cost-plus work by the project organisation. The dwellings of state paid employees would be implemented either on cost plus basis by the project organisation or as contract work. The actual construction work of the sanatorium as well as the water mains and pumping station, general plumbing, general electrical work, elevators, doors, windows, painting, kitchen machinery, technical medical equipment and fittings would be carried out as separate projects. Extra work would be performed or implemented on a cost-plus basis by the project organisation. Building Board March 15, 1930, Section 9. PSA.

552 Aalto 1933b, p. 86.

553 Born in 1902, Väinö Tähtinen also served as the General Foreman on the construction site of Standard. He had graduated from the Turku Industrial School building construction department in 1924 and worked as the junior master builder at the construction site for the Turun Suomalainen Säästöpankki new build between 1925 and 1926 and as a master builder for the constructions sites of Housing Company Lounas and Olavi new builds in Turku between 1927 and 1928 and Maarian Sähkö Oy transformer station new build in 1929. Tolonen 1930, p. 586.

554 Building Board 3 May 1930, Section 3. PSA; Building Committee May 9, 1930, Section 1. PSA.

Committee meetings show that most of the tenders had been addressed directly to architect Aalto, that is to say, he had requested them as a representative of the Building Board. He therefore had a great influence on the choice of contractors.

The work was carried out as a part contract under client supervision. In a contract of this type, the financial risk for the outcome rested with the developer, who was responsible for the acquisition of both labour and materials, and was therefore exposed to price fluctuations. The adopted form of contract, the in-house contract, was chosen based on the assumption that building costs level would have decreased from that of 1928–1929.

The inspection of the buildings and furnishings of the Tuberculosis Sanatorium of Southwest Finland was conducted on February 10–11, 1933. The inspection was attended by Y.J. Sadeniemi, Director General of the National Board of Public Building; S.I. Launis, architect; Torsten Kranck, engineer; Edward Horelli, Senior Medical Officer; and K. Oksanen, mechanical engineer.

3.1.3 THE ARCHITECTS BEHIND PAIMIO

Aino Marsio-Aalto and Alvar Aalto's architectural practice was selected to design of the Tuberculosis Sanatorium of Southwest Finland through an open architectural competition. Initially, the intention of the Building Board had been to organise an invited competition with entries from architects Jussi Paatela, Eino Forsman and Ilmari Ahonen. In July 1928, before launching the competition, the Building Board toured other sanatoria to gain deeper knowledge about relevant issues. They visited the City of Helsinki Tuberculosis Sanatorium, designed by Eino Forsman, the Takaharju and Harjavalta Satalinna Sanatoria, designed by Onni Tarjanne, the latter of which also housed a paediatric department designed by Jussi Paatela.[555]

Forsman himself introduced the 400-bed hospital in Helsinki to the Board, still under construction and considered state-of-the-art at the time. The Board realised during the excursion that the sanatorium differed from the one designed for Paimio in that the Helsinki hospital was designed also to treat the very ill, terminal patients who needed to be hospitalised just to prevent them from contracting the disease further. Paimio Sanatorium was aimed at patients with pulmonary tuberculosis who were at least 10 years of age and who could be expected to recover fully or at least regain their ability to work.[556] The Board was impressed by the modern amenities of the new institution: the modern lifts, bathrooms and washbasins. It noted that the level of hygiene should be good, which was achieved through placing only one or two patients in each room and isolating units from each other. The organisation of the building provided much to learn, the Board opined. In Punkaharju, Medical Director Niilo Mäkinen introduced his realm, the Takaharju Sanatorium, which represented a slightly older building style

555 Building Board 7 July 1928, Section 4. PSA.
556 *Tietoja parantolaan pyrkijöille* (Information for Persons Applying to the Sanatorium). Anon 193-.

and was designed by architect Onni Tarjanne. At the time of its completion in 1903, it had been Finland's first tuberculosis sanatorium that was accessible also for the poor. Mäkinen mentioned its downsides being the lack of concentration in functions and the shortage of space, as well as the narrow, dark corridors and the placement of sundecks in the centre of the building. He also objected to situating the boiler room within the main building.[557] The Board also visited Tarjanne's Harjavalta Sanatorium, which had been completed in 1925. The Board noted that some of the disadvantages they had witnessed in Tarjanne's older design at Takaharju had been remedied, but again, for example, the sundecks had been placed in the middle of the main building and not at the ends, which the Board saw as a preferred arrangement. The sanatorium also lacked lifts big enough for hospital beds and certain washing and kitchen facilities were criticised in the report as being too small. The bakery, in which the products were baked using steam, was considered modern by the Board. The recently completed 50-bed paediatric unit (1927) designed by Jussi Paatela made a positive impression on the Board.

Forsman and Paatela were both accomplished hospital designers. Ilmari Ahonen, the third architected invited to participate in the initial invited competition, instead had no merits in hospital design specifically.[558] The Board's decision to organise an invited competition was debated outside the meeting to the extent that it revoked its decision.[559] The debate or decision on organising an open competition has not been recorded in the minutes, possibly because of the delicate nature of the matter. Reviewing competition rules was a topical issue for the architectural profession, which is the reason why the competition procedures regarding the Tuberculosis Sanatorium of Southwest Finland would have elicited critique among Turku-based architects. It is also the most likely reason why the Building Board approached the subject with such vigour and saw best to retract and change its decision. The new competition rules issued by the Finnish Association of Architects were adopted only in June 1929, when the competition period had already closed. They provided ethical guidelines and, for example, private negotiations and any exchange of opinions between the competition jury members and participating candidates were from now on forbidden during the competition.[560]

In autumn 1928, the Building Board of the Tuberculosis Sanatorium of Southwest Finland issued the following announcement: "Esteemed Architects are invited to participate in a competition for drawing up the designs for said sanatorium with 184 sick beds".[561] The announcement effectively excluded representatives of all other professions except architects, and futhermore, the wording of the Finnish original also made it clear that the architects were assumed to be male. The competition jury

557 Building Board October 27, 1928, Section 1. PSA.
558 Anon 1948, p. 8.
559 Building Board September 27, 1928, Section 3. PSA.
560 Rules for Architectural Competitions June 5, 1929. Suomen Arkkitehtiliitto (Finnish Association of Architects) 1937a, pp. 383–384.
561 The announcement of the architectural competition of the tuberculosis sanatorium of Southwest Finland. Varsinais-Suomen tuberkuloosiparantolan rakennuslautakunta (The Building Board for the Tuberculosis Sanatorium of Southwest Finland), 1928b.

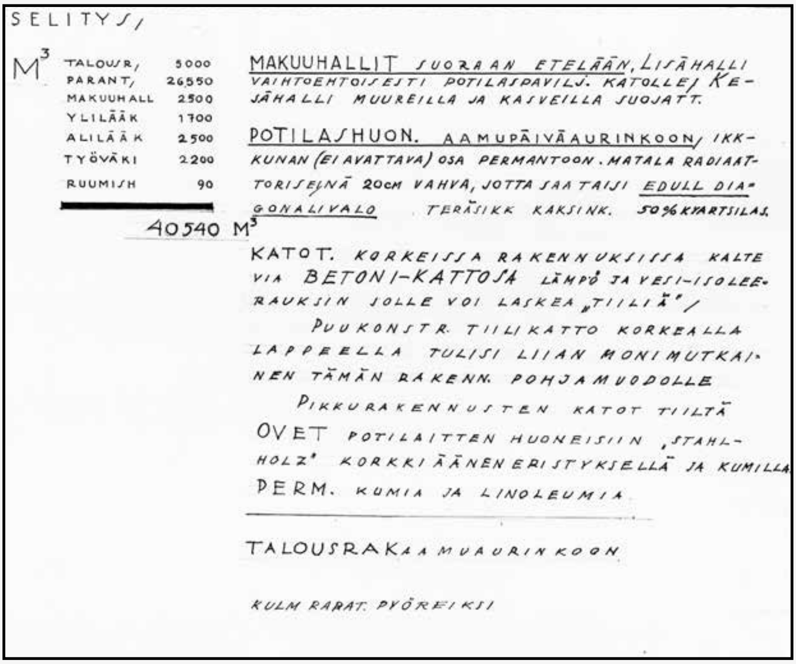

Fig. 3.1.3a. Detail of the competition-stage drawing No. 50-26. The drawing has been edited. AAM.

SPECIFICATION

[Volumes]	[m^3]
Service building	5,000
Sanatorium	26,550
Sun deck	2,500
Medical Director's villa	1,700
Junior Physicians' residence	2,500
Workers' apartment building	2,200
Morgue	90
Total	40,540

Sun decks facing the south directly, additional deck alternatively on patient pavilion roof, summer decks protected by walls and plantations.

Patient rooms facing towards morning sun, the non-opening window reaches the floor, low radiator wall 20 centimetre thick to allow for favourable diagonal light, steel windows with double quartz glazing.

The tall buildings have slanted, heat and water insulated concrete roofs that can be laid with "tiles".

Timber-structured tile roof with a steep pitch would be too complicated for the footprint of the building.

Tile roofs for the small buildings.

Patient room door with "Stahl-Holz" structure, cork sound proofing and rubber.

Floor covering rubber and linoleum.

Service building facing the morning sun.

Corners rendered into a rounded shape.

comprised Bernhard Heikkilä, Chairman of the Building Board and farm owner; Jussi Paatela (1906–1962) and Väinö Vähäkallio (1886–1959), architect members elected by the Finnish Association of Architects; Akseli Koskimies,[562] Professor elected by the Finnish Association for the Prevention of Tuberculosis and former Director General of the State Medical Board; and elected by the Building Board, Severi Savonen,[563] the Secretary and Ombudsman of the of the Finnish Association for the Prevention of Tuberculosis and Medical Director Väinö Horelli.[564] As an architect of industrial and commercial buildings, Väinö Vähäkallio was familiar with the development of construction technology and the demands of rationalisation.[565] Vähäkallio had also been a member of the architectural competition jury for the 1927 Southwest Finland Agricultural Cooperative Building, which elected Aalto as the winner.[566] Paatela, in turn, had specialised in hospital design and during the competition he served both as an advisor for the Hospital Unit of the State Medical Board and as a lecturer of architecture at

562 Akseli Yrjö Koskimies (formerly Forsman) was born in Turku in 1869. He graduated with a Master's degree in philosophy in 1890, as a physician in 1892 and as Licentiate of Medicine in 1896. His entire medical career was remarkably multidisciplinary. He made study trips to the Nordic countries and Germany in the 1910s and 1920s. In his early career, he served as the Medical Officer of Health in the municipalities of Ilmajoki and Seinäjoki, Medical Officer of Health in the City of Hämeenlinna, House Officer at the City of Helsinki Health Department for the prevention of venereal disease, Senior Medical Adviser at the State Medical Board 1911–1915 and 1917–1920, Director General of State Medical Board 1920–1927 and Medical Director at Mutual Life Insurance Company Salama since its establishment in 1910. He held notable Finnish and international positions, such as the chairmanship of Finnish Medical Society Duodecim in 1909. Koskimies was a member of several organisations and associations including the Finnish Insurance Association and the German Association for Insurance Science, and he was one of the founding members of the Finnish Medical Association and member of its advisory board from 1927, the Chairman of the Finnish Society of Dermatology, a member of the Finnish Psychiatric-Neurological Association and the Nordic Association of Dermatology, and he was made an honorary member of the Swedish National Association for the Prevention of Tuberculosis in 1929. Koskimies had participated in the work of a committee appointed for the prevention of tuberculosis as early as 1889, and he had served as a member of the planning committee of the City of Helsinki Tuberculosis Sanatorium in 1912. Koskimies was given the honorary title of Professor in 1927. Soininen 1935, pp. 253–255.

563 Severi Sefanias Savonen was born in Turku in 1886 as a son of a painter. He graduated as a physician in 1908, as a Licenciate of Medicine in 1913 and specialised in pulmonary diseases in 1915. Savonen made a remarkable number of study trips in the 1920s and early 1930s to Scandinavia, UK, Austria, Hungary, Czechoslovakia, Germany, France, Italy and the Netherlands. He participated in the Nordic tuberculosis specialists' conferences in 1921, 1925, 1927, 1929, 1931 and 1933. He served as the ombudsman and secretary of the Finnish Association for the Prevention of Tuberculosis from 1925, having previously made a career as a physician at a number of sanatoria. He held positions at Finnish, Nordic and international tuberculosis specialist associations and was a sought-after lecturer. Savonen also wrote a large body of literature on tuberculosis, both popular and scientific books and articles. Soininen 1935, pp. 466–467.

564 Väinö Valpas Horelli was born into a farming family from Kokemäki in 1882. He graduated as a physician in 1907, he became a Doctor of Medicine in 1930 with the thesis *Keuhkotuberkuloosin kirurgisesta hoidosta* (On the Surgical Treatment of Pulmonary Tuberculosis); in addition he published other publications on the topic of tuberculosis in the early 1930s. Horelli conducted study trips to Sweden, Norway, Denmark and Germany in the 1920s. He mainly practiced his profession in Southwest Finland, where he held several positions, including acting Junior Physician at Turku Regional Hospital, Medical Officer of Health for the City of Uusikaupunki, Physician at the District Psychiatric Hospital of Southwest Finland, Physician for the railway construction project between Turku and Uusikaupunki and Medical Director for Satakunta Sanatorium from 1924. Horelli also held positions of trust in local politics. Soininen 1935, pp. 180–181.

565 During the competition period, he served as the Technical Director of the building department of the Confederation of Finnish Co-operatives. The organisation in question observed a rationalistic building method and collective design approach, in which the contribution of individual designers remained anonymous. Niskanen 2005, passim. and especially pp. pp. 53–54.

566 Suominen-Kokkonen 2007, p. 52.

Helsinki University of Technology.[567] The architect members of the jury were, in other words, experts in hospital design and rationalist construction methods.

The architectural competition programme listed the buildings to be designed together with the spatial requirements of the functions to be situated in the main building and provided guidelines for the grouping of spaces. Furthermore, the competition programme specified separate buildings for the Medical Director's residence, Junior Physicians' and the Administrative Director's residences, a maintenance building and a residential building for the staff. The four separate wards in the main building were to accommodate 184 beds. The rooms were to be designed for either two, three or four patients, 25 cubic metres of indoor air per patient. Each ward was also to have two private rooms. The sanatorium building was also to accommodate offices and examination rooms, spaces on each ward for the use of staff and patients as well as communal spaces for all patients. In addition, kitchens, rooms for the use of nursing and domestic staff, communal spaces and equipment, and an isolation ward with its own entrance for patients with contagious diseases were also to be located in the main building. Each ward was to have two toilets for the use of patients and one for the nursing staff.[568]

Alvar Aalto sent sketches for his competition entry while the competition period was ongoing to the State Medical Board and received in response eleven knowledgeable comments on his proposal. The response letter had the pencil marking "E.J. Horelli", which would have been added at the receiving end – the letter was not signed, but Aalto knew it was sent by Senior Medical Officer Edward Johan Horelli, brother of one of the competition judges. It was suggested in the comments that the patient rooms be made smaller;[569] the patient corridors widened from 1.8 metres to 2 metres; the window area of patient rooms halved in size from 8.4 square metres, as not all patients could tolerate direct sun; the 10 centimetre thick partition walls between patients rooms were difficult or impossible to sound insulate; wards designed for 42 patients were far too large; the phototherapy room needed to be more centrally situated; the Junior Physician's residence and night nurses' rooms were not allocated suitable locations; the kitchen was small; there were not enough cellar spaces; the 240 square metre dining hall was oversized for 180 patients; the staff dwellings were too small, and it was not suitable that the toilet door in them opened directly to the living room.[570]

It would appear that Aalto did not concern himself with professional ethics when striving towards success in the competition any more than the Senior Medical Officer was aware of such rules, as he agreed to respond to the architect. Perhaps the Senior Medical Officer's concern that the hospital should become the best it

567 Henttonen 2009, pp. 145–148 and p. 343.

568 [Varsinais-Suomen tuberkuloosiparantolan rakennuslautakunta] (The Building Board for the Tuberculosis Sanatorium of Southwest Finland) 1928a.

569 The sketch allocated 30 cubic metres and 9.5 square metres per bed while the State Medical Board considered that 24 cubic metres and 7.5 square metres would suffice. A letter from the State Medical Board to Alvar Aalto, January 2, 1929. Correspondence. AAM.

570 Ibidem.

could be and that public money should not go to waste when such a significant new piece of legislation had been passed, overrode his regard for any moral concerns over due process.

The competition period closed on January 31, 1929, by which 13 entries had been submitted. The competition entries were placed in three classes by the jury: one entry in the lowest class, eight in the middle class and four in the top class, three of which were awarded. The jury was unanimous as regards the winning entry, submitted under the title *Piirretty ikkuna* (Drawn Window), by Alvar Aalto. The second prize was awarded to a team of three architects, Kaarlo Borg, Otto Flodin and Paavo Hanstén for their entry, *Valo* (Light). The third prize went to Antero Pernaja, Martta Ypyä and Ragnar Ypyä for their entry, *Ammon-Ra*.[571] The Award Committee proposed purchasing Erik Bryggman's entry, entitled *Ympyrään piirretty kolmioristi* (Triangular Cross Drawn Inside a Circle), for its architectural merit, but the Building Committee rejected the proposal.[572]

The jury considered Alvar Aalto's *Piirretty ikkuna* architecturally interesting, but somewhat "restless and pretentious" as a whole. The arrangement of rooms was considered pleasing and their layout successful. However, the dimensioning of the building was criticised: the main stairway was too narrow, the patients' bathing facilities overestimated and the cubic volume of the building insufficient. The jury favoured economy in the basic solutions, and felt that a wider frame would reduce the external wall surface and thus the heating costs.[573]

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571 In her doctoral dissertation, architect Leena Makkonen has analysed Martta and Ragnar Ypyä's entries in the architectural competitions for Paimio Sanatorium and South-Carelia Sanatorium in 1928–1929. Makkonen 1999, pp. 51–56.

572 Building Board February 25, 1929, Section 2. PSA.

573 Anon, 1929b, pp. 42–46.

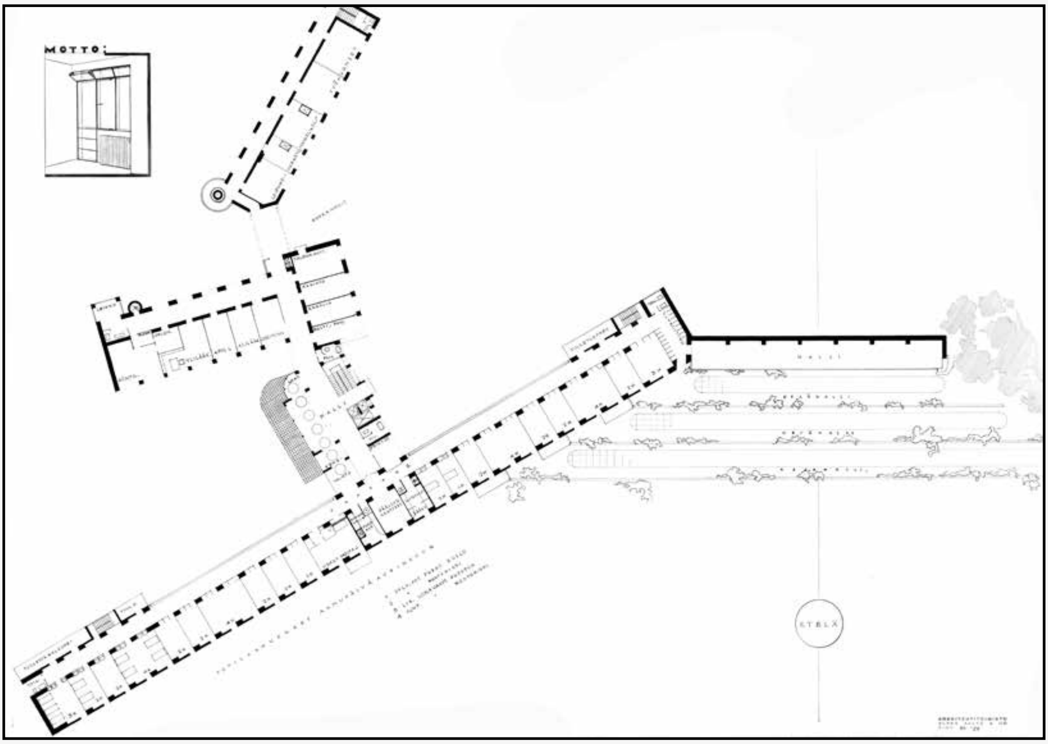

Fig. 3.1.3b. Main building ground floor plan of the competition-stage design. Drawing No. 50-25. The drawing has been edited. AAM.

The entries gaining second and third place, *Valo* and *Ammon-Ra,* were similar in their basic concepts. The buildings had L-shaped floor plans within an orthogonal coordinate system, with the wards leading off side corridors, located on different storeys in one wing, and an open sundeck wing continuing from it. The entrances were at the joint of the L-shaped building. The jury criticised the placing of individual functions in the building and the dimensioning of the spaces. Also criticised was the use of ribbon windows on the façade of the *Ammon-Ra* entry, despite the fact that the building envelope was a load-bearing structure. All the prize-winning entries had flat roofs.[574] In his competition sheet, Aalto justified the use of flat roof by pointing out that a timber-framed tile roof with a steep gradation would be too complicated to execute given the shape of the floor plan.[575]

In February 1929, the Building Board gathered to study the drafts and jury statements of the architectural competition. The Board was convinced by Aalto's entry but, before they commissioned him to finalise the drawings, they consulted Severi Savonen and Niilo Mäkinen to ascertain their preferred candidate.[576] While Severi Savonen, who was the Secretary and Ombudsman of the Finnish Association for the Prevention of Tuberculosis and Niilo Mäkinen, the Medical Director of Takaharju Sanatorium, supported choosing Aalto's entry, they presented a list of comments.[577] They criticised many details that were central to the overall architectural design, such as the outdoor sun patios, which they did not think were fulfilling their purpose as the sanatorium was situated in the middle of a forest and the patients could rest in the fresh air in the woods. They also assumed that the trees to be planted in front of sun balconies would not provide sufficient shade to the halls and the halls would therefore be too hot. Their second point of criticism was the patient room window that reached to the floor, as it would make floor cleaning impractical. The two doctors recommended taller windows to secure sufficient daylight. Thirdly, the doctors recommended that the ward sisters' rooms be moved away from the ward and to a nurses' floor, which could be located in the service wing. Fourthly, the Medical Director's private office, where he could receive guests and hold meetings with patients' family members, was to be located next to his surgery. The radiology department and dark room were to be located on the other side of the Medical Director's surgery, and the Administrative Director's office was to be located between radiology and the Junior Physicians' office. Fifthly, the phototherapy department needed to be larger, and the doctors suggested it be placed next to the bathing facilities. Sixthly, a space for a stage platform was to be reserved in the lounge and dining hall as well as a small projector room for screening films. Seventhly, the doctors criticised the arrangement of the dining hall: "According to the drawings, unless we have misinterpreted them, the ceiling of the dining hall partly adjoins the ceiling of the

574 Ibidem.

575 Drawing No. 50-26. AAM.

576 Building Board February 25, 1929, Section 1. PSA.

577 Severi Savonen and Niilo Mäkinen's statement to the Building Board concerning Alvar Aalto's competition entry on April 4, 1929. Documents related to the Paimio Sanatorium project. AAM.

next floor, resulting in a vault-like space at the top of the room. The northern wall of the dining hall has not been drawn a single window. In such a situation, the airing of the dining hall will be extremely difficult. We find that such a vault construction could be omitted altogether and some windows added on the northern wall".[578] Eighthly, each ward should have a designated room for handling meals. Ninthly, the doctors considered the potential future extensions and were of the opinion that the kitchen and its auxiliary spaces had been scaled too small. According to the doctors, the pharmacy and laboratory also needed to be relocated.[579]

Once the expert statements had been received, the Building Board decided to request further statements on Aalto's drafts as well as opinions on any necessary changes to them from Medical Director Väinö Horelli and Administrative Director Setälä of Harjavalta Sanatorium.[580] Horelli's statement addressed many of the key characteristics in Aalto's proposal. He agreed in his statement with Savonen and Mäkinen on the superfluous nature of the sun balconies. In Horelli's view, it was inappropriate to place men and women in the same hall or in halls on top of each other. On such moral grounds, he recommended that the halls were built at both ends of the patient building and also suggested that the building would be slightly reoriented to align more with the sun balconies, as he saw no justification for the room windows partly facing the east. He wrote: "I hope that with this suggested change we can also shorten the corridor somewhat between the building housing the dining hall and the kitchen building. Assuming that I have understood the proposal for sun balconies correctly, built in the proposed manner, they will prove unnecessarily expensive. Small pillars at the front of the balcony will not interfere with the appearance of the balcony, and are in any respect an impediment." Horelli also commented on the patient room windows: "As ingenious as the window arrangement would appear to be regarding the amount of daylight allowed into the rooms, I would nonetheless advise against them. I am, again, referring to Savonen and Mäkinen's statements on the matter and would also emphasise the fact that this method would result in the creation of colder wall surface – the external wall is only 20 centimeters thick and the window arrangement would, in my understanding, prove inordinately expensive."[581]

In Horelli's view the second bathing facilities in the basement could be removed as well as the disinfecting and sorting room for bath sheets, with the latter freeing up space for a phototherapy room. He also saw no need for a screen between bathtubs, and suggested that the pharmacy and the laboratory were to be relocated nearer to the doctors' offices. In addition, he expended advice on the location of rooms reserved for handling laundry. He suggested that the rooms for cleaning equipment, bed linen, medicine storage and a cloakroom be removed from the southern side, which in his

578 Ibidem.
579 Ibidem.
580 Building Board April 27, 1929, Section 2. PSA.
581 Ibidem.

opinion should be entirely dedicated to patient rooms and lounges. In Horelli's opinion, the place for the nurse's room was not on the ward, neither should they live in a special unit, which according to him would be an unpopular arrangement. He opposed the four-bed room as these were exactly twice the size of a twin room and therefore would not add space or bring savings. He pointed out that the patient rooms had no ventilation channels and that they were difficult to place in the small space that the drawings allowed.[582] Neither was Horelli content with the doctors' surgery section nor with the workshops, which were too small. He criticised the ceiling of the second-floor dining hall and called for windows on the northern wall as well as a film projection room. He would have situated the stage in the lounge and spaced out the central pillars to accommodate this. He also suggested the addition of a kitchen manager's office, and noted that the kitchen was cramped and the service staff dining room far too small. The kitchen was placed too far from the dining hall and particularly the wards, making the distance between the kitchen and a room approximately 100 metres. He suggested that the food-serving pantry in each ward could be replaced by a service trolley. In his view, the number of lifts needed to be reduced from seven to three. The nurses in the third hall did not need a dining room, but a lounge and a reading room allocated for their use would be appropriate. The kitchen maids' rooms, which were twin rooms, seemed confined. He also thought it advisable to move the House Officer's residence away from the nurses' unit.[583]

The architect was expected to take into consideration the critique provided by the experts. Many of the issues mentioned by the doctors were central to Aalto's architectural design. Adjusting the design in accordance with the demands that the doctors had made was a challenge. The Tuberculosis Sanatorium of Southwest Finland and architect Alvar Aalto signed two separate contracts. The design contract governed the execution of drawings, work specifications and cost calculation[584] against a fee of FIM 300,000. Master drawings and the cost calculations were to be completed by December 1, 1929, after which the Building Board reserved the right to submit them for review by expert physicians. The architect was expected to make alterations to the drawings without separate remuneration, if the expert physicians' statements so required, and the developer unanimously concurred. A similar procedure was applied in case the State Medical Board required alterations to the drawings as a condition for their approval or for granting state aid. The developer paid the fee in instalments. The first three instalments, FIM 170,000 in total, were to be paid against master drawings, cost calculation, work specifications and the standard working drawings. The remaining fee was to be paid on the completion of working drawings.[585]

582 Ibidem.

583 Ibidem.

584 The students had to prepare cost calculations and a work specification as parts of their diploma work at Helsinki University of Technology at the time Aalto was a student in 1916–1921. Härö 1992, p. 215.

585 Contract No. 1 between the Building Board of the Sanatorium of Southwest Finland and architect Alvar Aalto on June 28, 1929. Documents related to the Paimio Sanatorium project. AAM.

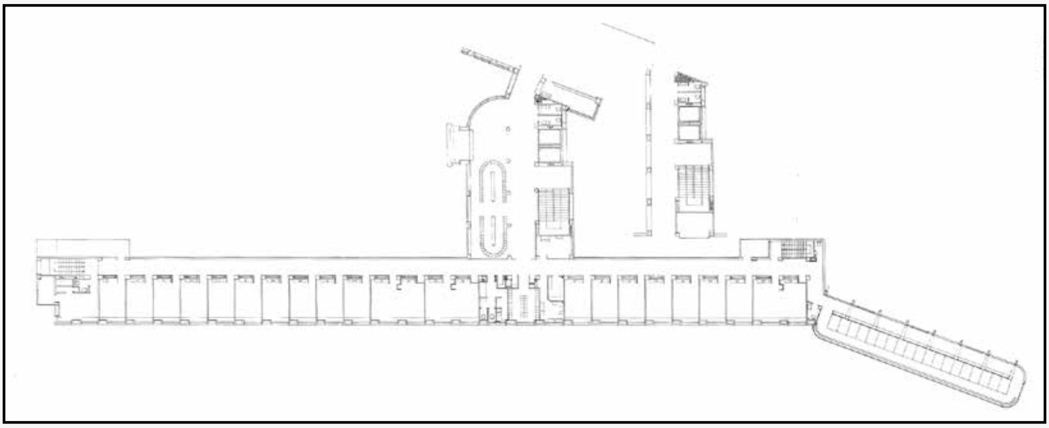

Fig. 3.1.3c. Main building ground floor plan in December 1929. There were still three four-person patient rooms per ward. Drawing No. 50–62. The drawing has been edited. AAM.

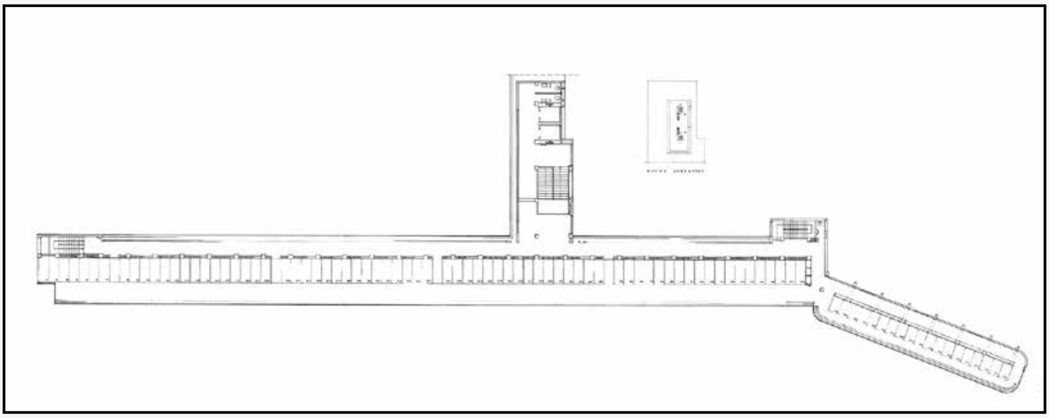

Fig. 3.1.3d. Main building sun deck plan in December 1929. Drawing No. 50–63. The drawing has been edited. AAM.

According to the second contract, the architect undertook the general management of the sanatorium construction work including the back office and administrative work, and negotiations with the developer, subcontractors and contractors. He was also required to take responsibility for similar duties during the actual construction phase. In addition to building planning, the architect's remit also included drawing up complete designs for furnishings and special equipment as well as programmes, managing the procurement thereof and the management of construction work concerning the entire sanatorium, except for accommodation intended for private use. The architect's fee for the general management of the construction work was FIM 250,000, of which FIM 70,000 was paid against the interior design drawings.[586] The architect's fee was not tied to the building costs. The contracts Aalto entered into gave him a great deal of power on the project, particularly in terms of the interior design, as he was in charge of procurement for the interior.

According to Alvar Aalto, the design team at his practice consisted of, in addition to himself, architects Aino Marsio-Aalto, Erling Bjertnæs, Harald Wildhagen, Lauri Sipilä and Lars Wiklund.[587] Aino Marsio-Aalto[588] and Harald Wildhagen[589] were between 30 and 40 years of age, while the other designers were approximately 30 years old. The Norwegian Wildhagen had the most work experience, having previously worked in Berlin, among other places. Another Norwegian Bjertnæs[590] and the Finn Wiklund[591] had graduated in the same year, 1925, the former in Oslo and the latter in Helsinki. The Finn Sipilä had only recently received his degree and was the youngest in the team.[592]

Alvar Aalto typically did not mark his drawing with his initials and he only signed the set of drawings addressed to the State Medical Board and some of the drawings intended for exhibitions or publications. Apparently only few, probably less than five

586 Contract No. 2 between the Building Board of the Sanatorium of Southwest Finland and architect Alvar Aalto, June 28, 1929. Documents related to the Paimio Sanatorium project. AAM.

587 Aalto 1933b, p. 86.

588 Aino Aalto (née Marsio) was born in Helsinki in 1894, and she studied architecture at Helsinki University of Technology between 1913 and 1920. She initially worked at Oiva Kallio's firm and from 1923 at Gunnar A. Wahlroos' practice in Jyväskylä until 1924, when she started working together with Alvar Aalto and also married him the same year. Heporauta 2004, pp. 12–45.

589 Harald Carlsön Wildhagen was born in Bergen in 1895 and he graduated from the Norwegian University of Technology in 1919. At the beginning of his career, he had served as an assistant for M.A. Bachke's practice in Trondheim and for Philip Holtmann's practice in Berlin in 1922. He worked for Aalto's practice from 1928 to 1930. Between 1930 and 1934 he worked as a private practitioner in Oslo together with Edgar Smith Berentsen. Register of Norwegian architects. NN.

590 Erling Bjertnæs was born in Fianarantsoa on Madagascar on November 13, 1899. He completed his architecture studies at the Norwegian University of Technology in 1925, and at the beginning of his career worked at the architectural practice of Alvar Aalto for three and a half years in Turku, Finland. He also worked at the practices of Norwegian architects including Blakstad, Munthe-Kaas, Arneberg, Reinhart and Reppen for about two years. During the period 1931–35, he spent part of his time practising privately. Register of Norwegian architects. NN.

591 Lars Alexander Wiklund was born in Angelniemi, Finland, in 1899 and finished his architecture studies at Helsinki University of Technology in 1925. He was Swedish-speaking. Anon 1948, p. 578.

592 Lauri Rafael Sipilä was born in Mynämäki in 1904 and graduated as an architect from Helsinki University of Technology in 1929. He had previously served as a lecturer at the Helsinki Industrial School between 1928 and 1929. Anon 1948, 479.

Fig. 3.1.3e. The Norwegian architects Harald Wildhagen and Erling Bjertnæs celebrating the Christmas at Aaltos' in 1929. Photo No. 91-005-010. AAM.

of the drawings were by Aino Marsio-Aalto.[593] Most of the drawings bear the initials of Lauri Sipilä, Lars Wiklund, Erling Bjertnæs or Harald Wildhagen. In addition, the initials "T.T." that appear in at least five architectural drawings belong Teuvo Takala,[594] who was the most senior of Aalto's staff, a model builder and draughtsman.[595] A person who used the initials "H.H." also contributed to the design process but his identity is not known, although it is possible that it can be attributed to a student by the name of Hugo Harmia. Aalto never mentioned Takala or the person behind the initials "H.H." in the project description that appeared in *Arkkitehti* (The Finnish Architectural Journal). It is quite possible that he found it inappropriate to credit a draughtsman or a student as members of such a high-profile team.

593 Only few of the architectural drawings for the Paimio Sanatorium competition bore the initials "A.A." or the drawings can be credited to Aino Marsio-Aalto, based on the hand-writing. The drawings in question are for the interiors of the staff dwellings. AAM.

594 Arne Hästesko's email to the author concerning the identity of "T.T." on January 7, 2012.

595 Teuvo Takala was born in Jyväskylä as a son of a master builder who had been taught by his father to make building drawings and models. He knew Aalto's family for some time having lived as their tenant. Takala worked at Aalto's practice since it was established all the way until the 1950s. Schildt 1982, pp. 125–126.

The architects used sequential numbering on certain sets of drawings, but a large proportion of the drawings were unnumbered. Amongst the material, certain design documents would seem to form coherent series, allowing us to form a picture of the progress and different stages of design and construction work. The material included freehand sketches, which were linked with the competition stage.[596] The competition-stage drawings were easily identifiable thanks to the vignette marking on their top left corner.[597] The vignette showed the patient room window with the word "motto" above. The title of the competition entry was *Piirretty ikkuna* (Drawn Window). The competition sheets were identifiable also by the hand-written number '9', which was the number assigned by the competition jury to the entry.

Once the competition result had been announced and the design contract signed, Aalto set out to design the four-storey sanatorium for 184 patients. The decree stipulated that drawings on the actual hospital buildings specify the location and height of rooms, the number of beds to be placed in each room, the structure of windows, and lighting, heating and ventilation equipment.[598] Aalto presented his designs to the Building Board in December 1929, as scheduled.[599] The Building Board took note that the architect had for the most part incorporated the changes as required by various parties during the competition stage.[600] The Building Board refrained, however, from confirming the drawings at this time, as it had in the meantime entered into negotiations with the City of Turku on their possible participation in the project. The Turku authorities had approached the Building Board before Christmas 1929 and enquired under which conditions it could join the project.[601] A confirmation on Turku joining the project was received in February 1930, which meant that the number of beds was to be increased by one hundred, while the number of staff would remain unchanged from the original 70. Aalto was assigned the task of updating the design to accommodate the new situation and his fees were raised accordingly.[602] The changes created a need to improve the efficiency of the staff facilities. A series of drawings has been preserved that relate to the design phase in the spring of 1930, when Aalto was compelled to reassess the building design that had been fairly complete by this time.[603] Aalto based his changes on this existing work but also created some new designs from scratch. For example, the load-bearing structure has been marked in red pencil on top of the older black pencil drawings. The orientation of the main staircase was changed by 90 degrees, the number of floors in the A wing increased by two, the elevations were redesigned and the solution for the reinforced concrete frame took shape. In the

596 Drawings from No. 50-638 to No. 50-654. AAM.

597 Drawings from No. 50-24 to No. 50-33. Drawing No. 50-655 is the vignette drawing presenting Aalto's window design, which did not appear as an independent drawing amongst the competition sheets. AAM.

598 Asetus valtionavusta 270/1929, pykälä 3. (Decree on State Aid 270/1929, Section 3).

599 Drawings from No. 50-62 to No. 50-65, No- 50-68, No. 50-71 and No. 50-73 are of this design phase. AAM.

600 Building Board December 8, 1929, Section 2. PSA.

601 A letter from the Town Council of the City of Turku to the Building Board on December 19, 1929 is attached to the minutes. Building Board December 22, 1929, Section 2. PSA.

602 The fee was raised by FIM 69,000. Building Board March 15, 1930, Section 11. PSA.

603 Drawings from No. 50-656 to 50-708. AAM.

SKETCHES OF THE LOBBY AREA FROM EARLY 1930

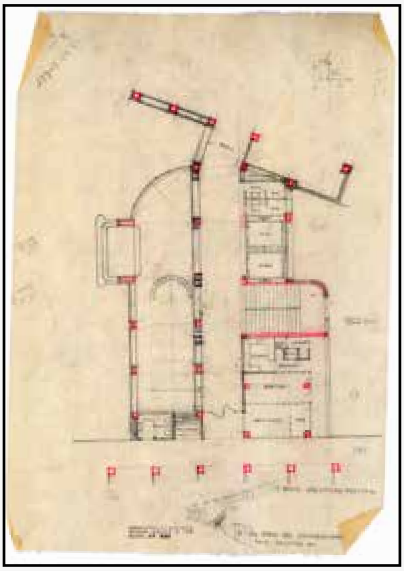

Fig. 3.1.3f. The load-bearing structure is marked with red. The main stairs have been rotated by 90 degrees. Drawing No. 50–684. AAM.

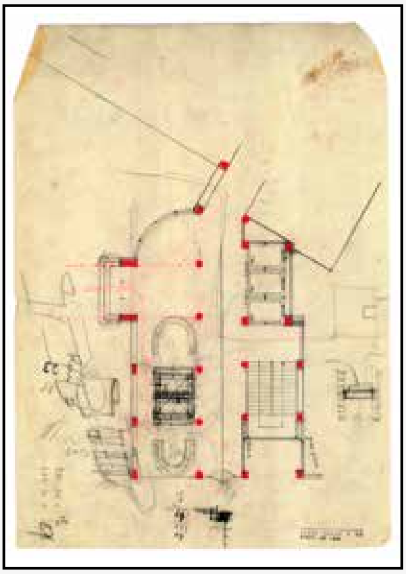

Fig. 3.1.3g. Sketch of the lobby area from early 1930. Drawing No. 50–686. AAM.

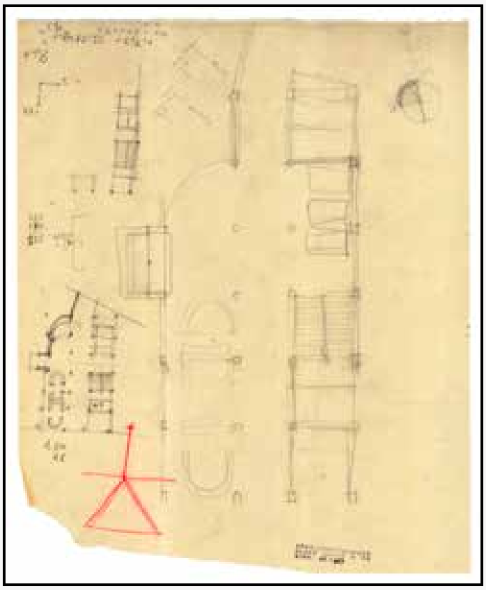

Fig. 3.1.3h. Sketch of the lobby area from early 1930. Drawing No. 50–687. AAM.

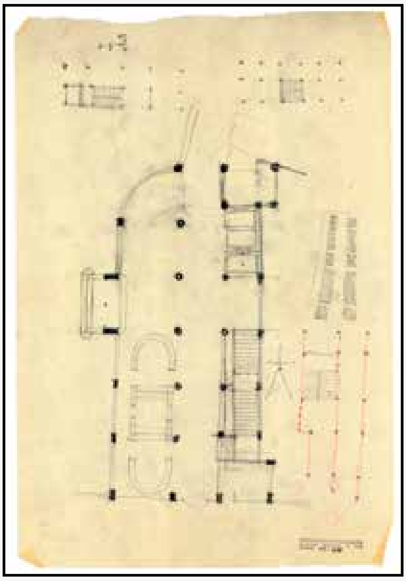

Fig. 3.1.3i. Sketch of the lobby area from early 1930. Drawing No. 50–688. AAM.

basement of the B building, the bathing facilities for male and female patients were combined and the work spaces previously placed in the basement were now relocated to the fourth floor, from where the flats with recessed terraces were in turn removed. The patio from the top floor of the B wing was removed altogether. The toilets in A wing were relocated and the ward nurse was given a larger office. In December 1929, the wards had still included three four-bed rooms, but by April 1930 there was only one on each ward. The design matured and became more detailed between December 1929 and April 1930.

Aalto introduced the third version of his design to the Building Board in April 1930. The Building Board accepted it and authorised Aalto to submit his drawings to the State Medical Board for approval.[604] Aalto filed the application for approval two days later. In addition to drawings, the application was appended with general building specifications, a summary of construction costs, a table of furnishings and 12 standard drawings[605], which were binding for the contractor. The State Medical Board approved the design without amendments.[606] This series of drawings was signed by Alvar Aalto.[607] This third stage of design can, with good reason, be treated as the master drawings for the project, as it served as the point of departure for the actual construction work.

In May 1930, Aalto's office was completing the C series of the working drawings, including the floor plans, sections and elevation drawings for buildings A, B, C and D. The floor plans specified the scaling of the frame, the window and door codes as well as materials marked with symbols for reinforced concrete, bulk concrete and heat-insulated walls. The C series drawings beared Erling Bjertnæs' or both Bjertnæs and Wildhagen's initials, except for one, which beared Bjertnæs and Wiklund's initials.[608] Two drawings dated July 1930 beared the initials "H.H." Two C-series drawings from 1931 beared the initials of Erling Bjertnæs, with one also marked with Lauri Sipilä's initials.

The D series drawings were dated between 1930 and 1932, and the numbering ends at 197. They were initially drawn by Erling Bjertnæs, the person behind the initials "H.H.", and Lars Wiklund. From August 1931 until November 1932, the drawings were created by Lauri Sipilä and Lars Wiklund. Sipilä's contribution became notable towards the end of the project. These drawings covered, among other aspects, details of various features, drawings for technical systems, interior drawings, fixture designs and images of doors. The archive material included an E series with drawings dated between July 1930 and June 1931. They were mainly door and window details drawn by Lars Wiklund.

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604 Building Board April 8, 1930. PSA.

605 The standard drawings presented the floor edge trims; stair and stair coverings; handrails; roof edges and roof; roof railings; window casing; patient room window; glass-concrete; open electrical line; blinds (external); ventilation duct cap; ceiling rose. Record No. 2466. State Medical Board 1930 Ea:19. NA.

606 Ibidem.

607 Drawings Nos. 50-72a, 50-74, 50-75, 50-76a, 50-97a, 50-98a, 50-102a, 50-108a and 50-485. AAM.

608 The name label on drawing No. 50-101 is damaged and the information is not available. AAM.

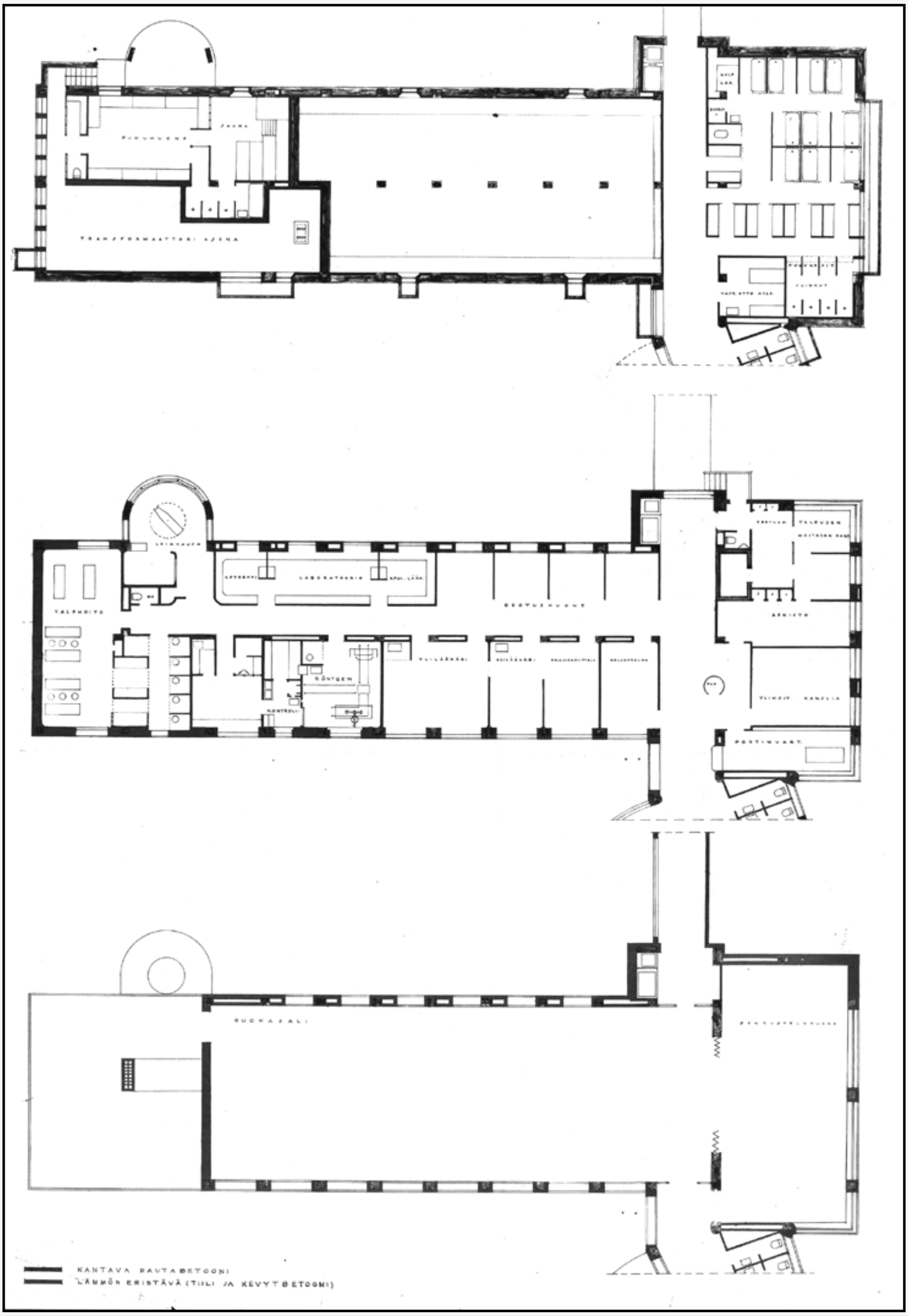

Fig. 3.1.3j. Master drawing of the B wing plans, April 1930. The top image shows the basement floor plan. The ground floor (in the middle) houses treatment rooms and surgeries, doctors' offices and the operating theatre. The plan of the first floor (bottom) shows the dining hall and lounge. There was access from the dining hall to the kitchen wing via a footbridge. Drawing No. 50-72a. The drawing has been edited. AAM.

Some of the drawings were marked with a special 'standard' stamp. Most of such drawings were dated between August 1929 and September 1932, while some were undated. The numbered standards 201–206 were not related to Paimio Sanatorium, as earlier mentioned in Chapter 2.6 "The Horizontal Sliding Window". The door standards were to do with the plate frame, curved threshold and the cladding materials of the flush panel door. The plate frame was used for patient room doors and it is quite possible that the curved threshold was also realised in patient rooms. The fixture standards were for a glass shelf, presumably designed for the operating theatre[609], various tables and iron shelves in the work spaces[610] and patient room furnishings, hand-washbasins and wardrobes[611]. Standards for windows included, among others, the numbered standard signed by Aalto, drawn in October 1930.[612] Visual presentations, sheets and montages created for publications, which contain both drawings and photographs, formed a separate group. These images were created in 1932 or later.

The catalogued material held by the Alvar Aalto Museum also included unfinished or for some other reason undated drawings related to Paimio Sanatorium. The archives also included drawings for other buildings within the sanatorium compound and later alterations, which have been excluded from the present research. Some detail drawings were originally from Aalto's other projects.

609 Drawings Nos. from 50-199 to 50-201. AAM.
610 Drawings Nos. 50-175, 50-176 and 50-190. AAM.
611 Drawings Nos. from 50-177 to 50-189. AAM.
612 Drawings Nos. from 50-169 to 50-174. AAM.

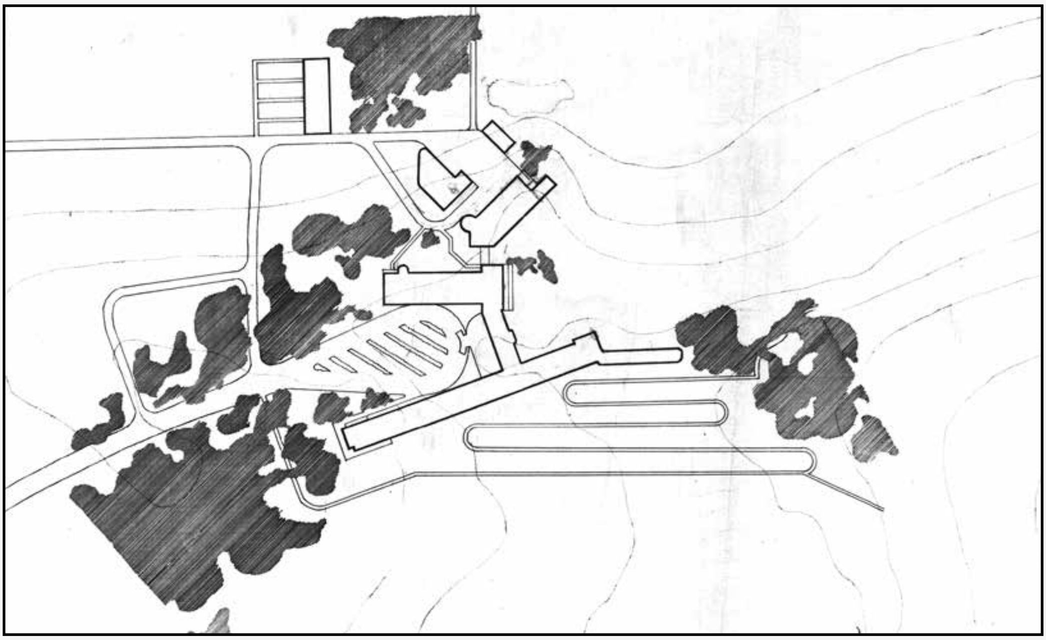

Fig. 3.1.3k. Master drawing of the site plan, April 1930. The building was approached from southwest along a road. The yard between the main wings had a car park and plantations. On the southside of the A wing was a geometric garden as a contrast to the surrounding pine forest. This site plan, which was the one presented to the State Medical Board, did not include the Medical Director's residence, or the terraced house for Junior Physicians and the Administrative Director. Detail of drawing No. 50-74. AAM.

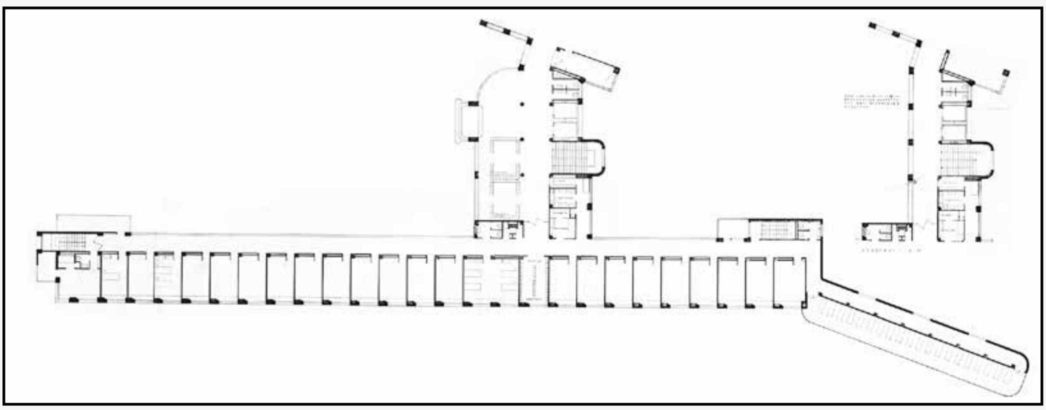

Fig. 3.1.3l. Master drawing of the ground floor plan, April 1930. The main staircase was turned 90 degrees to be east-west-oriented. There was now only one four-bed patient room in each ward. There was an open ward in every six wards. Drawing No. 50-75. The drawing has been edited. AAM.

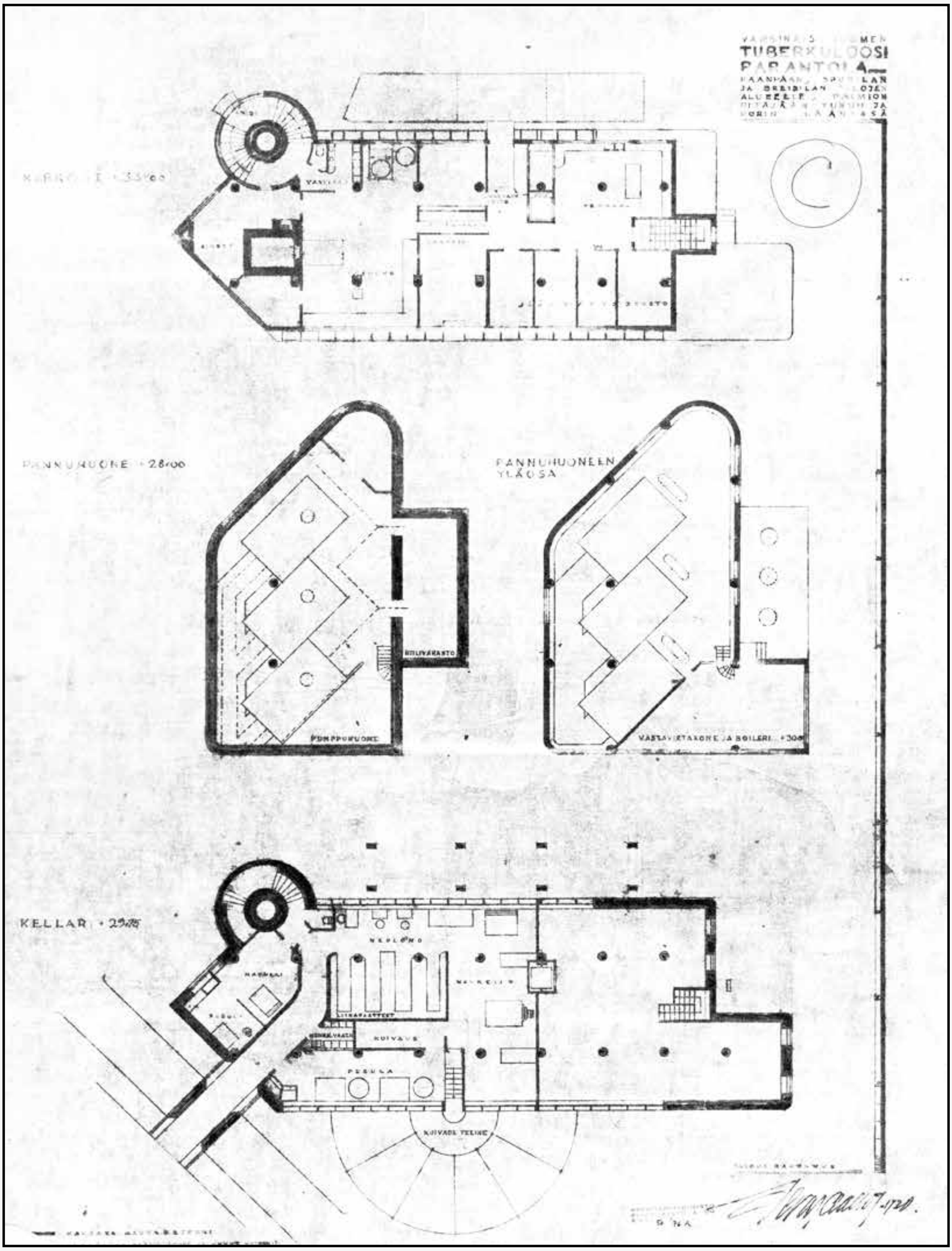

Fig. 3.1.3m. Master drawing of two plans of the C wing, and plans of the D wing, the district heating plant, in the middle, April 1930. Drawing No. 50-76a. The drawing has been edited. AAM.

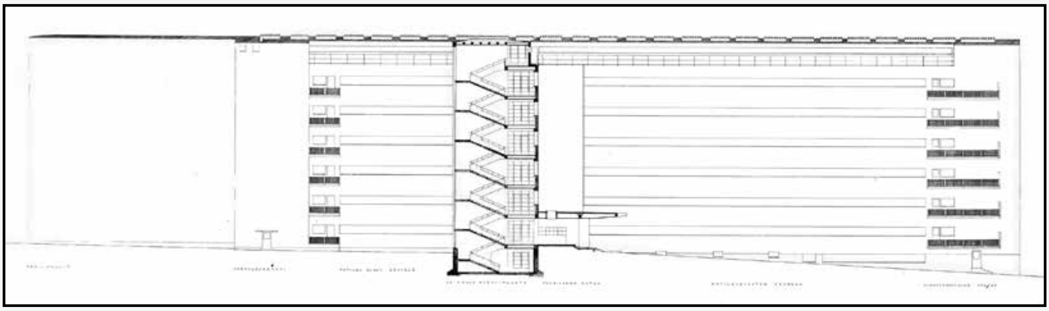

Fig. 3.1.3n. Master drawing of the north façade of A wing, April 1930. The north-facing elevation of the sundeck wing with its closed back wall on the left. Drawing No. 50-97a. The drawing has been edited. AAM.

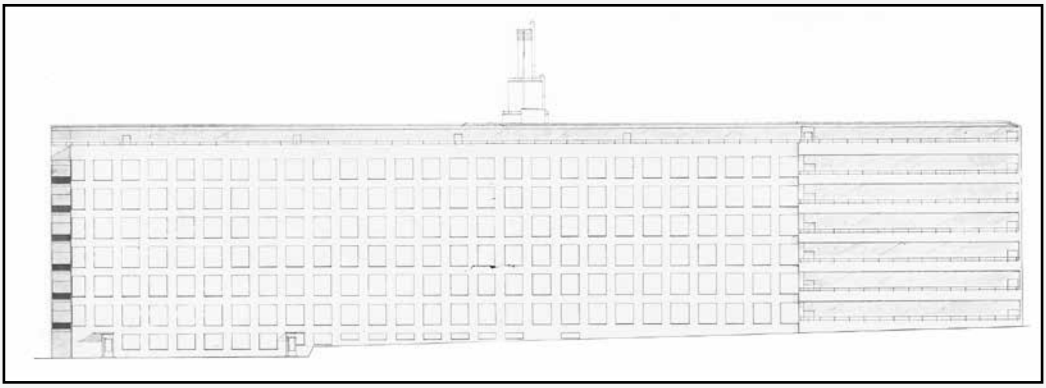

Fig. 3.1.3o. Master drawing of the south façade of A wing, April 1930. Drawing No. 50-98a. The drawing has been edited. AAM.

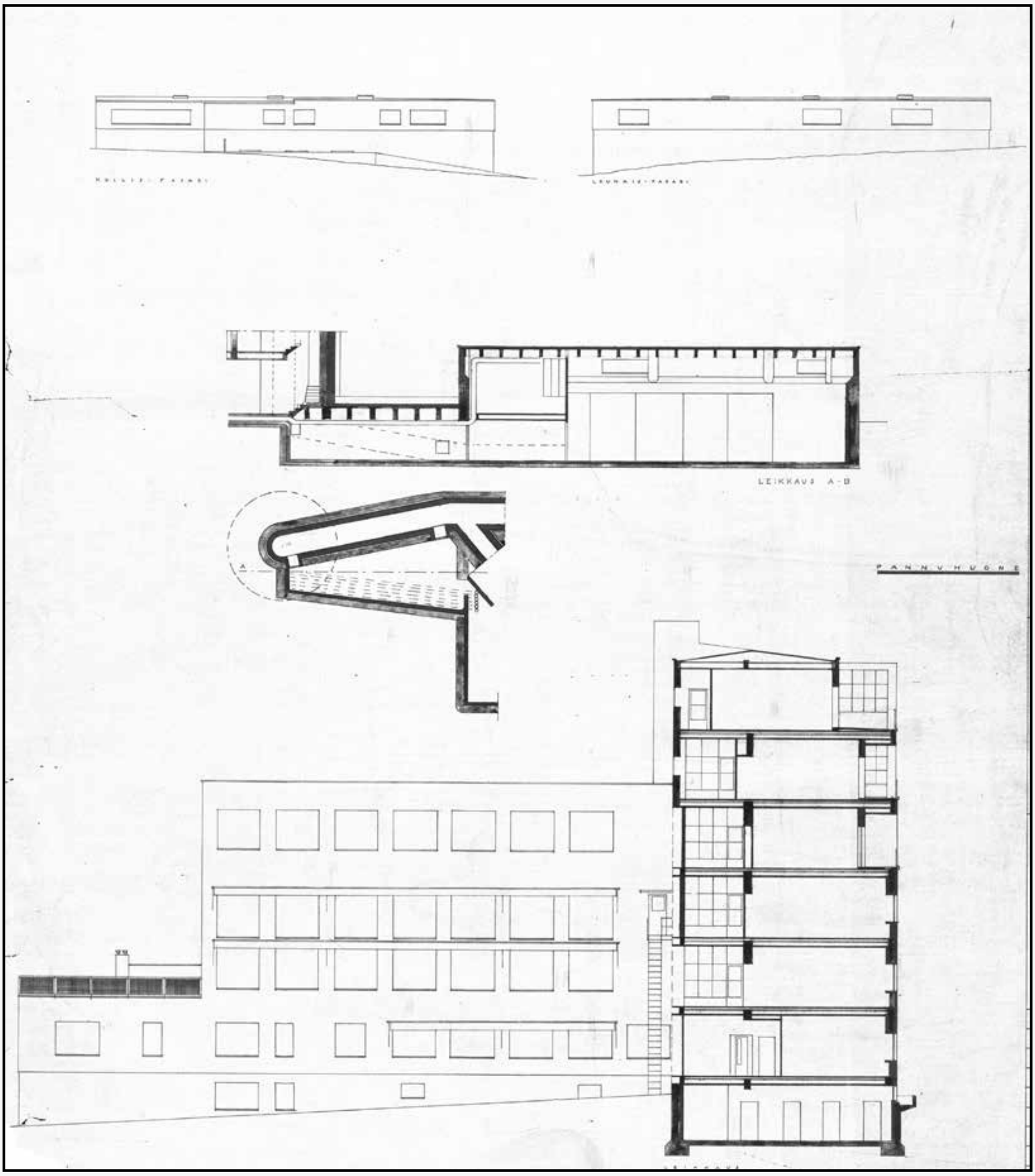

Fig. 3.1.3p. Master drawing of the façades and section of the district power station, and the B wing south façade, April 1930. Drawing No. 50-102a. The drawing has been edited. AAM.

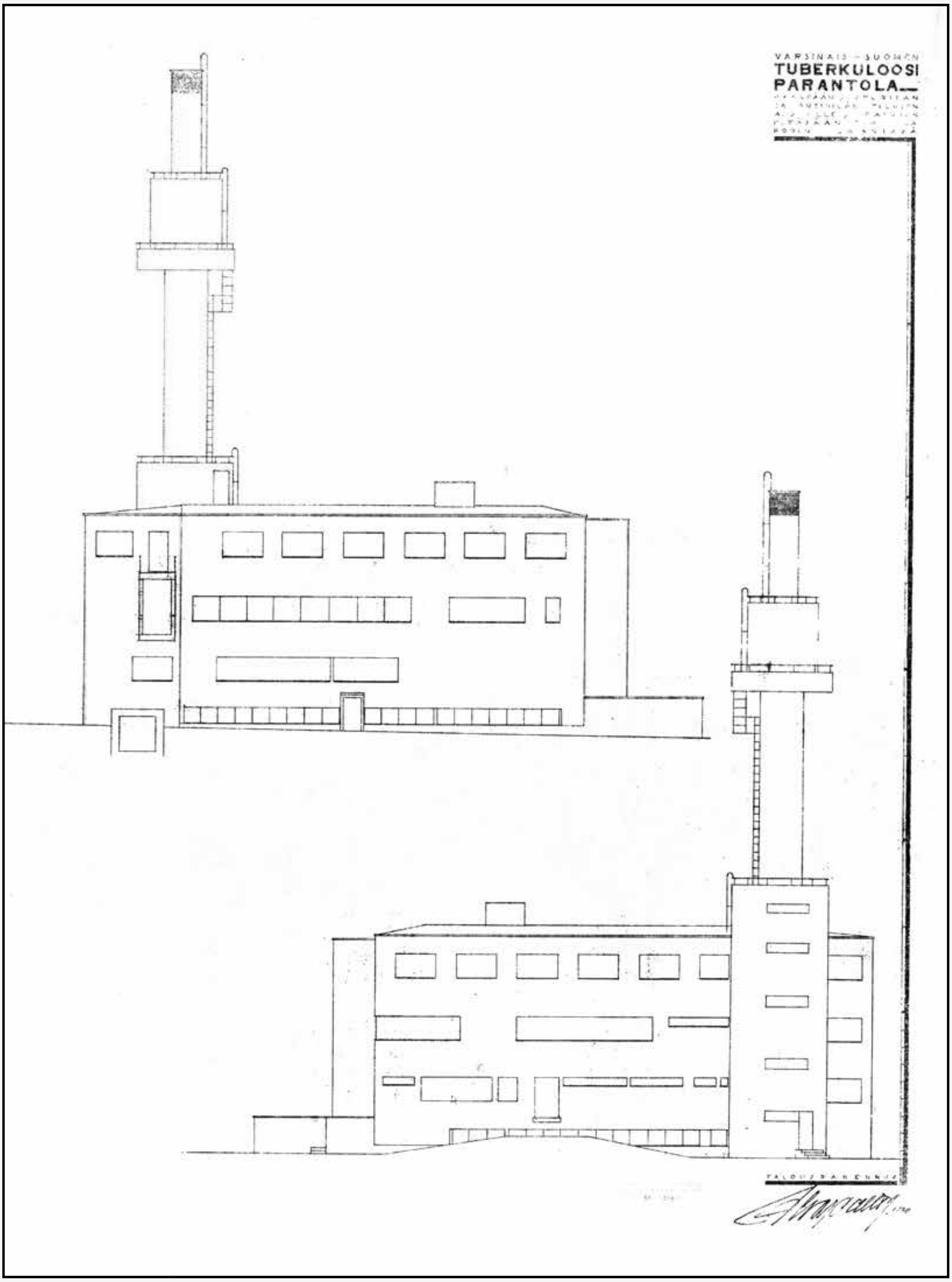

Fig. 3.1.3q. Master drawing of the C wing long façades facing southeast and northwest, April 1930. Drawing No. 50-108a. The drawing has been edited. AAM.

3.2 THE FINANCIAL CIRCUMSTANCES SURROUNDING THE BUILDING PROJECT

3.2.1 PROJECT GREW, THE BUDGET WAS EXCEEDED AND FUNDING TANGLED

The Tuberculosis Sanatorium of Southwest Finland was one of the largest facilities to be built in Finland during the early 1930s. In spring 1930, after the City of Turku had joined the project, the project budget was FIM 22 million.[613] The Building Board assumed that three quarters of this sum would be covered by state aid and the rest of the funding would be covered by the participating municipalities.[614] The City of Turku, which joined the project only later, was not obliged to pay any more per bed than the other municipalities.[615]

However, the costs increased by FIM 5.5 million between spring 1930 and the completion of the building in April 1933. Furthermore, the state was unable to cover the statutory three quarters of the funding. What is noteworthy is that, although the number of beds was increased during the project, this did not entitle the project to increased state aid.[616] Based on the state aid granted for the project, it can be inferred that the budget approved by the State Medical Board was FIM 15.5 million. The final budget, FIM 27.5 million, had therefore nearly doubled, and the share of state aid was 42 percent of the real costs.

The project required supplementary funding, and raising such funding became a routine part of the Building Board and Building Committee's work. The local authorities had probably foreseen this much earlier, and had therefore selected two bank managers to serve on the Board, to bring financial competence to the table. The construction work required short-term loans, since both the state and municipal shares were paid late.[617] For example, municipalities reserved beds gradually, so their share of funding was initially small, increasing only later.[618] In addition, cities were unable to raise loans for longer than two years without applying for state permission, a process which the Building Board found cumbersome.[619] The Minister of Finance was fully aware of the slowness of the state aid payment, and in 1931 he advised the Chairman of the Building Board to negotiate a loan from the Bank of Finland, which the Building Board could pay back immediately upon receiving the state aid

613 The share of state aid was, in other words, estimated at FIM 15.5 million and that of the municipalities at FIM 5.5 million. Building Committee May 9, 1930, Section 2. PSA.

614 All the municipalities paid a yearly fee of FIM 5,000 per bed between 1929 and 1932, and a fee of FIM 2,500 in 1933. Kalkas 1933, p. 15.

615 Building Board February 10, 1930, Section 1. PSA.

616 The motion of the State Medical Board to the Ministry of Finance on July 16, 1930. Record No. 2856 6673 III. State Medical Board 1930 Da: 9. NA.

617 See e.g. Building Board February 25, 1929, Section 4. PSA; and Building Board April 1, 1931, Section 3. PSA.

618 A letter from the Building Board for a loan application dated May 23, 1931. AAM.

619 See Building Board November 3, 1930, Section 2. PSA; Building Board November 3, 1930, Section 14. PSA; Building Board November 15, 1930, Section 15. PSA; and the application of the Building Board for a loan on May 23, 1931. Documents related to the Paimio Sanatorium project. AAM.

for that year.[620] The Building Board took out loans from both private lending institutions and the state.[621] The interest rate varied between 7.0 and 8.5 percent.

The project was scheduled for completion in 1932. The increasing costs and the difficulty in raising the necessary funds were major factors delaying the project. The Building Board attempted to find reasons for the increasing costs and delays in the building schedule. In the view of the Building Board, the most cost-effective method was to carry out the work as sub-contracts. In this way, the developer would benefit from the price decrease in materials and labour during an economic decline.[622] In May 1931, the Building Board entertained the possibility of carrying out the building work so slowly that no loans would be necessary. However, it decided against this strategy, as leaving a half-finished building to the mercy of the changing elements of the seasons would make this approach uneconomical, even if the loss of interest and the fact the sick were not receiving the treatment they needed were left out of the equation. The Building Board wanted to bring the project to a conclusion systematically and at a brisk pace.[623] According to a report written by Aalto in 1931, the financial situation of the building project was in line with the plan.[624] In October 1931, Aalto again reported on the progress of construction to the Building Board. Bank Manager Paavo Saarinen expressed displeasure that the budget had been exceeded, as the general price level had declined by approximately 20 percent since the project began. However, he conceded the fact that some of the increased expenses were due to exceeded quality specifications. Farmer Juho Pilppula pointed out that the budget was likely to be exceeded by another million marks because the waste water treatment plant would cost more than had been planned. The Building Board discussed the budget and, ultimately, whether it would have been less expensive to contract the project out as a whole. Aalto responded that cost estimates could never be absolute, and that the figures were always approximate. Furthermore, the State Medical Board had added to its requirements in the course of the building projects. Medical advisor Markus Sukkinen noted that the cost estimate in the

620 Building Board May 23, 1931, Section 3. PSA.

621 Insurance Company Tarmo, Länsi-Suomen Osuuspankki (Southwestern Finland Cooperative Bank), Ministry of Finance, the State Treasury, Bank of Finland, Central Bank of Savings Bank and the Suomen Raakasokeritehdas sugar manufacturers granted loans for the project. Building Board minutes 1928–1933. PSA.

622 Application of the Building Board for a loan on May 23, 1931. Documents related to the Paimio Sanatorium project. AAM.

623 Ibidem.

624 Excavation, drainage, foundations, the concrete frame, external masonry, heat insulation, floor insulation, major road works, forest clearing and main waterline had been carried out on site at the sanatorium. Partially complete or in progress were internal walls, the waterproofing of the roof, other insulation work, water, sewage and heating pipes, iron and wooden windows, concrete surface treatment, the machinery for the bakery, upper leaf sound insulation and iron structures on façades. The completed or confirmed orders, the delivery or installation of which was still pending, included all electrical works, lifts, some of the machinery, awnings, sun screens, the telephone, paging and signalling equipment, some of the stair coverings and floor covering in the sun balconies. Aalto also pointed out that external rendering was in the early stages and that the internal walls and the sound insulation work was 50 percent complete. In terms of piping, the main pipes and some of the risers were installed. Of the residential and auxiliary buildings, the staff dwellings progressed in parallel with the sanatorium while the power and heating plant were all but complete. The foundations for physicians' dwellings, the funeral chapel and car garage were being laid and the brickwork was scheduled to begin on July 1. Aalto commented, with regard to the progress and costs on June 1, 1931, that the costs had at that point exceeded the estimate by 1.2 percent. The project had experienced setbacks excavating foundations as the rock profile differed to that indicated by the soil testing map. The construction of two kilometres of drainage running into a nearby river had also proved more expensive than anticipated. On the other hand, many of the works had been completed under the original budget. Aalto's account of the construction work June 15, 1931. Record 1245. State Medical Board 1931 Ea:34. NA.

case of every single sanatorium had been exceeded by two to four million marks, including those projects that had been contracted out. The Board was satisfied with the supervision and management of the project. Aalto noted that the interior had been allocated more funds than in other sanatoria so far.[625]

In August 1932, the Building Board again voiced its concern about the delayed schedule and expanding costs. According to Pilppula, several changes had been made during construction work without notifying the Building Committee. Pilppula felt that the Building Committee should speed up the work. The matter was left on the table until the next meeting, which would be attended by Aalto.[626] The discussion continued at the next meeting, which was held soon after. Aalto, Sukkinen and Kalkas were given the task of drawing up a report on funds used so far and those yet to be required.[627] The Building Committee then discussed the new building cost estimate, according to which the budget was to be exceeded by FIM 1.316 million.[628] The new cost estimate by the Building Committee, dated January 1, 1933, put the total costs of the sanatorium at FIM 27 million.[629]

Aalto participated in the work of both the Building Board and Building Committee and was responsible for preparing and following up on the cost estimates. This experience made him particularly conscious of the importance of pricing in procurement.

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625 Building Board October 17, 1931, Section 6. PSA.

626 Building Committee August 5, 1932, Section 3. PSA.

627 Building Committee August 11, 1932, Section 1. PSA.

628 Costs incurred so far at the time of cost analysis totalled FIM 19.245 million and the anticipated further costs were estimated at FIM 5.131 million, bringing the total cost to FIM 24.376 million. Extraordinary costs (waste water treatment, interest, the sauna and greenhouse, kitchen acquisitions, cars and other unforeseeable costs) came to FIM 1.06 million. Building Committee August 18, 1932, Section 1. PSA.

629 Building Committee January 1, 1933, Section 2. PSA.

SUMMARY OF BUDGET AND STATE AID

YEAR	MONTH	BUDGET [FIM]	STATE'S EXPECTED SHARE, MAY 1930 [FIM]	STATE'S ACTUAL SHARE [FIM]	PAYMENTS FROM LOCAL AUTHORITIES
1929		15,500,000	1,000,000	1,000,000	
1930	May	22,000,000	3,000,000	2,000,000	
1931			5,000,000	3,500,000	
1932	August	24,376,000	6,375,000	3,000,000	
1933	January	27,500,000		2,000,000	
TOTAL [FIM]			15,375,000	11,500,000	5,700,000

Table 3.2.1a. The budget of the project increased by 42 percent when the City of Turku joined in spring 1930. The state aid covered 74 percent of the original budget, which was scaled for a smaller sanatorium. The Building Board funded the project with short-term loans. This information has been compiled from minutes of the Building Board meetings. See also Kalkas 1933, p. 15.

SUMMARY OF BUILDINGS COSTS

ACTUAL BUILDING WORK [630]	Excavation, preliminary work	302,600
	Foundations	554,545
	Reinforced concrete frame	2,799,775
	Bricklaying	2,393,836
	Staircases	178,498
	Roofing, insulation	372,800
	Windows and doors	1,586,350
	Piping work	4,008,700
	Rendering	579,955
	Construction drying	169,000
	Floors	1,015,880
	Painting	720,000
	Façade work	522,815
	Specialist interior work	88,430
	Machine installation (kitchen, laundry, bakery, etc.), fireplaces	795,840
	Management	1,765,000
TOTAL [FIM]		17,854,024
INSTALLATIONS, OUTDOOR AREAS AND INTERIORS	Installations (electricity, low-current, specialist heating systems, wastewater treatment)	1,392,000
	Interior work	863,950
	Materials	657,650
	Medical technology	587,500
	Outdoor areas	231,500
TOTAL [FIM]		3,732,600
TOTAL	Construction work proper	17,854,024
	Installations, outdoor areas and interiors	3,732,600
	Other	313,376
TOTAL [FIM]		21,900,000

Table 3.2.1b. Cost estimate 1929.

630 Cost estimate, December 1, 1929. (PSA).

3.2.2 THE PIT OF DEPRESSION WAS REACHED IN 1932 IN FINLAND

The magnitude of the Great Depression of the 1930s as well as its repercussions varied greatly from one country to the next. In Finland, the depression lasted from autumn 1929 until spring 1934, and it was moderately severe in comparison with the rest of Europe.[631] Prior to the depression, Finland had witnessed an economic boom. The Finnish currency, the mark (FIM) was pegged to the gold standard in 1926, which had increased developers' confidence in the banking system and improved the prospects for profitable business. Besides the stabilisation of the currency exchange rate, several other structural factors were boosting property speculation, including the lower Central Bank interest rate, the establishment of the Housing Mortgage Bank of Finland to bring added funding to the market, the foreign loans invested by the State in commercial banks in 1928, the increase in the price of land in towns and the Limited Liability Housing Companies Act enacted in 1926.[632] Housing construction had increased 3.5-fold in the six years between 1922 and 1928 and the gross value of Finnish industrial output had doubled between 1920 and 1927 and reached its height in 1928.[633]

The year 1928 was a peak year in construction and the turning point for the Finnish national economy in general. As imports grew and exports declined, the current account posted a deficit and the foreign-exchange reserves were depleted. The Bank of Finland was keen to curb the growth of the deficit. It raised its discount rate, which created difficulties for construction in autumn 1928.[634] The decisions were based on the assumption that the construction industry was the culprit for the rise in imports. While the volume of construction goods imported had increased in the latter half of the 1920s, their share of total imports was modest – according to a 1930 report, only six percent of imports in 1928 were construction goods. The imbalance in foreign trade was mainly caused by factors other than excessive building activities.[635] The trend in the timber trade took a turn for the worse at the beginning of 1928, when Russia increased its supply. The price level of exports that was crucial for the Finnish economy sank and the Finnish timber industry faced difficulty.[636] From August 1928 until the end of 1930, the price level of agricultural produce decreased by 36 percent and that of forest-industry products saw an even steeper decline. [637]

In 1930, the situation in Finland changed in many respects. Compared to previous years, only a fraction of new building projects were initiated. The depression first hit the countryside and factories adopted a shorter working week as domestic demand

631 Hannikainen 2004, p. 10.
632 Hannikainen 2004, pp. 26–30.
633 Kahra 1938, p. 5.
634 Hannikainen 2004, pp. 30–32.
635 Hannikainen 2004, pp. 32–33.
636 Kahra 1938, p. 6.
637 Kahra 1938, p. 7.

declined. The depression resulted in wide-spread unemployment and tensions in the workplace grew. Right-wing radicalism reached its peak in 1930 and the Lapua movement, a Finnish nationalist and anti-communist radical movement, grew in popularity. It staged violent kidnappings of left-wing councillors and pressured them to resign from the local councils in 70 municipalities, including the City Council of Turku.[638] In the late 1920s, the degree of organisation among construction workers had been high. In the 1930s, trade union activists and active members of the Finnish Communist Party, which operated underground, were under surveillance by employer organisations, employers and the Finnish Secret Police. The Finnish Trade Union Federation, which represented workers in the collective bargaining agreements for the construction industry in the 1920s, was discontinued owing to the national-level disputes between left-wing parties.[639]

Public emergency employment programmes became a central method of creating jobs for the unemployed during the depression. Rising unemployment created a poverty problem, which fell on the local authorities to resolve. The Poor Relief Act obliged local authorities to ensure the livelihood of its residents. In cities, emergency employment was indeed organised by the local authorities. Rural municipalities, however, did not have the necessary resources to organise emergency employment, which subsequently fell on the State to arrange.[640] The pit of the depression was reached in 1932, when the unemployment rate was at its highest.[641] The Finnish State ordered contingency work to be carried out in winter 1931–1932 to combat unemployment in state-run hospitals and sanatoria run by municipal federations.[642] The Paimio site employed no contingency workers, and all employees were on a normal contract. However, the State ordered emergency work on several hospital building sites. The Ministry of Transport and Public Works had requested the State Medical Board to propose sites where contingency work could be organised to alleviate unemployment. The State Medical Board made a proposal in 1931 on a number of hospital building sites for contingency work[643]

638 Peltola 2008a, p. 121.

639 Peltola 2008a, p. 316.

640 Hannikainen 2009, pp. 16–17.

641 Peltola 2008a, p. 317.

642 The Ministry of Transport and Public Works obliged the State Medical Board to organise contingency work for the winter and autumn seasons 1931–1933. Record No. 1596 3462 III. State Medical Board 1931 Da:13. NA; Record No. 201744 5411 III. State Medical Board 1932 Da:19. NA; Record No. 2793 7110 III. State Medical Board 1933 Da: 25. NA.

643 Sites included in the 1931 proposal by the State Medical Board were the excavation and foundation work for the Gynaecological and Obstetrics Department for Helsinki General Hospital, Kajaani General Hospital and Sortavala General Hospital. Record No. 1596 3462 III. State Medical Board 1931 Da:13. NA.

and as late as in 1933, it provided a list of hospitals undergoing refurbishment projects that would suit this purpose.[644]

The general employment situation was reflected in the work of the Building Board of Southwest Finland Sanatorium. The Building Board discussed in October 1931, whether the wages on site should be lowered, as it transpired that they were slightly higher than the average in Turku. Engineer Kilpi pointed out that if the aim was to maintain the right spirit and good morale at the site, the wages should not be cut. Moreover, piecework contracts had been applied as much as possible.[645] Kilpi, the clerk of works, also referred to reliable work teams, by which he meant teams that would not be causing difficulties. During the depression and after it, building sites hired piecework contract teams, one of whom was named as the leader.[646]

Economic growth following the depression was rapid in Finland. Finland abandoned the gold standard on October 12 in 1931, around the same time as the UK and other Nordic countries did the same. The devalued currency gave a boost to exports and improved the competitiveness of Finnish manufacturers in the domestic market. The unemployment rate began to rise in 1929, with the trend continuing until 1932, when the unemployment figures peaked. In 1933, the situation continued to be dire.[647] The entire sanatorium building project was executed in a period of time that was marked by economic instability and political tensions.

644 The list itemises state and municipal federation institutions separately. Suitable sites among state-run institutions were Pori General Hospital, the Nursing School and halls of residence adjacent to the Viipuri Regional Hospital, Rovaniemi General Hospital extension, Oulu Regional Hospital, Häme Regional Hospital service building, Turku Regional Hospital extension and Mustasaari Hospital extension. The suggested sites among municipal federation hospitals were the new tuberculosis sanatorium sites of the Finnish-speaking municipalities of Uusimaa, municipalities of South Karelia, the Swedish-speaking municipalities of Central Ostrobothnia and the Finnish-speaking municipalities of the same region as well as the extension of Oulu District Psychiatric Hospital. Record No. 2793 7110 III. State Medical Board 1933 Da: 25. NA.

645 Building Board October 17, 1931, Section 1. PSA; Törrönen 1984, p. 39.

646 This was a network, the membership of which depended on the approval of its other members. When the employer's power increased during the depression, the degree of organisation amongst workers fell. In the 1930s, finding work depended on being a member of such a work team. The team membership gave security on many levels, including secure income when times were good and also added security during low seasons. If a builder was accepted into a team, was skilled and the team leader competent, the member of a team could pay back his "debt" by committing to the goals of the team. A team of good reputation could operate fairly freely and, for example, join unions without having to fear major resistance. In this way, a high professional skills level also gave workers a certain ideological freedom. Peltola 2008a, pp. 321–323.

647 In 1935, the unemployment rate normalised, showing typical seasonal fluctuations. Kahra 1938, pp. 8–9.

3.3 THE REINFORCED CONCRETE FRAME: A GREAT ARCHITECTURAL CHALLENGE

3.3.1 AALTO COLLABORATED WITH LOCAL DESIGNERS AND BUILDERS

The concrete structures of Paimio Sanatorium were designed and dimensioned by Emil Henriksson, a young engineer and master builder who played an active role in the business life of Turku and held several positions of trust.[648] He graduated as a reinforced concrete engineer from the Technical School of Strelitz, Germany in 1924. After his return to Finland, he ran his own private engineering firm specialising in reinforced concrete structures in Turku from 1924 until 1932.[649] Aalto and Henriksson had collaborated prior to the sanatorium project on the Southwest Finland Agricultural Cooperative Building, the Standard Apartment House[650] and the Turun Sanomat Newspaper Building. In these projects, modern reinforced concrete structures were employed, as showcased by the roof truss structures of the theatre auditorium of the Agricultural Cooperative Building.[651] They also collaborated on the Turun Sanomat Newspaper Building, which had a flat slab construction throughout the edifice. Its foundation was a reinforced concrete slab poured on timber piles. The basement exhibited a mushroom column arrangement and the asymmetrical columns of the printing hall were cast in metal formwork. Emil Henriksson, who kept abreast of new developments, wrote an article for *Rakennustaito* (The Finnish Construction Magazine) magazine about reinforced mushroom slabs even before the Turun Sanomat project began, in 1927. The mushroom columns, introduced in the article and used in the Turun Sanomat building, represented a novel solution in Finland that was first used in industrial buildings.

648 Henriksson had been a member of the third bridge-building committee in Turku in the 1920s, as well as a member of the board of Turku Industrial School since 1927 and a board member for numerous business enterprises. In 1932, he was made managing director in the construction firm Hakkala & Tuominen, in which he was partner. Henriksson also wrote and lectured on concrete construction. Tolonen 1930, pp. 116–117; Jaakko Hartela's interview, June 6, 2001 by the author.

649 Emil Herman Henriksson, who, in 1930, changed his name to Hartela, was born in Värtsilä in North Karelia in 1894. He trained as a master builder on a three-year program at Kuopio Industrial School's building construction department. In summer 1914, he worked as a trainee at the construction site of Bühler steel factory in Düsseldorf's Buderich. After graduating, Henriksson worked for Turun Insinööritoimisto Oy engineering office in Turku and Helsinki from 1915 to 1916. After this, he joined a Helsinki-based construction firm Tähtinen & K:nit, returning to his native town of Värtsilä in 1917, where he served as a master builder for Ab Wärtsilä Oy until the beginning of the Civil War, in which he fought on the side of the White army. Having worked as an independent draughtsman and master builder between 1919 and 1922, Henriksson travelled to the Netherlands and from there to Germany, where he continued his studies. In 1932, he was one of the founding partners of the construction firm Hakkala & Tuominen and moved from being a designer to a builder. Henriksson died in 1970. Möttönen 2012.

650 Building permit granted July 30, 1928. Record No. VII-30-3. TKA.

651 Constructional drawings. Record No. VII-20-4. TKA.

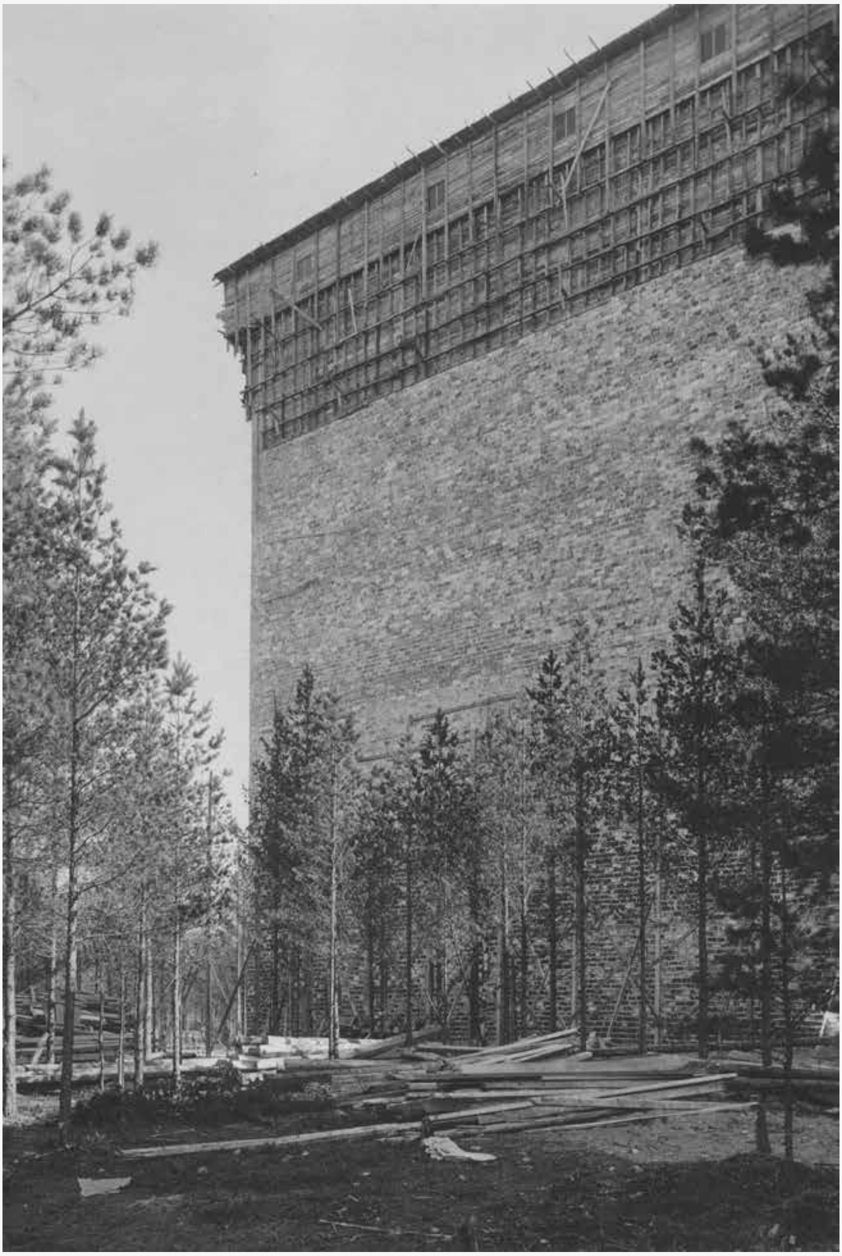

Fig. 3.3.1a. The wall of the sundeck was cast against a layer of bricks placed in the formwork. The wall was built using the slip forming technique. Photo PSA.

The series of structural drawings for the Southwest Finland Agricultural Cooperative Building, 104 drawings in total, was enclosed with the building permit materials.[652] The number of drawings was considerable as in the 1920s the City of Turku did not yet require structural drawings as part of building permit applications.[653] For example, no structural calculations have been preserved on the highly advanced and modern reinforced concrete structures of the Turun Sanomat Newspaper Building, which was granted a building permit a year and a half later than the Southwest Finland Agricultural Cooperative Building.[654]

Emil Henriksson had also conducted concrete structural calculations for the residential development Kellonsoittajankatu 8 (1925), designed jointly by architects Erik Bryggman and Ilmari Ahonen[655] and shortly after the sanatorium project for Bryggman's Sports Institute of Finland in Vierumäki, which was based on a competition win.[656] Master builder Arvi Ahti also collaborated closely with a network of these Turku-based builders.[657] Ahti built the houses designed by Bryggman for the Suomen Sokeri (Finnish Sugar Company) office and plant workers (1923–1924)[658] and the apartment building Atrium (1926–1927), and the aforementioned apartment building at Kellonsoittajankatu 8 and the Seurahuone Hotel, designed jointly by Bryggman and Ahonen (1926–1928).[659] It is likely that it was Bryggman who introduced Ahti and Aalto to each other.

The reinforced concrete frame of Paimio Sanatorium was contracted to Arvi Ahti, a notable and influential Turku-based contractor.[660] He had served as the chair of the Master Builders' Union of Turku since 1923. Ahti and Henriksson were closely associated both personally and professionally. Ahti was Henriksson's brother-in-law and his business partner at Akso Oy company,[661] which imported PH light fittings, designed by Poul Henningsen, to Finland in 1929 for at least two sites designed by Aalto.[662] It was likely lucrative to combine the roles of a contractor and master builder with a

652 The structural calculations for the Southwest Finland Agricultural Cooperative Building reinforced concrete structures were made between July and December 1927 and the project was granted a building permit on November 8, 1927. Record No. VII-20-4. TKA.

653 Constructional drawings have only been a requirement since 1956 when applying for a building permit in Turku. Information received from Kirsi Helenius, information services secretary, January 18, 2013.

654 In the Turku City Archives, where the building permit documents are kept, there are no constructional drawings concerning the Turun Sanomat Newspaper Building. The authority, responsible for granting permits at the time, was the Provincial Archives of Turku. Similarly, in that archive there were no such documents concerning the project either. No constructional drawings related to this project were found in the archives of TS either.

655 Database of architectural objects. MFA.

656 The seventh floor of the flat-roof building, the roof level, was recessed. There are three lower, flat-roofed wings branching from the higher main mass. The construction of the main building began in 1933 and it was inaugurated in 1937. For an image of the model see Bryggman 1937, pp. 81–87.

657 Arvi Verner Ahti was born in Turku in 1888 and graduated as master builder from Turku Industrial School building construction department in 1911. He had made study trips to Sweden, Denmark, Germany, the Netherlands and France in the 1920s. Having worked as a master builder, contractor and draughtsman until 1922, he continued as a contractor. Tolonen 1930, pp. 16–17.

658 Soiri-Snellman 2010, p. 34 and p. 114.

659 Soiri-Snellman 2010, p. 61.

660 Veljekset Ahti Rakennusliike (Ahti Brothers Construction Firm) was one of the two major firms that dominated the construction industry in Turku in the 1920s, carrying out 13 building projects in Turku between 1922 and 1926. The firm employed ten master builders at its peak. Kankaanpää 1997, p. 78.

661 Jaakko Hartela's interview on June 6, 2001 by the author.

662 The Defence Corps Building in Jyväskylä and Kemijärvi Church. Ollikainen 2010, p. 82.

partnership in a company supplying building materials.[663] It appears that Aalto was inspired in his own business operations by the entrepreneurial approach of these two Turku businessmen.

Attaching a structural engineer to the sanatorium project was not a foregone conclusion. In May 1930, the Building Board of the sanatorium discussed the designs for the reinforced concrete structures. Although some members felt that delivering the structural calculations should have been assigned to the contractor, the Board decided to employ an independent engineer for the project to carry out the calculations.[664] The clerk of works, engineer Kilpi completed the structural calculations for the small buildings and Aalto was allocated a budget of FIM 50,000 to carry out the calculations for the main building.[665] After this decision was made, Aalto commissioned Henriksson to carry out the task.

In May 1930, the Building Board published a call for tenders and received nine bids in the first building phase, the construction of the reinforced concrete skeleton.[666] The Building Committee established that all the companies were financially sound, and decided to base its decision on the most economical price. It started negotiations with the three contractors who had submitted the least expensive bids. Ab Jernbeton Oy (Reinforced Concrete Ltd), which shared third place in the price comparison, was left out of the negotiations at this point. The most inexpensive bid was made by Oy Tektor Ab.[667] Aalto started the negotiations and soon informed the Building Board that the manager of Tektor had said that the company had not taken into account the masonry work of the chimney, and would for this reason need to raise the bid. The Building Board decided to accept Tektor's revised bid of FIM 3.94 million as the least expensive.[668] As a consequence, the building contractor and master builder Arvi Ahti, whose bid had been placed fifth in the price comparison, informed the Committee that he had made a mistake in his calculations by including the masonry work in his first bid, and was therefore interested in lowering the price to FIM 4.075 million. The Committee considered that Ahti's announcement did not lead to the need for further measures to be taken. It continued the negotiations with Tektor until it emerged that the concrete work of the rear wall of the sun balcony was not included in their bid as it was only presented in Aalto's final drawings. The minutes do not reveal whether Aalto presented new drawings or ideas during the negotiations. When no agreement was reached, the

663 Kankaanpää 1997, pp. 65–66.
664 Building Board May 3, 1930, Section 4. PSA.
665 Building Committee May 9, 1930, Section 3. PSA.
666 Bids were placed by the following companies, listed from the lowest quote to the highest: Oy Tektor Ab (FIM 3.845 million); master builder A. Löfström and entrepreneur A. Lyly (FIM 3.994 million); master builder Lauri Mattila (FIM 4.4 million); Ab Jernbeton Oy (FIM 4.4 million); master builder Arvi Ahti (FIM 4.5 million); master builder Tähtinen & Heikinen (FIM 4.56 million); master builders K. Artukka and E. Viljanen (FIM 4.713 million); Oy Construktor Ab (FIM 4.65 million); and Huhtala, Lahti & Viljanen (FIM 4.85 million). Building Committee June 4, 1930, Section 1. PSA.
667 Two of the companies who placed a bid, Oy Tektor Ab and Constructor Ab led by Manne Muoniovaara, were among Finland's most notable construction firms. Rantamo 2009, pp. 96–98.
668 Building Board June 10, 1930, Section 3. PSA.

negotiations were terminated. Simultaneously the Building Committee decided to ask Ahti whether his new bid was still valid.[669]

The legal adviser of the Federation, Armas Kataja, participated in the next meeting of the Building Committee a few days later. The Committee found that no agreement had been reached with Tektor, the Committee members had continued negotiations with Arvi Ahti, and the contractor had lowered his bid to FIM 3.995 million. The Committee solicited the Board to sign the contract with Arvi Ahti.[670] The Board accepted the proposal "because it was feasible". A recent closing of accounts of Ahti's company was presented at the meeting.[671]

With this procedure, the three companies who had submitted lower bids than Arvi Ahti were also dismissed. The minutes do not reveal whether any negotiations were arranged with them. The Helsinki-based Tektor, which operated all over Finland, was a significant contractor with experience in different types of projects, ranging from industrial buildings for notable companies and schools to multi-storey apartment buildings.[672] In several of these buildings, modern concrete techniques had been applied and mushroom columns had been used, for example, in a warehouse in Helsinki (1929) built for the OTK, a cooperative wholesale company.[673]

The construction of the reinforced concrete frame was to commence without delay and the work was to be completed by the end of November. The frame construction was based on architectural drawings, of which there were 12, as well as a work specification. In addition, the contractor had special and full-scale drawings, which were based on the aforementioned documents and were made after the contract was signed. The scope of the work was defined in the work specification. In the event that the master drawings contained any discrepancies, the client was to decide which drawing should be applied. The contractor was to check the material volumes from the structural calculations. According to the work specification, the contractor was to adhere to the construction methods as provided in the drawings, and was not allowed to alter their structural nature. Supervisors appointed by the developer, Aalto and Henriksson, were to be treated as fully authorised representatives of the client.

The contract agreement required that the contractor employed mainly workers based in Southwest Finland. Local workforce was to be at least 90 percent of the total workforce. The cement, bricks and other materials used in the reinforced concrete frame construction were to be produced in Finland.[674] Emil Henriksson's

669 Building Committee June 12, 1930, Section 5. PSA.
670 Building Committee June 17, 1930, Section 1. PSA.
671 Building Board August 21, 1930, Sections 12 and 14. PSA.
672 References to Tektor from the late 1920s were also listed in an advertisement published in *Suomen arkkitehtiliiton rakennusteknillinen käsikirja SARK* (Construction Technical Handbook of the Finnish Association of Architects). Harmia ed. 1937, p. 20.
673 The building is located in Katajanokka, Helsinki. Heikinheimo et al., Ark-byroo architects, 2012.
674 Contract between the Building Board and construction manager Arvi Ahti for the erection of the reinforced concrete skeleton of the main building of the sanatorium June 17, 1930. Work and contractor contracts 1929–1951. PSA.

office drew up structural calculations in June–November 1930 simultaneously with the moulding of the reinforced concrete frame.

The Building Committee discussed the cost estimate drawn up by Aalto prior to the contractor selection process in May 1930.[675] However, the accepted contract offer was 42 percent higher than the cost estimate drawn up by Aalto one month earlier. The Building Board did not, however, enter into discussion on the reasons for the substantial increase in price. Nor was the solution for the reinforced concrete frame ever questioned, despite this being a novel structure to be used in building construction.

The government had passed a decision on regulations governing concrete and reinforced concrete structures in 1929. The regulations were divided into sections on general guidelines, static calculations, materials, execution and test cubes. The regulations concerned all government institutions and all concrete and reinforced concrete structures built by local authorities or private builders in a municipality that had a building inspection unit. As the Finnish State was one of the financiers of Paimio Sanatorium and the City of Turku one of the partner municipalities, these regulations were to be observed in the project. The section on static calculations covered load assumptions, moments, determining normal and shear forces, tension calculations and structural regulations. The section on the execution focused on the handling of reinforcements, the quality of concrete and formworks.[676] The norms in question were the first of their kind in Finland. However, the City of Helsinki Building Inspection Office had issued regulations in 1913 on work on reinforced and unreinforced concrete structures, which were amended in 1926 and 1929.[677] In the 1920s, the City of Turku had a building code in place, which had been issued in 1883 and amended in 1907 and 1916.[678] According to this code, fireproof material could be used for building multi-storey residential buildings. The building code of Turku did not provide any guidelines for reinforced concrete structures.[679] Finnish builders and designers acquired theoretical and practical knowledge about reinforced concrete structures through international literature, professional journals, studies and study trips as well as from experts who arrived in Finland to work. Those training as master builders studied reinforced concrete structures from Finnish textbooks from the early 1900s, which were modelled on German books.[680] Established in 1921, the Association of Finnish Concrete Manufacturers had educated concrete builders widely since 1923.[681]

675 The concrete frame construction had been allocated FIM 2.8 million. A cost calculation of the sanatorium. Building Committee May 9, 1930, Section 2. PSA.

676 *Valtioneuvoston päätös betoni- ja rautabetonirakenteita koskevista määräyksistä 182/1929* (The Decision of the Council of State Concerning Instructions on Concrete and Steelconcrete Structures 182/1929).

677 Neuvonen et al. 2002, p. 147.

678 Kankaanpää 1997, p. 104.

679 *Turun kaupungin rakennussääntö 1921* (The Building Regulation of the City of Turku 1921), pp. 19–20.

680 Gustav Edvard Asp, architect, teacher, Rector of Turku Industrial School, used German literature as his source for chapter on reinforced concrete structures in his 1908 textbook *Huonerakenteiden oppi* (Textbook on Building Structures). Neuvonen et al. 2002, p. 28.

681 Junttila 1946, pp. 17–23.

3.3.2 THE COOPERATION AND CONFLICTS IN DESIGNING REINFORCED CONCRETE FRAME

The main building of the Tuberculosis Sanatorium of Southwest Finland was built on a reinforced concrete frame in situ. The building report written by the architect, which exhibited the input of the structural engineer, gave a thorough picture of the execution of the concrete structures in the main building. Aalto considered the dimensioning of the column system a demanding task.[682]

The entrance lobby columns were cast in three-millimetre iron plate formworks so that the formwork stayed in place as the surface of the finished column. Aalto and Henriksson had used similar formwork in the asymmetrical columns of Turun Sanomat newspaper printing hall. The exposed surfaces of the columns on the external wall or the internal columns flanking the patient rooms were insulated with expanded cork. The cork was cast onto the column surface.[683]

All floors were made of reinforced concrete as well as the topmost beams supporting the roof. Apart from a few exceptions, such as the boiler room and workshops, all roof structures had double-slabs with the topmost slab cast last. Tapered beams were widely used in the building, with a thicker depth in the middle, where the compression stress was at its highest.[684] The intermediate floors were built in three stages: first the lower slab and beams were cast, followed by the laying of heating, water and sewer pipework and electrical wiring, and finally the upper leaf was cast on a bed of filling. With the upper leaf not resting directly on the beams, step sound insulating structure was achieved. The filling used in the intermediate floors was fine-grade coke cinder and the structural height was 45 centimetres.[685] The beam and slab floor system with a floating upper leaf was a typical structural solution used in sanatoria in Finland in the 1930s. A similar structure was used in the City of Helsinki Tuberculosis Sanatorium and Tarinaharju Sanatorium, both designed by Eino Forsman.[686] The large and technologically advanced City of Helsinki Tuberculosis Sanatorium was held as a forerunner and model for other sanatoria built in the 1930s, including Paimio Sanatorium.[687]

Part of the beam system at Paimio Sanatorium served to carry air exhaust ducts, and at these points the walls of the ducts were made of concrete slabs.[688] The upper slab of the service building and the radiology department in B wing were designed to withstand the weight of machinery.[689]

682 Aalto [1930]a, p. 8.
683 Ibidem, p. 8.
684 Emil Henriksson's structural drawings show that tapered beams were used in the wings. PSA; See also Neuvonen et. al 2002, pp. 100–101.
685 Aalto [1930]a, p. 9.
686 Heikinheimo et al., Ark-byroo architects 2014, p. 48.
687 Laurila and Tandefeld 1968, pp. 607–662, particularly p. 660.
688 Aalto [1930]a, p. 9.
689 Ibidem, p. 9.

The open sundecks and balconies were constructed as single-leaf slabs. In this case the load-bearing structure was a slab resting on a beam or a cantilevered slab. Console structures were employed in the intermediate floors in C wing and in the corridors of A wing. Here, the walls beneath and above the window were connected directly to the floor slab as narrow concrete beams and the internal insulation material was cork.[690] A free-bearing wall allowed for the use of ribbon windows.

The structural solution of A wing differs from that of the patient rooms and sundecks. In patient rooms, the building has two load-bearing rows of columns, one of which aligns with the south-facing external wall and the other with the corridor wall. These columns support the transverse primary beams, which in turn support the longitudinal secondary beams. The load-bearing vertical structure in the sundeck wing is one row of columns balanced with tensioned steel rods cast within the thin rear wall.[691]

The sundeck ceilings, parapet and other concrete surfaces were cast with clean joints. The cast walls were smoothed and coated with thin-coat coloured render. According to the work specification, similar treatment was applied to the concrete shell on the bottom section of the chimney, water tank and all balconies and canopies.[692] In these, the casting surface of the structural elements was left in view. The reinforced concrete structure contained contraction joints. The architectural drawings showed a detail of the expansion joint in the ceiling structure.[693] The water tank was constructed around the chimney. It was made of trowel-finished reinforced concrete and coated on the inside with a sealant.[694] According to the building specification, the air-entrained surface concrete in the water tank was placed in the formwork before it was filled. The plan was to smooth the external surface with concrete and cover with thin-coat coloured render. A photograph taken during the construction reveals that the water tank surface was clad with vertically-laid roofing tiles, probably redbrick. The outer shell of the chimney, which supported the water tank, was built from redbrick and left unrendered.[695]

The semi-open floor slab of the second floor in the dining hall in the B wing was supported by a wire construction, suspended from the beams of the third floor. The construction was enveloped in a cement-filled iron tube.[696] The structural designer drew a detail of the bottom section of the suspended structure. The architect had sketched the idea of a semi-open intermediate floor in the competition phase, and it was one of his most central spatial solutions. It emphasised the importance of the communal space: the dining and banqueting hall. The medical experts had unanimously rejected the idea as too expensive before the actual design commission commenced. They had also recommended that windows be added to the northern wall, to facilitate airing.

690 Ibidem, p. 9.
691 Ibidem, pp. 8–9
692 Ibidem, p. 8.
693 The image shows the attachment of the roofing felt at an expansion joint. Drawing No. 50-382. AAM.
694 Sica was used as a sealant for concrete and render surfaces. Harmia 1937 ed., p. 116.
695 See e.g. photos ar 26-33, ar 26-34 and ar 26-42. AAM.
696 Aalto [1930]a, p. 8.

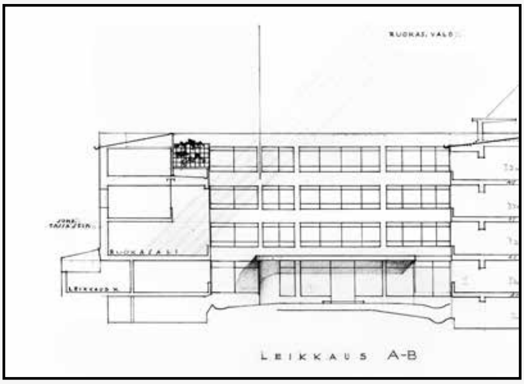

Fig. 3.3.2a. The solution of the suspended intermediate floor in the dining hall was already included in the design at the competition stage. The top floor housed apartments and a terrace. The wire was fixed to the beams of the floor between the first and second floors. Medical experts criticised the solution for its costs and the difficult air flow. In the master drawing, the wire is fixed to the third floor beam. Detail of drawing No. 50-29. The drawing has been edited. AAM.

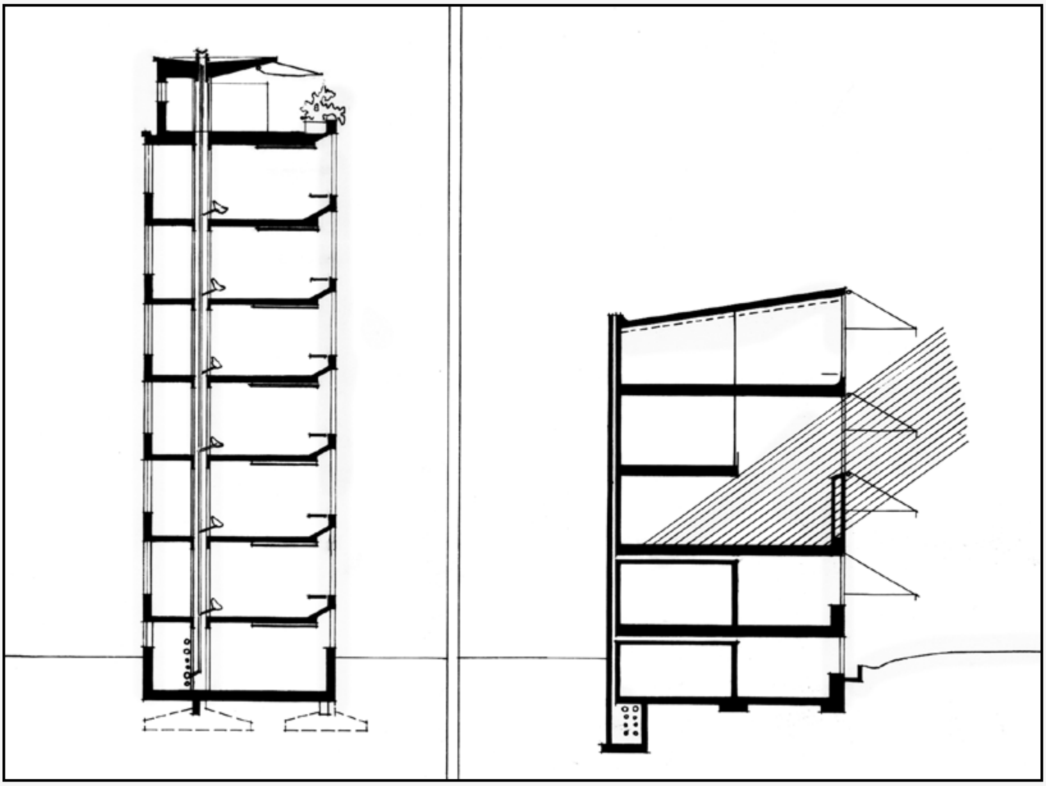

Fig. 3.3.2b. This section and its variations helped the architect to defend the solution that had been strongly criticised by medical experts. The image shows how Aalto's intermediate floor solution allowed daylight to flood deep into the building frame. He justified his choice by showing how this structural solution would allow daylight to penetrate deeper into the building, and the section diagram of the dining hall became an important tool of translation. Drawing No. 50-764. The drawing has been edited. AAM.

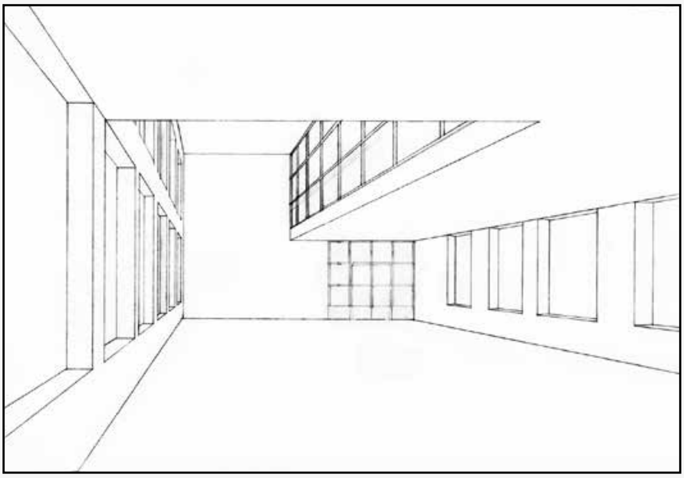

Fig. 3.3.2c. This perspective drawing is probably from spring 1930. The windows on the north-facing wall of the dining hall are extremely large. Medical experts had required the addition of windows to the north-facing wall to facilitate airing. These windows were realised as small ventilation windows. Drawing No. 50-226. The drawing has been edited. AAM.

Fig. 3.3.2d. Dining hall. The top part of the back wall housed the film projector. A panel radiator was mounted on the back wall and beneath the glass wall. The encased radiator heaters were mounted on the suspended ceiling. Windows were added to the north-facing wall as demanded by the medical experts. Photo No. 50-003-401. AAM.

Aalto added the north-facing windows, but did not change the design in which the first-floor beams were suspended from the third-floor beam. He justified his choice showing how this structural solution would allow daylight to penetrate deeper into the building, and the section diagram of the dining hall became an important tool of translation. The discussion on the dining hall intermediate floor structure has not been entered into any records. It would appear, however, that the matter had been discussed in December 1929, as the minutes state that the architect had for the main part incorporated the requested changes into his designs.[697] Aalto did not at any stage suggest any alteration to the structural or spatial solution of the dining hall; on the contrary, with the aid of his powerful drawings, he was able to translate other actors' interests to support his view. In other words, Aalto improved on the health-related aspects of his proposal on the request of the medical experts, but he did not compromise on his own architectural vision. There are no records of the discussions.

All wings in the sanatorium had flat roofs. A similar structure was used for the roofs as for the intermediate floors – a separate upper slab. If the beam came within five centimetres or closer to the upper slab, a two-centimetre insulating panel was to be used on the surface of the slab. The top slab was trowel-finished. Roofs that did not serve as balconies or decks, were covered with two layers of bitumen felt, with bitumen sealing. The sundeck floors were similarly covered with two layers of felt. On top of them, concrete slabs were laid and attached, then sealed with red asphalt. The bitumen felt was continued up the wall by 30 centimetres as a plinth. The felt edge curved underneath the render or galvanised sheet. The water-proofing of the ward-specific sundecks and balconies was executed using only one felt layer, according to the work specification. The insulation of the roof structure with coke cinder was included in the contract for the construction of the building frame.[698]

Roof drainage took place via drain pipes. The pipes running across ordinary roof areas were made of galvanised plate and were joined under the roof edge to the asphalt gutter with a double lead sleeve. One-metre long ground gutters grooved into granite directed rainwater to the perimeter drain. Rainwater was drained from the sundecks and the northern elevation of the patient wing through three-inch Mannesman pipes running inside the building frame. The internal roof pipes were connected to the sewer with an odourless system.[699]

Corridors and staircases had reinforced concrete walls. When casting the walls, roofing tiles were placed on the outside of the formwork and the thermal insulation layer on the inside. The insulation material used was expanded cork.[700] Similar wall structures were used in the kitchen building, the top section of the boiler room and some sections of the

697 Building Board December 8, 1929, Section 2. PSA.
698 Aalto [1930]a, p. 12.
699 Ibidem, p. 13
700 Expanded cork was made by heating cork to 150 degrees centigrade and by bonding it with odourless bitumen. The use of the material for insulation became popular in the 1920s as concrete structures gained ground. It was more expensive than peat board, which was also used for insulation. Kaila 1997, p. 523.

B wing. The walls of the safe and the radiology department, which required exceptionally strong structures, were cast in conjunction with the frame construction.[701]

Sundeck parapets and the railing of certain staircases had been specified to be made of rough-case concrete and were included in the frame construction. The stairs were largely cast together with the rest of concrete construction, reinforced like slabs, but some stairs were constructed as free-bearing structures, with steps made separately. Staircases B (ward sister's staircase) and C (ward staircase) in the patient wing were cast in situ and covered with mosaic flooring plates.[702] In other words, Aalto used prefabricated parts in these stairs.

The use of a reinforced concrete frame led to the use of hybrid structures, with the different material layers in the wall serving a certain function. The purpose of the reinforced concrete was to bear load. Questions of heat and sound insulation qualities in different structures were raised for discussion in professional journals during the early 1930s. The building report for Paimio Sanatorium recommended the use of expanded cork, insulite or Celotex board in places where the concrete structures of the intermediate floor creates a thermal bridge.[703] On external walls, heat insulation was resolved using redbrick and expanded cork, and with coke cinder in intermediate floor cavities.

The Paimio Sanatorium archives hold 28 structural drawings by Emil Henriksson and the set of drawings is incomplete. Emil Henriksson's office archives were destroyed in a fire that started by an incendiary bomb during World War II,[704] and the Alvar Aalto Museum Archive holds no copies of Henriksson's structural drawings. The structural drawings contained markings indicating the person who made the strength calculation and drawings, but some pictures lacked these markings. In addition to Emil Henriksson, the structures were scaled and drawn by Runo Cairenius,[705] Henriksson's student friend from Germany and a person using the initials "H.L." Henriksson completed a major share of the work.

In the following section, the evolution of the tectonic solution for the sundeck wing has been approached as a dialogue between the architect and the structural engineer by organising their respective drawings in a chronological order. This solution, a structure balanced on one column row, lent itself to further investigation as a result of being exceptionally demanding to execute, large-scale and architecturally significant. Furthermore, drawings by both the architect and the structural engineer had been preserved, allowing the sequence of developments to be followed.

701 Aalto [1930]a, p. 8.
702 Ibidem, p. 15.
703 Ibidem, p. 9.
704 Jaakko Hartela's interview on June 6, 2001 by the author.
705 Runo Cairenius was born in Hanko in 1897 and graduated from the Turku Industrial School building construction department in 1918 and from Technical School of Sterlitz reinforced concrete department in Germany in 1923. Between 1923 and 1927, he worked as a master builder on various building sites, as the director of Richard Helander's coke cinder plant between 1925 and 1926, and as a constructor at engineer Henriksson's office in Turku from 1927 onwards. He invented an extrusion roller for the manufacturing of partition panels and man-made stones and received Patent No. FI12424 in 1929 for his innovation. Tolonen 1930, pp. 51–52.

At the competition stage, the sundeck wing had four floors and no roof terrace. The pictured cantilever tapered towards the outer edge. It was supported by gigantic consoles. The cantilevered section was four to five metres long. The rear wall was load-bearing and it was supported by buttresses. In the competition stage, all wings had a load-bearing column row in the exterior wall. Only the sundeck wing had a cantilevered structure.[706]

Just before the structural engineer joined the project, the floor plan of the sundeck wing showed the load-bearing column row inside the sundeck as square shaped and paired with another column in the enclosed rear wall – the architect was developing a ladder structure. The sundeck continued to be open and cantilevered.[707] A section of the sundeck wing drawn by Aalto is related to this stage of the design process. In the drawing, the wing reached its final height, six storeys and a roof deck. The columns in the middle of the deck are of even width while the columns at the rear wall taper upwards. The beams of the sundeck are cantilever structures of mainly even width, although slightly tapered towards the outer edge. The foundation method for the sundeck wing has not been specified. It is inferred from this solution that the sketch was drawn by the architect without the input of a structural engineer. The upward-tapering structure of the rear wall resembled the structure of a traditional brick wall.[708]

The architect's drawing from July 1930 shows a sundeck structure that is comprised of sophisticated cantilevered slabs tapering in two directions towards the outer edges. Created by the person behind the initials "H.H.", the drawing also clearly showed how the load-bearing row of columns tapered upwards. At this stage, the structure had also been designed on the basis of calculations, the structural engineer having been engaged on the project in May 1930. This drawing created by the architect's office showed that the designer had a good insight into the material and was familiar with its behaviour. The functionality of the structure had been addressed and, for example, the role of the rear wall as a counterbalance to the cantilever was optimal. The solution was also aesthetically accomplished.[709] It would appear that the design evolved considerably once the structural designer had joined the team.

Emil Henriksson's calculations and structural drawings of the ground floor and first floor ceiling of the sundeck wing were dated August 1930. They showed a floor plan with a load-bearing row of five columns with a rectangular section, and a closed rear wall with no windows. The concrete layer in the rear wall was enveloped by a protective structure. The structural drawings also included a section and reinforcement drawings for the slab of the two floors. The double-beam connecting the columns was resolved as a box beam construction allowing for a lighter structure. The columns tapered between the ground floor and first floor by 20 centimetres. They narrowed down further on the five lower storeys to continue in even width on storeys six and seven.[710] The cantilevered part

706 Drawings Nos. 50-29 and 50-25. AAM.
707 Drawing No. 50-661. AAM.
708 Drawing No. 50-708. AAM.
709 Drawing No. 50-296. AAM.
710 Drawings Nos. 22 and 23 by Emil Henriksson. PSA.

of the slab did not have secondary beams as in the A wing, except for in the outer edge. The structural engineer used the architect's design as a starting point but added value to it by optimising the use of material. This cantilevered slab exhibited Emil Henriksson's experience in beamless reinforced roofs, which was the type of solution he had used in the paper warehouse of the Turun Sanomat Newspaper Building and on which he wrote an article for *Rakennustaito* (The Finnish Construction Magazine) magazine.[711]

The architect continued with drafting the sundeck wing once this building element had been resolved. These schematic and simplified drawings were made for the presentations. The vertical section of the sundeck wing was sketched by the architect probably at the end of 1930. It illustrates the principle of the reinforcements.[712] In the second drawing of the section, the sundeck slab illustrates the reinforcements in the slab and shows the box construction.[713] Aalto understood the novelty and media value of the structure they had developed as a team with the structural engineer.

The enclosed rear wall of the sundeck wing was in the drafting stage in the spring of 1930, marked as a reinforced concrete structure without insulating layers.[714] However, at the construction stage, the structure was cast against a protective layer of bricks. The photographs of the Paimio Sanatorium Archive showed the bottom storeys having already been cast and the formworks erected for the top part. The wall was constructed using the slip forming technique, a method employed in industrial construction, particularly in the construction of silos, which were admired by European modernist architects.

The image inked-in for publication shows a simplified version of the seven-storey structure supported on one column row. The columns tapered upwards. The rear wall was non-load-bearing and contained the tensile reinforcement. The rear wall was protected on the outside with brick in conjunction with the casting. The rear wall did not appear to have a foundation.[715]

The tectonic solution of the sundeck wing acquired its final form as a joint effort between the architect and the engineer. The drawings showed that the structural engineer did not join the design team until May 1930. He gave added value to the architect's draft. The architect's draft from July 1930 shows how the functionality and form of the structure had eventually been resolved. The drawing created by "H.H" was crucial to the final outcome.

The two lowest storeys of the sundeck wing were dated August 1930. The structural engineer created drawings in the order of construction, but naturally the sundeck wing structure had to be conceived as a complete entity. It is therefore likely that the structural drawings of the sundeck wing, which have not been preserved, were also created in August 1930. The construction of the sundeck wing progressed in parallel with the rest of A wing, one storey at a time.

711 Henriksson 1927.
712 Drawing No. 50-155. AAM.
713 Drawing No. 50-409. AAM.
714 Drawing No. 50-60. AAM.
715 Drawing No. 50-414. AAM.

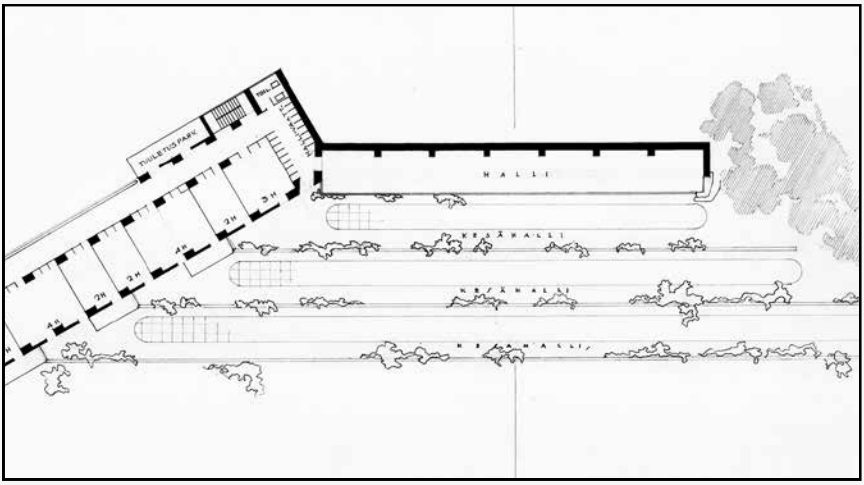

Fig. 3.3.2e. The sun patios planned at the competition stage to be situated in front of the sundeck. Drawing No. 50-25, detail. The drawing has been edited. AAM.

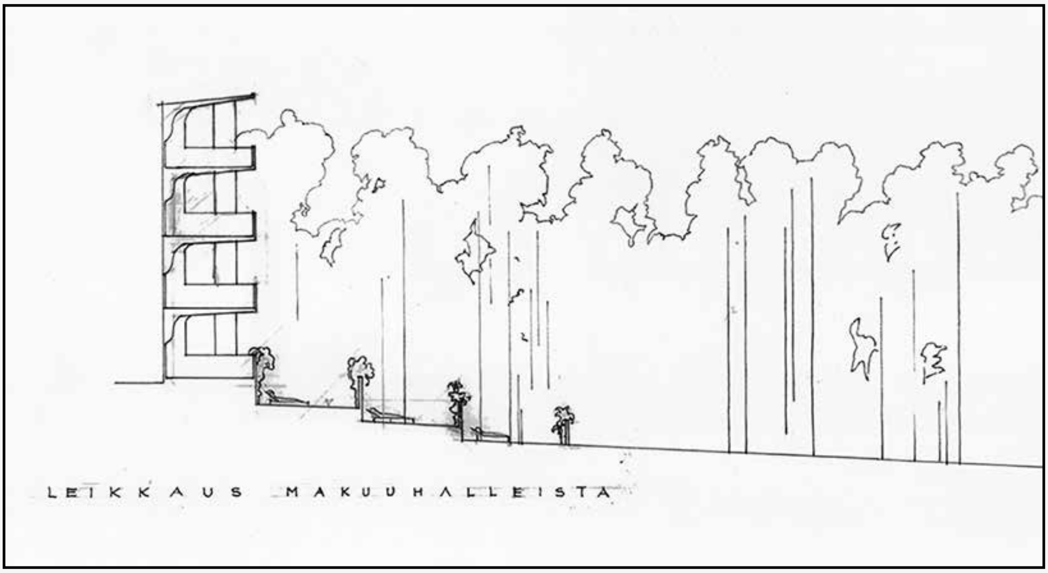

Fig. 3.3.2f. At the competition stage, the sundeck wing had four floors and no roof terrace. The cantilever, pictured, tapered towards the outer edge. The rear wall was load-bearing and it was supported with buttresses. At the competition stage, all wings had a load-bearing column row in the exterior wall. Only the sundeck wing had a cantilevered structure. Pictured also, the terrace garden in front of the sundecks, designed by Alvar Aalto. Drawing No. 50-29, detail. The drawing has been edited AAM.

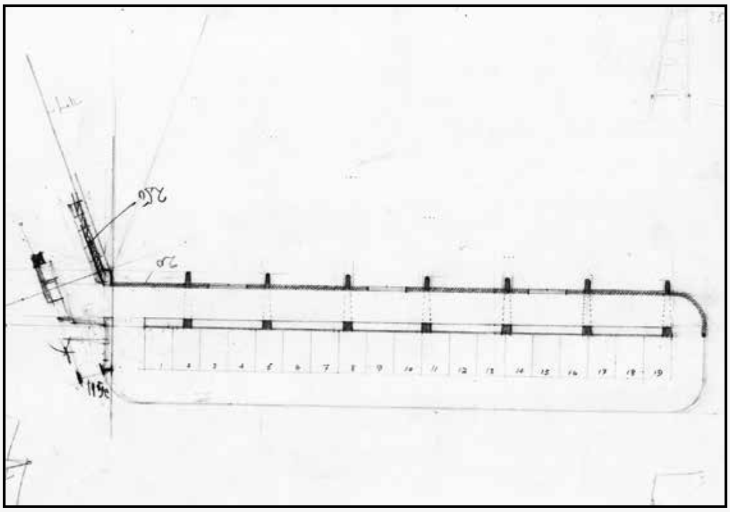

Fig. 3.3.2g. The floor plan of the sundeck wing from 1930 before the finalisation of the design. The load-bearing column row inside the sundeck was square shaped, and paired with another column in the closed rear wall – the architect was apparently developing a ladder structure balanced between two lines. Drawing No. 50-661. The drawing has been edited AAM.

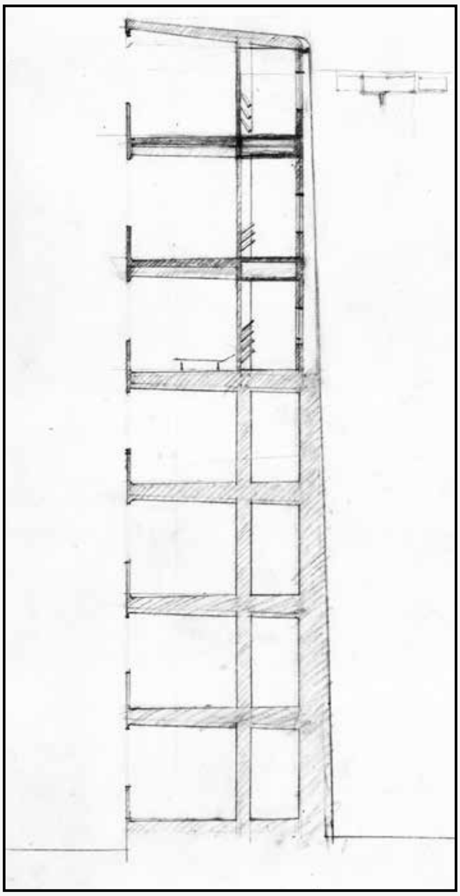

Fig. 3.3.2h. The section of the sundeck wing is at its final height, so the sketch is from around February 1930, before the structural designer had joined the project team. The columns in the middle of the deck were of even width, while the columns in the rear wall tapered upward. The sundecks were cantilevered, but fairly thick structures. The foundation method for the sundeck wing had not been specified. This sketch was probably drawn by the architect without the input of a structural designer. Drawing No. 50-708. The drawing has been edited AAM.

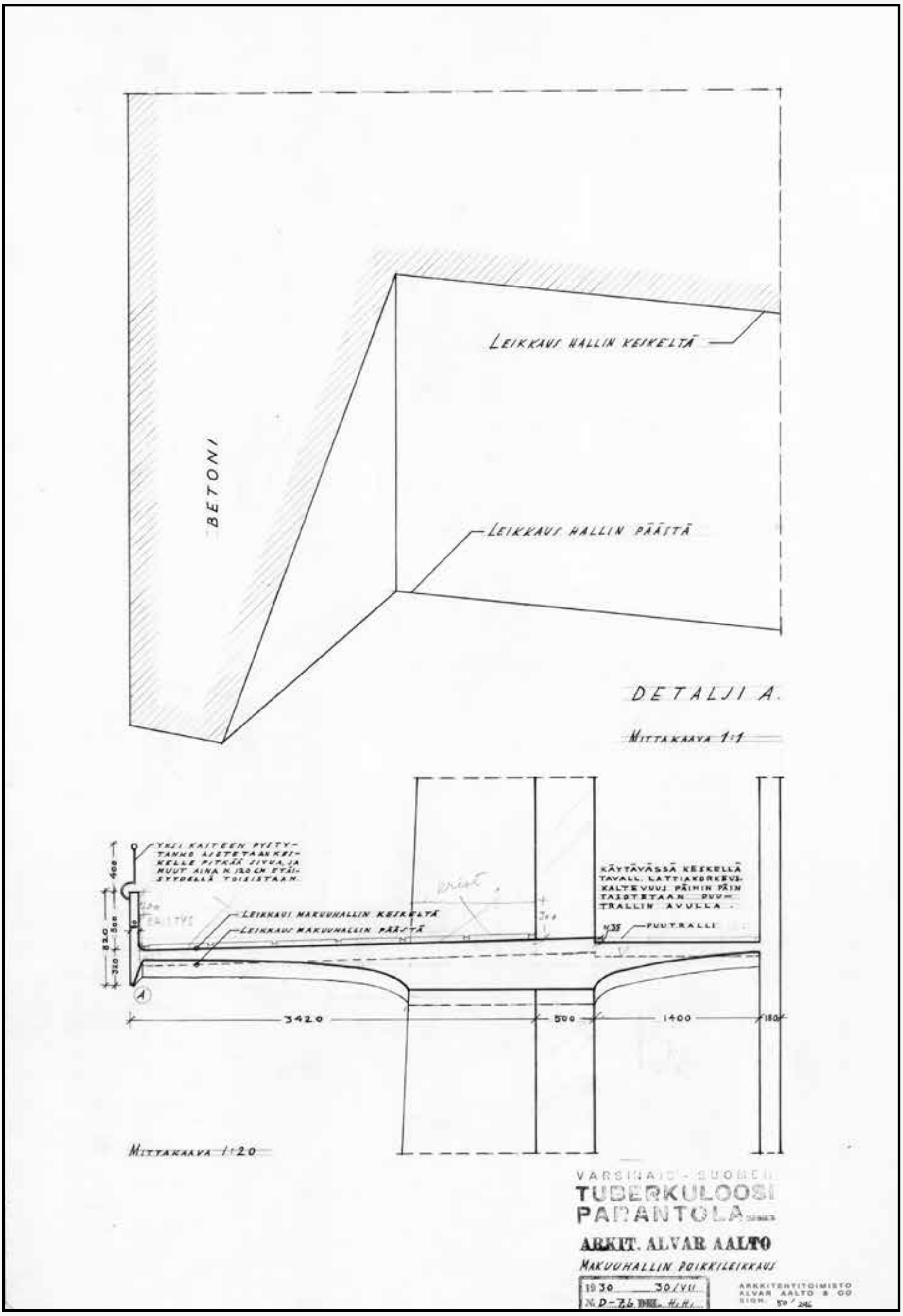

Fig. 3.3.2i. This drawing by "H.H." from July 1930 shows a sundeck with a sophisticated structure tapering in two directions towards the outer edges. The solution was developed in collaboration with the structural designer. Drawing No. 50-296. The drawing has been edited. AAM.

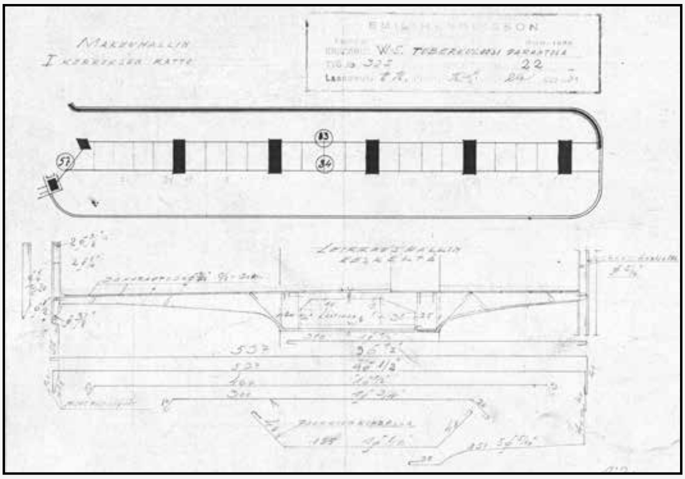

Fig. 3.3.2j. Emil Henriksson's structural drawing of the ground floor ceiling in the sundeck wing was dated August 1930. It showed a load-bearing column row, five columns with a rectangular section, and a closed rear wall with no windows, so that the concrete layer is enveloped by a protective envelope. The double-beam connecting the columns was resolved as a box beam construction. The drawing was from a later date than the corresponding architectural drawing, Fig. 3.3.2i. Emil Henriksson's drawing No. 22. PSA.

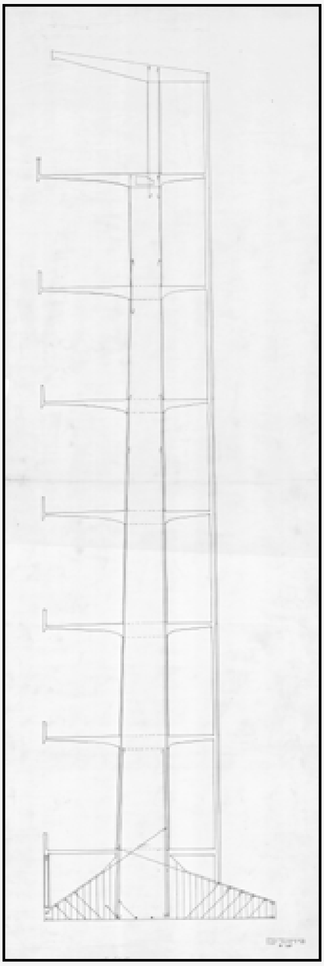

Fig. 3.3.2k. The vertical section of the sundeck wing was sketched by the architect probably at the end of 1930. It illustrated the principle of the concrete reinforcements and the foundation. Drawing No. 50-155. The drawing has been edited. AAM.

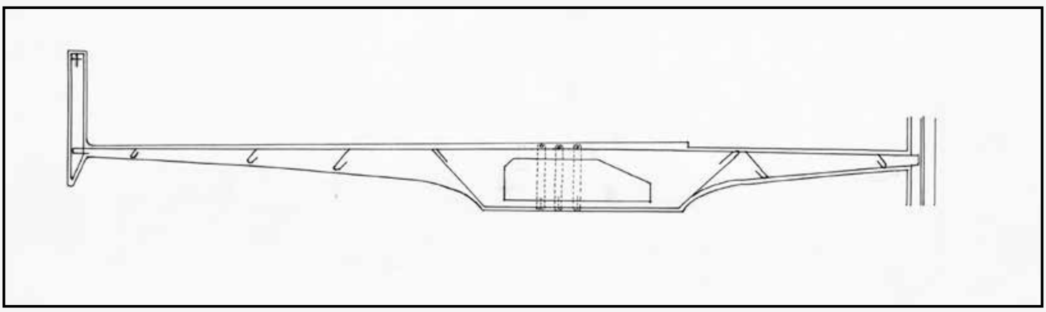

Fig. 3.3.2l. The section of the sundeck slab shows a schematic drawing of the reinforcements. The image was made afterwards for presentation purposes. Drawing No. 50-409. The drawing has been edited. AAM.

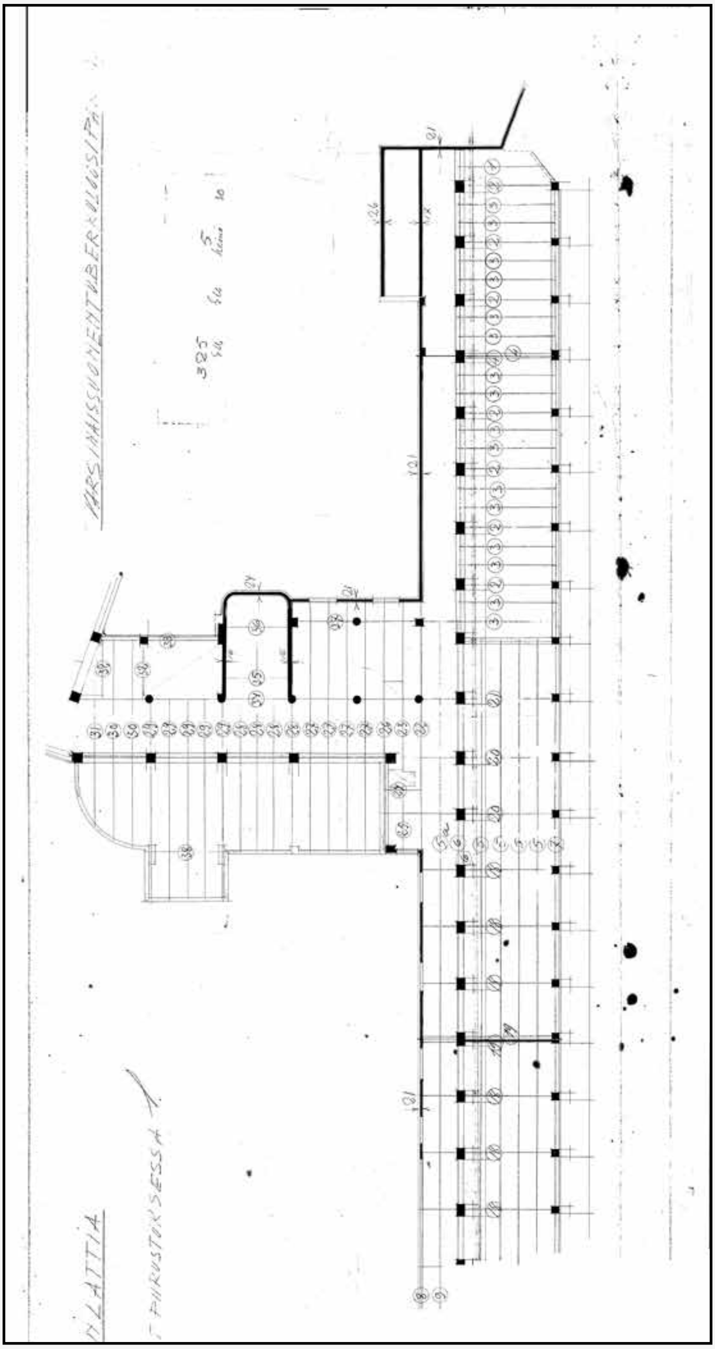

Fig. 3.3.2m. Emil Henriksson's structural drawing showed the primary and secondary beam systems in A wing. At least on the ground floor, the beams are different at the eastern end of the long patient wing. Dated July 1930. Emil Henriksson's drawing No. 5. The drawing has been edited. PSA.

3.3.3 THE CONSTRUCTION PROCESS

The structural drawings served as work specifications for casting the concrete. Since the structural design was being carried out simultaneously with the construction work, the progress of the work could be inferred from the dates of the structural drawings.[716] The drawings were made between June and November 1930, when the concrete frame construction also took place.[717] The drawings dated June refer to the beams in the boiler room (D wing). The drawings dated July refer to the A wing foundations and the ground floor slab and beams; the B wing foundations, basement ceiling and the ground floor columns; and the C wing basement ceiling and walls. The drawings contained markings on the work methods on site and completion dates for interim goals. The work progressed at a rapid pace.[718] In August, designs were completed for the ground and first floor ceilings of the sundeck and the ground-floor ceiling of B wing, the special drawings for the suspension rods and three staircase drawings: the staircase spiralling around a chimney in C wing, a straight staircase for C wing, and staircase C in A wing. The structural drawing for the bridge connecting B and C wings as well as the lobby ceiling and main entrance canopy pillars were dated September. Drawings for the water tank, certain beams in the boiler room and B building as well as the ground floor ceiling in B building were dated October. The cantilevered beam tapering towards the outer edge for A wing was dated November 1930.[719]

The final inspection of the frame construction was conducted by the architect Alvar Aalto, clerk of works Kaarlo Kilpi, contractor Arvi Ahti, site foreman Yrjö Oskari Vuokko and architect Ilmari Ahonen, who was secretary to the inspection panel. The engineer who conducted the structural calculations, chief supervisor Emil Henriksson did not attend the final inspection.[720] The final inspection was conducted in harmonious spirit. The panel stated that the work had been carried out with commendable diligence, both in terms of progress and quality. It was recorded in the minutes that the execution deviated somewhat from the original designs. Work that had been omitted included the roof-top machine rooms of the two smaller lifts, four staircase steps, the masonry work between the chimney and boiler room and the slab between beams in the boiler room ceiling. The volume of the kitchen staircase had also been reduced. Extra work included the enlargement of the large lift machine room in the main staircase, the expansion of the channel between the boiler room and the main building and masonry work on the boiler room walls. The boiler room

716 Structural calculations were completed in a similar manner, concurrently with the construction, in the Southwest Finland Agricultural Cooperative Building. TKA.

717 The contract for erecting the steel concrete skeleton was concluded June 17, 1930. It came into effect immediately after the contractor had set a guarantee. Contract between the Building Board and contractor Arvi Ahti, June 17, 1930. Work and contractor contracts 1929–1951. PSA.

718 For example, the beams based on the designs for the lower slab beams dated in July were cast almost immediately, on August 2. Emil Hendriksson's constructional drawing No. 3, July 1930. PSA.

719 Emil Henriksson's constructional drawing No. 7, November 1930. PSA.

720 Minutes of the final inspection, December 5, 1930. PSA.

Fig. 3.3.3a. The image shows the floor curving up towards the window in the patients' rooms under construction. The load-bearing pillars in the corridor wall. Photo PSA.

Fig. 3.3.3b. The skeleton of the building was cast in situ floor by floor. Photo PSA.

Fig. 3.3.3c. The water storage tank cast from reinforced concrete around the pipe, a delicate work, was constructed only in 1931. Photo PSA.

ceiling and the top part of the kitchen staircase had proved more complicated to execute than anticipated. Casting the roof had been omitted following the instruction of the supervisors and the water storage tank had not been built owing to its sensitive nature. Furthermore, the developer had delivered to the site on behalf of the contractor the special bricks for the horizontal section of the central heating piping. It was estimated that the cost savings made by omitting certain work and the costs incurred by additional work could be offset against each other.

The foundation work carried out by the developer had revealed that the bedrock on the site required drilling which had delayed the beginning of the framework. Although the completion of the building frame work was postponed for the above reason until a less opportune season, the contract was completed within the set time. The contractor emphasised the fact that receiving working drawings and structural calculations on time had sped up the work. According to the contractor, the supervisors had also agreed on all actions in a timely manner. The developer signed off the work, the casting of the roof slab and the water storage tank supported by the central heating chimney excepted.[721] Ahti built the water storage tank, which was part of the building frame contract, in summer 1931.[722] The final inspection report does not mention any test loads as stipulated in the new concrete building standards or that any test cubes of the reinforced concrete structure were sent for examination at the material testing laboratory.[723]

The contract also included the purchasing of all building materials and tools and equipment. The structures were cast in situ in timber formworks, except for the columns in the lobby, which were cast in three-millimeter sheet metal formworks.[724] The contractor purchased timber from the Building Board to build the formworks[725] and had access to sand and water on the sanatorium plot without charge. The aggregate for the reinforced concrete was pit-run gravel from the near vicinity of the sanatorium. The developer was, however, responsible for purchasing coke cinder and any other fillers. The lift towers built by the contractor remained in the possession of the developer after project completion. The Building Board purchased timber form Contractor Arvi Ahti as well as two motors, a hoist and other machinery. He also rented two stone mills, two hoists, a pump and a steam generator, among other things.[726] At a minimum, the following machinery was in use at the building site: a motorised concrete mixer; one new and one old electric motor; circular rip saw and its motor; annular water pump; weighing machine; pushcarts; hand pump, kitchen cooker; two telephones and various mechanical devices such as iron pushcarts which were used

721 Minutes of the final inspection, December 5, 1930. PSA.
722 Building Committee July 4, 1931, Section 1. PSA.
723 Minutes of the final inspection, December 5, 1930. PSA.
724 Aalto [1930]a, p. 8. AAM.
725 On commencing the frame construction, the Building Committee sold Arvi Ahti timber from forest clearance as concrete structure props at a minimum price of FIM 2.75 a piece. Building Committee June 27, 1930, Section 2. PSA.
726 Building Board December 15, 1930, Section 3. PSA; Building Committee August 21, 1931, Section 3. PSA.

Fig. 3.3.3d. The patient wing building site in autumn 1930. The A wing pillars on the external wall line were cast in situ and protected by a brick layer. Photographer Alvar Aalto or Aino Marsio-Aalto. Photo No. 50-003-079. AAM.

for transporting concrete mass horizontally on upper floors.[727] However, the building of Paimio Sanatorium took place largely using manpower without machinery. The foundations were excavated manually with shovels, bricks were carried along a gangway into the building and mortar was pulled up in 20–30 litre buckets using a manual hoist. The small farmers in the area drove sand to the site with horses, forming a chain. The bricks were driven from Paimio train station to the site on a small truck.[728] Bricks and insulating firebricks were purchased from Suomen saviteollisuus Oy in Paimio.

3.3.4 INSIGHT, KNOWLEDGE, SKILLS AND MATERIAL CAME TOGETHER IN THE REINFORCED CONCRETE FRAME

The Paimio Sanatorium project involved three master builders who had trained as concrete engineers in Germany. The structural engineers Henriksson and Cairenius as well as the clerk of works Kilpi had studied in the same Technical School of Sterlitz. Kilpi designed the concrete and other structures for the smaller buildings in the sanatorium compound.[729] These master builders and engineers had made study trips to many European countries and were well informed about the latest international developments in their field. Therefore, the design and execution of the modern concrete structure of Paimio Sanatorium did not depend on the knowledge of one or two individuals. According to Aalto, the building management in the Sanatorium project had aimed to keep the design and execution of each specialist structure separate and that the design and building supervision were left in the hands of a senior professional advisor. When the building was complete, Aalto recounted that the structural calculations had been conducted in close collaboration with Emil Henriksson, from the very early stages of the drawing process, and that, of all the specialists, his contribution was the most notable. [730] Aalto did not, however, specify when exactly the collaboration had started. Henriksson had probably served as an advisor in the competition stage in developing the overall solution for the building. One should bear in mind that during the Paimio Sanatorium competition stage, Aalto was collaborating with Emil Henriksson on the Turun Sanomat Newspaper Building. However, it is equally possible that Henriksson assisted Erik Bryggman, who also participated in the competition.

Aalto set store by expertise, on the one hand, and the separation of design and execution, on the other. The structural engineer and the concrete frame contractor were connected with each other on many levels, both professionally and personally. Aalto himself had also built a relationship with Emil Henriksson during his earlier projects.

727 Tools and machinery. Summary of the building costs. I. Gm 1:1. PSA.
728 Törrönen 1984, p. 37.
729 Building Committee May 9, 1930, Section 3. PSA.
730 Aalto 1933b, p. 86.

He was also aware of connections between Henriksson and Ahti. Owing to the economic depression, the contracts were hotly competed, as evident in the case of the concrete frame contract for Paimio Sanatorium.

The frame solution for A and C wings altered between the competition stage, January 1929, and the master drawing stage, April 1930, to a significant degree, while B wing changed only in its roof terrace. In January 1929, A wing had two load-bearing external wall alignments and one row of columns within the frame. In April 1930, only one of the external walls was load-bearing. In January 1929, C wing similarly had load-bearing external walls and a load-bearing row of columns inside. By Christmas 1929, it had acquired two load-bearing rows of columns within the frame and non-load-bearing external walls. B wing in turn kept its load-bearing external wall alignments throughout its development. As a result, each of the three main wings had a different frame solution.

In April 1930, when the principles for the load-bearing structures had been resolved, the design was submitted to the State Medical Board for approval. The work specification at this stage included such detailed instructions on the execution of the concrete construction that the author of these specifications must have had both theoretical and practical competence on the subject. The architectural drawings and building specification of this specific stage were given priority in the concrete frame contracting process. It would appear that Aalto had invited Henriksson to join his team before the design collaboration formally began in May 1930. From the perspective of power relations, it is interesting to note that the strength calculation engineer signed the contract specifically with Aalto, not the Building Board of the Tuberculosis Sanatorium of Southwest Finland. The Building Board did not want the contractor to conduct the structural calculations although this was common practice at that time. If the contractor had been allowed to use their own strength calculation engineer, the collaboration between Aalto and Henriksson, which had lasted several projects, would have probably ended and perhaps a similar fruitful relationship would not have formed with any other engineer.

The column, beam and slab frame in Paimio Sanatorium was innovative considering the type of building it was applied to and the period. Some of the structures were more conventional, such as the intermediate floors supported on external walls[731] while others were more ground-breaking, such as the cantilevered interim floors of the sundeck wing and the large freeform entrance canopy, which acquired its final shape between July and August 1930 as a collaboration between the architect and the structural engineer.[732] Aalto also managed to salvage the suspended interim floor slab in the B wing dining hall, regardless of the medical experts having unanimously rejected the structure in their statements on the competition entries. Aalto drew diagrams to translate the doctors' interests, illustrating how the structure would allow sunlight penetrate to the furthest

731 In the interwar period, interim floor slabs were almost without exception built from reinforced concrete. The most typical structure was the slab-and-beam construction, on top of which rested a separate floor structure. The structural thickness was typically 40–45 centimetres. Neuvonen et al. 2002, pp. 100–101.

732 See drawings Emil Henriksson No. 5. PSA dated July 1930; and drawings Nos. 50-306 and 50-307, dated August 25, 1930, and signed by "H.H."

corner of the building wing. In A wing, the primary beams transversed the wing while the secondary beams were longitudinal.[733]

Reinforced concrete has good load-bearing but poor heat insulation qualities. The use of concrete as the load-bearing structure in Paimio Sanatorium required the use of composite structures on the building envelope. In composite structures, each layer has a different function; brick was used in the external walls of Paimio Sanatorium not as a load-bearing structure but as heat insulation. As a load-bearing material, brick was used only in isolated structures, such as the chimney, which supported the water storage tank. Also, the columns of the outer wall in A wing were thermally isolated with bricks.[734] Aalto's building report and, for example, plumbing specifications revealed that he approached sound and heat insulation as an entire system.

The D series drawings by the architectural office are working drawings of various building elements. The input of "H.H." was significant, and he created some 20 drawings in the period between 1930 and 1931. In 1930, "H.H." created drawings particularly for building parts relating to reinforced concrete structures, such as balconies, ramps, sundeck sections and the canopy of the main entrance. They were drawn with great consideration and their creator has clearly understood the qualities of reinforced concrete structures, perhaps to the extent of being able to design them. The person using the initials "H.H." may have been Hugo Harmia (1907–1952)[735], who at this time was still a student. Harmia, born Hackstedt, was Alvar Aalto's maternal first cousin.[736] Harald Wildhagen, for whom this role would fit perfectly, only used the initial "W" or no initials in his drawings. Schildt has referred to the collaboration between Aalto, Henriksson and Wildhagen. The Norwegian was professionally more experienced than Aalto, in conjunction with the concrete columns for the Turun Sanomat Newspaper Building; it would be plausible to assume that the collaboration continued with Paimio Sanatorium. Or perhaps "H.H." was Emil Herman Henriksson, using the initial of his middle name rather than the first? This is an unlikely explanation, as Henriksson is known to have marked his structural drawings with "E.H." in his recognisable and completely different, round handwriting.

The Turku-based businessman Juho Tapani did not place an offer for a contract on the Paimio Sanatorium concrete frame. Tapani and Aalto had had disagreements during the execution stage of the Southwest Finland Agricultural Cooperative Building, as witnessed by meeting minutes in which mutual accusations for delays in the delivery of designs and the construction work were recorded.[737] Juho

733 The beam system was different at the eastern end of the A wing, at least on the ground floor. Emil Henriksson's drawing No. 5. PSA.

734 Photograph No. 50-003-079. AAM.

735 Hugo Edward Harmia (Hackstedt) was born in 1907 and finished his studies of architecture in 1933. He made study trips to Sweden, Germany, France and Italy. Between 1933 and 1934 he worked as assistant at the architectural practices of P. E. Blomstedt and of K. Borg. He started working for the Public Worls Department of the City of Helsinki in 1934. Anon 1948, pp. 121–122.

736 Emails from curator Arne Hästesko on January 14 and 31, 2013, from chief curator Katariina Pakoma on January 22, 2013 and two emails from archivist Marja-Liisa Hänninen on January 28, 2013 to author.

737 Pakoma 2003, p. 24.

Tapani was bound to be dissatisfied with the Standard Apartment House in that the structural solution created by Aalto and Henriksson was not based on utilising the qualities of the concrete bricks that Juho Tapani had developed and marketed. The selection process of the concrete frame contractors in Paimio is a testimony to Aalto's skills, ability and willingness to manoeuvre things to his benefit. Individuals who were interconnected in many ways promoted each other and thereby their own goals. Selecting Arvi Ahti as the contractor was in Aalto and Henriksson's own interest. In the Building Board's view, Ahti as a Turku-based builder was a preferable choice for the Building Board rather than the Helsinki-based Tektor, who was the initial contractor poised to win the contract. The innovativeness of the concrete structure also had a bearing when selecting the contractor in another way: the Building Board did not hold official discussions on the discrepancy between the cost estimate made by Aalto in 1930 and the final costs. Owing to provincial protectionism in a time of recession, local labour and construction materials were to be preferred at the construction site.[738]

Comparison between Aalto's competition-stage design and the final building shows that the most significant change is in the increased scale of the patient wing. The structural solution of the imposing sundeck wing underwent three development stages until it acquired its final shape in an apparently close collaboration between the architect and the structural engineer. A number of details, such as the canopy above the main entrance, the cantilevered balconies of the sundeck wing and the highlighting of certain concrete structures, were finalised during the summer and autumn of 1930 as construction work progressed. Aalto was able to keep the suspended interim floor in the dining hall, which had been unanimously criticised by the medical experts before the actual design process began. Once execution was underway, the issue was no longer raised for discussion.

How useful were Latour's concepts of actor-network theory when studying the realisation of the Paimio Sanatorium reinforced concrete frame? There were a large number of documents covering this central building system, variable in quality, which made it easier to understand the different dynamics of relationships affecting the work. Articles written by Aalto, which were discussed in Chapter 2, revealed the architect's deep engagement in creating the concrete structure, a challenge he found inspiring. Firstly, he translated the interests of the Building Board so that it would favour a structural designer, with whom he was close, by pleading the merits of using the designer's independence and expertise instead of allowing the contractor to make the structural calculations, which was a more commonplace practice at that time. As an innovator, he took an active role in the contracting negotiations with the reinforced concrete contractor, even if this tested the boundaries of his own integrity. The conract negotions were simply

738 Contract on constructing the reinforced concrete frame for the Tuberculosis Sanatorium of Southwest Finland signed by the Building Board and Building Supervisor Arvi Ahti, June 17, 1930. Work and contractor contracts 1929–1951. PSA.

Latourian trials he had to win. Aalto and Henriksson's previous joint projects had been successful and Aalto had come to rely on his expertise, knowledge and competence as a designer. The professional respect must have been mutual. Henriksson, in turn, was Arvi Ahti's business partner and they had worked together on many developments in Turku. The fact that he was from Turku motivated the Building Board to select Ahti as the contractor instead of the Helsinki-based Tektor. Henriksson trusted Ahti's knowledge of concrete structures and the latter performed to expectation. Moreover, the men were related, which may have been an added motivation to support each other's businesses during the economic recession. To mobilise Latour's set of concepts, Aalto acted as the innovator, the initiating force, who steered the project in the direction he wished and who was ready to encounter various trials in order to achieve his personal goals. Aalto, with his architectural vision, Henriksson, with his understanding of reinforced concrete structures, and Ahti, with his track record as a builder of concrete structures, together with reinforced concrete as the material, formed a strong hybrid that was capable of action. The process was carried out as a joint undertaking by these builders, in good spirit and according to schedule, producing an impressive tectonic outcome for the concrete frame. The Building Board did not debate over the fact that the reinforced concrete frame exceeded its budget quite substantially. Aalto's solution, which allowed sunlight to flood deep into the building frame, appealed to the medical experts after all. He used section drawings as his tool of translation of their interests, showing the medical experts how rays of sun reached the farthest corner within the structure. As Aalto had succeeded in first persuading the medical specialist of the superiority of his concrete frame design, the lay members of the Building Board voiced no doubts on this issue. Even the final cost, which exceeded the budget by more than 40 percent, was not questioned. The process was, in terms of actor-network theory, a successful translation.

3.4 THE HYBRID WINDOWS

Plenty of sunlight and good ventilation were key principles alongside rest and diet in the treatment of tuberculosis patients. The decree governing the state aid for sanatoria prescribed that the State Medical Board be presented the structural specifications of the sanatorium's windows.[739] During the competition stage, Aalto had wanted to ascertain the views of the State Medical Board experts on the architectural solutions in his proposed design and asked for their opinion. Edward Horelli, Senior Medical Officer of the State Medical Board, agreed to comment on Aalto's proposal while the competition was still ongoing, suggesting that the 8.4 square-metre windows in the patient rooms were too large, given some patients could not tolerate sunlight. From the medical perspective, Horelli saw that the patients should have the option of avoiding sunlight in their rooms, so half the proposed window size would suffice.[740]

3.4.1 ARCHITECTURAL DRAWINGS

The window programme for Paimio Sanatorium included wood and steel windows, their combinations and special windows, such as skylights. The archives of the Aalto Museum hold some 50 drawings that have been categorised as window drawings associated with the Paimio Sanatorium project. These drawings include 13 standard window drawings, only three of which are for the Paimio Sanatorium building. The rest of the standard window drawings illustrate the architect's aim to develop universal window standards.[741]

Aalto used the patient room window as a vignette in the competition sheets. It was an asymmetrical, vertically divided three-part steel window with only the left-hand section reaching to the floor. Each vertical section was equal in width: some 70 centimetres wide. The bottom edge of the two sections on the right was approximately 90 centimetres from the floor, and beneath them stood a floor-standing column radiator. The window area specified in the drawing was approximately four square metres. The floor and the window wall were joined at right angles. The window was a double-sash window with an air pocket in between. The top part of the window was a window type known as the "health window". This window type had grown popular in public buildings in Finland at the end of the 19th century. The inner window was bottom hung and the outer one top hung. The ventilation

739 Asetus valtionavusta 270/1929, pykälä 6. (Decree on State Aid 270/1929, Section 6).
740 E.J. Horelli's letter to Alvar Aalto, January 2, 1929. AAM.
741 Elina Standertskjöld has discussed Aalto's standardisation objectives in her articles "Alvar Aalto and Standardisation" and "Alvar Aalto's standard drawings 1929–1932". Standertskjöld, 1992a, pp. 74–88; Standertskjöld, 1992b, pp. 89–111; for further discussion on Aalto's standard window drawings, see Section 2.6.

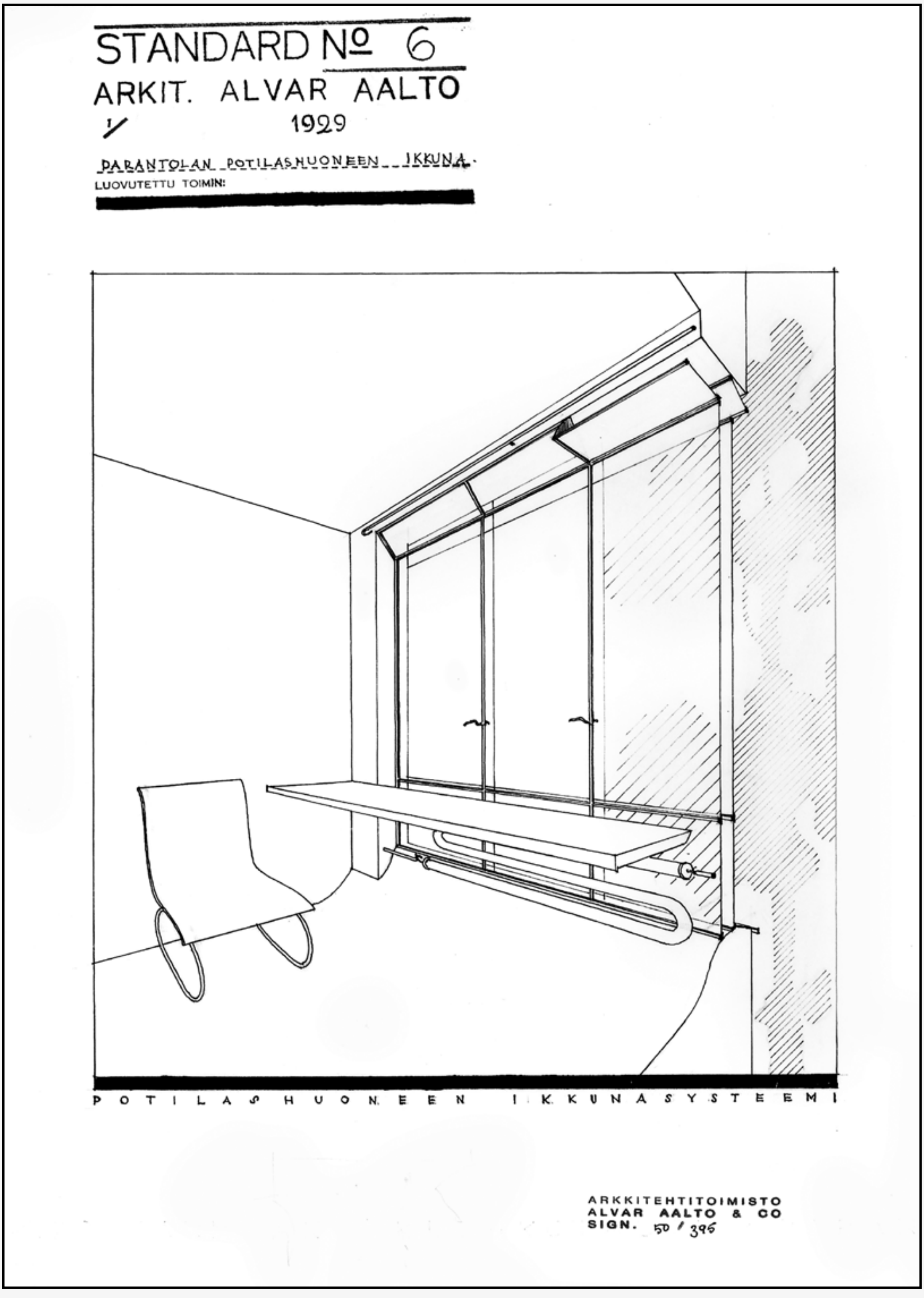

Fig. 3.4.1a. Standard No. 6. The window system in the patient room. Visually, it seemed as if the window reached all the way down to the floor level, although the actual floor level was 30 centimetres lower than the bottom edge of the window. Drawing No. 50-395. The drawing has been edited. AAM.

window had special hinges connecting the interior and exterior sash together. The ventilation window was opened and closed with a simple mechanism.[742]

The doctors had considered Aalto's window design that reached all the way down to the floor too difficult to clean and had recommended a higher window to secure sufficient daylight.[743] Standard No. 6, which showed the patient room window[744], was part of a series of drawings approved by the State Medical Board.[745] The delicately structured window now had sections of uniform height. Its area had grown to approximately 6.5 square metres and it was a double-glazed steel window divided into three vertical sections and equipped with a ventilation window. A fixed desk was fitted in front of the bottom panes, underneath which the floor rose towards the outer wall in an S-shaped profile. Visually, it seemed as if the window reached all the way down to the floor level, although the actual floor level was 30 centimetres lower than the bottom edge of the window. The standard drawing showed radiator pipes under the desk and a chair with tubular steel legs and bent plywood seat. Aalto presented ventilation, heating and fixed furniture as an interlinked system together with the window. The drawing showed that Aalto treated the patient room window as an overarching solution rather than a separate element.

Aalto designed a wooden blind to be installed outside the window.[746] The drawing for this design is not marked as being a standard, but the list of standard drawings presented to the State Medical Board refered to a standard drawing for an external wooden blind.[747] The intention was to create the appearance of a gigantic wooden wall, when the blinds were down.[748] In addition, one unnumbered standard drawing showed the heat insulation of the window sill, including the flashing, internal sill and steel window.[749] Aalto aimed to use this solution that he had initially designed for another building in the patient room window. This drawing showed that the architect was aware of the problems of thermal conductivity with steel windows, also known as the thermal bridge.

A diagram of the joining of the patient room and exterior wall was yet another indication of Aalto's holistic intent. The section presented a double-sash steel window with a ventilation window. The top sash was now perpendicular instead of slanted, as they had been in the previous version. Wooden blinds were placed outside the window. The floor rised towards the exterior wall in an S-shaped profile. A fixed desk was installed in front of the window, with radiator pipes underneath. The width-to-height ratios were measured and the angle of the sunlight was shown at 45 degrees.

742 See the competition drawings Nos. between 50-24 and 50-30, 50-32 and 50-33. AAM.
743 Severi Savonen and Niilo Mäkinen's statements to the Building Board concerning Alvar Aalto's competition entry on April 4, 1929. Documents related to the Paimio Sanatorium project. AAM.
744 Three drawings, all marked with a stamp "standard", Nos. 50-53, 50-395 and 50-396, show the patient room window and the related technical solutions. They are similar in content. In two of the drawings, the standard has been marked with No. 6. AAM.
745 Drawing No. 50-395. AAM.
746 Drawing No. 50-225. AAM.
747 Work specification. Record No. 2466. State Medical Board 1930 Aa:4. NA.
748 Hahl 1933, p. 65.
749 Drawing No. 50-215 dated August 21, 1929 and related to Turun Sanomat Newspaper Buildling. AAM.

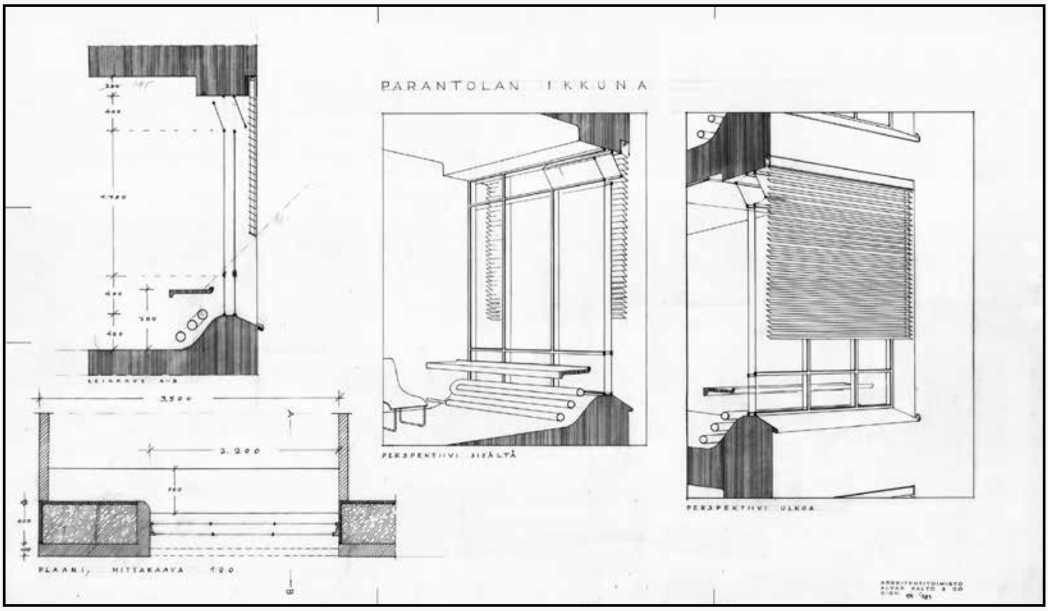

Fig. 3.4.1b. The vertical and horizontal sections of the sanatorium window and two perspective drawings. The same image showed the angle of lighting on the desk, the ventilation, heating and wooden shades. The patient room window and the related interior solutions were designed as one complete entity. Undated, no initials. Drawing No. 50-181. The drawing has been edited. AAM.

The window opening height was lower than the room height. The joint between the wall and the ceiling was coved.[750] This diagram indicated how the solutions had yet again been investigated further than in the previous version.

The final window solution for the patient room was developed through three drawings. In the first drawing made for the contract calculations, a mullion ran through the double-sash wooden window which opens both inwards and outwards and was supported with a steel T-profile. The second version of the patient room window was dated the following day. In the latter drawing, the window was a tripartite steel-framed window with wooden sashes. Both drawings are created by architect Lauri Sipilä.[751] The third drawing[752], which corresponded to the windows eventually realised, is by Lars Wiklund. The tripartite window had two transoms running the depth of the structure. The middle row of windows, however, did not have the same transoms as the top and bottom rows. Below the window elevation drawing there was a diagram indicating the opening directions of the window frames. The upper windows were top-hung, while the lower ones were bottom-hung and the middle windows side-hung. Aalto coined this unusual solution as the "horizontal health-window". The solution legitimised the use of iron profiles to reinforce the structure, which was Aalto's personal ambition. It was important for Aalto to be able to talk about wood-steel windows instead of simply wooden windows, as the latter represented the traditional building method in Finland. With this new design, Aalto set a new standard for "health" windows. His innovation was a clear departure from the past.

In addition to the window standard drawings and the competition vignette image, there were only five other drawings of steel windows drawn by the architect among the architectural drawings.[753] Details of Paimio Sanatorium steel windows and doors, such as the stays, were not designed by Aalto's office but by the manufacturer's drawing department. The architect's remit was exclusively to draw diagrams. One of the diagrams presented the steel window standards for the patient corridors and special units.[754] Another drawing was an extract of the former, drawn in pencil.[755] A third drawing was a comprehensive presentation of the sanatorium's steel windows.[756] The window wall in the lounge, with triangular, heated glazed cabinets for plants, appeared in two drawings. The internal windows of the conversation space were glazed according to the specifications using pitch pine beads. The two largest windows in the end wall were glazed with eight-millimetre special glass and the plant corner cabinets between these panes were heated with vertical radiator pipes running

750 Drawing No. 50-181. AAM.
751 Drawings Nos. 50-196 and 50-222 are related to this stage. AAM.
752 Drawing No. 50–321. AAM.
753 The drawings also include ones for interior windows, such as glazed lift walls, but these have been excluded from this discussion.
754 Drawing No. 50-319. AAM
755 Drawing No. 50-327. AAM.
756 Drawing No. 50-328. AAM.

through the cavity. The large windows in the end wall and the outer window of one of the corner cabinets were glazed from the outside using metal glazing beads.[757] There was also one pencil sketch of the window wall in question preserved in the archives.[758]

There were 17 architectural drawings related to wooden windows. Two of them were designs for the wooden sliding windows, which did not correspond to the realised windows. The drawings for the wooden windows were dated between August 1930 and September 1931, with most dated between March and June 1931. They were mainly drawn by architect Lars Wiklund. As a general observation, Aalto's practice produced a fairly large number of window details, and certain solutions recurred: most of the wooden windows had coupled double-sash windows. The external pane was usually fixed and the interior window could be opened for cleaning.[759] The external panes were fixed with glazing putty, and the inside panes with glazing beads. The method of cleaning the external window was not specified.

The use of different windows was hierarchical in relation to the space in which they were used. Wooden windows were used in secondary spaces, such as the corridor off the sundeck in A wing[760], staircase E in C wing[761] and the staff social room's corner window[762] on the second floor of C wing. The architects were well-versed in this area, which showed in the exhaustiveness and level of detail of the drawings.

There were two skylight drawings, presenting three different window types. One of the drawings was related to the separate morgue and to skylights in the main lobby.[763] In the other drawing, the top-glass of the cylindrical skylight in the operating theatre was rough cast glass, installed at an angle of incline 1:20. The inner surface of the cylinder was insulated with insulite. The top-part of the cylinder was equipped with cups for collecting condensated water, with the surgical lamp fitted in the middle with steel brackets and seven spot lights in the internal surface of the concrete cylinder. The lower glass was a conical milk glass cap.[764] The four cylindrical skylights in the main lobby largely represented a similar window type as the one in the operating theatre, only without electric light fittings. The drawings did not specify the lower glass but a photograph[765] taken from the newly completed lobby shows that the lower glass surface was on the same level as the ceiling and not conical. The skylights were steel-framed.

757 Drawing No. 50-332. AAM.
758 Drawing No. 50-749. AAM.
759 This type of window was presented, for example, in drawings Nos. 50-165, 50-314 and 50-385. AAM.
760 Drawing No. 50-315. AAM.
761 Drawing No. 50-314. AAM.
762 Drawing No. 50-311. AAM.
763 Drawing No. 50-358. AAM
764 Drawing No. 50-267. AAM.
765 Photograph No. 50-003-319. AAM.

3.4.2 WINDOW DELIVERIES

When presenting the final drawings to the Building Board in December 1929, Aalto enquired about the possibility of using iron-framed windows. The Building Board replied that the window frames had to be made of wood, but should Finnish-made iron frames become available, the work specifications should leave a reservation for this option.[766] According to the work specification submitted to the State Medical Board for approval, the staircases, corridors and dining halls in the main building would be fitted with wood-iron-framed windows, the patient rooms with wood-iron windows or wooden windows and the rest of the main building with wooden windows.[767] When discussing the work specification in May 1930, the Building Board left the decision regarding the windows on the table.[768] The window acquisitions became topical in spring 1931. Aalto's role in the window acquisitions was decisive, as the Building Board authorised him to call for tenders for the windows and doors to the sanatorium.[769]

Crichton-Vulcan was a Turku-based machine workshop, shipyard and rope manufacturer with long traditions. Its tender for the various windows[770] was enclosed with two drawings drafted by the workshop's drawing department, relating to the A wing corridor windows.[771] Chricton-Vulcan proposed 40 millimetre standard profiles with double glazing in a single casement. The windows would be delivered with pitch pine glazing beads and steel profiles with a single coating of anticorrosion paint. The brass screws for the glazing beads were also included in the tender. The tender specified the number, size and weight of each window type. The bronze fittings, including the hinges, handles and locks were listed by window type and priced separately. The tender also included the strip windows of the sundeck corridor[772], which had been crossed out by hand and the total price at the bottom of the tender was exclusive of these.[773] They were changed to wooden windows at the tender calculation stage.

Dated the same day was another tender placed by Crichton-Vulcan for the patient room windows. It proposed three different methods of manufacturing the required 150 windows. The first two options specified a 32 millimetre standard profile steel window, delivered sand blasted and with a single coat of anticorrosion paint, but without glazing. The third option, wood-framed with T-profile enforcements, was a substantially

766 Building Board December 8, 1929, Section 2. PSA.
767 Work specification. Record No. 2466. State Medical Board 1930 Aa:4. NA.
768 Building Board May 3, 1930, Section 4. PSA.
769 Building Committee January 25, 1931, Section 2. PSA.
770 The tender covered the following windows: 6 x IR 12; 6 x IR 13; 102 x IR 14; 5 x IR 2; 17 x IR 22; 5 x IR 23; and 24 x IR 24. Cost estimate No. 6161/T-1079. Offer of Ab Chrichton-Vulcan Oy, April 7, 1931. Work, location and material specifications and cost estimates. Contract agreements. PSA.
771 The drawings in questions, PF-33-½ and PF-34-½, are held at the drawings archive of Paimio Hospital. PSA.
772 Window type IR 24. Drawing No. 50-327. AAM.
773 Cost estimate No. 6161/T-1079. Offer of Ab Chrichton-Vulcan Oy, April 7, 1931. Work, location and material specifications and cost estimates. Contract agreements. PSA.

lower-cost alternative to iron-windows.[774] The tender was based on two architect's drawings, [775] although the architectural drawings and the workshop specifications did not fully correspond to each other. The second of the drawings had the word "rejected" added to it in handwriting, probably at a later time, although the drawing largely corresponded to the realised window.[776] The drawing that fully corresponded to Aalto's realised window design was made after Crichton-Vulcan's tender had been accepted and the architect had discussed the design with the workshop.[777] The previous version was crossed out at this stage. The variation was indicative of Aalto's aim to develop a window for the patient room that would in some manner make use of steel profiles. Negotiations with Crichton-Vulcan's highly competent staff allowed for the architect to develop the technical solution for the window that satisfied all parties. The wooden window designed as a result eventually had only a fraction of the intended steel profiles.

The Building Committee placed the hybrid window that had resulted from the collaboration under competitive tender with other manufacturers, although Crichton-Vulcan had quoted a clearly lower price for them than the steel windows. The Building Committee decided to order the patient room windows from Turun Puutyötehdas Oy, as its quotation was only one-fourth of the price quoted by Crichton-Vulcan.[778] From a financial perspective, this was a sound decision. However, Crichton-Vulcan, which to all intents and purposes was the developer of the window, in reality ended up handing over its specialist expertise for which it received no remuneration.

The Building Committee ordered a number of steel windows from Crichton-Vulcan.[779] Aalto requested an offer from Crichton-Vulcan for the steel windows for the rinsing and linen storage rooms[780], six for each.[781] The Building Committee decided to also order the doors and windows for the staircases, balconies and ground-floor lobby from the Crichton-Vulcan workshop. At the same time, the dining hall and lounge windows were ordered from the same workshop following a number of changes made to the offer, as requested by Aalto.[782] Aalto had in the same regard suggested that the

774 According to the first option, the double-glazed windows, measuring 2,200 millimetres x 2,500 millimetres would include three opening section, measuring 350 millimetres x 1,700 millimetres, and be fixed with glazing putty. Each window would weigh 212 kilograms. In the second alternative, the windows would be otherwise similar but fixed with pitch-pine glazing beads fastened with brass screws. In both options each window would be fitted with 12 bronze fittings. The cost of the former was FIM 2,670 and that of the latter FIM 2,920. The difference in price being FIM 250. In the third alternative, the windows were made of iron and wood as specified in the architect's drawings. Its size was 2,200 millimetres x 2,550 millimetres and they had three opening sections, each 650 millimetres x 1,700 millimetres in size. The glass panes were fixed with glazing putty. The price excluding fittings was FIM 1,650 and the fittings were separately priced. Cost estimate No. 6161/T-1079. Offer of Ab Chrichton-Vulcan Oy, April 7, 1931. Work, location and material specifications and cost estimates. Contract agreements. PSA.

775 Drawings Nos. 50-380 dated April 2, 1931, and 50-196 dated April 3, 1932. AAM.

776 Drawing No. 50-380. AAM.

777 Drawing No. 50-321. AAM

778 Building Board May 5, 1931, Section 4. PSA.

779 Building Committee May 5, 1931, Section 2. PSA.

780 Window types IR 12 and IR 13. Drawing No. 50-328. AAM.

781 Request for offer addressed [by Aalto's office] to Mr. Nylund of Crichton-Vulcan dated May 15, 1931. Documents related to the Paimio Sanatorium project. AAM.

782 Building Committee May 30, 1931, Section 6. PSA.

dining hall windows be made from oak[783] and requested an offer from Huonekalu- ja rakennustyötehdas (Furniture and Building Work Factory).[784] Aalto did not, however, bring the oak alternative to the attention of the Building Committee.

Changes were made to several windows during the course of the building work. The steel-profile staircase windows were realised as single-glazed, except for staircase A windows, which had double-glazing. The entrance lobby windows were realised as single-glazed and in addition some fixed windows were changed to opening ones and vice versa.[785] The orders for steel windows were placed in summer 1931 and they were installed in the autumn of the same year. The Building Board discussed with some indignation the delayed deliveries by Crichton-Vulcan and the exceeded cost estimates during an economic low.[786]

The delivery of wooden windows from Kolhon Saha (Kolho Sawmill) at Vilppula was also not completed without problems. Building inspector Ilmari Ahonen from Turku[787] paid a visit to the site and, as a result, requested that the building site foreman inspect the delayed delivery from the sawmill. Clerk of works Kilpi took note of the poor quality of the timber. In his opinion, a professional should know immediately from the architectural drawings that the designs required premium quality timber. The features Kilpi was referring to included coupled sashes, the double rebate on the frames and tall mullions. All the frames delivered to the site were made of young timber and the heartwood was visible in nearly all boards. Some of the material was excessively tarry, some coarse-grained and overall it was too knotty. To conclude, Kilpi wrote: "We regret the state of the Finnish timber industry as it is not looking after its own interests regarding the quality of products, even now as the iron industry is already gaining ground in the window frame and sash markets." [788]

The Building Board decided to demand Kolhon Saha to replace the inferior quality frames it had delivered with new ones and reserved the right to claim for damages.[789] Kolhon Saha delivered part of the wooden windows for the sanatorium.[790] The fittings of the wooden windows were not included in the delivery, and the Building Board obtained them as a separate purchase. In August 1931, the Building Board gave both the wooden and steel window glazing contracts exclusively to a Turku-based company

783 Drawing No. 50-748 of the large wooden windows is dated May 29, 1931. AAM.

784 The dining hall windows, if made of oak, would have cost FIM 2,000 each. A letter from Huonekalu- ja Rakennustyötehdas, signed by Otto Korhonen, to Alvar Aalto, dated May 30, 1931. Documents related to the Paimio Sanatorium project. AAM.

785 Window types IR 17, 18 and 20 would be realised without an opening window while IR 19 would be realised with one. Window types IR 8, 9, 10a, 10b, 5u, 5s, 6 and 28 would be realised as based on D-63. The drawing in question has not survived and was not available in the AAM archive.

786 Building Board October 17, 1930, Section 7. PSA.

787 The City of Turku contributed to the project with a substantial share and this probably made it necessary for Ahonen to pay inspection visits to the sanatorium building site. Ahonen had multiple connections to the sanatorium project. He had been intended to be one of the participants in the invited competition and he had served as the secretary for the final inspection of the concrete frame contract.

788 Kaarlo Kilpi's statement, June 27, 1931. Documents related to the Paimio Sanatorium Project. AAM.

789 Building Board July 4, 1931, Section 3. PSA.

790 Aalto 1933b, p. 91.

Fig. 3.4.2a. The patient wing corridor is nearly 100 meters long. Photograph No. 50-003-330, photo from the 1930s. AAM.

Kaune.[791] The Building Board decided that ultraviolet glass, or U-glass, would only be used in the windows of two patient floors, as instructed by a specialist physician.[792] The building industry representatives were actively contacting Aalto and, in return, Aalto asked sales representatives about the features of various part deliveries, obtaining, as a result, information on innovations in the field. Some agents were also offering foreign-made steel window systems for the project. In May 1931, the Helsinki-based Nic. H. Mannsdorff approached the architect by advertising window fittings and offered to draw up an offer for the Dutch Braat windows to be used in the Paimio Sanatorium. The letter referred to a telephone conversation with Aalto and said that the company had exclusive retail rights for Braat windows and doors in Finland. Aalto had used the Crittal Braat system for the Turun Sanomat building, when the Gothenburg company Torsten Linbeck had represented the system in Finland.[793]An offer on Braat windows was never requested for Paimio Sanatorium. In December 1931, Aalto also received a letter from T. Bonnevie who, on behalf of Yale & Towne, invited Aalto to visit the company's workshop in Germany. Bonnevie also enquired in his letter whether Aalto could send a sketch of Paimio Sanatorium, so that they could prepare an offer on steel windows.[794] Bonnevie was, naturally, much too late with his queries at this stage of construction.

In February 1931, Aalto was in contact with the Helsinki company Hartkopp & Krüger, who sent a letter to Aalto, written in German, regarding the special windows for the operating theatre. The company had a suitable window for the theatre, manufactured by the German company, Garny. The window had been used in the operating theatre of the Deaconess Hospital in Lötzen, East Prussia, where an operation had been carried out requiring an indoor temperature of 28 degrees on a day when the outdoor temperature had been -30 degrees centigrade. The window offered had coupled sashes with an air lock in between, the temperature of which could be adjusted.[795] The design of the window at the Lötzen Deaconess Hospital helped Aalto understand the special requirement for operating theatre windows.

Hartkopp & Krüger also sent Aalto an advertisement explaining the opening mechanism of Vita Glasjalousien ventilation windows. Aalto subsequently applied a similar solution in the dining hall of the B building.[796] The patient room windows had external blinds designed by Aalto, and the dining hall awnings, which were ordered from Suomen Persiennetehdas (Finnish Shutter Factory).[797]

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791 Building Committee August 8, 1931, Section 1. PSA.
792 Building Committee August 21, 1931, Section 1. PSA.
793 Aalto 1930c, p. 83.
794 Bonnevie's letter to Alvar Aalto, December 2, 1931. Documents related to the Paimio Sanatorium project. AAM.
795 Hartkopp & Krüger's letter to Alvar Aalto February 17, 1931. Documents related to the Paimio Sanatorium project. AAM.
796 Drawing No. 50-352. AAM.
797 Building Committee May 5, 1931, Section 1. PSA.

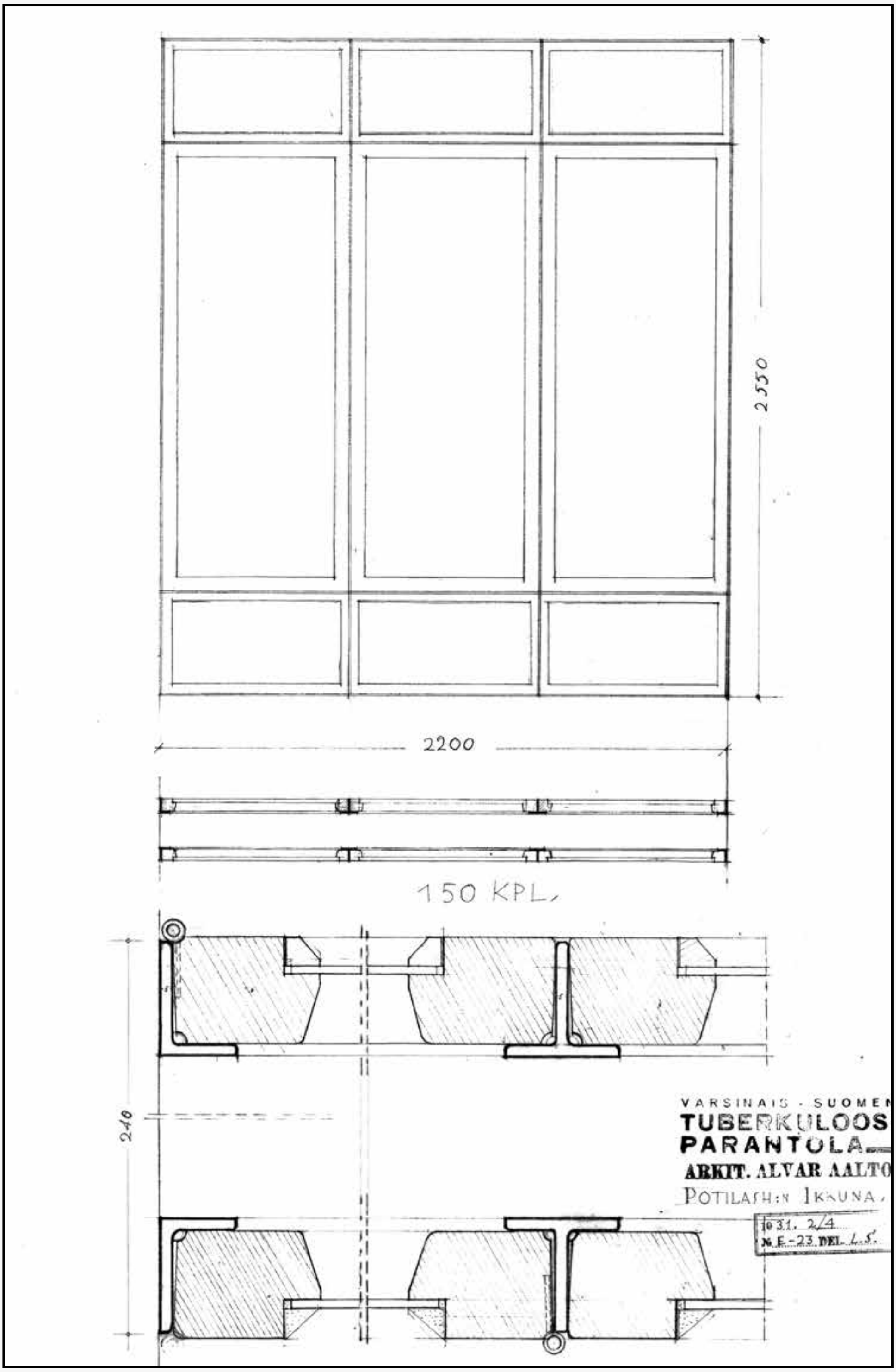

Fig. 3.4.2b. The window drawing of the patient room, with the quantity, 150 pieces, added afterwards. The window designed by Lauri Sipilä and dated April 3, 1932 had steel frames and wooden casements. The request for quotation to Crichton-Vulcan was presumably based on this drawing. Drawing No. 50-196. The drawing has been edited AAM.

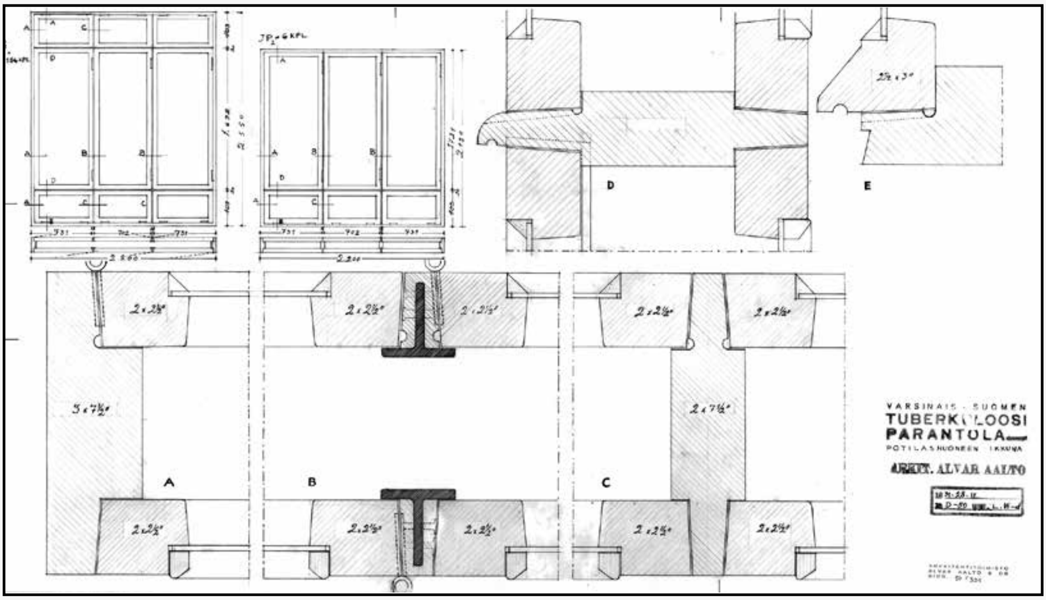

Fig. 3.4.2c. Drawing of the realised version of the patient room window. The two mullions of the middle row of the nine-section window were supported by T-profiles. In the top and bottom rows, the mullion ran through the structure. The drawing was dated April 28, 1931 and was drawn by Lars Wiklund. Drawing No. 50-321. The drawing has been edited. AAM.

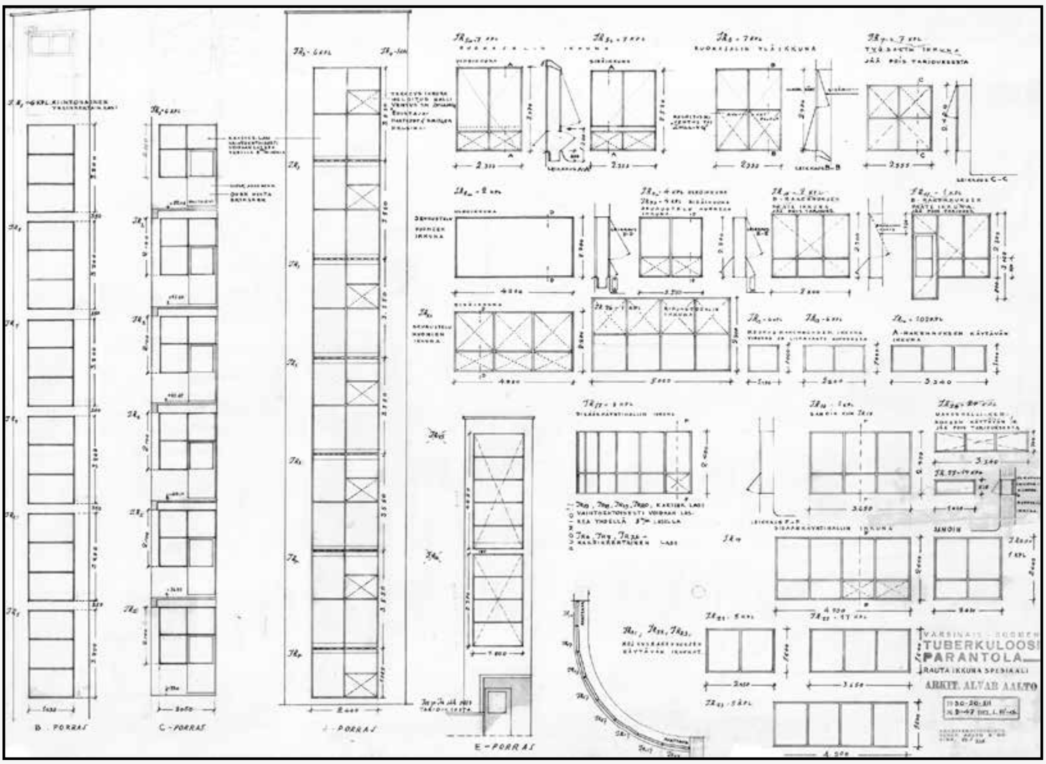

Fig. 3.4.2d. Window diagram of steel windows. Drawing No. 50-328. The drawing has been edited. AAM.

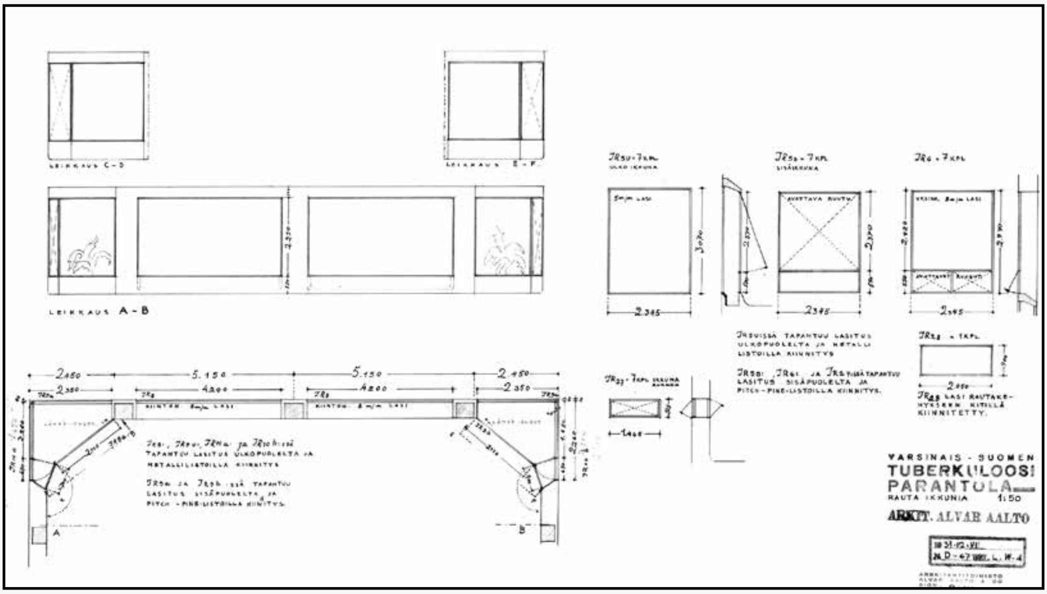

Fig. 3.4.2e. Lounge windows of steel. Drawing No. 50-332. The drawing has been edited. AAM.

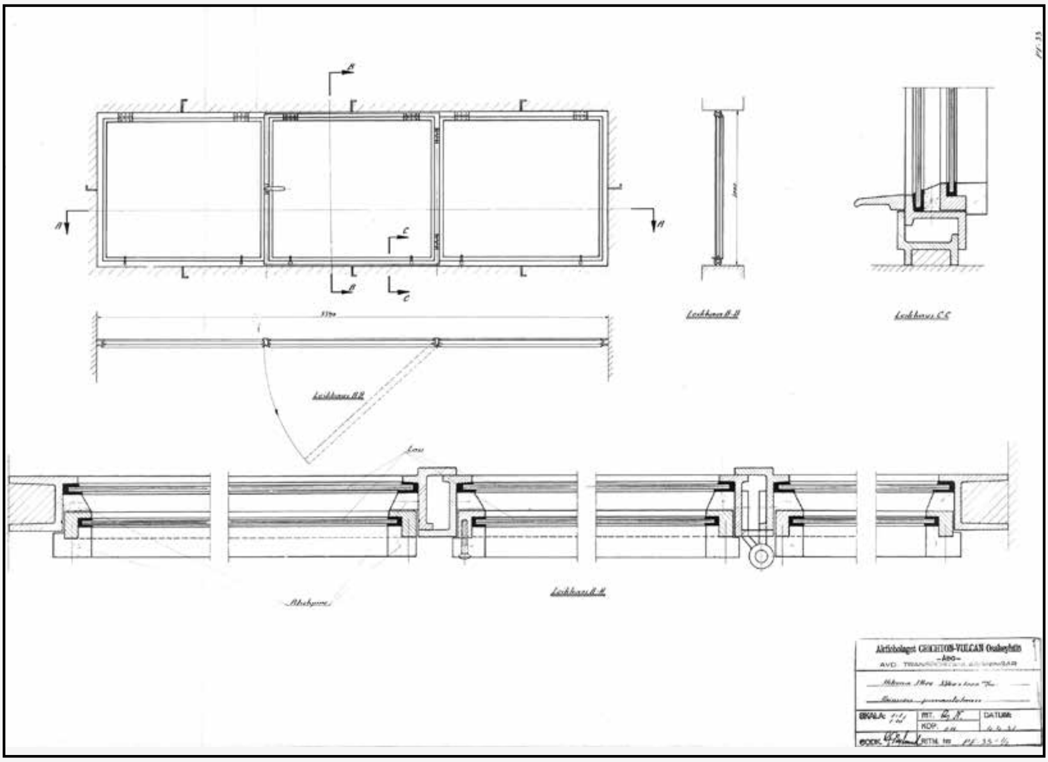

Fig. 3.4.2f. Workshop drawing by Crichton-Vulcan of the strip window for the 100-metre long corridors. The image showed that the middle window was top-hung. The drawing has been edited. PSA.

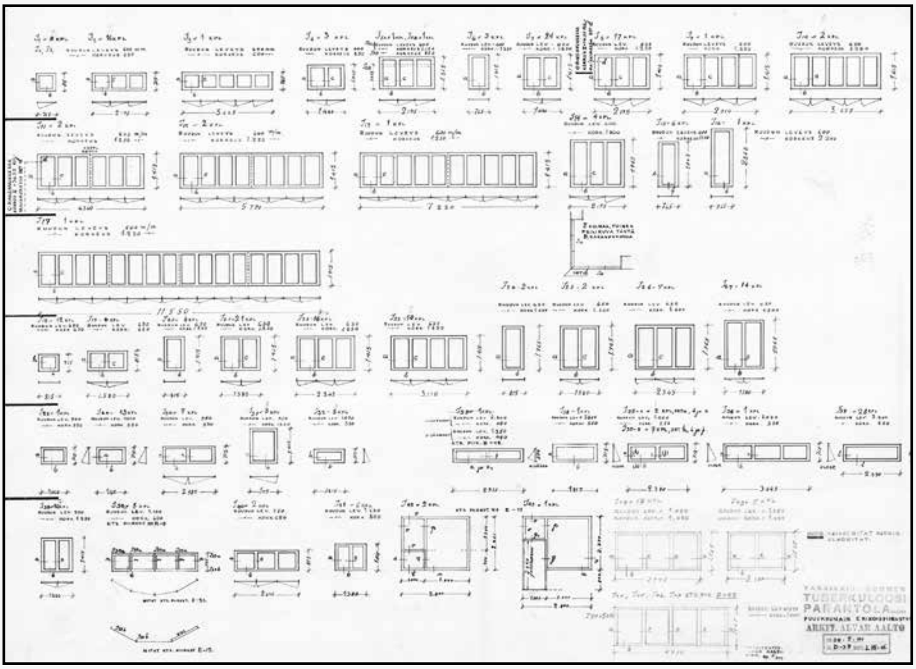

Fig. 3.4.2g. Window diagram of the wooden windows, showing the window types. Drawing No. 50-311. The drawing has been edited. AAM.

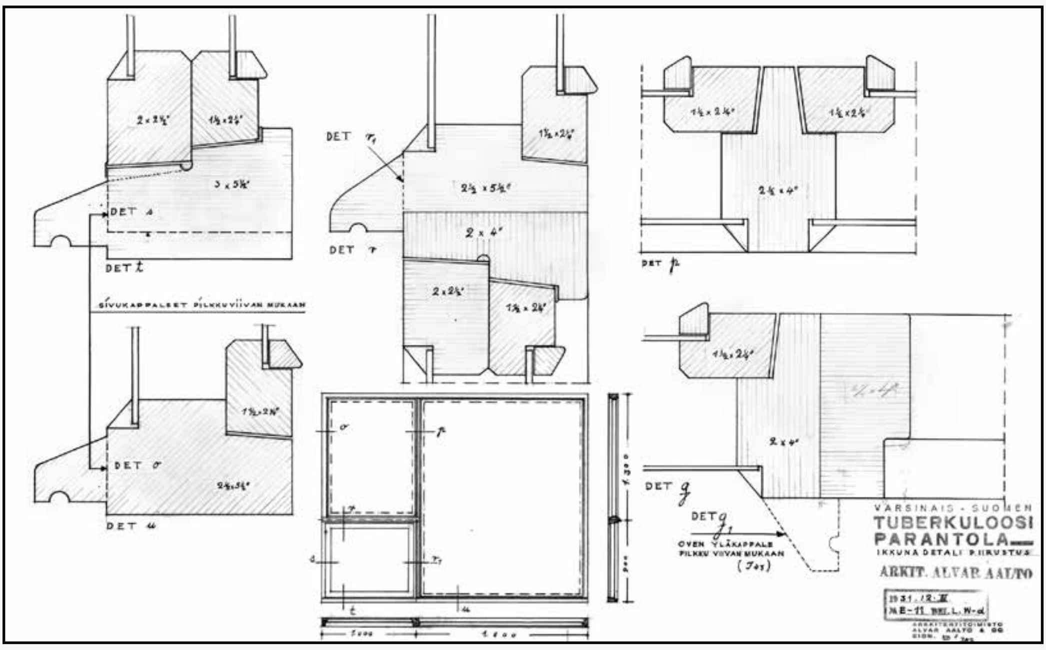

Fig. 3.4.2h. The image presented a double-glazed wooden window with the two opening casements coupled. The outer window was fixed to the frame with putty and the inner casement was a wooden one opening inwards. The fixed part was washable. Drawing No. 50-387. The drawing has been edited. AAM.

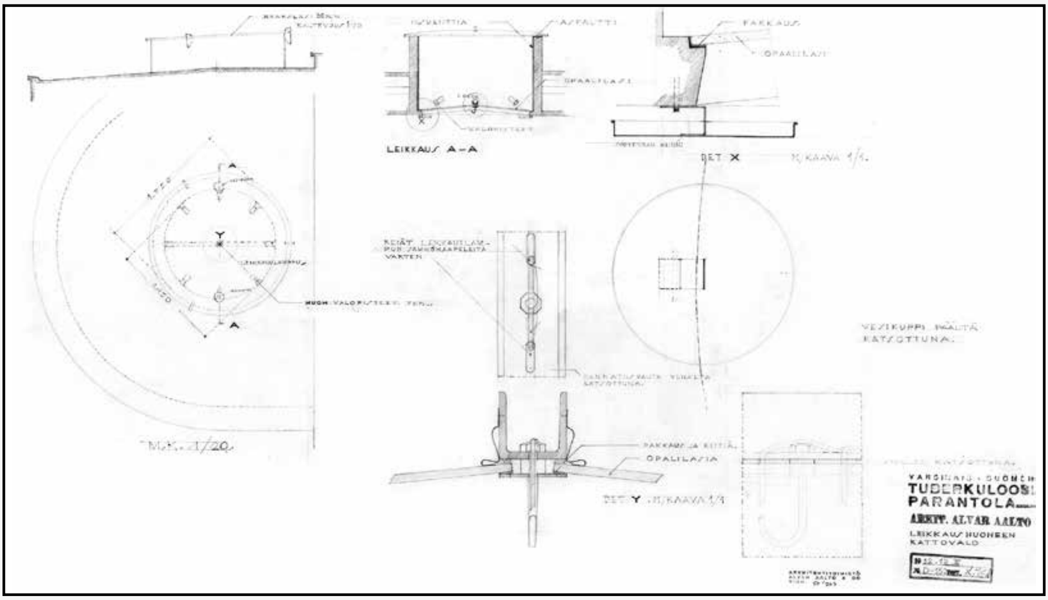

Fig. 3.4.2i. The skylight in the operating theatre. Drawing No. 50-267. The drawing has been edited. AAM.

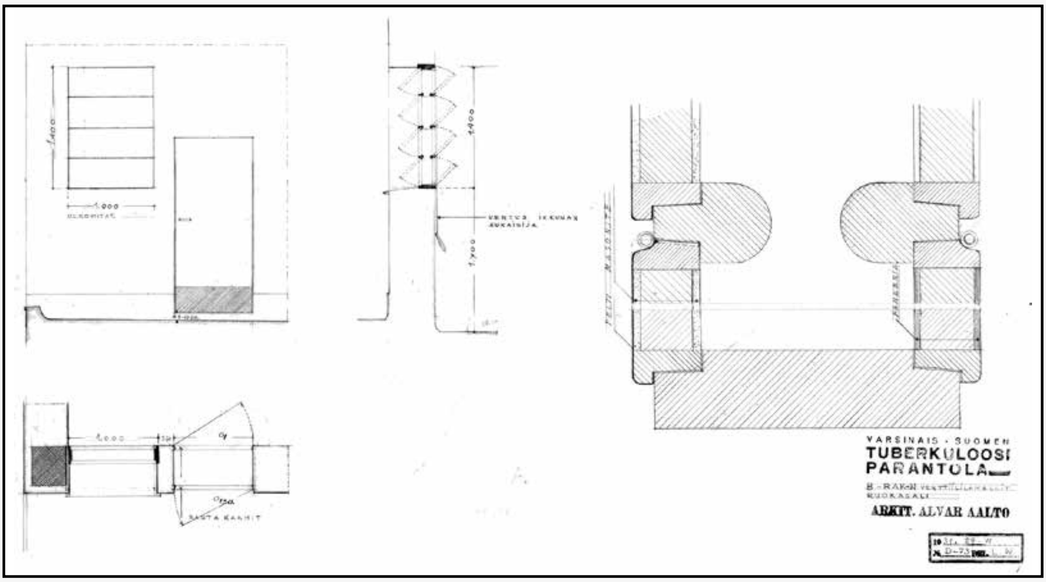

Fig. 3.4.2j. The dining hall shutter vent in B wing. The vent had a similar opening mechanism to the health window. Drawing No. 50-352. The drawing has been edited. AAM.

3.4.3 THE HORIZONTAL HEALTH WINDOW

Aalto reduced the window area in the patient room by half during the competition period, having been advised to do so by the medical expert of the State Medical Board that financed the project. He gained advantage compared to the other competitors as, in this way, he became privy to the medical expert's opinion on the window size while the competition was still ongoing. The actions of the medical expert as well as Aalto seem unethical. At the construction stage, Aalto also followed the recommendation of medical experts by giving up the asymmetrical window that partly reached down to the floor.

Aalto had previous experience of using foreign-made steel window systems in the Southwest Finland Agricultural Cooperative Building, the Standard Apartment House and the Turun Sanomat Building, in which he had made use of the Dutch Crittal Braat steel windows and doors.[798] Aalto kept in contact with the building element manufacturers and obtained information on new products. The key innovation of Aalto's window standards made for Brussels was the use of tubular profiles in sliding windows, one sliding inside the other. The window systems used in Finland, such as the Crittal Braat systems, typically employed fairly simple, straight-angle profiles. Tubular profiles were used in the Braat system as a standard for corner joints.[799] In Paimio Sanatorium, the round profile was used exclusively in the detailing of the outer corners of the strip windows in patient corridors of the A wing. Another special feature in Aalto's windows was that the interior sash of fixed windows could be opened for cleaning. This principle was carried through to the wooden and steel windows used in the building.

Aalto drew up the window diagrams, measured the windows and determined their maximum opening angle. Aalto's office did not, however, design the details of the steel windows for Paimio, and instead relied on the skills of Crichton-Vulcan's drawing department. Crichton-Vulcan determined the suitable profiles and drew up the detailed working drawings. The drawings were signed by, at least, O. Nylander of Crichton-Vulcan. Exquisite details that especially stood out were the serial window opening devices used in the B wing reading room, dining hall and patient corridor. The windows in Paimio Sanatorium were either outward or inward opening. According to European modernists, inward-opening windows took up too much space while outward-opening windows were difficult to clean.[800] Thus the motivation behind Giedion's exhibition of sideways sliding sash windows was to provide a space-saving solution. Aalto apparently gathered that using sideways sliding sash windows was not feasible in the harsh Finnish climate, as the structure was unsealable. It was probably therefore, he did not propose the use of this window type in Paimio Sanatorium. Aalto did, however, introduce a whole sliding timber-framed glass wall in one of his later projects, Villa Mairea from

798 Aalto 1929a, p. 83; Aalto 1929d, p. 97; Aalto 1930c, p. 85.
799 Heikinheimo 2002, p. 70.
800 Standertskjöld 1992b, p. 92.

1939. Entire sliding glass walls in the treatment of tuberculosis had been used in the state-of-the-art German sanatoria of the early 1900s.[801]

The construction of Paimio Sanatorium took place during a transitional period, when the manufacturing of wooden windows had already moved to factories and Finnish companies had begun producing steel windows, which thus far had been imported.[802] Around 1930, the steel window industry was gaining ground in Finland as Finnish metal workshops started to bring steel frames onto the market. Steel profiles, however, still continued to be imported from abroad. The local origin of the steel windows in Paimio Sanatorium was of crucial importance for the developers. The Turku-based Crichton-Vulcan was, in fact, the only workshop that was invited to tender for them, unlike several other equally prominent ones that were based in other towns in Finland. Aalto did not even bother corresponding on the matter of steel windows with the representatives of Braat window systems, although they had previously successfully supplied such systems for Aalto's projects. On the other hand, steel windows were widely exhibited at various shows, such the 1931 Berlin Building Exposition, which Aalto attended.[803] Steel windows eventually featured to a much lesser extent at Paimio Sanatorium than Aalto would have preferred, as they were more expensive than wooden windows or the hybrid solutions designed by Aalto.

Kaarlo A. Kilpi's concern for the lack of quality control in the Finnish timber industry would suggest that at least he and the then supervising architect, Ilmari Ahonen, agreed on the issue. The fact that Kilpi addressed his letter to Ahonen, who represented the City of Turku, was a way of putting pressure on the contractor. The contractor would find it impossible to win any contracts from the major customer that the City of Turku was, should it fail to comply with requirements. In his statement, Kilpi referred to the quality problem as a general problem concerning the entire Finnish timber industry.[804] He also mentioned that the Finnish timber industry, which did not pay adequate attention to the quality of its products, had only itself to blame if it lost market share to steel window manufacturers. The Building Board most likely took notice of this episode and it may have destabilised their opinion on the superiority of wooden windows.

The discussion on the quality of the construction work, materials and equipment was topical in general. The Finnish Association of Architects had realised that normative building standards had become highly necessary. Architects were not familiar with new building materials and methods, which left them at the mercy of the industry and contractors.[805] The episode with the Paimio Sanatorium wooden windows shows that traditional materials also suffered from quality issues in industrial production.

801 Campbell 2005.
802 Prior to the 1930s, steel windows were imported from Germany, the Netherlands, Sweden and the UK. Heikinheimo 2002, p. 46.
803 Välikangas 1931, p. 107; Standertskjöld 1992b, p. 92.
804 Kaarlo Kilpi's statement, June 27, 1931. Documents related to the Paimio Sanatorium project. AAM.
805 A committee appointed in 1930 included Professors Onni Tarjanne, Jussi Paatela and architect Akseli Toivonen as secretary. The compilation of normative standards. Anon [eds.] 1932c, pp. 17–19.

Coupled sashes were used in the 1930s, but this was not a traditional solution. A typical double-sash wooden window would have been an inward-outward opening, painted wooden window. Kilpi's reprimand to Kolhon Saha (Kolho Sawmill), stating that a professional craftsman should immediately be able to see from the drawings that the solution required premium-quality windows, was fair. Aalto used steel windows in the public spaces such as staircases, dining halls and patient corridors. Apparently he attempted to use oak windows in the dining hall, or at least he considered them a possible alternative. Varnished oak windows were considered especially distinguished in the architecture of the day.

Aalto also wanted to use steel windows in the patient room, which was of particular ideological value to him. The window was eventually realised as a hybrid made of wood and steel. In the Finnish context, wooden-framed windows were less expensive than the steel ones: Finnish-made steel windows were not mass-produced and were available only to order although they were made from industrially produced steel profiles. Designers took pains to develop a wooden window standard that, quite necessarily, incorporated steel elements.

The patient room windows were an essential and salient architectonic feature in the sanatorium, and underwent a complete overhaul in the time leading to the final realisation. Besides changing from a steel window to a hybrid window, Aalto also developed the window as a holistic concept, integrally linked with heating, ventilation and the amount of daylight benefitting the patient. He wrote in a publication aimed at Swedish architects in 1932: "The patient room has, among others, the following characteristics: morning sun on the patients' beds, afternoon sun on the front part of the room, in front of the window. Double glazed windows in wood with L-shaped frames, with permanent ventilation through glass panes with vertical openings. Exposure to the sun can be adjusted using the external blinds …".[806] Aalto discussed the idea of continuous ventilation, and considering that he was addressing his professional peers, this question may be interpreted as a sign of his intention to design a wall-sized sliding window for the patient room. With this rhetorical gesture, he wanted to demonstrate his expertise about the overlapping trends in health care and architecture. Naturally, the timber-framed window was not designed to be kept continuously open in the Finnish weather conditions.

The ventilation took place horizontally through the central row of windows, which is why there could be no mullions. The wooden-framed large window opening would have required a sturdier frame for structural reasons had the frame been wooden. Now that the frames were built equal in strength to the sash, they had to be reinforced with steel profiles both on the exterior and interior window. A window combining wood and steel was genuinely a hybrid. Wooden windows were not of any interest to the media. This was why Aalto highlighted in all publicity wooden windows reinforced with steel

806 Aalto 1932, p. 30.

profiles and their vertical ventilation air flow. The window systems of the patient room were a victory for him, in the rhetorical sense. The thick-framed windows were not a victory for Aalto in the aesthetic sense, as he was keen to create an impression of a glass wall that was perpetually open. On the other hand, by drawing the attention of his target audience to the concept of the "health window", Aalto succeeded in translating their opinions into ones favouring his hybrid window.

Aalto's design of a window reaching to the floor, which still existed at the competition stage, was reminiscent of André Lurçat's tourist hotel in the Mediterranean (1927), while, according to Heinonen, the plant windows at Paimio Sanatorium were inspired by the refurbished Palmgarten restaurant in Frankfurt am Main (1929).[807] Aalto may have paid a visit to the restaurant when attending the CIAM seminar in Frankfurt am Main in August 1929. Plant windows first appeared in the floor plan for B wing, dated May 24, 1930.[808] Aalto had used similar oblique display cabinets on the ground level of Turun Sanomat building.

There had been attempts in Germany in the 1920s to incorporate skylights into new architecture. In 1924, German architect Hugo Häring divided the functions of the windows in a dwelling into three categories: lighting, ventilation and views.[809] Häring favoured toplight over sidelight, as this made a room easier to furnish, the light fell from the same direction as natural light and natural ventilation was easy to arrange through a skylight. [810] For Le Corbusier, the strip window was at once a structural, aesthetic and lighting-related solution.[811] In his view, the use of a reinforced concrete structure automatically led to the use of strip window, which in turn provided four times as much daylight as a vertical sash window. Le Corbusier considered the strip window to be the foundation of the new architectural aesthetic. He also sketched diagrams for a window-cleaning platform.[812]

The skylights in the entrance lobby and operating theatre at Paimio Sanatorium were fitted with milk glass sheets to provide diffuse light. In the entrance lobby, electrical light fittings were situated alongside skylights affording daylight into the space, while in the operating theatre the lights were fitted within the skylight cylinder. According to Norvasuo, Aalto was influenced in his design for the operating theatre window by a lecture given by a German doctor in 1928, subsequently cited by Kjäldman.[813] It would seem more likely that it was Markelius' view on the operating theatre windows seen at the hospital section of the Stockholm Exhibition as well as Garny's advertisement of similar equipment that helped Aalto arrive at his own window solution for Paimio.

807 Heinonen 1986, pp. 239–240.
808 Drawing No. 50-84. AAM.
809 Häring 1965 [1924], p. 14; Norvasuo 2009, p. 43.
810 Häring 1965 [1924], p. 14.
811 Le Corbusier, 1928b, pp. 96–106; Norvasuo 2009, p. 47.
812 Le Corbusier, 1928b, pp. 96–106.
813 Norvasuo 2009, p. 84.

True to his international ideology, Aalto was more interested as an architect in using industrially produced shallow-profile steel windows than Finnish-made wooden windows. However, steel windows were more expensive and they needed to be imported. At a time of recession, imports were regulated and local production was favoured. At the early stages of the work, the Building Board had agreed on the use of steel windows on the condition that they were made in Finland. For this reason, Aalto never invited tenders from foreign window manufacturers, whose products he had used in his earlier work. He mobilised the site supervisor to raise the issue of the quality of industrially produced wooden windows and turn it into a wider question of principle regarding the Finnish timber industry, with the likely ulterior motive of influencing the views of the Building Board on wooden windows. When the final decision had been made that the patient rooms would not be fitted with steel windows owing to their high cost, Aalto developed a new type of wooden window which necessitated the use of some steel profiles for structural reasons. This window was like the traditional ventilation window, known as the "health window", only this time horizontal in orientation. Recommended and well known by doctors, the health window had been used since the early 19th century in schools, hospitals and other public buildings. By reiterating this concept and defining his window as a "health window", Aalto managed to translate the opinion of medical experts and win them over to his side. It was a question of cultural classification of window solutions. Aalto's unusual window design required the use of a few steel components, which entitled him to talk about an innovation and a hybrid. A material hybrid was for Aalto a conceptual victory over a traditional window. This was a significant achievement for Aalto, who could now postulate his solution to his peers in the media. In addition to other innovations implemented in the Paimio Sanatorium project, Aalto was also an innovator of windows, and took the project in the direction he wanted. While the outcome was not ideal from the architect's own perspective, it is likely to have been an acceptable compromise. Doctors had requested in their statements after the architectural competition that the windows were not to reach to floor level for reasons of hygiene. Aalto changed the windows accordingly so that the bottom edge of all window sections was level. He also changed the shape of the floor so that it curved upwards near the window, so that visually, the window was connected to the floor in the final, realised version. The doctors were given the hygienic standard they had asked for, and the architect had windows reaching to the floor. This example is illustrative of the unpredictability of the evolution of technological solutions – it is impossible to know at the beginning of a project, what kind of artefacts will ultimately be realised as a result of the trials. A static artefact, in this case a window in the finalised building gives no clues to the process of which they are the result.[814]

814 See Latour and Yaneva 2008, pp. 80–89.

3.5 THE STANDARDISED PATIENT ROOM

This section discusses the architectural design of the most typical patient room, the twin room: its spatial and related technical systems, fixtures, furniture and equipment. The patient rooms were to have 25 cubic metres for each patient. The patients required a sufficient amount of fresh air to breathe in order to foster the best possible conditions for recovery.[815]

Aalto's office placed the furniture purchases for the sanatorium into four categories.[816] The first category included fixtures to be designed by the architectural practice. The only built-in furniture in the patient room was the table to be installed in front of the window. Loose furniture was divided into two categories, those designed by the architectural office and those purchased as ready-made standard items. The suppliers of the latter would be required to provide samples for appraisal.This category included iron beds and sofas, sundeck recliners, wardrobes, nightstands and certain tables. The fourth category was the chairs, which were also classified as standard furniture. Offers for medical equipment and other related special furniture would be received by the consulting medical advisor and, if necessary, he could refer the designs to the architect for an opinion.[817] The sanatorium furniture acquisitions became topical in April 1932 and the Building Board authorised the Building Committee to purchase the beds and other furnishings for the sanatorium.[818]

3.5.1 THE METAMORPHOSIS OF THE WARDROBE

In the earliest of the architect's sketches, the patient room wardrobes were made of metal. The common features in the four-leg metal wardrobes were the slanted top-part of the wardrobe and the rounded corners. Otherwise, the design was basically rectangular. The right angle between the side panel of the wardrobe and the wall was stabilised with an angle iron and the shelves rested on angle irons.[819] In the next stage, the wardrobe material had been changed to plywood with a batten frame. The corner battens were rounded to create softly curving edges to the wardrobe. The plywood panels were straight and the shelves were supported by tubular profiles. This as well as the previous version was drawn by Lars Wiklund.[820]

815 The Programme for the Architectural Competition of the Tuberculosis Sanatorium of Southwest Finland. Varsinais-Suomen tuberkuloosiparantolan rakennuslautakunta (The Building Board for the Tuberculosis Sanatorium of Southwest Finland) 1928a.

816 An acquisition plan of furniture created by Alvar Aalto's architectural practice. Building Committee April 10, 1932, Section 2. PSA.

817 An acquisition plan of furniture created by Alvar Aalto's architectural practice. Building Committee April 10, 1932, Section 2. PSA.

818 Building Board April 10, 1932, Section 3. PSA.

819 Drawing No. 50-276. AAM.

820 Drawing No. 50-266. AAM.

Fig. 3.5a. View of the patient room towards the window wall. Photographer Gustaf Welin. Photo No. 50-003-360. AAM.

Marked as a standard, a drawing dated April 28, 1932 of the patient room wardrobe illustrated the general appearance of the final design.[821] The drawing already featured the idea behind the wooden structure, which made essentially for a "frameless" wardrobe.

In the fourth drawing, the design of the metal wardrobe was also marked as a standard. As such, the schematic drawing was not ready for execution. The structure of the wardrobe had been simplified and, for example, the angle irons have been abandoned. The straight door was placed in the front of the wardrobe. The door panel and the side of the metal wardrobe were reinforced with metal sheets. The sides of the wardrobe slanted, marking the designers attempt to depart from the traditional rectangular design.[822] This was an alternative to the wooden wardrobe.

The starting point for offers invited was possibly Lauri Sipilä's drawing of a wooden wardrobe, dated May 17, in which the back and bottom panel were made of double-layer and the sides of single-layer plywood some eight millimetres thick. The metal parts, the coat rails and brackets and the legs, were nickel plated. The wardrobe had been specified to be painted with first-class enamel paint both inside and outside. All shelves were perforated. The legs made of flat bar iron were shaped to form a circular shape to align with the curving shape of the skirting board.[823]

The offers were addressed to Aalto. Three offers by furniture manufacturing companies were placed on time on May 18, and one after the offer period closed. N. Boman offered to manufacture the wardrobes for the price of FIM 625 each,[824] while Huonekalutehdas ja Sorvimo quoted FIM 1,150[825] and Laaksosen Huonekalutehdas FIM 650 per item. The offer of the latter also included an alternative method of manufacturing, by which the wardrobes would have painted legs, the straight sides would be at a slanted angle and the front corner rounded, priced FIM 75 lower.[826] The quotation from Huonekalu- ja Rakennustyötehdas (Furniture and Building Work Factory), headed by Otto Korhonen, arrived a week later than those of the others and it offered to manufacture the wardrobes as specified for a lower price than the others. The price of an ordinary wardrobe manufactured at the factory was FIM 520 and the factory's own standard model was priced at FIM 450–510, depending on the details. Moreover, one of the standard wardrobes had been delivered to the sanatorium for appraisal.[827] It is likely that during the week between May 17 and 23 that Korhonen's offer was delayed, the factory together with Aalto was taking pains to produce a sample wardrobe. The processing of the matter continued. J. Merivaara furniture manufacturing company was also invited to submit an offer on the wardrobes, which it did.

821 Drawing No. 50-189. AAM.
822 Drawing No. 50-210. AAM.
823 Drawing No. 50-244. AAM.
824 An offer of the N. Boman limited trade company to Alvar Aalto related to the Sanatorium of Southwest Finland, May 17, 1932. Documents related to the Paimio Sanatorium project. AAM.
825 Manufacturer Huonekalutehdas and Sorvimo's (Furniture Factory and Turnery) offer to the Sanatorium of the Southwest Finland signed by Emil Hongisto, May 18, 1932. Documents related to the Paimio Sanatorium project. AAM.
826 A cost estimate from Laaksosen Huonekalutehdas Oy (Laaksonen Furniture Factory), signed by K. Laaksonen, dated on May 18, 1932. Documents related to the Paimio Sanatorium project. AAM.
827 A letter from Huonekalu- ja Rakennustyötehdas to Alvar Aalto, dated May 23, 1932. Documents related to the Paimio Sanatorium project. AAM.

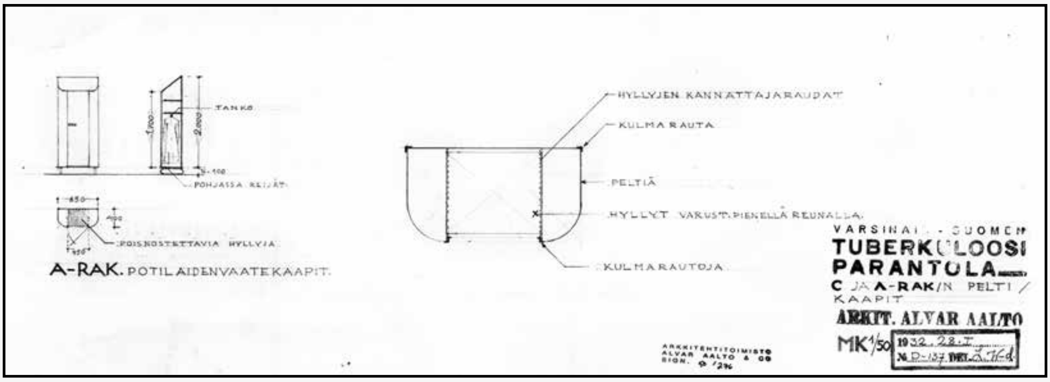

Fig. 3.5.1a. The first version of the patient room wardrobe was from January 1932 and it was a metal-framed one. In the earliest of the architect's sketches, the patient room wardrobes were made of metal. The common features of the metal wardrobes, which had four legs, were the slanted top-part of the wardrobe and the rounded corners. Otherwise, the design was basically rectangular. The right angle between the side panel of the wardrobe and the wall was stabilised with an angle iron and the shelves rested on angle irons. Detail of drawing No. 50-276. The drawing has been edited. AAM.

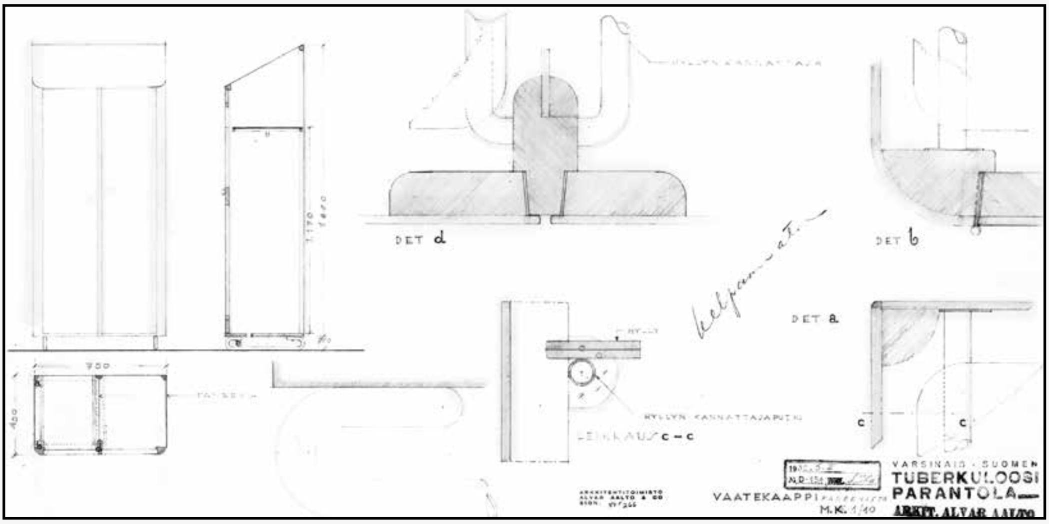

Fig. 3.5.1b. The drawing is marked "rejected". At this stage, the wardrobe material had been changed to plywood with a batten frame. The corner battens were rounded to create softly curving edges. The plywood panels were straight and the shelves were supported by tubular profiles. The drawing is dated February 5, 1932 and was drawn by Lars Wiklund. Drawing No. 50-266. The drawing has been edited. AAM.

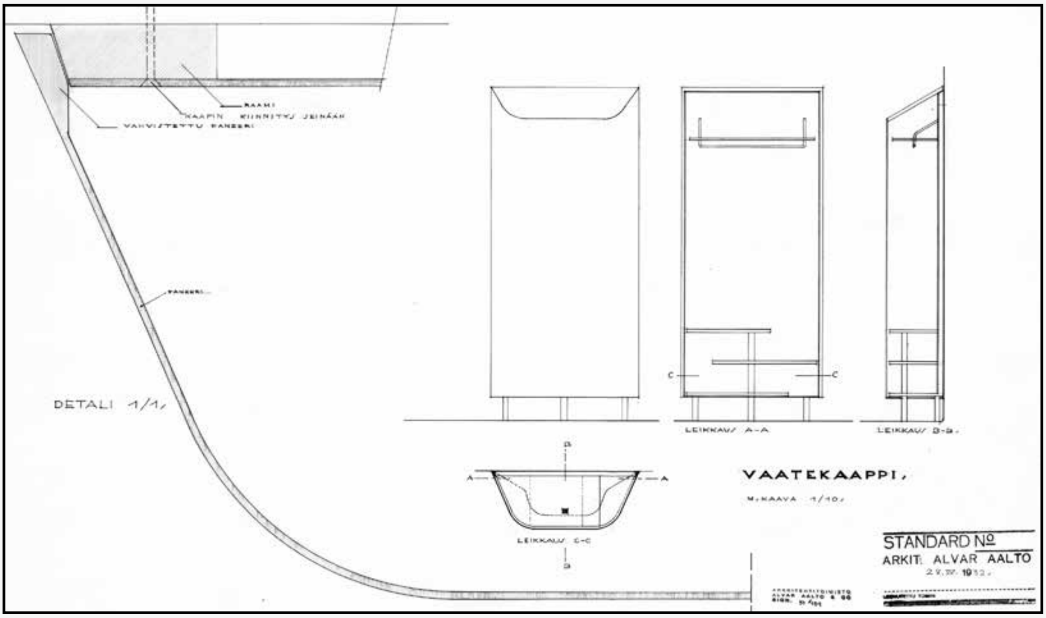

Fig. 3.5.1c. The drawing, which is marked as a standard, shows the idea of the wardrobe that was built. It does not, however, show all the structural details possibly in order to prevent it from being plagiarised. The drawing is dated April 28, 1932. Drawing No. 50-189. The drawing has been edited. AAM.

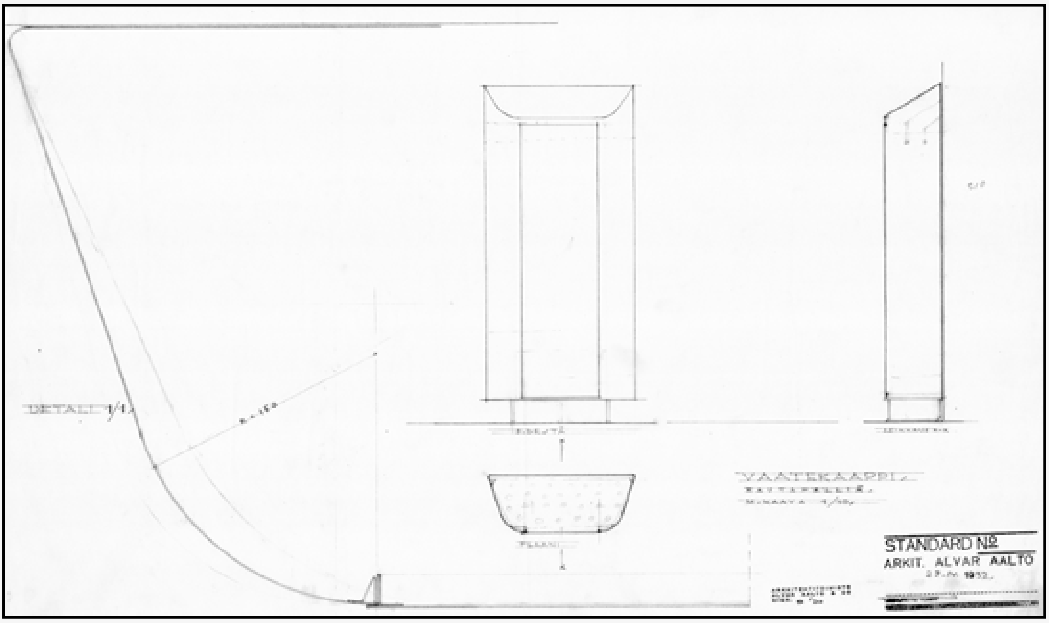

Fig. 3.5.1d. The design of the metal wardrobe was marked as standard. As such, the schematic drawing was not ready for execution. The structure of the wardrobe has been simplified and, for example, the angle irons have been abandoned. A straight door has been placed in the front of the wardrobe. The door panel and the side of the metal wardrobe were reinforced with metal sheets. The sides of the wardrobe were slanted, marking the designers attempt to depart from the traditional rectangular design. The drawing was dated April 29, 1932. Drawing No. 50-210. The drawing has been edited. AAM.

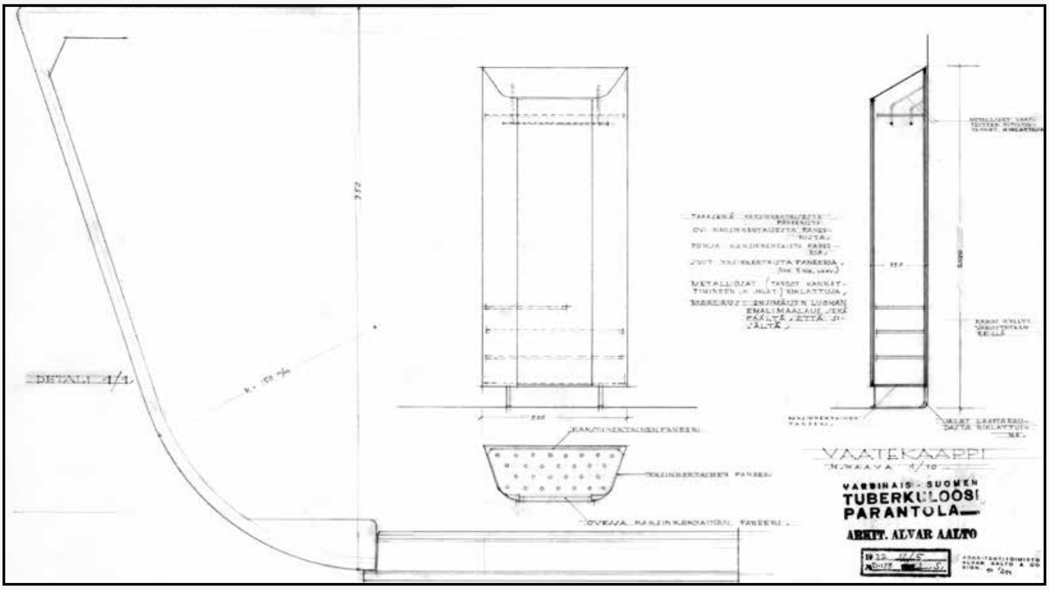

Fig. 3.5.1e. Lauri Sipilä's drawing was dated May 17, 1932. At this stage, the wardrobe material was wood, and the rounded shape originally designed for a metal wardrobe was retained. The offer and the sample wardrobe of the Huonekalu- ja Rakennustyötehdas company was based on this drawing. Drawing No. 50-244. The drawing has been edited. AAM.

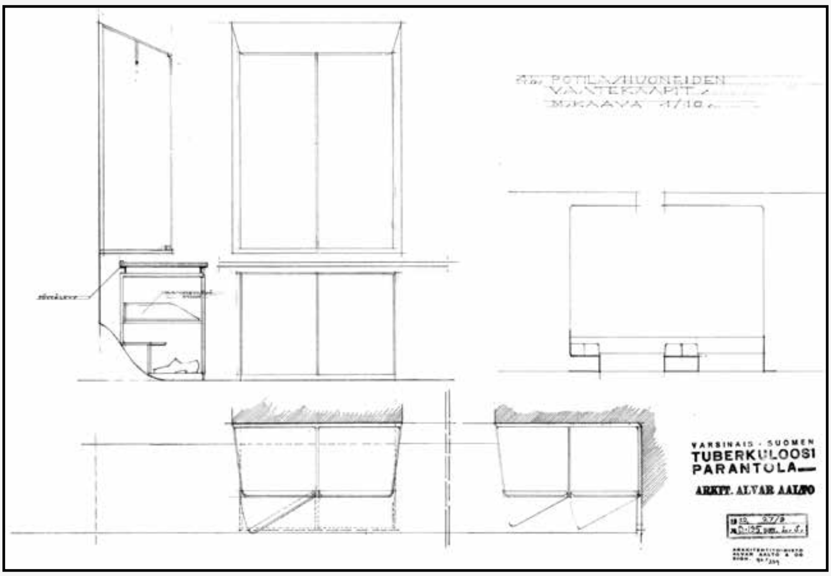

Fig. 3.5.1f. Further changes to the wardrobes were developed in the autumn. In a drawing dated September 27 and signed by Lauri Sipilä, a two-part wardrobe for two patients has been placed in the four-bed patient rooms, with straight doors, slanted sides and rounded outer corners. The wardrobe was divided into a top unit attached to the wall and a separate shoe cabinet with a table top. Drawing No. 50-239. The drawing has been edited. AAM.

The alternatives were a wardrobe which would be made based on Aalto's model, probably the design dated April 29, for FIM 515 or another version, priced at FIM 475. These alternatives would be manufactured by machine from flattened iron plate and painted in the shade required by the architect, as illustrated in the sample wardrobes delivered by the factory.[828] The Building Board had thus received one plywood wardrobe and two iron plate wardrobes for appraisal, all designed by Aalto, based on which the Building Board decided to order the plywood wardrobes from Huonekalu- ja Rakennustyötehdas for the prices approved by the Building Committee.[829] The factory produced altogether 280 wardrobes for the patient rooms for FIM 465 each.[830] Aalto did not disqualify himself, although he was the designer of the standard wardrobe produced by Huonekalu- ja Rakennustyötehdas.

In a drawing dated September 27, 1932 and signed by Lauri Sipilä, a two-part wardrobe for two patients has been placed in the four-bed patient rooms, with straight doors, slanted sides and rounded outer corners. At this stage, the outer corners no longer feature a timber frame.[831]

Huonekalu- ja Rakennustyötehdas Oy's 1932 brochure recommended the company's special standard furniture for the home, public spaces and hospitals. According to the brochure, the furniture had no back and it was highly hygienic. The furniture offered added comfort in spaces where surfaces must be easy to keep clean. The factory advertised that the furniture comprised standard pieces and was the result of meticulous testing. There was a photograph on the second page of the brochure of the plywood plinth painted in a light colour.[832]

828 J. Merivaara's offer to the Building Board of the Sanatorium of Southwest Finland, June 2, 1932. Documents related to the Paimio Sanatorium project. AAM.

829 Building Board June 14, Section 7, 1932. PSA.

830 A list of furniture produced for the Sanatorium of Southwest Finland, March 15, 1933. KOR.

831 Drawing No. 50-239. AAM.

832 The brochure of the Huonekalu- and Rakennustyötehdas entitled "Soft Wooden Chair" was printed at the earliest in 1932, because the cabinet described in it was only developed in 1932. Huonekalu- ja Rakennustyötehdas Oy, s.a., 1932?.

Fig. 3.5.1g. The wardrobes of the museum room of the former sanatorium in 2015. Photograph Ark-byroo.

3.5.2 OTHER FURNITURE OF THE PATIENT ROOM

Huonekalu- ja Rakennustyötehdas (Furniture and Building Work Factory) manufactured a total of 300 nightstand and cabinet combinations priced at FIM 250 each.[833] J. Merivaara furniture manufacturing company had also offered a nightstand model used in the Finnish Red Cross Hospital for FIM 425 each.[834] The nightstand was classified as standard furniture in the furniture purchase listing. However, the sanatorium eventually ordered a piece designed by Aalto, which was less expensive to manufacture than standard pieces by other manufacturers. Aalto took no part in the discussion on this issue, disqualifying himself, as he was the designer of the piece in question and stood to gain financially form the order.[835]

No architectural drawings or work specifications have been preserved of the nightstand-cabinet combination. The unit comprised two parts. The bottom part was a closed volume with a cabinet and two drawers. The cabinet part was fitted with caster wheels and framed by a tubular structure that supported a table top. Nested inside the tubular frame, the unit took up less space, but the two parts could also be used separately. Its height was designed so that the table top could be used as an overbed table.

The desk was the only piece of furniture classified as a fixture. It was installed in front of the window.[836] Aalto invited offers for different surface materials and treatments. The options were birch plywood, painted desk; a plywood table with an Okoumé or flame birch veneer with Becko varnish; or a pitch-pine Becko-varnished desk. Five factories placed an offer.[837] Huonekalu- ja Rakennustyötehdas' offer is dated two to three days later than those of the other companies in the competition and it quoted only a slightly lower price than the three offers placed earlier. Huonekalu- ja Rakennustyötehdas, again, won the order.

An undated axonometric drawing shows the patient-room bed executed with a tubular steel frame with curving end-panels. The panel at the foot of the bed is lower than the headboard. The architect used sketches to study the bending of the tubular leg as well as the shape and scaling of the end-panels.[838] None of the versions include casters. The execution differed from the drawings for the part of the tubular frame.

The patient-room twin beds were positioned along one wall with the end facing the wall. J. Merivaara submitted an offer for the hospital beds based on their own standard model.[839] The beds were eventually ordered from August Louhen Rautasänkytehdas

833 A Huonekalu- ja Rakennustyötehdas invoice, March 15, (1933). KOR.

834 J. Merivaara's offer to the Building Board of the Sanatorium of Southwest Finland, April 7, 1932. Documents related to the Paimio Sanatorium project. AAM.

835 Building Board May 18, 1932, Section 4. PSA.

836 Drawing No. 50-278. AAM.

837 An offer from Laaksosen Huonekalutehdas, May 3, 1932; an offer from Oy Puutehdas Ab, May 4, 1932; an offer from Oy Huonekalutehdas ja Sorvimo, May 4, 1932; an offer from N. Boman Oy, May 4, 1932; and an offer from Oy Huonekalu- ja Rakennustyötehdas Ab, May 6, 1932. Documents related to the Paimio Sanatorium project. AAM.

838 Drawings Nos. 50-143, 50-154, 50-156 and 50-182. AAM.

839 J. Merivaara's offer to the Building Board of the Sanatorium of Southwest Finland, April 7, 1932. Documents related to the Paimio Sanatorium project. AAM.

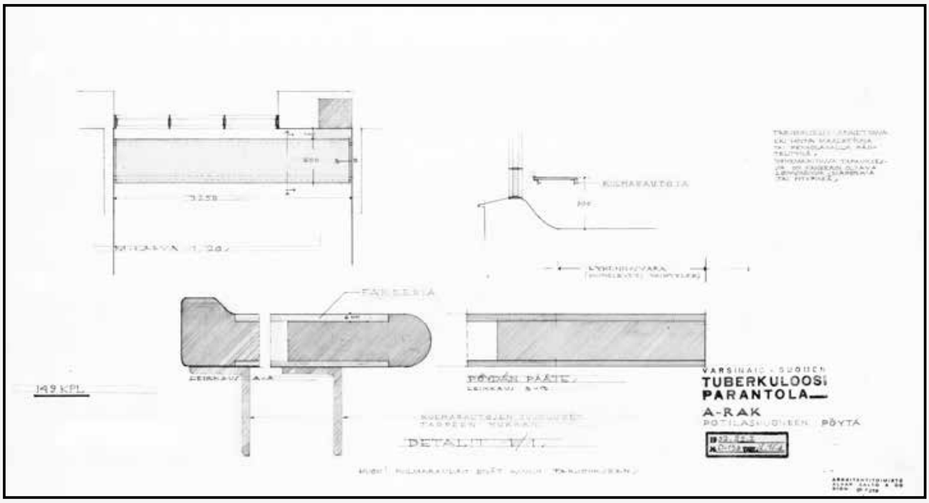

Fig. 3.5.2a. The plywood-top desk fitted in front of the patient room window. Drawing No. 50-278. The drawing has been edited. AAM.

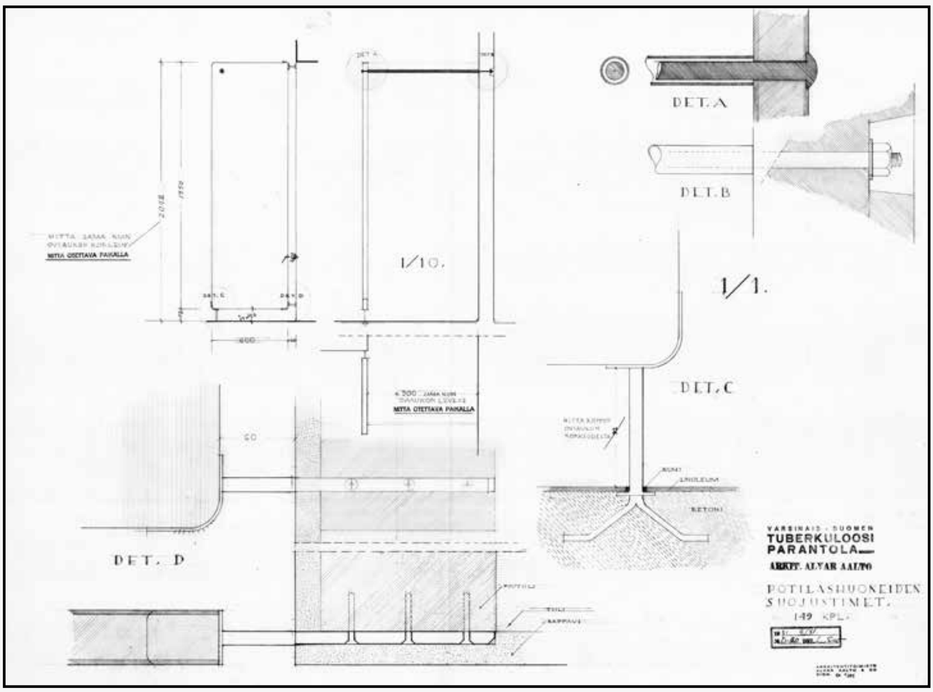

Fig. 3.5.2b. The patient rooms were fitted with a fixed screen between the door and the washbasins. Drawing No. 50-281. The drawing has been edited. AAM.

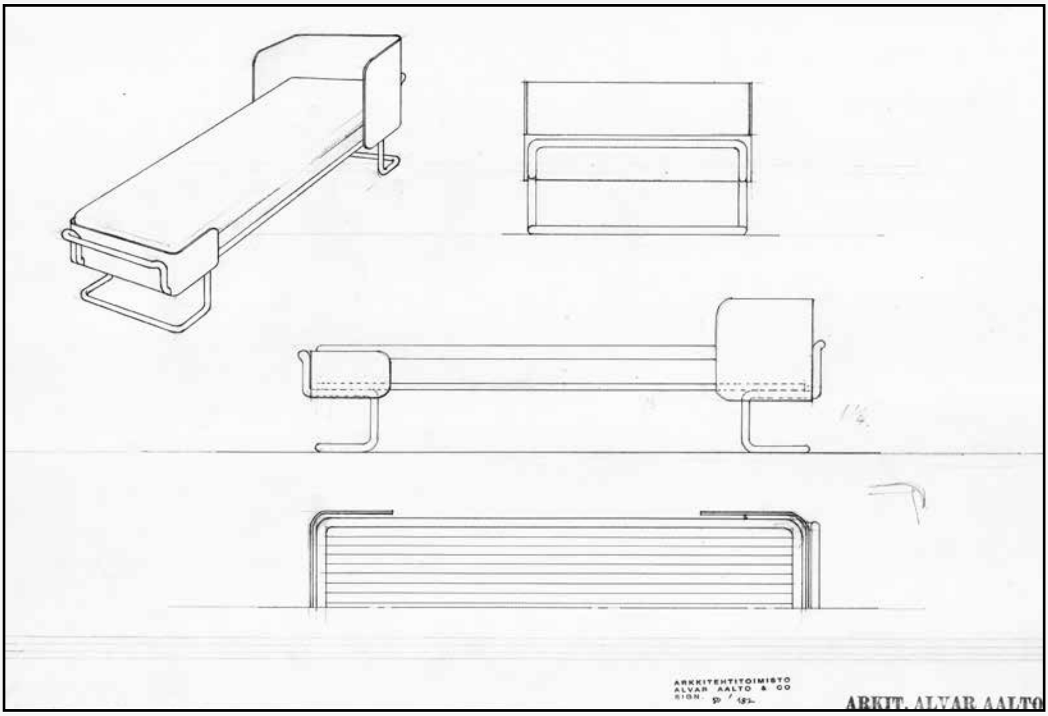

Fig. 3.5.2c. An undated drawing shows the patient room bed executed with a tubular steel frame with headboards of bent plywood, offering privacy for the patient. The footboard was also of bent plywood, but lower. The head and footboards were eventually made as straight. Drawing No. 50-182. The drawing has been edited. AAM.

Fig. 3.5.2d. Bedside table for the patient room manufactured by Huonekalu- ja Rakennus-työtehdas. Photograph Ark-byroo. 2015.

(August Louhi Iron Bed Factory) for a slightly lower price. It was recorded in the minutes that architect Aalto did not participate in the discussion on the matter.[840] Aalto again excused himself as he was the designer of the piece in question and stood to gain financially from the order. August Louhen Rautasänkytehdas served as a subcontractor for Huonekalu- ja Rakennustyötehdas in the manufacturing process of Aalto's tubular-frame chairs in the early 1930s.[841]

Standard No. 6, presenting the overall solution for the patient room, shows a chair placed in front of the window. The chair was drawn as a metal-leg chair with a plywood seat. There are two drawings amongst the drawings corresponding to this chair, one illustrating the bending of the plywood seat[842] and the other a stackable, light-weight chair seen from different angles and a detail.[843] In the design of the patient room, Aalto had the opportunity to use the world's first "soft wooden chair" that had been introduced in 1929 at Turku's 700th anniversary exhibition.[844] The advertisement of Huonekalu- ja Rakennustyötehdas from 1934 presented the realised version of the patient room chair. The fully timber-structured chair was assigned number 51 and was called the miniature easy chair. It was recommended as suitable for meetings rooms, hospitals and other such spaces, and it could be stacked. The frame of the chair in the advertisement was polished birch and it had a hard seat.[845] Huonekalu- ja Rakennustyötehdas manufactured a total of 300 such chairs for the patient rooms, that is, two for each twin room.[846] As far as is known, no other offers were invited on the chairs except the one from Huonekalu- ja Rakennustyötehdas. Seating formed a separate category in Aalto's purchasing list, purchased ready-made.

840 Building Board May 18, 1932, Section 4. PSA.
841 Mikonranta 2002.
842 Drawing No. 50-167. AAM.
843 Drawing No. 50-146. AAM.
844 Huonekalu- ja Rakennustyötehdas Oy, s.a., 1932?.
845 Huonekalu- ja Rakennustyötehdas Oy, published January 1, 1934.
846 An invoice of the Huonekalu- ja Rakennustyötehdas on the furniture for the Sanatorium of Southwest Finland, March 15, (1933). KOR.

Fig. 3.5.2e. “Soft wooden chair” was advertised in the carpentry shop’s brochure of 1934. This chair type was the first suggestion for the patient room. Photo No. 105890. AAM.

Fig. 3.5.2f. Huonekalu- ja Rakennustyötehdas’ chair No. 51, or the small arm chair, was used in the patient room. The chair was stackable. Photo No. 105931. AAM.

3.5.3 FIXED HYGIENE EQUIPMENT OF THE PATIENT ROOM

Maintaining high standard of hygiene was a key ritual at a tuberculosis sanatorium and a designer's interest would particularly focus on furnishings that would allow for immaculate hygiene. The schematic diagram (Fig.3.5.3b) showed the shape and positioning of two basins, a spittoon with a drain placed between them and a screen standing between the washbasin area and the door. The diagram illustrated the placement of piping in the rising within the wall facing the corridor. The drawing was signed with the initials "H.H".[847] Another drawing illustrating the design of the washbasins is a freehand schematic diagram of two round washbasins. They have been marked with the taps, the location of the water pipe, the spittoon and the screen wall. The drawing is by Lars Wiklund.[848] The Building Committee authorised Aalto to negotiate with the Arabia porcelain factory an order of Finnish-made special washbasins for the patient rooms, provided that these would be less expensive than foreign alternatives and that the State Medical Board would approve of them.[849] The washbasin standard for the patient room drawn by Erling Bjertnæs was included in the documentation. The basin had been given measurements and the water trap was enclosed in the riser.[850] The Building Committee decided to order the basins from the Finnish china factory, Arabia.[851]

Among the drawings created by the architectural office there are two photomontages illustrating the use of the washbasins, which have been made for presentations. One of them includes an inscription: "No noises, no water splashes when washing your hands in running water, because the basin china is at a 45-degree angle". Neither drawing is dated or marked with the draughtsman's initials.[852]

The patient room spittoon is presented in two standard drawings. They differ from each other in the placement of the water trap, which is placed in the riser in one drawing and in the room in the other. Both drawings show a conical glass spittoon with an inward-curling rim with water running inside the rim fed by a 20-millimetre pipe.[853] A third drawing shows two variations of a glass spittoon with a circular flush and bottom valve. Type A has a straight and Type B an angled rotational piece. Type A has been referred to as the perfect rotational piece. Based on the handwriting, the drawing is probably by Alvar Aalto.[854] The drawing in question represents yet another attempt to develop a universal type.

847 Drawing No. 50-365. AAM.
848 Drawing No. 50-205. AAM.
849 Building Committee August 16, 1930, Section 6. PSA.
850 Drawing No. 50-177. AAM.
851 Building Committee November 20, 1931, Section 3. PSA.
852 Drawings Nos. 50-950 and 50-977. AAM.
853 Drawings Nos. 50-152 and 50-203. AAM.
854 The drawing No. 50-192 beared the initials "A.A." AAM.

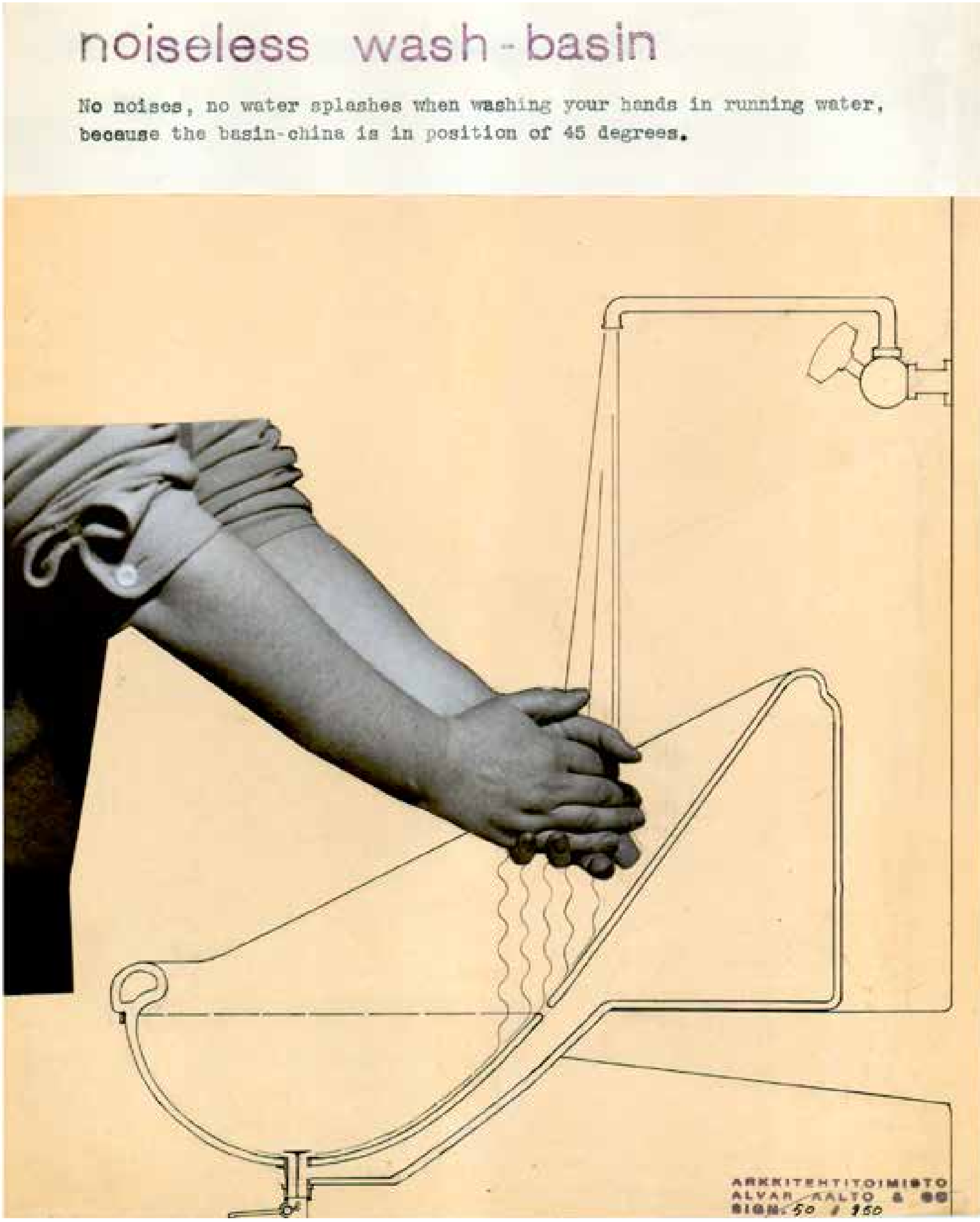

Fig. 3.5.3a. "No noises, no water splashes when washing your hands in running water, because the basin china is in position of 45 degrees." Drawing No. 50-950. AAM.

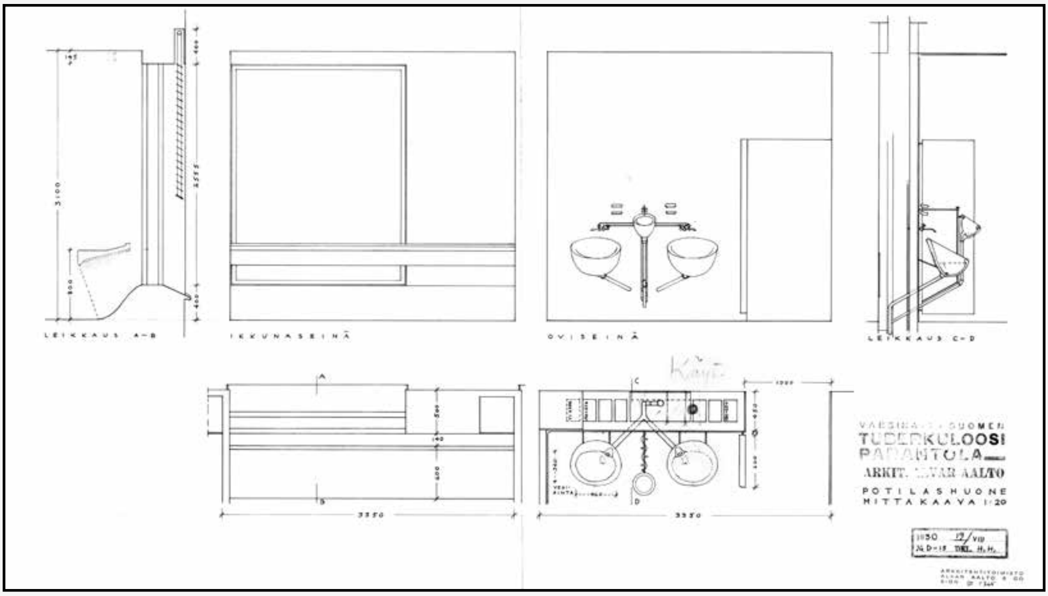

Fig. 3.5.3b. This drawing, in which the design is still unrefined, shows the key hygiene fittings for the patient room. Drawing No. 50-365. The drawing has been edited. AAM.

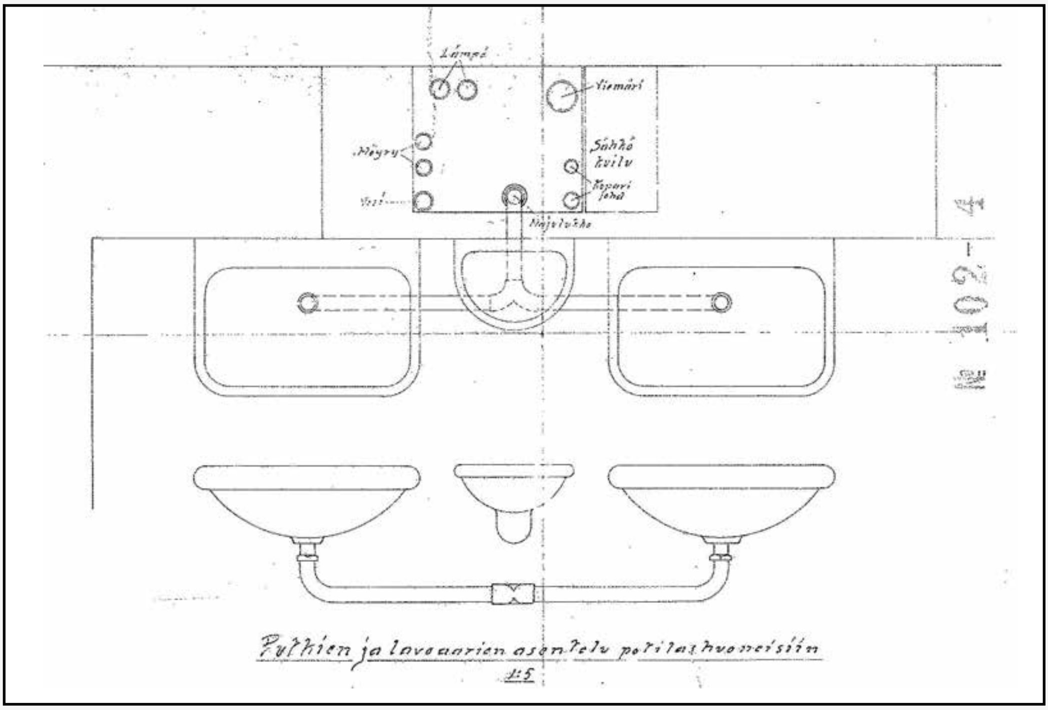

Fig. 3.5.3c. The installation of pipes and washbasin in the patient rooms, according to the plumber contractor's drawings. Drawing No. 102-4. The drawing has been edited. PSA.

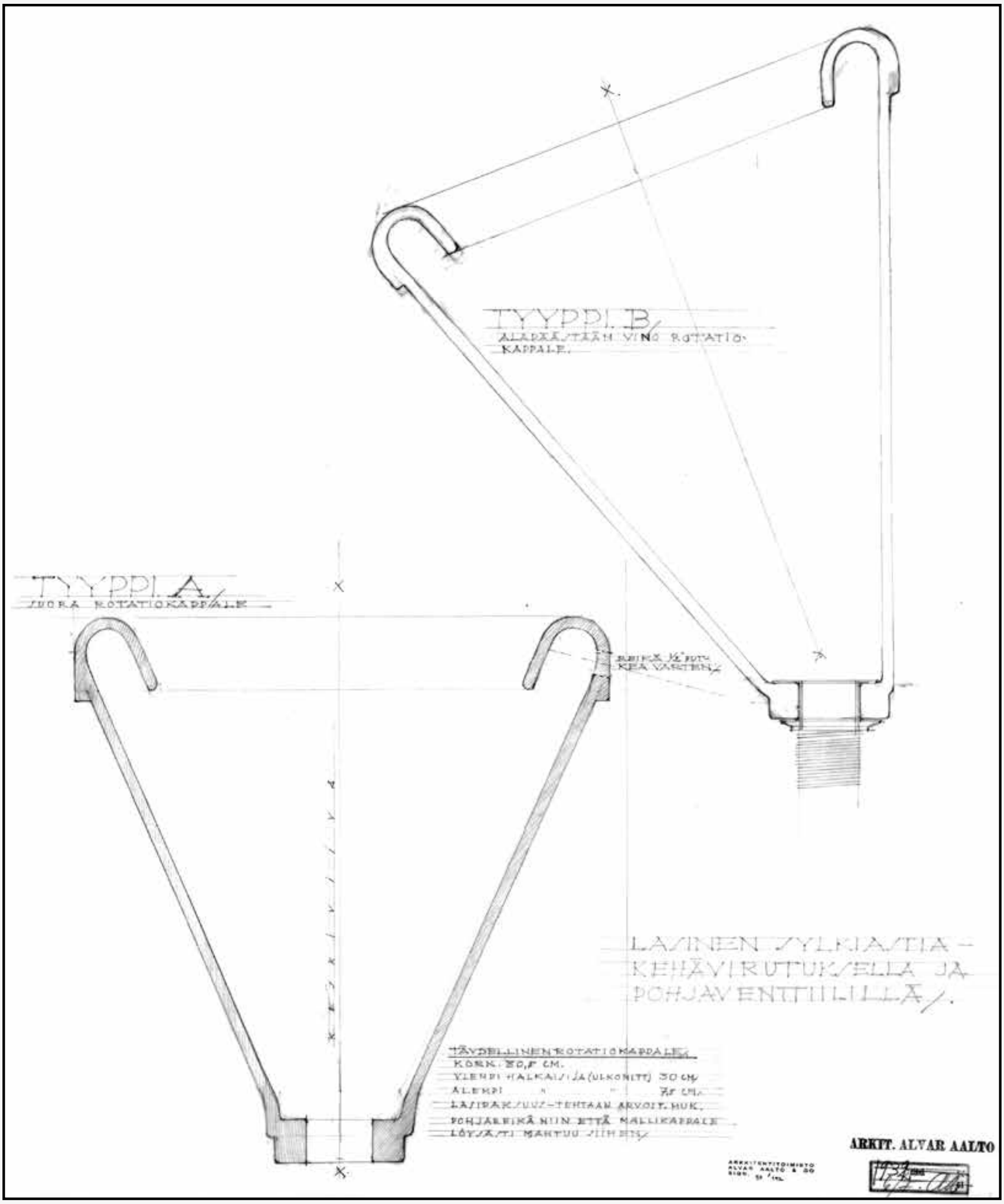

Fig. 3.5.3d. The glass spittoon designed by the architect was equipped with a circular rinsing action and bottom drain. Drawing No. 50-192. The drawing has been edited. AAM.

Fig. 3.5.3e. The glass shelf of the patient room was manufactured by Karhula glass factory. Photograph Ark-byroo.

Above the washbasins, glass shelves were commissioned. The drawings also included two glass shelves with covers[855], which were probably designed for the operating theatre, and one iron plate shelf.[856] No architectural designs for the final glass shelf exist. The Building Board refused to pay the supplier of the glass shelves, Lasitehtaitten Myyntikeskus (Glass Factories' Sales Company), more than had originally been agreed. [857]

The Committee favoured Finnish-made light fittings and decided that, at most, one quarter of them could be foreign-manufactured.[858] The draft list of light fittings included four special lights, one for the overhead light in the patient room, the bedside lamp, table lamp A and a table lamp. Special lamps were made to order.[859] The architect's goal was, in other words, to design the lights for the patient rooms himself. The patient rooms also had small conical fixed wall lamps above the washbasins, "wall plinth B", [860] designed by the architect.

Taito Oy manufactured the overhead lights and the other lights for the patient rooms.[861] The architect created a standard for the overhead light in the patient room and handed it over to the manufacturer. The bottom of the drawing reads: "Special light for the patient room. The reflector will be surfaced as instructed later. Other parts white enamel. The protective glass may possibly be left out, in which case the removable part could instead be fixed, but equipped with a small hatch for changing the night lamp.

855 Drawings Nos. 50-200 and 50-201. AAM.
856 Drawing No. 50-190. AAM.
857 Building Board March 6, 1933, Section 6. PSA.
858 Building Committee August 18, 1932, Section 4. PSA.
859 Drawing No. 50-709. AAM.
860 Drawing No. 50-710. AAM.
861 A letter of Oy Taito Ab lamp manufacturing company to Aalto, September 11, 1932. Documents related to the Paimio Sanatorium project. AAM.

Metalwork zinc or similar."[862] The light fitting was hygienic, as the protective glass kept the light free of accumulating dust. The final realised version was simpler than the design and does not correspond to the architect's drawing. For example, the night lamp downwards-reflecting light was completely omitted from the final execution. In one of the sketches drawn by the architect two shapes for the overhead light in the patient room were outlined: one that was presented in the standard and the one that was eventually realised.[863] It is difficult to draw any conclusions based on this regarding the degree to which the manufacturer influenced the final design. It seems that the manufacturer guided the architect towards lower production costs. Paavo Tynell's contribution to the design becomes evident in the sketch for the corridor lights, which was created by him and on which he had entered comments about the structure of the fitting.[864] In other words, Tynell drew the concept drawings for the corridor lights, which Aalto's office developed further into a second standard.[865] Prior to this, the architect and lighting designer probably held discussions on what the light fitting should be like.

A table lamp was designed for the patient rooms, with the plan to order a total of 320 units in three different colours.[866] One of the architect's sketches outlined the shape of the patient room table lamp.[867] Again, it is difficult to discern, whether the sketch came before the realisation or whether it was drafted based on the manufacturer's suggestion. The Building Committee approved the acquisition of a patient room lamp that could be used both as a table and night lamp.[868] Only 180 patient room table lamps were bought all in one colour and they were supplied by Idman company.[869] Idman was, at that time, a reseller for Taito Oy lamp manufacturing company, so it is most likely that Paavo Tynell was the designer of the lights purchased from Idman.[870] The lights in question could be installed at the end of the bed or placed on the bedside table.

862 Drawing No. 50-191. AAM.
863 Drawing No 50-753. AAM.
864 Drawing No. 50-721. AAM
865 Drawing No. 50-180. AAM.
866 A list of lamps of the Sanatorium of Southwest Finland created by Alvar Aalto's architectural practice. Documents related to the Paimio Sanatorium project. AAM.
867 Drawing No. 50-752. AAM.
868 Building Committee July 28, 1932, Section 6. PSA.
869 Building Committee August 18, 1932, Section 3. PSA.
870 According to an advertisement promoting artistic light fittings of the Taito company, in *Domus* magazine, its lamps were mainly sold by the Stockmann Department Store and Idman company. Oy Taito Ab 1933, p. 3.

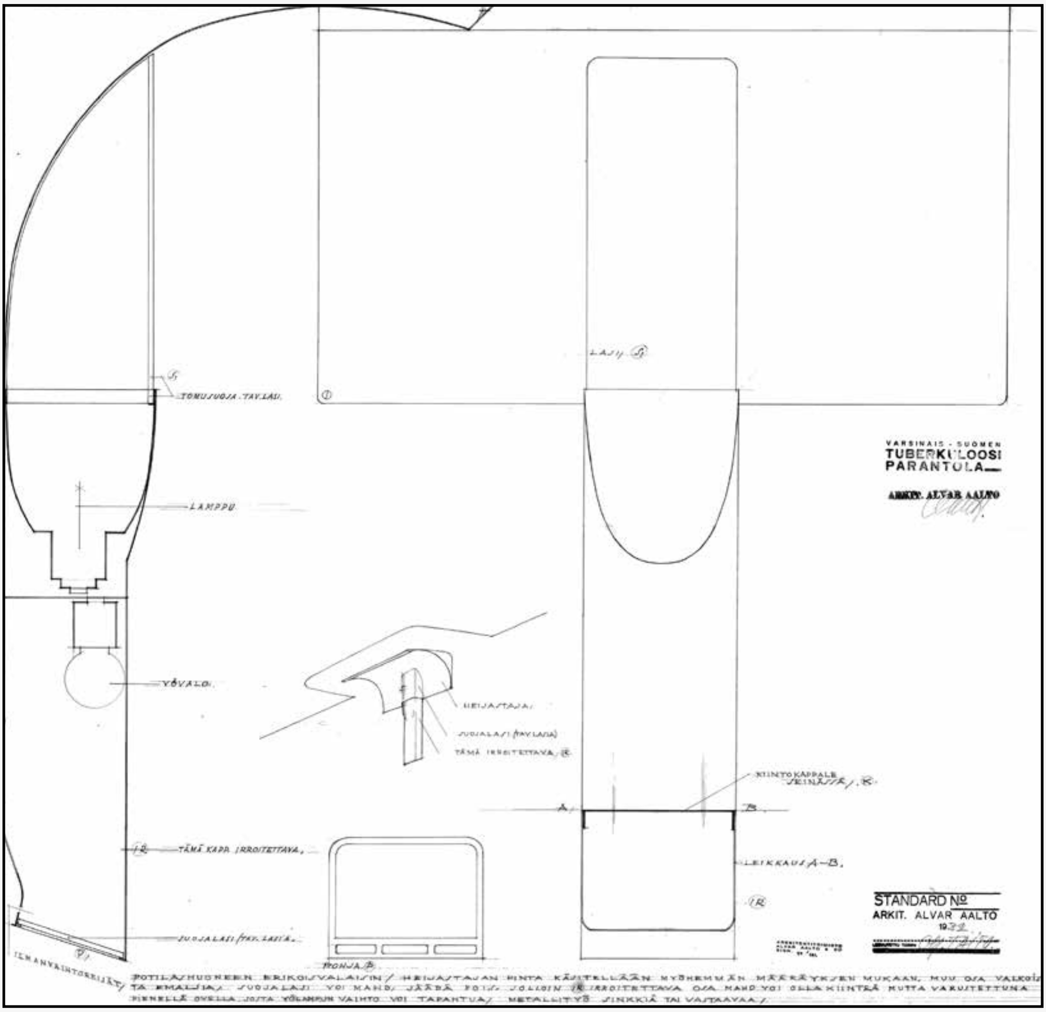

Fig. 3.5.3f. The overhead light designed by Aalto's office, from 1932. According to the instructions, the reflector would be surfaced as specified later. The other parts would be white enamel. The protective glass could probably be left out, in which case the removable part could as well be fixed. In the latter option, a small hatch would have to be added for changing the nightlight. The metal was designed to be zinc or similar material. Drawing No. 50-191. The drawing has been edited. AAM.

Fig. 3.5.3g. The overhead light in the patient room was manufactured by Taito. Photograph Ark-byroo, 2015.

Fig. 3.5.3h. The nightlight in the patient room was manufactured by Taito.
Photograph Ark-byroo, 2015.

Fig. 3.5.3i. Small conical lights were installed above the washbasins.
Photograph Ark-byroo, 2015.

Fig. 3.5.4a. A newly completed patient room. Photo No. 50-003-361. AAM.

3.5.4 INTEGRATION OF THE HEATING, DRAINAGE, WATER AND ELECTRICITY IN THE PATIENT ROOM

Besides furniture and fittings, the patient room interior was influenced by the way in which the architect managed to integrate various technical systems into the design. He approached the design solutions in specific fields from a holistic perspective, as discussed in earlier chapters in relation to the window design and hygiene equipment. In the early stages of the design, the heating of the patient room was arranged solely by means of fixed radiator pipes under the desk. Two round washbasins and the conical spittoon in between had drains and the pipes were placed in the risers within the wall facing the corridor. The spittoon and washbasins had separate drains. The architectural drawings showed no water traps. [871]

871 The drawing was signed by "H.H." Drawing No. 50-365. AAM.

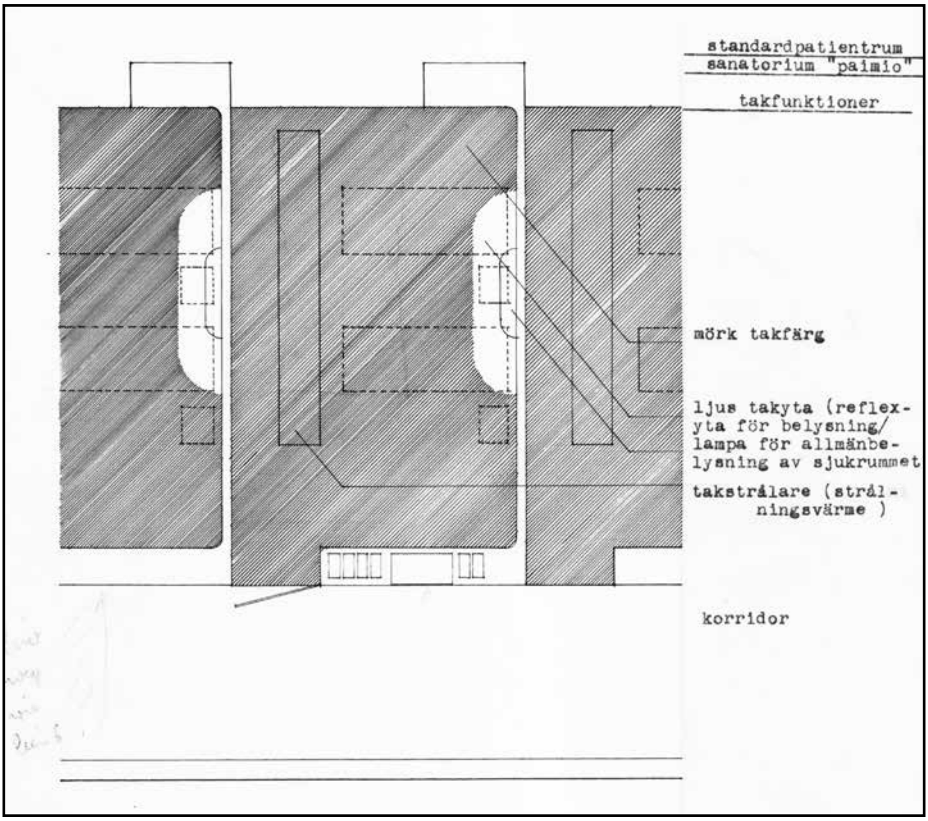

Fig. 3.5.4b. The functional principles of the standard patient room ceiling as shown in the drawing with the darker and lighter sections, the latter serving as a reflector for the overhead light. The drawing also shows a place for the radiator mounted on the ceiling. The drawing was created for the 1932 article in *Byggmästaren*. Drawing No. 50-372. The drawing has been edited. AAM.

Standard 6 relating to the window system in the patient room has already been discussed in depth in the Section 3.4 on windows. Although the architect had aimed to integrate various systems, the ceiling showed no evidence of ceiling heaters.[872] The interior and ceiling diagrams for the patient room were first published in the Swedish journal *Byggmästaren* (The Master Builder) in 1932, by which time the principles for the interior design and technical systems had taken shape but were not yet finalised. In the published ceiling diagram with Swedish annotations, the ceiling was shown as mainly dark, except for the area around the overhead lamp, which was light in colour. According to the commentary, the light-coloured surface served as a reflector for the elongated ceiling lamp. In addition, the diagram included a radiator heater.[873]

872 Drawing No. 50-395. AAM.
873 Drawing No. 50-372. AAM.

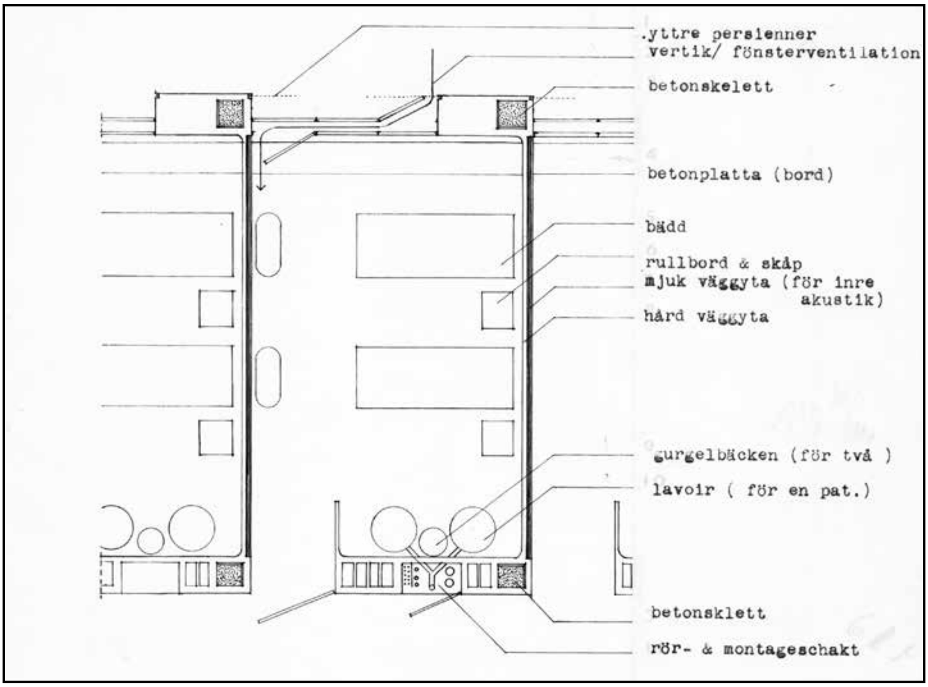

Fig. 3.5.4c. Diagram of the patient's room created for the article appearing in *Byggmästaren*. Drawing No. 50-636. The drawing has been edited. AAM.

In an undated interior diagram for the patient room, the functional principles of the room have taken shape: the horizontal airing mechanism of the window was indicated with arrows, the washbasins were in place and the furnishing of the room were complete.[874] Marked with annotations in Swedish, the diagram was made by adding to a previous drawing and was published in *Byggmästaren* in 1932.[875]

In these drawings, which were created for presentation purposes at the time of their completion, the ideas and forms of objects corresponded to reality. The diagram presented the completed room with the essential solutions numbered.[876] The German-language patient room diagram included two drawings: the functions of the floor and the ceiling respectively. The annotations in German have been translated into English and the translations have been added to the drawing by hand. In addition to the correct scaling of the furniture, the diagram also illustrated the window solutions, airing, the washbasins and spittoons, and the ventilation system. The load-bearing structures, the risers in the corridor-facing wall and the opening of the riser onto the corridor have been presented. One of the diagrams showed the functional principles of the ceiling in their final form: the shape of the dark and light-coloured areas, the lighting and the positioning of the radiator heater. However, the size of the reflective areas compared to reality was exaggerated in the image.[877]

874 Drawing No. 50-402. AAM.
875 Drawing No. 50-636. AAM.
876 Drawing No. 50-407. AAM.
877 Drawing No. 50-412. AAM.

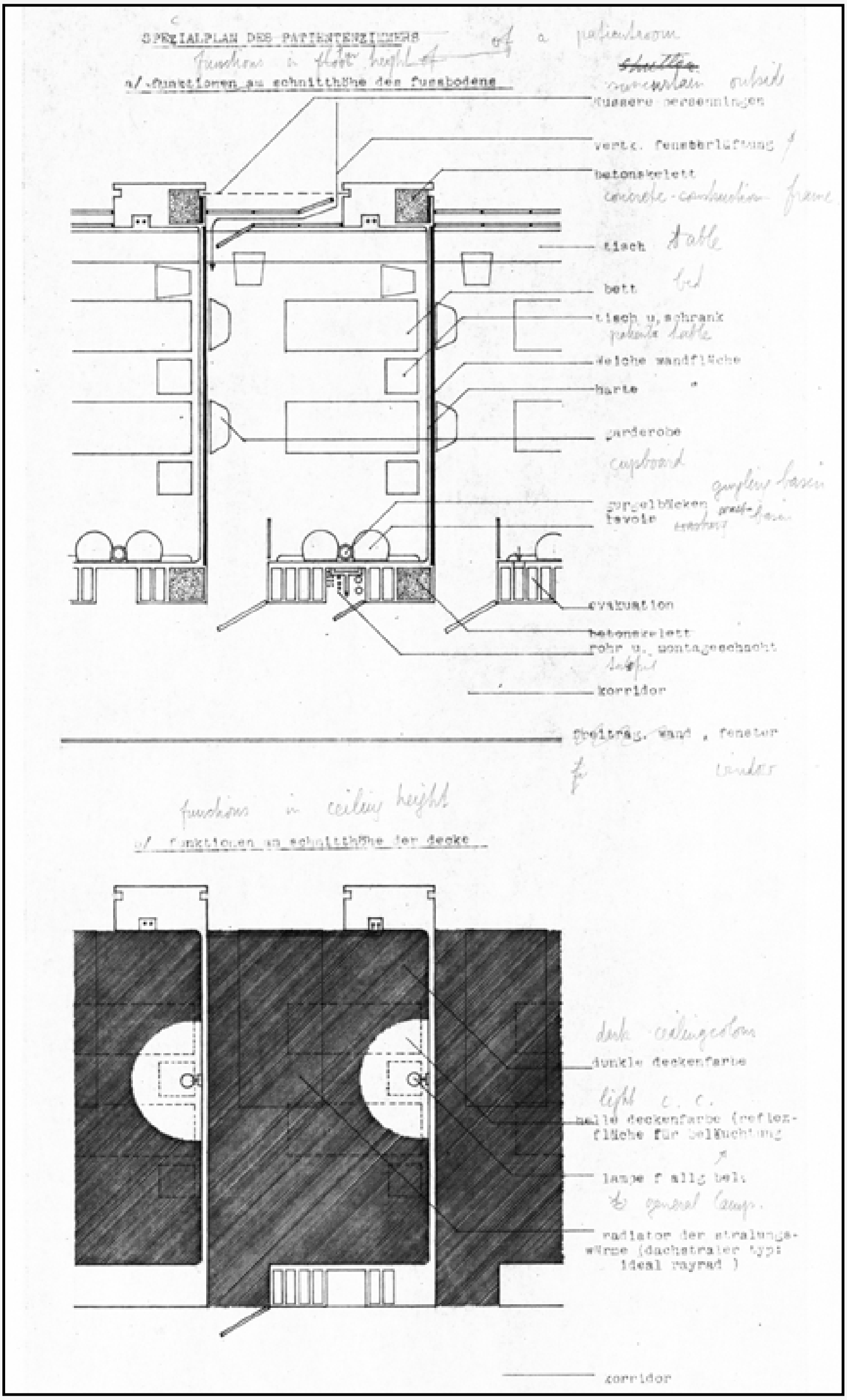

Fig. 3.5.4d. In this diagram, the wardrobes are in their final form, as are the ceiling radiators. Drawing No. 50-412. The drawing has been edited. AAM.

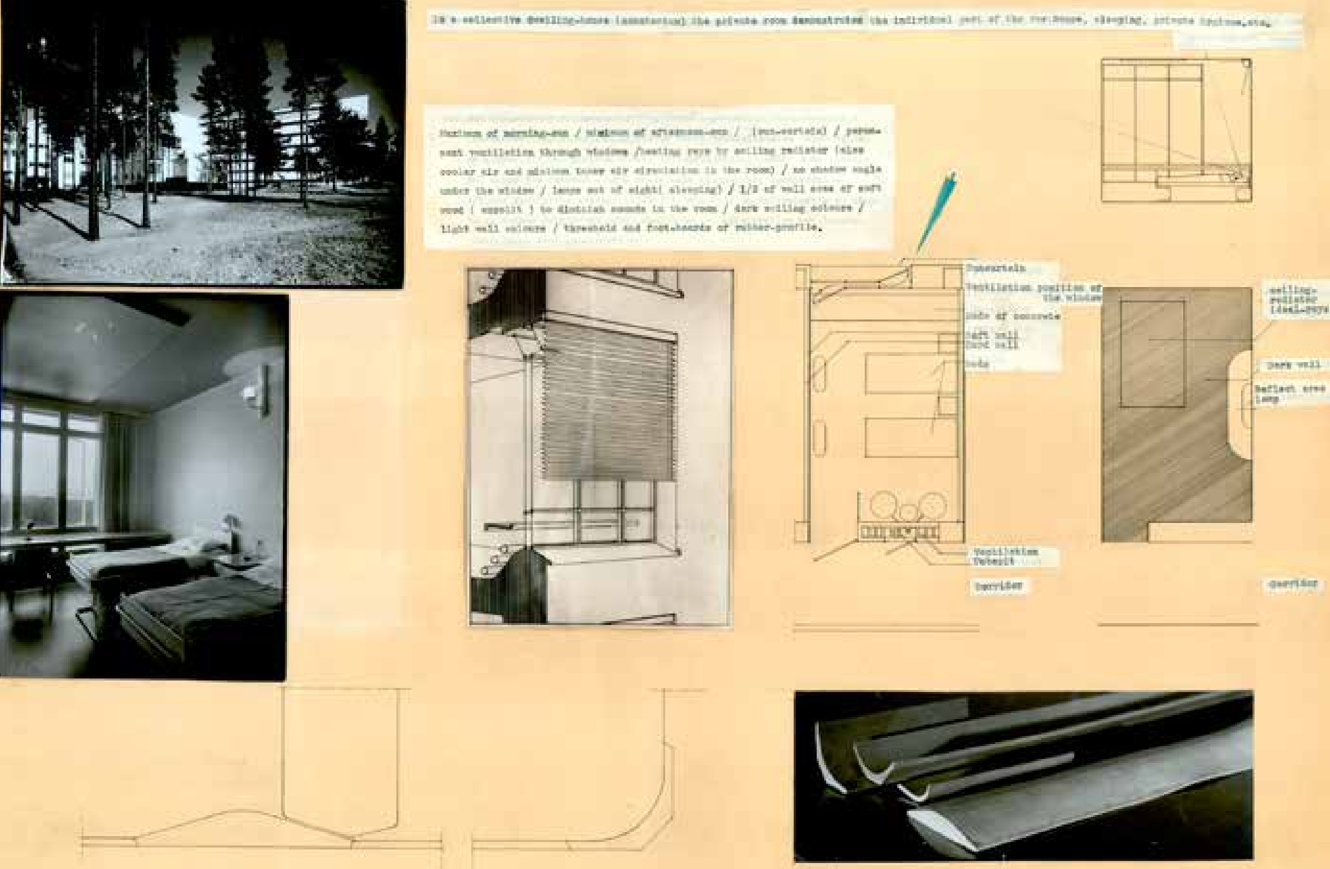

Fig. 3.5.4e. This sheet has been created for a presentation by the designer wishing to introduce his central ideas. The text is of great interest since it likens the sanatorium to a collective house and the patient room to an apartment. Drawing No. 50-400. AAM.

A sheet created for presentations, a compilation of drawings and photographs, summarised the architects' intentions regarding the patient room: "In a collective dwelling-house (sanatorium) the private room demonstrates the individual part of the residence, sleeping, private hygiene etc. Maximum of morning-sun / minimum of afternoon-sun / (sun-curtain) / permanent ventilation through windows / heating by rays by ceiling radiator (also cooler air and minimum inner air circulation in the room) / no shadow angle under the window/lamps out of sight (sleeping) / ⅓ of wall area of soft wood (Ensolit) to diminish sounds in the room / dark ceiling colours / light wall colours / threshold and foot boards of rubber profile.[878] The drawing showcased the key features of the design solution: the curving threshold and skirting board, the window and black-out blinds, radiator pipes underneath the desk, the colour scheme for the ceiling, the airing mechanism of the window, the possibility for patients to enjoy the view outside, soft and hard walls, the beds and the ceiling radiator. The architect refered to the sanatorium as a collective apartment building in the diagram annotations, which indicated that he was inspired by the new paradigm in housing architecture in designing the sanatorium. The impact of the radiator heater on a reclining patient was illustrated in a separate diagram.[879]

878 Drawing No. 50-400. AAM.
879 Drawing No. 50-405. AAM.

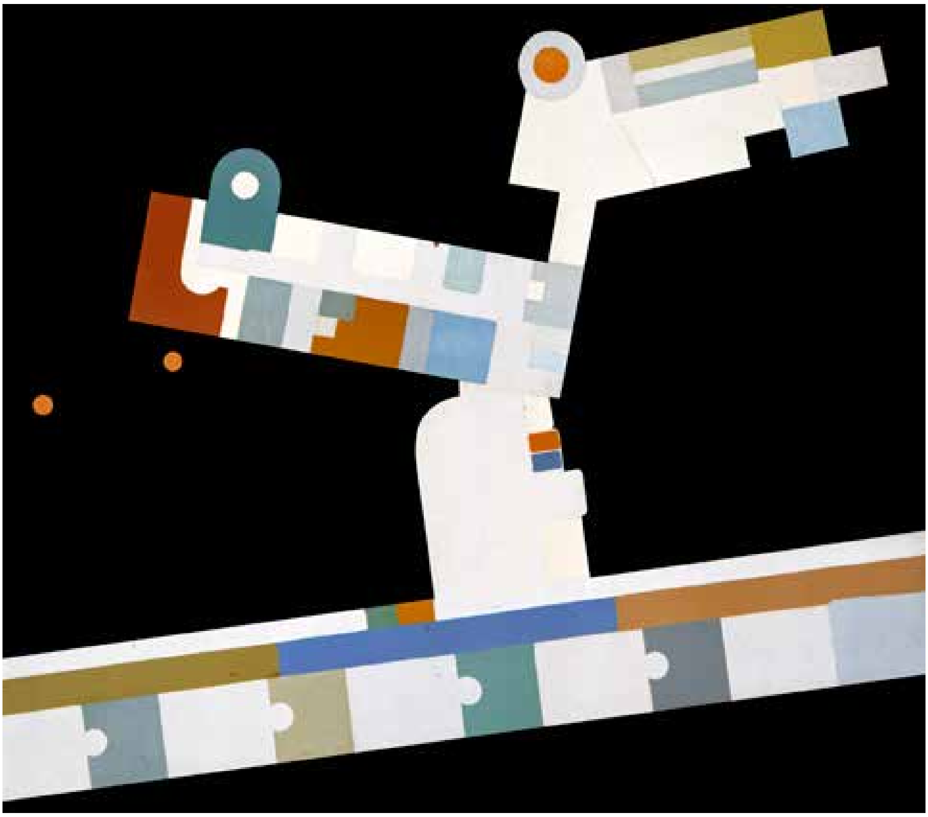

Fig. 3.5.4f. The darker tone of the ceiling probably varied from one room to the next as did the corridor wall colour on different floors. Colour plan by Eino Kauria. Photographer Mikko Hietaharju. Photo No. av 78. Photo has been edited. AAM.

Artist Eino Kauria served as the supervisor of painting work of Paimio Sanatorium from June 1932 onwards.[880] The Alvar Aalto Museum drawing archive holds a gouache painting by Kauria presenting the colour scheme for Paimio Sanatorium. Based on his painting, the darker tone of the ceiling varied from one room or floor to the next as did the corridor wall colour on different floors.[881] Nils-Gustav Hahl has also described the interior palette of the sanatorium in a 1933 article in *Domus* magazine: the lobby had a fresh yellow colour on the floor, the iron window frames were red and the pipes were painted in different colours according to their function, which in his opinion added a decorative aspect to the design.[882] The patient room had few pipes other than heating pipes in view.

880 Building Board June 14, 1932, Section 12. PSA.
881 Prior to Paimio Sanatorium, architect Eino Forsman had used bright colours in the Tarinaharju Sanatorium in Siilinjärvi, completed in 1931. Heikinheimo et al., Ark-byroo architects 2014, p. 36 and p. 111.
882 Hahl 1933, pp. 63–67.

Aalto's office drew up several designs for internal doors. Detail drawings show a round-shaped threshold rising from the floor, metal plate covered frames and a variety of treatments on wood door panels. Seven door plans were marked as standards.[883] The patient room doors were wooden flush panel doors, with the corridor-facing panel varnished and the room-facing one painted.[884] The metal plate covered doorframe was manufactured by Crichton-Vulcan, [885] and the door leaves were ordered from Wilhelm Schaumans Fanerfabrik factory.[886] The piece of metal painted in different colours on either side strung on a piece of wire was hanging on the corridor-facing side of the patient rooms. This was used by the patients to communicate whether they were in their room or not. The rooms had no name plates. It is not known to whom this completely manual mechanism can be attributed. The handles in the patient room doors were specially made and designed by the architect.[887] They were supplied by Turku-based Kaune Takomo (Kaune Artistic Blacksmithing), which advertised them as their own standard-type handle.[888]

Architects sketched several drawings studying the joint of the S-shaped floor and the wall. The Building Committee decided that the skirting board should be made of rubber.[889] In a photograph from the Aalto archives, the skirting boards are coved but wooden.[890] The patient room floor was clad with linoleum, an important detail for Aalto. He wanted to ensure that the floor material would be linoleum and therefore bring forward the material purchase to autumn 1931.[891] The Building Committee decided to purchase 2.2 millimetre thich linoleum for the floor covering in December 1931[892], well in time before the materials for other floors were decided on.[893] One of the patient room walls was covered with soft Enso pulp-paper wallpaper to even out the internal acoustics of the room. The advertisement of Enso-Gutzeit Ltd illustrated the structure of the acoustic wall panel: a fibreboard attached to the wall, clad with thick Enso wallpaper.[894] This advertisement was created at Aalto's office and illustrated with photographs taken by Aino Marsio-Aalto.

883 Drawings Nos. 50-159, 50-160, 50-161, 50-162, 50-163, 50-166 and 50-390. AAM.
884 Research on colour layers, card No. 6. Heikinheimo et al., Ark-byroo architects, 2000.
885 Building Committee May 20, 1931, Section 3. PSA.
886 Building Committee November 4, 1931, Section 3. PSA.
887 Drawing No. 50-956 presents a handle, which is more simple than the one that was manufactured.
888 An advertisement of the Kaune company. Sukkinen, M. et al. eds. 1933, p. 70.
889 Building Committee March 21, 1932, Section 6. PSA.
890 Exhibition plate No. 50-400. AAM.
891 Aalto proposed to the Building Committee that the linoleum be ordered in good time because the price might increase as the exchange rate of foreign currencies could rise. However, the Committee did not press for a desicion because in its view it was not possible to say how the exchange rates would develop. Building Committee November 4, 1931, Section 2. PSA.
892 Building Committee December 23, 1931, Section 2. PSA.
893 In March 1932 the Building Committee decided that coloured linoleum of 3.5 millimetres thickness would be used in the corridors. In toilets and other spaces, rubber sheets of the thickness of 3 millimetres would be used. The rubber flooring material was ordered from Nokia and the linoleum from Oy Wiklund Ab, located in Turku. Building Committee March 5, 1932, Section 2. PSA.
894 An advertisement of Enso Gutzeit Ltd. Sukkinen, M. et al. eds. 1933, p. 65.

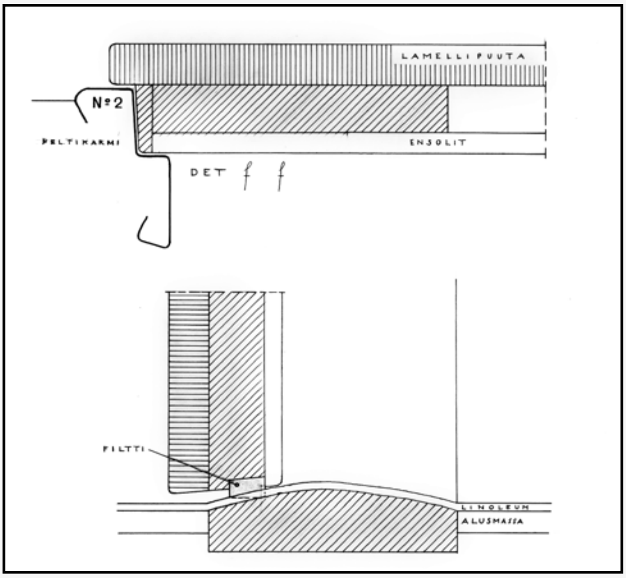

Fig. 3.5.4g. Detail of a standard drawing with sheet metal door frame and undulating threshold. The door panel does not correspond to the reality. Drawing No. 50-162. The drawing has been edited. AAM.

Fig. 3.5.4h. The patient room door handle was designed by Aalto's office. Photo No. 50-003-352. AAM.

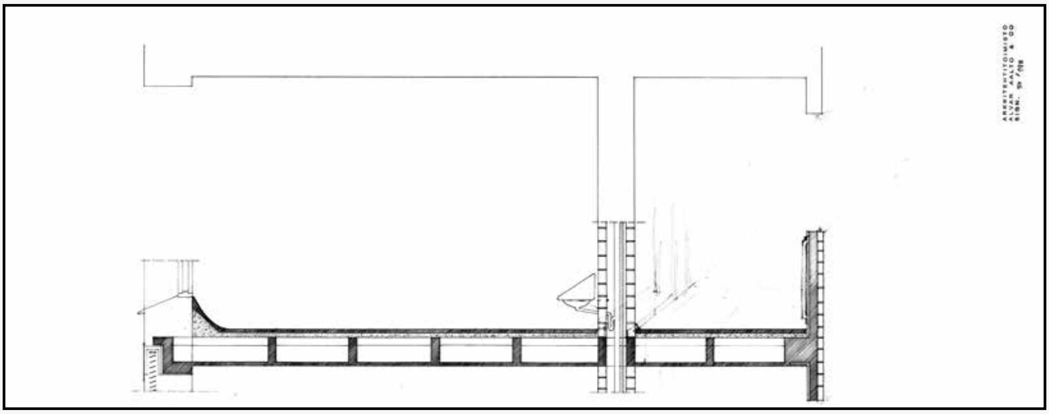

Fig. 3.5.4i. The drawing is a study of the integration of the intermediate floor building technical systems. Drawing No. 50-198. The drawing has been edited. AAM.

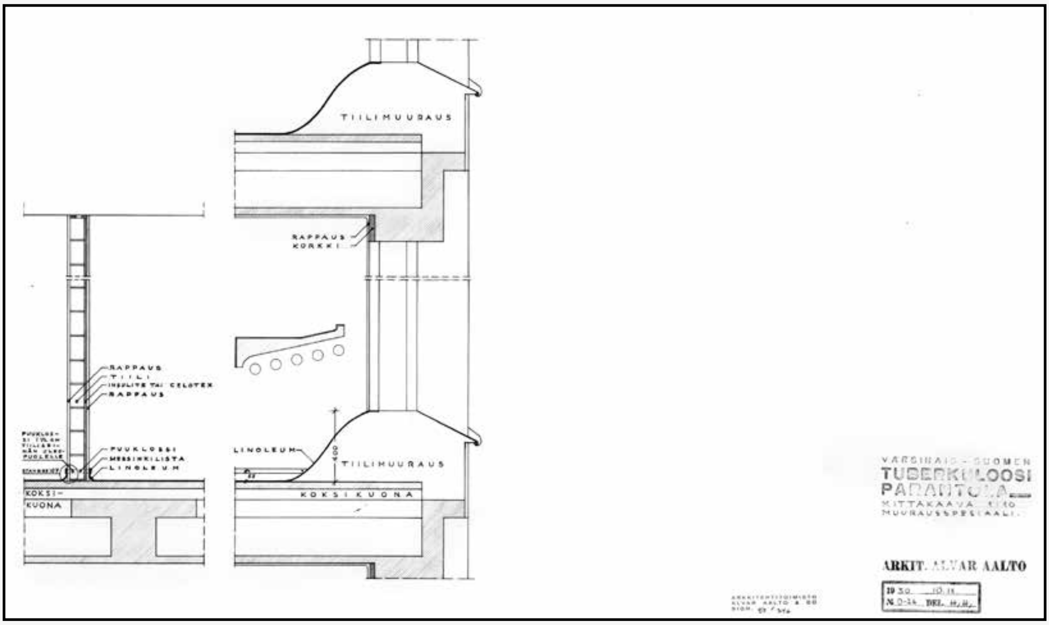

Fig. 3.5.4j. The drawing shows the connection of the ceiling and the floor to the walls. Aalto used coved corners for easier cleaning. Drawing No. 50-346. The drawing has been edited. AAM.

Fig. 3.5.4k. The risers were contained in the wall between the patient room and the corridor, and their service hatches opened into the corridor. Servicing therefore did not require entering the patient room. Photo No. 50-003-153. AAM.

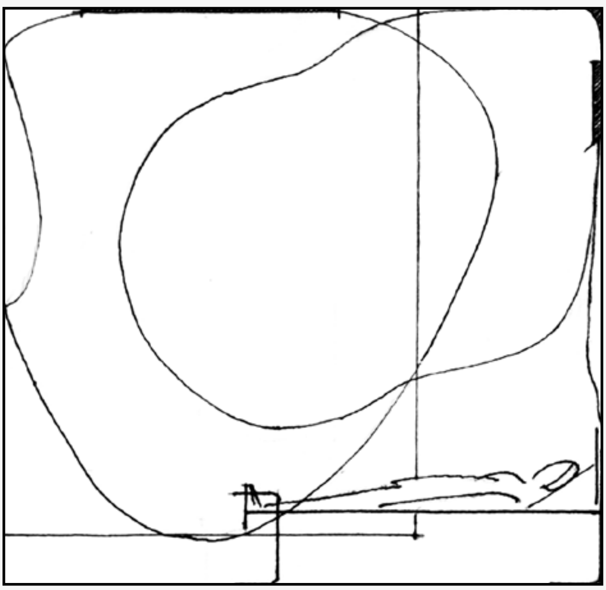

Fig. 3.5.4l. The architect's diagram shows how the ceiling radiator emitted heat evenly to the reclining patient. Drawing No. 50-405. The drawing has been edited. AAM.

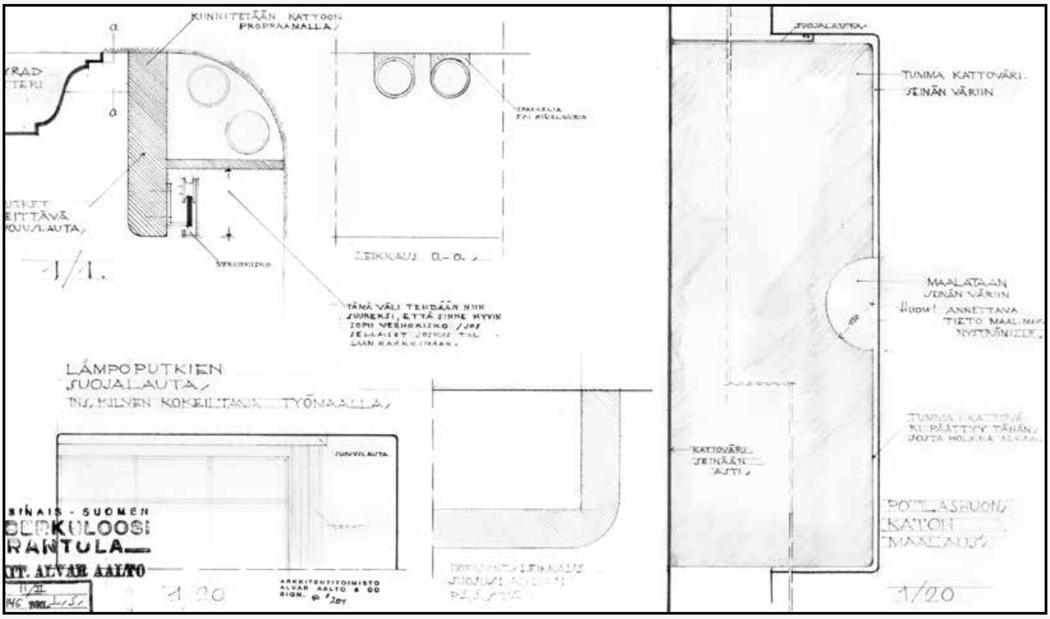

Fig. 3.5.4m. The detail shows the joint of the ceiling surface and the window wall. It also shows the decoratively profiled edge of the ceiling radiator, acknowledged by Mateo Closa. A covering board was attached in front of the window to hide two heating pipes. The covering board also enclosed curtain rails in case curtains should one day be fitted. One end of the covering board reached the wall while the other end was rounded. The narrow gap between the heating pipes and the ceiling were planned to be filled. The drawings also show a diagram of the paint boarders on the ceiling. The drawing is dated February 11, 1932 and it has Lauri Sipilä’s initials. Drawing No. 50-284. The drawing has been edited. AAM.

3.5.5 THE INTEGRATED DESIGN OF THE PATIENT ROOM

Aalto conceptualised the two-bed patient room as a "minimum apartment". The room was small in size, making space-saving design solutions necessary. Aalto multiplied the available space by way of adding details of his own design, and by approaching the compact dwelling as a holistic problem. To approach the design problem from the perspective of a minimum apartment was justified by a number of factors: the serial production – the patient room was not a singular space. Instead, it was repeated 120 times in an identical form; space-saving, which resulted in meticulous scaling and placing the radiator on the ceiling; multiplying the space through added functional features, with the bedside table and night lamp as good examples; and emphasising individual patients' privacy in a twin room by various acoustic means. Aalto had addressed the importance of acknowledging patients' psychological and physiological needs as the basis for design in a talk he gave in Oslo in 1931.[895] The architect meticulously studied each individual solution for the patient room. This was the method he had called for in his critique on the Stockholm Exhibition.[896] When the project was nearing completion, he drew numerous diagrams analysing the functions of the space. His paradigm and work method was also in line with current international discourse.

As the person responsible for the purchasing of patient room furnishings, Aalto's role in securing the overall furnishing design of the patient room was decisive. He divided the purchases into four categories: fixtures designed by the architectural office, freestanding furniture designed by the architectural office, standard furniture, and chairs, which were also standard. By "standard furniture", Aalto referred to serially produced furniture generally available on the market.

Aalto had already for some time collaborated with Otto Korhonen and his company, Huonekalu- ja Rakennustyötehdas (Furniture and Building Work Factory), developing their standard collection. In this way, Aalto could with good reason propose the purchase of furniture designed by himself, although it had not been specified in the design contract as part of the architect's remit. Separate quotations were requested for all furnishings. Huonekalu- ja Rakennustyötehdas and August Louhen Rautasänkytehdas (August Louhi Iron Bed Factory) submitted quotations later than the other competitors, and without exception, their prices were slightly lower than those proposed by the others. This seemed like a conscious tactic. Aalto disclosed to his collaboration partners the price level that would secure them the contract. Aalto excused himself from the decision-making regarding the bed and bedside table-drawer unit because he was the designer. However, he did not excuse himself from the purchasing decision regarding the wardrobe, although he had designed the standard model for Huonekalu- ja Rakennustyötehdas.

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895 Anon, 1931, p. 6.
896 Aalto 1930d. pp. 119–120.

Aalto's strategy was to introduce products of his own design into serial production and general markets. Looking after his own interests meant that he would also look after the interests of his partners. In the competitive tendering for the furnishing contracts for Paimio Sanatorium, the competitors were not placed on an even playing field. Aalto made sure, however, that the lowest price was the decisive factor. His task was to persuade the decision-makers by demonstrating the high quality of the furniture with the models delivered to the sanatorium and to convince them that the requirements for both the lowest price and highest quality were met by the companies favoured by Aalto and that this was also in the best interest of the sanatorium. It is clear that Aalto's actions would have raised criticism amongst the Building Board. What is also clear, however, is that they chose to turn a blind eye, as the Building Board stood to benefit from the lower prices. The relationship between the architect, developer, the material supplier and provider as well as his peers was regulated in the ethical guidelines, or Norms of Honour, of the Finnish Association of Architects, which emphasised the role of the architect as a neutral mediating party. According to the ethical guidelines, the architect may be reimbursed by the client only: "Accepting any conceivable compensation in any form from the executor of work, material supplier or provider is dishonest and dishonourable."[897] In this light, Aalto's actions were testing the boundaries of professional ethics.

PATIENT ROOM FURNISHINGS

FURNITURE	BUILT-IN FURNITURE	LOOSE FURNITURE designed by architect	LOOSE FURNITURE purchased standard	CHAIR purchased standard	MANUFACTURER
wardrobes			X		Oy Huonekalu- ja Rakennustyötehdas Ab
table	X				Oy Huonekalu- ja Rakennustyötehdas Ab
bedside table and cupboard			X		Oy Huonekalu- ja Rakennustyötehdas Ab
bed			X		Aug. Louhen Rautasänkytehdas
chair				X	Oy Huonekalu- ja Rakennustyötehdas Ab

Table 3.5.5a Patient room furnishings.

897 Suomen Arkkitehtiliitto (Finnish Association of Architects), 1937b, p. 382.

The hospital furniture acquisitions were based on model pieces, as especially evident in the case of the wardrobe purchase. From the perspective of design philosophy, the evolution of the patient room wardrobe from a metal sheet cabinet through a rectangular plywood cabinet with a separate frame into a fully opening wardrobe, in which the material formed its supporting frame, is an interesting process. The material, the structure and the use of space changed through the different stages of design. The wardrobe changed from a static piece into a mobile one. The product development progressed between February and September 1932, in collaboration with the manufacturer and the designer, before and after the offer had been formally accepted. A similar use of nesting and combining two functions is exhibited in the two-piece combination of the bedside table and drawer unit. The bed design grew simpler during the design process and it did not have mobile features. The patient room chair, originally made of bent plywood with a tubular steel frame, became a timber structured one. The reason for this alteration was probably the price.

The light fittings were a topical design task, as electricity was used to an increasing degree and the quality of light bulbs improved.[898] Helge Kjäldman had introduced three principles of overhead lighting in a 1927 issue of *Arkkitehti* (The Finnish Architectural Journal): direct, semi-diffuse and diffuse, which were similar to the principles discussed by Gispen in his article of the following year in the Deutscher Werkbund publication, *Innenräume* (Interiors), a volume that Aalto had in his library.[899] Norvasuo has argued that Poul Henningsen related to Aalto the method in which analytical and empirical approaches converged and were utilised in creating the form of a light fitting.[900] Bauhaus, in contrast, was interested in lamps as sculptural objects.[901] Norvasuo has also maintained that the overhead lighting in the Paimio patient room represented the view that gained popularity among architects in the 1930s, according to which light-coloured ceilings or walls could be used instead of reflecting surfaces incorporated in the lamp. According to Norvasuo, Aalto's patient room lighting design appeared to be a compromise, in which technically appropriate lighting and an experientially satisfactory environment have been brought together.[902] What is significant is that Aalto's lighting design developed in parallel with its execution. Initially, the reflecting surface was part of the light fitting instead of a light-coloured area on the ceiling. The design of the lamp probably changed owing to cost pressures, and was altered in collaboration with Taito's designer and factory owner Paavo Tynell.

Besides rays of light, like Henningsen, Aalto also studied the reflection of sound. Furthermore, it would seem that a calm acoustic environment was a more important factor than the lighting in the sanatorium environment. This would be the rationale

898 Norvasuo 2009, p. 33.
899 See Kjäldman 1927, pp. 37–41; Gispen 1928, pp. 147–152; Norvasuo 2009, p. 37.
900 Norvasuo 2009, pp. 53–54.
901 Banham 1984 [1969], pp. 129–130 and pp. 36–137.
902 Norvasuo 2009, p. 79.

behind the splash-free noiseless washbasin, the use of Enso's fibreboard and pulp-paper wallpaper in the patient room walls and Aalto's drawing illustrating the behaviour of sound in the patient room corridor published in the *Byggmästaren* (The Master Builder) journal. In this image, the corner of the patient room has been presented as rounded.

Aalto was interested in developing panel radiators, as indicated by his contact with the Wärtsilä Corporation at the same time as the Building Board was debating whether ceiling radiators should as a rule be used. The profile of the Rayard standard radiators used in the ceiling of the patient room allowed for the connecting pipes to run inside the radiator.[903] The Spanish architect Mateo Closa has perceptively pointed out that the technical features of the ceiling radiator were hidden beneath a decorative shell, and considered this a characteristic of older architecture.[904] Closa was not, however, familiar with the story of how the ceiling radiators became part of the design. In reality, Aalto would have had no opportunity to influence the design of the radiators, even if he had wanted to.

Owing to the small-size, holistically designed furniture and integrated technical systems, the twin patient room of Paimio Sanatorium is based on a similar ideology to the small apartments in German housing estates at the time. The centrality of the patient room for Aalto becomes evident in the sheer number of drawings related to it. Aalto standardised the patient room with the objective of introducing the furniture designed for the room into serial production. He succeeded in integrating technical systems into his own design as advised by medical experts as well as sub-contractors and manufacturers. The essential values informing the design of the patient room were preventing the spread of disease and providing a quiet environment, fresh air, good heating and eye-friendly lighting. Paimio Sanatorium can be interpreted as a collective, where each resident is reserved a private space, albeit small, and the a great deal of consideration is given to facilitating shared activities and practicality.

According to Adams, hospitals in the United States and Canada aspired towards impeccable cleanliness, with priority given to the design of hygienic surfaces, medical applications, and financially and ideologically motivated solutions. She argued that, in the case of interwar-period hospitals, it was difficult to differentiate whether a certain solution stems from an attempt to create and maintain an image of cleanliness or to prevent the transmission of diseases.[905] She maintained that, in addition to the countless cleaning devices, there were numerous design details for fitting doors, windows, wall foundations, medicine cabinets, lavatories and even ventilators seamlessly onto the wall surface.[906] Similarly at Paimio, the profile of the patient room floor in front of the

903 Contract No. 4 of Vesijohtoliike Onninen (Plumbing Company Onninen), July 9, 1931. Documents related to the Paimio Sanatorium project. AAM.

904 Closa writes: "Por el contrario, el radiador que se sitúa en el techo de las habitaciones de enfermos y en el comedor, que pertenece al sistema tecnológico del edificio, oculta la visión de todo mecanismo con la intención de pasar a integrarse inadvertidamente en la arquitectura de la habitación. La estrategia de ocultación de lo mecánico coincide, en este caso, con la referencia retórica a la ornamentación tradicional. Dentro de este contexto algunos detalles del interior del edificio muestran formas de carácter histórico construidas con un material moderno." Closa 1991, pp. 92–93.

905 Adams 2008, p. 126.

906 Adams 2008, p. 126.

window was informed by the hygienic considerations pointed out by medical advisors. The coved ceiling joint and rounded skirting board create an impression of a hygienic room. The lavatories in the Paimio Sanatorium lobby still have coved corners, which were probably also used in patient rooms as well. The washbasin pipes were placed in a separate riser within the wall and their rounded, clean shape would appear to be free of nooks and crannies in which dirt could build up. The wardrobes were not recessed into the wall, and their rounded profile gave the impression of a continuing wall surface.

When taking a closer look at the patient room, the entity comes across as a most harmonious one: all furnishings were the outcome of holistic thinking, and the technological solutions were implemented with great economy of space while optimising their functionality. However, this harmonious image tells nothing of the process that preceded the end result.[907] It might appear that Aalto was commissioned to create the interior design for the patient room, including all its parts. As the present study shows, this was not the case. The furnishings were divided into four categories, only some of which were part of the design remit of Aalto's office. From the Building Board's perspective, it was not a question of commissioning an artistically coherent whole. Aalto as a designer was, however, keen to realise the patient room according to his own visions, including the tiniest of details. This required a great deal of effort from the architect, or the innovator. By manoeuvring the purchasing processes through various trials he was able to translate the view of the Building Board to support his own intentions by always invoking the lowest price. He exercised a great deal of power within the project. As the person responsible for composing the acquisition programme, he knew the rules, and, as a representative of the client organisation, it was part of his role to invite tenders. In addition to this position and the resources of his architectural office, he also formed part of many local collaborative networks, which had taken shape in the course of previous projects. Therefore, the manufacturing of the model wardrobes for the patient room at Huonekalu- ja Rakennustyötehdas (Furniture and Building Work Factory) was completed in record time. Aalto showed great creativity in exploiting his social and material resources. He had managed to bring into existence a strong, viable hybrid made up of social and material actants, existing only for the purpose of the project. The way Aalto developed his standards, mostly for the patient room, can be seen as a method similar to Latour's laboratory, where a question is isolated from the surrounding reality and resolved in a laboratory or on a drawing board, and then introduced to the wider world or taken into industrial production[908]

907 Latour and Yaneva 2008, pp. 80–89.
908 Latour 1999 [1982], pp. 141–170, especially p 167.

3.6 A MASSIVE INFRASTRUCTURE PROJECT BROUGHT INTO A PRISTINE LANDSCAPE

For the purposes of this dissertation, infrastructure was referred to as installation technology. This technology is of interest as town planning was a highly topical theme at the time. Furthermore, Paimio Sanatorium was built in a rural area and as a modern institution helped to bridge the gap between the city and the countryside. It was, however, designed for patients with a serious illness, so it was understood appropriate among the medical experts to locate it in an isolated environment. Various large technological systems, which compose the essence of modern technology,[909] such as the national electricity grid, developed in leaps and bounds in the inter-war period.

3.6.1 THE CHALLENGES IN IMPLEMENTING WATER, SEWAGE AND HEATING SYSTEMS

The Building Board requested tenders for the water, drainage and heating piping contracts in spring 1930. The candidates were required to present a design solution as part of their tender. The tenders proved incommensurable so it was impossible to reach a decision based on them. Following the unsuccessful round of tendering, the Building Board commissioned the water, drainage and heating piping plan from Radiator, one of the companies that had submitted a tender.[910] Radiator was owned by Arthur E. Nikander (1881–1953), who was one of the first building engineers in Finland to run a construction firm. His firm Radiator was among the most significant ones at the time.[911] The new round of tendering took place based on the plan devised by Radiator together with Aalto in early 1931. Tenders were requested from five companies, three of which submitted a tender. Huber, which was one of the leading Finnish companies in its field and the one who had won the contract for the Turun Sanomat Newspaper Building, failed to submit a tender in either round. It is also noteworthy that in this contract, which was substantial in value, the tenders were not addressed to Alvar Aalto, who was in charge of the contracting as the highest-ranking expert on the project.[912] The Building Committee

909 Hughes 1989, pp. 184–248.

910 Building Committee August 16, 1930, Section 5. PSA; Building Board August 21, 1930, Section 4. PSA.

911 Arthur E. Nikander (1881–1953) finished his M.A. (in technology) at Helsinki Polytechnical Institute in 1910. During his studies he had been a trainee in the U.S.A. At the beginning of his career he worked at the municipal building inspection of the City of Helsinki 1910–1919, after which he established a construction company, which became one of the largest in Finland at the time. Arthur E. Nikander, one of the first builders with a solid background in technology in Finland, was an all-round businessman. His water pipe company Ab Radiator Oy, based in Helsinki, operated in other parts of the contry, including Turku. Construction companies, such as Ab Radiator Oy, bid also for cost calculations and site management in addition to planning and contracting. Hellsten 2011.

912 Bids were requested form five companies, out of which four had an office in Turku: Keskusosuusliike Hankkija, Ab Radiator Oy, Ab Vesijohtoliike Huber Oy, Vesijohtoliike Onninen Oy, and the Helsinki based Oy Johto. The bids were to be sent to the secretary of the Building Board Ilmo Kalkas by February 15, 1931, in a sealed envelope. Building Committee January 25, 1931, Section 1. PSA.

Fig. 3.6a. The biological wastewater treatment plant was built in 1932. Photo No. 50-003-518. AAM.

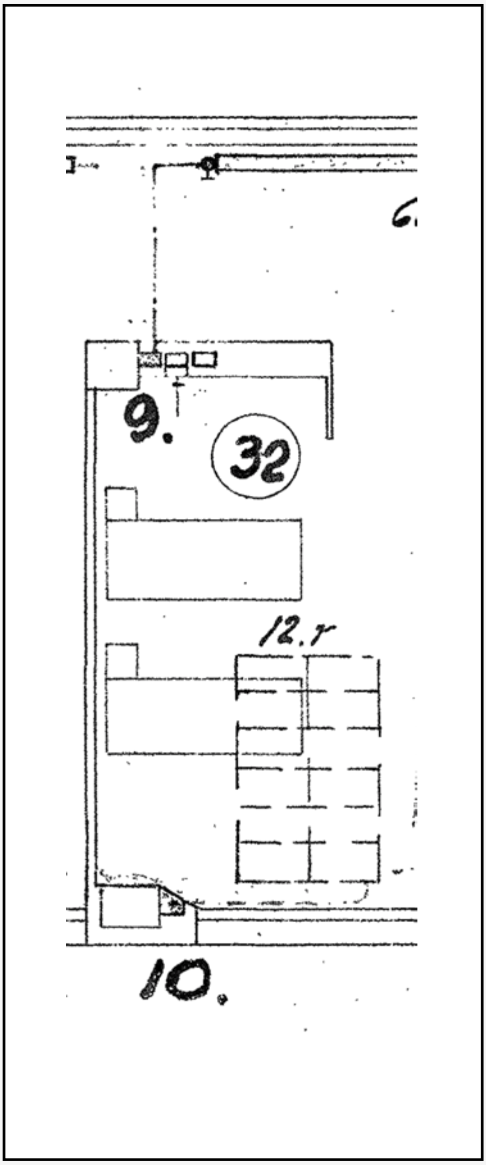

Fig. 3.6.1a. The image shows the hot-water radiators that were mounted on the ceiling, and the hot-water radiator in the corridor which was mounted on the wall without leaving a gap. The pipe routes are marked in the drawing. Detail of the drawing No. 102-7 of the contractor, Vesijohtoliike Onninen. PSA.

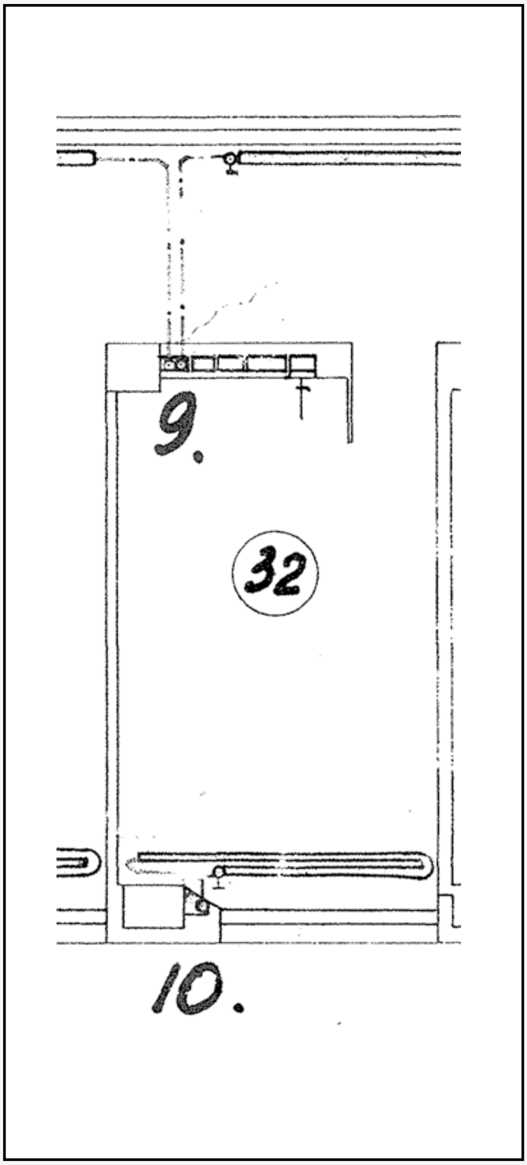

Fig. 3.6.1b. The picture shows the rapidly heating steam radiator pipes and the exhaust ventilation. The steam heating system was located under the fixed desk. Detail of the drawing No. 102-10 of the contractor, Vesijohtoliike Onninen. PSA.

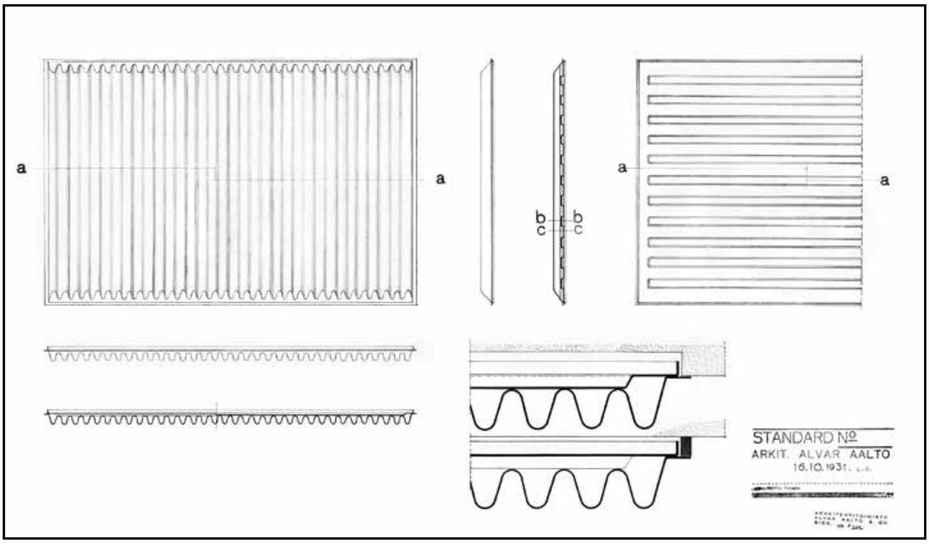

Fig. 3.6.1c. Aalto's standard drawing of a wall-mounted radiator. It would appear that the radiator design was never finished by the architect because he failed to attach to his team the contractor he had wanted to work with. Drawing No. 50-202. The drawing has been edited. AAM.

requested Voima- ja polttoainetaloudellinen yhdistys (The Energy and Fuel Economy Association) to evaluate the tenders, and as a result, Vesijohtoliike Onninen's (Plumbing Company Onninen) tender was evaluated as the lowest in price, although it required further information. Aalto and Raita were appointed to carry out the contract negotiations.[913]

While the contract negotiations were ongoing, the Building Committee initiated further investigations on radiator heaters.[914] It viewed the radiators[915] at Vesi ja Lämpö (Water and Heat) corporation's office in Helsinki and discussed the use of the new type of radiators with the Director General of the State Medical Board and Senior Medical Officer Edward Horelli, who took a positive view on the alternative.[916] The Building Committee proposed the use of radiator heaters in the patient rooms and dining hall to the Building Committee.[917] The matter was introduced by Aalto, who commended the radiators' smooth surface for being easy to clean. Aalto also pointed out that, owing to their radiation qualities, they created no draught or circulation of dust in the indoor air, as normal radiators would. Furthermore, the temperature of the patient room could be adjusted to a couple of degrees lower than with conventional radiators, as radiator heaters emit more heat into solid objects than the surrounding

913 Onninen had offered less equipment in its tender than had been the requirement, for which reason further negotiations had to be organised. Building Committee March 16, 1931, Section 1. PSA.

914 Building Committee March 16, 1931, Section 2. PSA.

915 Lämpö ja Voima Oy had contracted the water, sewage and heating pipes of the Pohja insurance company, completed in the same year. Their recessed, plain sheet radiators had been used under the window in the Pohja Insurance Building. Kallio 1930, p. 124.

916 Building Committee March 27, 1931, Section 1. PSA.

917 Building Committee March 27, 1931, Section 2. PSA.

air. According to Aalto, the radiator heaters where therefore an economic alternative for a tuberculosis sanatorium, where rooms were frequently aired. He also referred to the positive opinion of the State Medical Board. A long debate on the matter ensued[918], after which the Building Board decided to vote between two alternatives. According to the first proposal, three patient rooms on each floor would be installed with Rayard radiators in addition to conventional radiators. According to the second proposal, all patient rooms would be fitted with Rayard radiators and the contractor would set up a security note at the bank as a guarantee that the radiators would function as efficiently as conventional radiators and that the heating fuel costs would not be higher than with conventional radiators. As an additional condition for the second proposal, the Building Board required that the State Medical Board did not oppose the use of Rayard radiators. The latter proposal won by a narrow margin.[919] Aalto's objective in the contract negotiations was to engage the designer of the radiator concept to also win the contract. Using the ceiling-mounted radiator heaters was, after all, an idea that originated from Radiator. Aalto attempted to exclude other competitors by demanding that ceiling radiators be used. The tactic was not successful, as other plumbing companies were also relying on the same technology and were prepared to give the necessary guarantees. As a result of the round of negotiations, Vesijohtoliike Onninen's tender proved slightly less expensive than that of Radiator. The third tender was considerably more expensive than the other two.[920] Aalto was in favour of selecting Radiator as the contractor and suggested that contract negotiations be started with the company. Aalto's opinion was influenced by design collaboration with Radiator, during which questions and solutions relating to water, drainage and heating pipes had taken shape. Aalto had benefited from a number of new ideas from Radiator, which were particularly valuable for the designer. The Building Committee decided to give the contract to Vesijohtoliike Onninen, [921]

918 Mayor Ranta took a sceptical view on the radiator heaters on account of the quality of the sanatorium and the lack of user experience with the radiator type. He was supported by Saarinen, Thomander and Pyysalo. Ranta considered it possible, however, that the smaller number of Rayard radiators as mentioned in the work specification would be implemented. Farmer Rantasalo suggested that the discussion be continued with the companies supplying radiators to agree on lower prices and that radiator heaters could be introduced at least partially. Bank manager Saarinen suggested that the State Medical Board be asked for a statement on the matter. Master builder Thomander, in turn, opposed requesting such a statement, but said that one could be invited, should the State Medical Board be prepared to provide one. In his opinion, Rayard radiators could be tried with a small number of radiatiors. Farm owner Raita seconded inviting a statement from the State Medical Board, but was skeptical whether such a statement would be obtained. Aalto suggested that the decision depended on the recommendation of the State Medical Board hospital unit. Farmer Pilppula predicted the Building Board vote would result in a tie, so he suggested that if the notes of securities at the bank as discussed were obtained and the State Medical Board were in favour of the Rayard radiators, they should be used in the patient rooms but not in any other rooms. According to Mayor Ranta, the Building Board had to make a decision on the matter. He proposed that the decision be left on the table, if the Building Board was not prepared to make a decision on the matter. Master builder Thomander seconded this opinion. Farm owner Raita believed that the matter should be decided without further delay. Building Board April 1, 1931, Section 2. PSA.

919 The Building Board voted evenly five against four. Building Board April 1, 1931, Section 2. PSA.

920 The bid of Vesijohtoliike Onninen was finally FIM 3,111,000, the bid of Radiator FIM 3,150,000 and the bid of Keskusosuusliike Hankkija FIM 3,350,000. A sum FIM 15,000 was to be paid to Radiator for its design work, in case it was not selected. The sum had to be added to the bids of Onninen and Hankkija for comparison. PSA. Building Committee April 7, 1931, Section 1. PSA.

921 Medical adviser Sukkinen considered the bids of Radiator and Onninen equal, whereas the farmers Raita and Pilppula considered Onninen's bid better. PSA. Building Committee April 7, 1931, Section 1. PSA.

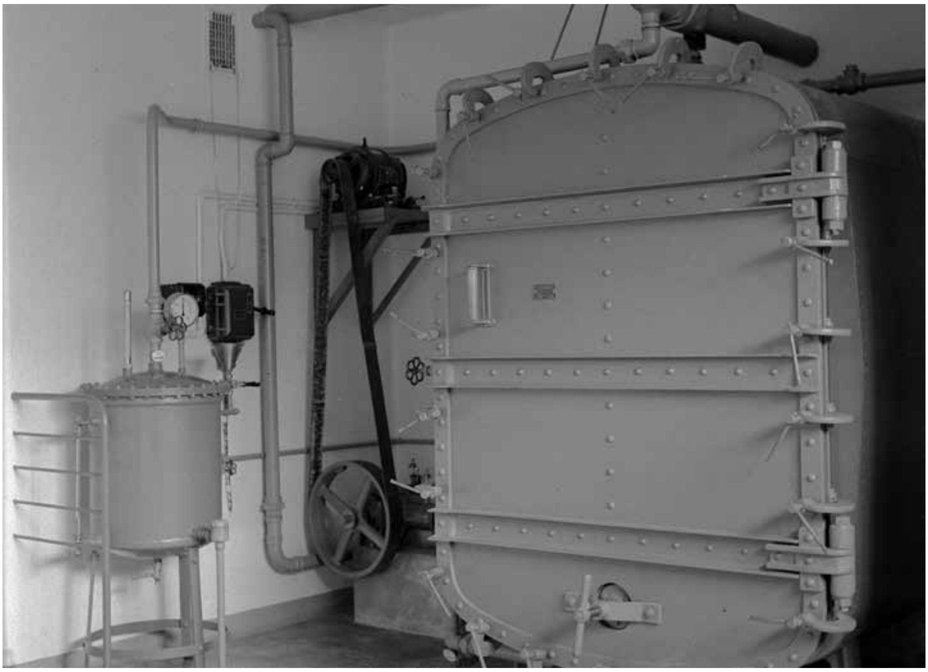

Fig. 3.6.1d. The disinfecting oven. Photo No. 50-003-407. AAM.

a decision on which Aalto left a dissenting opinion in the minutes.[922] Thus Aalto failed to form the collaborative team, a strong hybrid with an ability to act, he had aspired to. On the other hand he got a permission to use the ceiling radiators he, together with Raditior, had visioned. The handover inspection for the heating, water, hot water and steaming equipment was carried out in two stages in spring 1933.[923] The water piping contract supervision was conducted by the Voima- ja polttoainetaloudellinen yhdistys (Energy and Fuel Economy Association)[924], with Albin Hieta-aro as the supervisor.[925]

Although the State Medical Board granted permission to use radiator heaters in patient rooms, the responsibility for the feasibility of the system rested with the federation of municipalities, [926] who in turn transferred the duty to the contractor. At the

922 Building Committee April 1, 1931, Section 1. PSA; Building Committee April 7, 1931, Section 1. PSA.

923 The handover inspection was attended by technician and inspector Oksanen of the State Medical Board, foreman Hieta-aro and engineer Rindell representing the Building Board, engineer Onninen and foreman Pietilä representing Vesijohtoliike Onninen, Mr Kempe representing Pietarsaaren Konepaja Oy (Pietarsaari Machine Workshop) and engineer Väänänen representing Metalliteos Oy. In addition, engineers Rosenqvist and Witikainen from the Energy and Fuel Economy Association served as invited independent advisors. The report of the Energy and Fuel Economy Association on the handover inspection held on February 10–11, 1933, dated February 17, 1933. Documents related to the Paimio Sanatorium project. AAM; The report of the Energy and Fuel Economy Association on the handover inspection held on March 6–7, 1933, dated March 10, 1933. Documents related to the Paimio Sanatorium project. AAM.

924 Building Committee May 30, 1931, Section 1. PSA.

925 Building Committee May 23, 1931, Section 1. PSA.

926 When the Building Board asked the State Medical Board for permission to use Rayard radiator heaters in the patient rooms, the State Medical Board replied that if the new radiator system were prove unviable, it would need to be replaced and in that case the federation of municipalities would have to carry the cost without any state support. Record No. 1382. State Medical Board 1931 Ea:34. NA.

early stages of the work, Aalto familiarised himself more thoroughly on radiator heater markets, and learnt that the radiators could be obtained at a considerably lower price from another manufacturer in Sweden.[927] Aalto exchanged the Rayard radiators in the entrance lobby, the sundeck corridor, the dining hall and offices for Swedish-made panel radiators.[928] It was also decided to use panel radiators in ward corridors.[929] When discussing this alternative, the company Onninen pointed out that air should be able to flow freely on both sides of the panel, in other words, behind the panel as well. If the radiators were mounted onto walls, the back panel should be insulated, reducing the effective heat-emitting surface and creating a need for a larger number of radiators to be installed. However, the radiators were mounted onto walls without insulation.[930] In patient room ceilings, Rayard radiators were used. Their profile allowed for the connecting pipes to run within the structure.[931] In August 1931, Onninen approached Aalto to discuss the practicalities regarding the installation of radiators in B building, as Aalto had requested that the radiators be mounted further away from the wall, which required longer and thereby more expensive brackets.[932]

The installation of the three water traps of the patient room washbasins and spittoon within the wall between the room and the corridor proved problematic. In June 1931, the contractor reported to Aalto that installing three water traps in the riser was impossible owing to lack of space, and that they would be obliged to use one joint water trap for all three drains.[933] In December 1931, the contractor placed another offer on the alteration work on all drainage for patient rooms, which was required by the new installation method for the spittoons and washbasins.[934]

The wastewater treatment plant was not part of the main contract. In October 1930, the Building Board asked engineer R. Granqvist's opinion on whether an ordinary septic tank would suffice for the sanatorium's sewage system or whether additional equipment was necessary.[935] The Building Committee commissioned engineer Granqvist to design a biological treatment plant in March 1931, and the Building Board

927 On May 5, 1931, Aalto reported to the Building Committee having discovered that the Stockholm-based Luth & Roséns Elektriska Ab would be able to supply the radiator heaters for the sanatorium for FIM 130,000 less than the existing quote, for which reason the Building Committee requested a new offer from Vesijohtoliike Onninen. Building Committee May 5, 1931, Section 7. PSA.

928 Vesijohtoliike Onninen Oy, May 15, 1931. Contract No. 1. Documents related to the Paimio Sanatorium project. AAM.

929 Building Committee May 23, 1931, Section 2. PSA.

930 In the advertisement of the Luth & Rosén company it said that the radiators of the patient wing corridors were without a rear that needs to be cleaned, they were space saving and hygienic. Sukkinen, M. et al. eds. 1933, p. 53.

931 The radiators were ordered based on the National catalogue Nos. 21 and 23. Vesijohtoliike Onninen Oy, contract No. 4, July 9, 1931. Documents related to the Paimio Sanatorium project. AAM.

932 A letter from Vesijohtoliike Onninen to the Building Board, August 14, 1931. Documents related to the Paimio Sanatorium project. AAM.

933 A letter from Vesijohtoliike Onninen to the Building Board, August 26, 1931. Documents related to the Paimio Sanatorium project. AAM.

934 The work included the cutting and adjustments of 24 pipe lines so that the new interceptor trap of the spitting bowl could be installed by adding a T-pipe. The number of interceptor traps was increased by 162 and the amount of T-pipes by 173. The cost of the additional work was FIM 29,400. Vesijohtoliike Onninen's bid to the Building Board, December 14, 1931. Documents related to the Paimio Sanatorium project. AAM.

935 Building Committee October 25, 1930, Section 5. PSA.

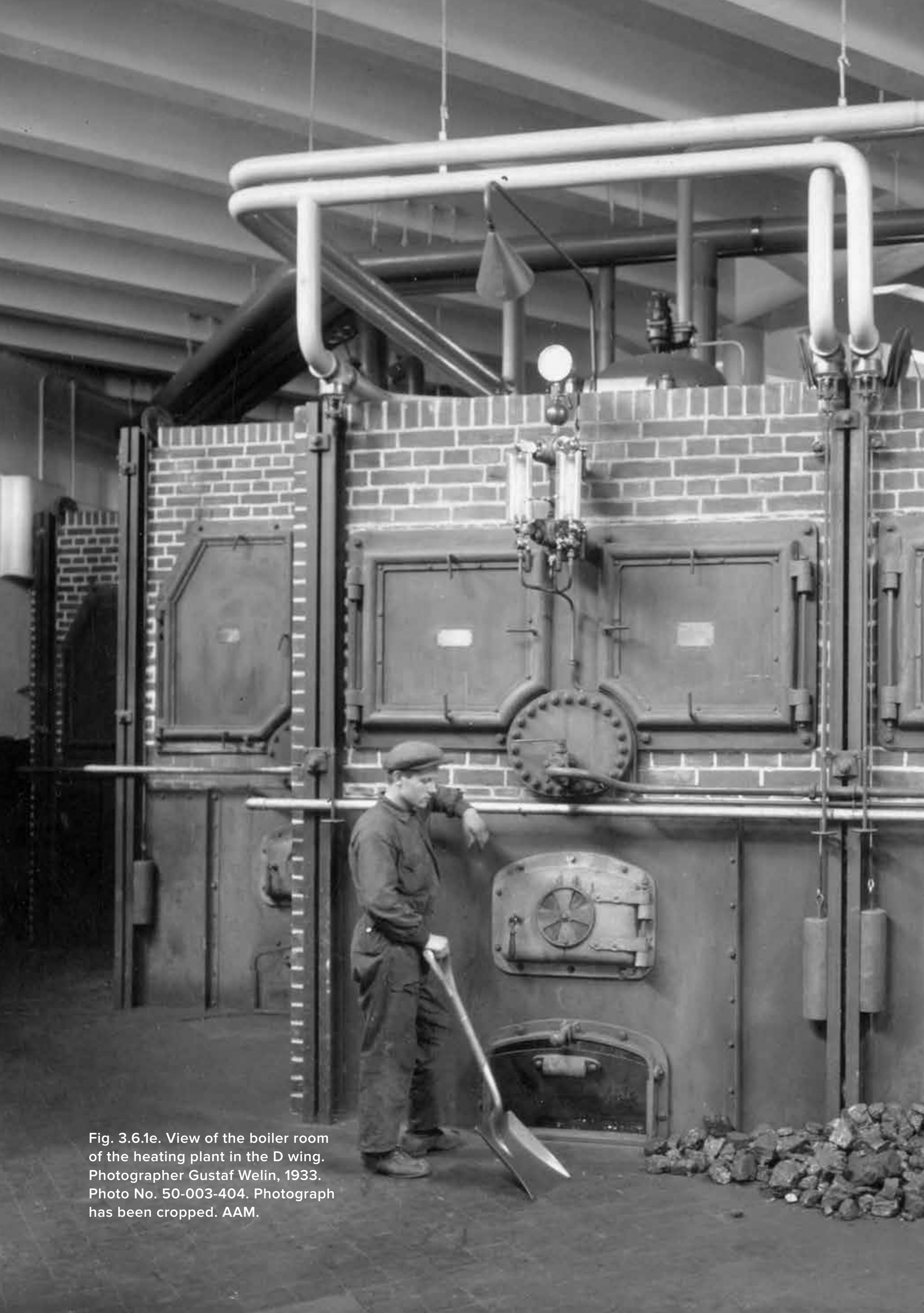

Fig. 3.6.1e. View of the boiler room of the heating plant in the D wing. Photographer Gustaf Welin, 1933. Photo No. 50-003-404. Photograph has been cropped. AAM.

subsequently decided to build one based on Granqvist's proposal.[936] Aalto was clearly unconvinced about the solution, as he asked as late as August 1931 for a statement from the Voima- ja polttoainetaloudellinen yhdistys (Energy and Fuel Economy Association) on the type of water treatment system that would best serve the sanatorium. Only this statement provided a clear analysis of the problem and its solution.

According to the statement, popular dual cesspits were outdated. They were only able to separate the majority of solid waste, but at the same time contaminated the water flowing through the tank, as decomposition processes always take place in the tank. Although the tanks had developed in previous years, they were only feasible for small quantities of water and there was not sufficient empirical evidence of their use. The City of Turku had septic tanks in use, in which only the waste water from lavatories was treated. Waste water from sinks, washbasins, bathrooms and laundry rooms was not treated and bypassed the treatment unit via a separate system. All buildings in Turku that had flushing lavatories had two separate wastewater systems: one for the lavatories and one for all other wastewater.[937]

Since the sanatorium's sewage water system and flushing lavatories were largely completed, with the waste water from lavatories and washbasins directed to the same system, introducing the septic tank system was difficult at this stage of a project. The treatment plant would have needed to be rescaled and it would have become very large and expensive to build. Voima- ja polttoainetaloudellinen yhdistys maintained in its report that both the cesspit and septic tank systems were unsuitable for Paimio Sanatorium. The only remaining option was the biological treatment plant, which was originally developed for treating large quantities of waste water, such as those from entire town districts and cities. Based on the positive experiences gained, the system had been used in hospitals, sanatoria and army barracks. It was further stated in the report that the water flowing through the biological treatment plant was adequately purified for release into an open ditch without adverse environmental impact, as had been the plan for Paimio Sanatorium. Moreover, the waste water from lavatories could be directed through the same pipes as other waste water, and the biological treatment plant would process all waste water. Voima- ja polttoainetaloudellinen yhdistys therefore recommended the use of a biological wastewater treatment system.[938] The selected supplier was Yleinen Insinööritoimisto Oy (General Engineering Office), which delivered the Danish-made biological treatment system including machinery, and carried out the installation.[939]

Since the project group had been unable to take into account the operating principles of and spatial requirements for wastewater treatment at a sufficiently early stage, the project group was left with no alternative solution. The expertise of the City of Turku waterworks did not benefit the decision-making on the wastewater system for Paimio Sanatorium, despite the fact that the City had been involved in the project with a one-third holding

936 Building Committee July 27, 1931, Section 1. PSA.

937 The letter and statement of the Voima- ja Polttoainetaloudellinen yhdistys, September 3, 1931. Documents related to the Paimio Sanatorium project. AAM.

938 Ibidem.

939 Building Committee October 24, 1932, Section 1. PSA.

Fig. 3.6.1f. View of the heating system controls. The incoming and outgoing heating pipes at the heating plant were different in colour. Photographer Gustaf Welin, 1933. Photo No. 50-003-411. AAM.

since 1930. The water pipe system, including the well, the pumps and water storage tank, had already been completed and the pipeline leading from the pump house to the main building laid before the main construction project began. The work had been carried out by Vesijohtoliike Onninen[940], which in other words was to continue work on the site.

The company Radiator drew up water, sewer and heating equipment specifications between August and October 1931. A separate ventilation design was not provided. The water, hot water and drain pipes for the sanatorium main building, the Junior Physicians' and the Administrative Director's building, the workers' apartment building as well as the garage formed a joint system, while the Medical Director's house had a separate system. Similarly, all other buildings apart from the Medical Director's house were heated by the heating plant located on hospital grounds, while the Medical Director's house had its own heating station. The work was to be carried out in compliance with regulations adopted by the City of Turku for similar projects, unless otherwise agreed.[941]

In terms of the installation work, the work specifications required that the water and drain pipes be placed within accessible shafts, or covered by a wall in a few places, or freely in front of a wall. As a rule, the specifications stated that the design and construction of the pipe system should aim at minimising noise.[942] Rain water was directed from the roof via a downpipe to the basement, where it flowed into the main sewer via water traps. Cold water pipes ran within the building. The building was equipped with fire hydrants. Film rooms were equipped with three automatic heat-sensitive sprinklers.[943]

The general heating system selected for the sanatorium was a central heating pump system.[944] The work specification drew special attention to reducing the noise of the two circulation pumps to a minimum. Steam heating was used as a secondary system for areas where heating was necessary even in the summer, when the main system was out of service. Steam was also required for water boilers and various machines and equipment, such as the mangle, soup kettles, washing machines, disinfection equipment and sterilisation stations. In August 1931, the Building Board decided to order furnace

940 Building Committee September 15, 1930, Section 1. PSA.

941 Specification of the water, sewage and heating systems, pp. 2 and 6. Specifications, cost calculations and contracts. PSA.

942 All joints in any piping placed within risers had to be accessible through service hatches. In rooms, mainly in buildings A and B, where all piping ran hidden and the walls had hard surfaces, each visible pipe section had to be chromed. Ibidem, pp. 2–3.

943 Ibidem, p. 4.

944 The central boiler station was fitted with two 2,000 litre boilers that could heat water to 70 degrees centigrade in one hour. Hotwater pipes were made of drawn copper pipe. The piping was equipped with supply and return pipes and electrical centrifugal pumps. Water circulation was optimised so that only one litre of cooled-down water at most needed to be run to obtain hot water, regardless of the outlet. To achieve even circulation, each riser and group was equipped with an electrical valve and each pipeline, including the main and supply and return pipes, were installed with a stop valve. The hot water pipes were insulated. The expansion U-bends were placed at 12 metre intervals at a maximum. Ibidem, pp. 5–6.

grates for the steam boilers that would allow the burning of wood as an alternative fuel.[945] The boiler room was located in a separate building.[946]

Two centrifugal pumps were used in the heating pipes to generate circulation, both alone sufficient for the entire institution. They were to be noiseless and they were placed in a separate room.[947]

As per the plan, 1,750 square metres of water and 29 square metres of steam radiators, 631 square meters of water and 24 square metres of steam radiators, and 274 square metres of water and 22 square metres of steam radiators were installed in the sanatorium building, the central building and the service building, respectively.[948]

945 Building Committee August 21, 1931, Section 4. PSA.

946 The boilers were cast-iron boilers enclosed in brickwork. Each had 100 square metres of heating surface. In addition, the boiler room housed two steam boilers, with six atmospheres of operating pressure and 50 square metres of heating surface each. The steam distributor and the pressure relief valve were housed in the boiler centre. The centre also housed a steam water tank. Specifications of the water, sewage and heating systems, p. 7. Specifications, cost calculations and contracts. PSA.

947 The pumps were equipped with stop valves and their joint inlet and pressure tube with thermo metres and pressure gauges. The pumps were powered by directly coupled electric motors. In case of potential power failures, one centrifugal pump was directly coupled with a combustion engine, with capacity for similar quantity of water as the electrical pumps. The pumps were housed in a pump room, where a marble control panel was also located. The control panel included thermometres showing water temperature in supply and return pipes, the electric for the resistors for the electric motors, switches, a recording ammeter and fuses as well as pressure gauges for the different pipes. The plant was divided into groups with stop valves, with one main group for each building. Each vertical pipeline was equipped with a stop valve and drain cock. The expansion pipes were based on a double-tube system. The expansion-tank was placed at the highest possible point in the attic in a heat-insulated shelter, which prevented the water in the tank from freezing. The pipe system was bled through the bleed valve in the radiators. Ibidem, pp. 7–9.

948 Each patient room in the south wing of A building was installed with Rayard radiator heaters in the ceiling, together with the necessary insulation. The dining hall and certain places in the offices were also designed to have Rayard radiators. The entrance lobby would be installed with steel panel radiators, Simplex models under the windows and additionally Värtsilä's steel panel radiators on the wall. The corridors would be fitted with Simplex radiators and the staircases with Värtsilä steel panel radiators. The lavatories and bathrooms would be heated with four-inch radiator pipes running from the ceiling to the floor. The sundeck corridor would be fitted with Simplex radiators as well as steam radiators on the opposite wall for drying out clothes warn on the sundeck. For the same purpose similar steam radiators would be installed at the end of the corridor on each floor. Steam radiators would also be installed in the ground-floor bathroom for summertime heating and the washroom on the same floor, to dry out urine bottles. In the B wing, the most common type were Värtsilä's steel panel radiators, while the sauna was fitted with cast-iron "Siro" radiators and the operating theatre with Hospital radiators underneath the windows as well as steam radiators on the interior wall, which also served as summertime heaters. The dining hall and workshop were fitted with Rayard radiators on the ceiling. The lounge was fitted with low cast-iron radiators underneath the windows. The dining hall was fitted with additional steam radiators in between windows to heat the air, as the cavity between the windows was designed for plants. In the C wing, the most common type was Simplex radiator, while the laundry was fitted with cast-iron Siro radiators. Ibidem, pp. 9–11.

The heating requirements of the rooms were calculated based on design specifications, with certain exceptions. When the outdoor temperature reached -30°C, the required room temperature varied between +10°C and +40°C. Ventilation was adjusted according to design specifications and it was required to work at full capacity when the outdoor temperature was between -10°C and +5°C.

BUILDING	ROOM	TEMPERATURE
A	patient rooms, ward nurses' rooms, entrance lobby, corridors and lavatories	+ 20°C
A	disinfecting facilities, storage rooms and sundeck corridor	+ 10°C
A	bathrooms	+25°C
B	operating theatres and phototherapy rooms	+30°C
B	bathing facilities, radiology and dressing rooms	+24°C
B	transformer room and basement storage	+ 10°C
B	in other rooms	+20°C
C	cellar and bakery	+10°C
C	dough proofing room	+40°C
C	kitchen, mangling room and laundry room	+15°C
C	bathrooms	+25°C
C	other rooms	+18°C

Table 3.6.1a. The required room temperatures when the outdoor temperature reached -30 °C. Specifications of the water, sewage and heating systems. PSA.

Despite the fact that the indoor temperatures and ventilation rates were designed separately for each room by type of space, it is not clear from the specifications how these design values were to be reached. For example, the architectural and structural designs did not take into account the heat insulation capacity of the structures. The design values for indoor temperature and ventilation were not dealt with in the designs in any systematic manner by analysing the combined impact of the systems and spatial entities.

Aalto was also interested in developing a panel radiator model. He contacted Ab Wärtsilä Oy, a shipyard and a mechanical workshop in Helsinki, in June 1931 and suggested a completely new panel radiator model. The company showed interest and were keen to know when Aalto would be able to deliver a proposal.[949] The architectural drawings include design of a wall-mounted panel radiator, stamped as a standard, showing a recessed version and one mounted on top of the wall surface.[950] In November 1931, Aalto received a letter from Willy Malmström company from Denmark, representing a company named Brøderne Dahl (Brothers Dahl), which supplied the wall-mounted panel radiators and the Rayard radiators for the sanatorium. The letter was enclosed with English-language illustrated materials on the operating principle of Rayard radiators.[951] The idea of using radiator heaters in Paimio Sanatorium emerged at a time when Radiator was drawing up the water, sewage and heating piping specifications in collaboration with Aalto. In the patient room diagrams dated prior to this, ceiling-mounted radiators did not appear.

The natural ventilation system was possibly paired with a mechanical exhaust system. Strikingly, no separate ventilation plan was designed, and it was dealt with in the specifications in conjunction with the heating system.

BUILDING	ROOM	AIR CHANGE RATE / h
A	patient rooms	50 m^3 per patient
A	bathrooms, washrooms and disinfection rooms	3 x volume of the room
A	toilet facilities	5 x volume of the room
B	dining hall, lounge and sewing room	2 x volume of the room
C	kitchen	15 x volume of the room
C	laundry	8 x volume of the room
C	laundry mangle and dish-washing room	5 x volume of the room
	other rooms	1 x volume of the room

Table 3.6.1b. The air change rate calibration. Specifications of the water, sewage and heating systems. PSA.

949 Wärtsilä's letter, signed by Wilhelm Wahlfors, to Alvar Aalto, June 27, 1931. Documents related to the Paimio Sanatorium project. AAM.
950 Drawing No. 50–202, which is dated October 16, 1931. AAM.
951 The letter of Brøderne Dahl signed by Willy Malmström to Alvar Aalto, November 14, 1931. Documents related to the Paimio Sanatorium project. AAM.

3.6.2 OWN POWER PLANT OR ELECTRICITY FROM A LOCAL PROVIDER?

Finnish domestic electricity production increased seven-fold between 1920 and 1938, which was the fastest rate after the Soviet Union in interwar Europe. Although by 1936 Finland had surpassed such industrialised countries as France, Germany and the UK in electricity production, the share of private consumption remained relatively low, as the electrification rate of private households was slow. The institutions served as models for households and housing architecture.The electrification in the country centred around Southern Finland.[952]

The Building Committee asked Aatto Edwin Suopanki[953], the operation engineer of Koskivoima corporation's Turku substation, as an expert to evaluate the tenders placed on the electricity installations. [954] Following the contract negotiations in June 1931, Keskusosuusliike Hankkija (Central Co-operative Hankkija) was selected as the contractor, although its price quotation had not been the lowest.[955] Suopanki was appointed the supervisor of the electrical installations.[956]

The Building Committee embarked simultaneously on negotiations with the power company Lounais-Suomen Sähkö (Southwestern Finland Electricity) on supplying electricity for the sanatorium.[957] The Building Committee had decided that the electricity supplied to the sanatorium would be measured by high-voltage transmission. It attempted to negotiate a lower tariff from the electricity supplier and although it managed to agree a lower electricity rate for the duration of construction,[958] agreement on the tariff was not reached. Next, the Committee considered whether establishing a separate own power plant for the sanatorium would be a more cost-effective solution than purchasing electricity from an external provider. Suopanki explained to the Building Board the problem of meeting the power and electricity needs of the sanatorium and presented the letters received from Keskusosuusliike Hankkija and Lounais-Suomen Sähkö.[959]

952 Myllyntaus 1991, pp. 79-98.

953 Aatto Edvin Suopanki was born in Kemi in 1900 and graduated as an engineer from the Finnish Industrial School department of electrical engineering in 1924. Prior to the sanatorium project, he had made a study trip to Sweden, and during the project also paid a visit to England and Scotland in 1932. He began his career in the sawmill industry and from 1926 onwards worked as an inspection engineer, engineer and foreman on a number of sites for the state-owned Koskivoima corporation. In 1929 he became the operating engineer for the Turku substation, where he served until 1933. Suopanki lectured in electrical engineering at Turku Industrial School in the early 1930s. Talvitie 1936, p. 270.

954 Building Committee May 30, 1931, Section 5. PSA.

955 Building Committee June 12, 1931, Section 1. PSA.

956 Building Committee July 4, 1931, Section 2. PSA.

957 Building Committee May 30, 1931, Section 5. PSA.

958 Lounais-Suomen Sähkö made an offer for a power and lighting tariff of FIM 600/kWh based on the average of four highest peak periods of 30 minutes added with the consumption charge FIM 0.50/kWh measured on the high-voltage side of the transformer. The Committee attempted to negotiate the consumption charge to FIM 0.45/kWh but the power company representative claimed not to have authority to decide on the matter. The Building Board suggested that electricity, lighting and power during construction work would be reduced close to FIM 1.00, to which the representative did agree. Building Committee September 29, 1931, Section 1. PSA.

959 Building Board October 17, 1931, Section 9. PSA.

Fig. 3.6.2a. View of the transmission room. Photo No. 50-003-405. AAM.

Hankkija's report stated that establishing a separate power plant for the sanatorium would require the acquisition of larger boilers and if the sanatorium relied completely on its own power station with no reserve capacity purchased from outside, two boilers and generators would be necessary. Hankkija did not discuss the profitability of a separate power plant to any degree, as there was not enough information to back up such calculations.[960] At this stage, Lounais-Suomen Sähkö reduced its offer to the level suggested by the Building Board[961], and the Building Board accepted the tariffs.[962] An agreement was reached at the end of 1931.[963] The sanatorium substation and part of the network were powered on in January 1933.[964] Aalto did not actively participate in the discussion on the electricity contract or the method of electricity production.

Established in 1912, Lounais-Suomen Sähkö was a leading operator in the region, but its competitive situation changed radically in 1929, when a State-owned power station was completed in Koroinen and the company lost its biggest client, the City of Turku. Many customers asked the company in 1930 to scrap its basic charge and

960 The letter of Keskusosuusliike Hankkija to engineer Kilpi, October 16, 1931. Attachment A. Building Board October 17, 1931, Section 9. PSA.

961 In case of a long term contract, the electric company would insist on having a paragraph that would allow it to take into account the currency fluctuation. Attachment B. Lounais-Suomen Sähkö's letter to the Building Board, dated October 17, 1931. Building Board October 17, 1931, Section 9. PSA.

962 Building Board October 17, 1931, Section 9. PSA.

963 Building Committee December 23, 1931, Section 1. PSA.

964 Building Committee January 1, 1933, Section 1. PSA.

to reduce its consumption-based rates on the grounds of the difficult economic situation.[965] It would appear that Suopanki, the supervisor of the electrical installation at Paimio Sanatorium, who worked for a competing company, was well aware of the plight that Lounais-Suomen Sähkö had found itself in and could use the situation to the advantage of the sanatorium.

Unlike the other installations in the hospital, the electricity contractors drew up electrical drawings as part of the tender, based on the acquisition plan.[966] The plan drawings presented building-specific light fittings, sockets and risers. The acquisition plan included some 40 motors, 1,586 light fittings and 650 sockets in the different buildings. Since the ventilation plan had not yet been completed, the necessary mechanical exhausts were excluded from the plan.[967]

A substation was built for the sanatorium where the high-voltage three phase current was reduced to low-voltage 320/220V current.[968] Lighting and power lines were arranged on the low-voltage side into separate networks. Underground cables to buildings A, B, C and the boiler room arrived at the distribution centres housed in the basement, which were connected to lighting and power lines in the basement and the risers. Each floor had its own distribution panels connected with final branches so that the light bulbs on one side were divided between at least a couple of risers, which originated in two different supply cables in the basement. To serve the patient rooms, 25 channels were reserved for the light fitting risers. Each patient room had two sockets, one wall lamp, one double wall lamp and two rotation switches. By each patient room, in a shaft accessible from the corridor, a distribution panel was installed.[969]

The light fittings were purchased by the developer, except for the outdoor lights, which were included in the acquisition programme. The main entrance road to the hospital was lined with 19 lamp posts, with eight all-night and 11 half-night street lights. According to the acquisition programme, the street lights were mounted on conventional timber posts.[970] The lights were, however manufactured according to the architect's design and they had a stem made of metal tube and concrete.[971]

The loss of current in the lighting cables between the substation control panel and any given light fitting was not allowed to exceed five percent. The permitted loss of current in the underground supply cables was only half of this. These were requirements that the contractor was to observe when measuring the cables. Since the hospital was located on a remote site and the electricity supply depended on a five-kilometre long high-voltage

965 Haikala 1987, pp. 18–20.

966 The acquisition plan was probably devised by Suopanki. The acquisition programme for the power current installation work at the Tuberculosis Sanatorium of Southwest Finland. Documents related to the Paimio Sanatorium project. AAM.

967 Ibidem, pp. 1–4.

968 Ibidem, pp. 4–5.

969 Ibidem, passim.

970 Ibidem, p. 12.

971 Drawings Nos. 50-299 and 50-356. AAM.

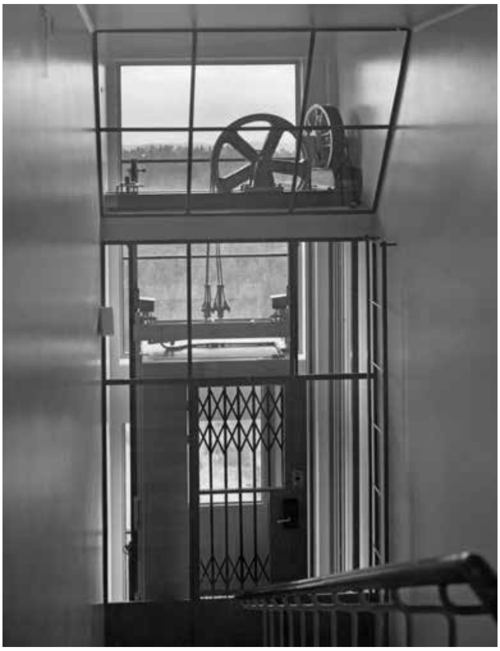

Fig. 3.6.2b. The lift shaft enclosed by glass walls at the other end of A wing. Photo No. 50-003-505. AAM.

line, the question of reserve capacity was crucial. The reserve capacity was designed for the lighting and power supply and the sanatorium was installed with an auxiliary generator.[972]

The sanatorium was equipped with a number of devices required in treatment and administration. These purchases were to be approved by the State Medical Board. The Building Board authorised Heikkilä, Pilppula, Aalto and Sukkinen to negotiate with the officials and the complete the purchases of devices and machinery.[973]

Aalto had already studied the internal communications in the sanatorium at the competition stage. In a block hospital, lifts were crucial. Different users had their designated lifts: the large lifts were for patients and for hospital bed transfers, all sputum was carried in a separate lift, while goods were delivered in their own lift and the staff used the staff lift. There was also another lift for catering and personnel. The work specifications refer only briefly to the lifts: they were to be manufactured by Kone or Schindler and all lift shafts were to be made of glass and steel.[974] The lifts formed a separate purchasing item.[975] The Building Committee ordered the lifts from Turun Insinööritoimisto Oy (Turku Engineering Office), who made them under Schindler Lift licence.[976] Its offer

972 Ibidem, pp. 12–13.
973 Building Board October 17, 1931, Section 2. PSA.
974 Aalto (1930)a, p. 23.
975 An agenda, which is attached to the minutes. Building Board March 15, 1930, Section 9. PSA.
976 An advertisement of Turun Insinööritoimisto Oy. Sukkinen, M. et al. eds., 1933, p. 57.

was the lowest.[977] The competitor, Kone Oy, Finnish elevator company, took exception to the decision to order the lifts from abroad and appealed to the Building Board: "We suspect that no other Finnish company – since only two machinery types are applicable judging by the high model costs – is able to deliver similar large lift machinery at a price lower than ours."[978] Kone also emphasised the obligation of the sanatorium project management to favour local and national suppliers, to no avail.

The architect's office designed versions of the lift cages, lift doors and one motor room.[979] In a letter from Aalto's office to the lift cage manufacturer, it is stated that the cage walls were to be smooth and no frame and mirror structure was to be used. The walls were to be clad with a protective nickel panel up to the height of 30 centimetres. The catering lift was equipped with sliding shelves, with the depth half that of the lift, so that there was room for one person to stand in the lift.[980] However, the architects made a new proposal on the combined catering and personnel lift, with an integrated catering cabinet in a three-person lift. The doors of the cabinet could be opened downwards to serve as a worktop, as illustrated by the drawing sent by the architect to the manufacturer.[981] The letter was probably attached with a drawing showing a lift cage with a catering cabinet placed at a suitable height.[982] The two lift cages of A lift were the most impressive. The inner corners were rounded, the sidewalls had mirrors and, above the mirrors, a backlit translucent glass. The lift floor coverings were made of rubber. The drawing was created by "H.H."[983] The main lifts were sized to fit a hospital bed.

The lift contract was carried out presumably without major problems, except towards the end. The electricity contractor had not scaled sufficient risers for the large motor rooms, which reduced the power of the lifts by 15–17 percent. As a result, Turun Insinööritoimisto waived all responsibility for any loss of current.[984] In April 1933, the main lifts in staircase A broke down and could not be used during repair.[985]

The low current devices in the sanatorium, including a signalling system, a telephone system, paging system and radio, were covered by a separate acquisition plan.[986]

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977 The final price came to FIM 441,700. According to the terms of payment, FIM 100,000 would be paid upon signing the contract, another FIM 100,000 in the following February, if the work was half-way through and the rest upon the completion and sign-off of the work. Building Committee May 30, 1931, Section 2. PSA.

978 A letter from Kone to the Building Board, June 9, 1931. PSA.

979 Drawing No. 50-337 shows six lifts: two lifts for 15 persons in staircase A, a goods lift, a sputum lift, a catering and personnel lift for three persons, and a lift for three persons in staircase B. The drawings are made by Erling Bjertnæs and are dated October 28, 1930. Drawing No. 50-348 was a lift cage drawing made by Lars Wiklund dated January 20, 1931, showing six cages. AAM.

980 A copy of the letter from Aalto to the manufacturer of the cabins of the elevators to Turun Insinööritoimisto, April 1, 1931. Documents related to the Paimio Sanatorium project. AAM.

981 A copy of the letter from Aalto to the manufacturer of the cabins of the elevators to Turun Insinööritoimisto, May 27, 1931. Documents related to the Paimio Sanatorium project. AAM.

982 Drawing No. 50-747. AAM

983 Drawing No. 50-355. AAM.

984 A letter from Turun Insinööritoimisto to Alvar Aalto, February 11, 1933. Documents related to the Paimio Sanatorium project. AAM.

985 Building Board April 9, 1933, Section 2. PSA.

986 Acquisition plan for low current devices and equipment. Documents related to the Paimio Sanatorium project. AAM.

It was drawn up by the Insinööritoimisto Limo engineers[987], who also supplied the light signalling and paging systems.[988] All patient rooms, lavatories and sundeck doors were equipped with signalling equipment. Each patient bed was equipped with a call button. The call buttons in bathrooms were equipped with a chain or a string. The lavatories and sundecks had call buttons embedded in the wall. The patient could call a nurse by pushing a call button, which lit up lights above the door to the room, in the nurse's room and in a designated spot in the corridor. The nurse's room would also sound a buzzer, which had to be manually turned off.[989]

All telephones in the sanatorium could be used for external calls. The incoming phone calls were received at the switchboard. The switchboard and automatic switchboard were built for 100 numbers on three incoming phone lines. The incoming lines were equipped with a call diverter to transfer calls at night time to certain numbers.[990]

Personnel pagers were used to reach certain staff members within the hospital, in case they could not be reached by telephone. The switchboard had three numbers reserved as emergency numbers. When the switchboard attendant noticed that a particular person was not available in his or her room, she would select the emergency number for that person, and a designated lamp would light up in the corridors and rooms where the person was most likely to be available. After this, the paged person would dial a certain number on the nearest telephone and would be automatically put through to the external line, where the call was waiting. For the Head Nurse, each room was also equipped with a socket, to which she could insert a small portable buzzer to alert of any incoming calls.[991]

The sanatorium also had a central clock system. Each patient in A building had a bedside radio with an ear-piece. Four rooms were equipped with electromagnetic loudspeakers. The radio receiver included a three or four-tube receiver and a connected output amplifier that had to be compatible with the ear-piece, electromagnetic speaker or electrodynamic speaker in larger spaces. Each radio and output amplifier also had to be compatible with a record player or microphone. The main building was also fitted with an emergency lighting system, which would switch on automatically if the general overhead lighting were to break down.[992]

The architect designed the phone booth for patient use. He placed the clock on the façade in the recessed roof terrace, where it was hardly visible. The placing of the clock appeared half-hearted and not well considered. The architect showed no interest in the electronic signalling equipment or other low current devices.

987 A letter from Insinööritoimisto Limo to Alvar Aalto, January 7, 1931. Documents related to the Paimio Sanatorium project. AAM.
988 Building Committee June 12, 1931, Section 2. PSA.
989 Acquisition plan for low current devices and equipment. Documents related to the Paimio Sanatorium project. AAM.
990 Ibidem.
991 Ibidem.
992 Ibidem.

3.6.3 DISTRICT INFRASTRUCTURE WAS A MAJOR ARCHITECTURAL CHALLENGE

The building design and construction preceded a number of fundamental decisions made on district systems, including sewage and electricity. When the time to make these decisions came, real alternatives did not exist. The requirements of district systems were not observed in the early stages of the building project regardless of the background organisations of the Building Board, including the Turku city officials, who had a wealth of technological expertise. Neither the principal designer nor any other stakeholder ever demanded that the installation systems be designed concurrently with architectural design.

From the perspective of today's building design, it appears unfathomable that the water, sewage and heating systems as well as the electrical installations were designed only after the architectural design was complete. The knowledge and skills of different specialists were not at the disposal of the architect until the construction had progressed to execution. The architect was assumed to be able to take the requirements of installation technologies without interacting with specialists in the respective fields at a time when heating, water and sewage technologies were still novelties in large, modern institutions. The confidence in the architect's competence was unwavering.

The work on water, sewage and heating systems was delayed by one year from the initial schedule. This was because the Building Board had initially requested offers without a reference plan. As a result of the first contracting round, it firstly commissioned a plan on the basis of which the second round of tendering could be held. The one-year delay in the water, sewage and heating system contract had a direct impact on the overall schedule of the project. Collaboration between the architect and Radiator, who designed the water, sewage and heating systems was fruitful and productive. However, the contract itself was given to another company, Vesijohtoliike Onninen (Plumbing Company Onninen), which had been carrying out a smaller contract on the site and was therefore familiar with the developer. Cooperation between Aalto and Onninen was not without its difficulties, and resulted in excess billing in relation to many details, for example, the water traps of the washbasins and spittoons in patient rooms. In June 1931, the contractor notified Aalto that the water traps must be joined, as there was not enough space in the wall cavity for them. In December of the same year, it transpired that the installation method of the spittoons and washbasins would have to be altered again, so that the spittoons would have a separate water trap, which incurred additional costs.

Aalto actively attempted to influence the choice of contractors on many occasions. He succeeded in engaging a contractor for the construction of the concrete frame with a quotation that was only fifth cheapest. When aiming to exert his influence in the selection of the water, sewage and heating system contractor so that the contract would have been awarded to Radiator, he chose a wrong tactic. Aalto emphasised the importance of Rayard radiators, which contrary to his expectation did not deter other candidates. Thus Aalto failed to form the collaborative team he had planned, he lost the trial. It is apparent that the relations between Aalto and Radiator deteriorated as a result of the decision, based of the tone of correspondence regarding billing. Aalto had probably specifically contacted the owner and director of Radiator, Arthur E. Nikander, who had contributed to the design by expending his know-how and had trusted in the gentleman's agreement with Aalto regarding the contract.

Aalto and a major Finnish plumbing company Huber had probably clashed in the course of their earlier collaboration, the innovative installation systems at Turun Sanomat Newspaper Building, as Huber elected not to submit a tender in either contracting rounds. Huber would have been able to provide Aalto with the necessary expertise as early as 1930.

Another unusual detail is that no ventilation design was made at any stage, and it simply emerged as part of the heating plan. The building was initially to be installed with a central vacuum system, but this was never designed or realised. Aalto requested quotations on low current devices but he had no interest as a designer in these systems. In terms of electricity, his interest was limited to the light fittings as functional design objects.

In the early 1930s, the depression and unemployment rates reached unprecedented levels. The developer of the sanatorium was a federation of municipalities and since local authorities were responsible for the livelihoods of the poor, the federation did its utmost to favour the local workforce and local manufacturers. The next best option was a Finnish-made product and only then an imported product. This principle marked all contracting and purchasing processes. The only exception to favouring domestic production were the lifts. Here, the Finnish manufacturer quoted a much higher price than a foreign supplier of a product that was made under licence in Finland.

With regard to Paimio Sanatorium's district systems, it is questionable whether Aalto can be attributed with the role of an innovator. He invited no tenders for the systems, and tenders were to be addressed directly to the secretary of the Building Board. Aalto was not capable of steering the development of heating, water and sewage systems to the degree that he would have liked, at least in terms of selecting contractors. By then, he may have exhausted his social capital in connection with the contracting negotiations for the reinforced concrete frame. When in Aalto's opinion the "wrong" water, sewage and heating piping contractor was selected, the architect seems to have lost interest in developing this area any further. Even the electrical installations, such as high and low-voltage systems, which were abstract in nature and which saw a rapid improvement in the early 1900s, were not of special interest to him. The only exceptions to this are the light fittings and lifts. Although Aalto wrote in his 1932 article "Bostadsfrågans geografi" (The Geography of the Housing Problem) about the division of Europe into the town and the country, he had not really grasped the character and potential of district systems. Perhaps he had not personally seen any real examples of architectural treatment of infrastructural systems. Perhaps it was this lack of vision that led him to abandon the role of an innovator in this instance. For example, in Paris, Le Corbusier had shown great creativity in designing an electronically operated wall for the Beistegui apartment's roof garden[993] and was proselytising for mechanical ventilation systems that operated on electrical motors. No viable hybrids in the area of heating, water, sewage or electrical systems emerged in the Paimio Sanatorium project. Collaboration with Radiator, which had started auspiciously, was discontinued and the building project lost one of its innovators. We shall never know what subsequent generations missed, as some potential collaborations or Latourian hybrids could not develop. It is not possible to know beforehand what technological processes might have produced, any more than we know what kind of a process has preceded a completed building.[994]

993 Colomina 1998 [1994], pp. 301–306.
994 Latour and Yaneva 2008, pp. 80–89.

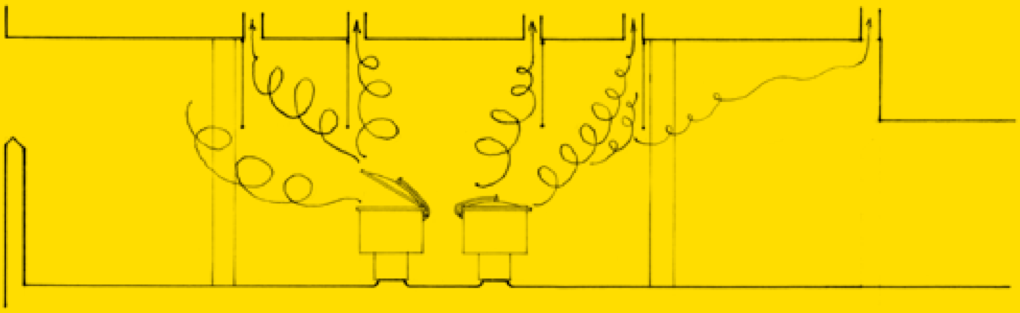

Fig. 4a By showcasing the Paimio Sanatorium kitchen through photographs and diagrams of its ventilation systems, Aalto created an impression of being a pioneer in institutional kitchens. Drawing No. 50-404, the drawing has been edited. AAM.

1 2 3 4

Conclusions

This study discussed the relationship between architecture and technology at Paimio Sanatorium. My key research questions were 'How did Aalto manage to reconcile international ideology and local building culture in a country where the degree of industrialisation in the building sector was relatively low?', 'How did architectural Modernism appear in the technological solutions of Paimio Sanatorium?', and, further, 'Could new technological systems be seen as part of the tectonics of Paimio Sanatorium?'

The systems for heating, ventilation, sewage and electrical installations developed rapidly in the early decades of the 20th century and the demand to implement them into the overall architectural design became paramount. Who were those in this specific project who knew how to implement these new systems and what were the critical points to consider in developing solutions? Were the systems ready to be used as such, or did they need further development? If so, did Alvar Aalto or the other project stakeholders or actants contribute to their development? An additional objective of my research was to find out which of the systems the architect overlooked as uninteresting, and to examine what the reasons were for the architect to approach different systems from a different architectural angle.

In Chapter 2, I have discussed Aalto's influences and professional networks during the construction of Paimio Sanatorium, based both on empirical evidence, such as CIAM's conference publications and Aalto's own articles in different publications as well as on prior research. I brought to the fore Aalto's professional goals so that his point of departure as the innovator in the Paimio Sanatorium project would be more transparent. In Chapter 3, I have applied an anthropological method and been guided by my empirical material to discuss the critical questions related to the technological solutions and the different stages of their evolution in the building of Paimio Sanatorium. In this present, fourth, Chapter, my aim is to mobilise the key concepts of the actor-network theory, such as actant, hybrid, innovator, trial and translation, in relation to empirical analysis. I have also used this line of discussion to some degree at the end of the previous subchapters from 3.3 to 3.6.

4.1 AALTO'S CONCEPT OF TECHNOLOGY

The general assumption underpinning the present research was that the architect's theory, his thinking, directs his actions. Aalto's letters and literary output were investigated to arrive at an understanding of what his concept of technology was during the construction process of Paimio Sanatorium. His intellectual influences were traced back to CIAM, because Aalto's joining the organisation coincided with the initial stages of the Paimio Sanatorium project. I argued that the ideas of CIAM's central ideologists, Walter Gropius and Le Corbusier, inspired Aalto in his own thinking. I further stated that Aalto drew influences from their culturally radical Modernistic discourse and applied these ideas to his work. The research question led the author also to analyse how the main ideologists of CIAM discussed technological themes in their own texts and how Aalto reflected these ideas in his own writings between 1928 and 1933. Aalto's texts were read in juxtaposition with the international discourse. CIAM's members were expected to actively promote the new movement in their respective local spheres, a task that Aalto undertook vigorously by penning articles, participating in exhibitions, and designing buildings.

I arrived at the conclusion that particularly Die Wohnung für das Existenzminimum conference, held in Frankfurt am Main in October 1929, was a decisive source of inspiration for Aalto. That was the first time he entered into personal dialogue with his major European peers at a serious professional forum. Although the papers written for CIAM conferences by its two leading ideologists, Le Corbusier and Walter Gropius, were focused in this research, it is noteworthy that neither of these authors were present at the event in 1929, which Aalto attended. Pierre Jeanneret and Sigfried Giedion delivered the papers on their behalf, which probably only added to their aura of authority. Le Corbusier's challenging ideas about observing the biological needs of human beings, a new architectural attitude, the necessity of a thoroughgoing methodology when realising minimum apartments and breaking down problems into parts, were adopted by Aalto. These priorities were clearly expressed, for example, in Aalto's article in *Domus* magazine, in which Aalto introduced the discourse on the minimum apartment undertaken within CIAM to his Finnish peers, and also in his critique on the Stockholm Exhibition. Walter Gropius, in turn, appealed to Aalto's sense of social responsibility and imagination. With the cool detachment of a scientist Gropius stated, that the structural change in society was more profound than the housing shortage prevalent at that time. Bringing to the fore the social dimensions of modernisation, for example the social status of women, resonated with Aalto. In my view, Aalto came to be aware of the new social order particularly through the influence of Gropius.

While Gropius' ideas were reflected in Aalto's texts from the early 1930s, Aalto's discourse did not take place exclusively in the literary domain. Aalto's discourse was also about operating locally. In Paimio Sanatorium, the new social order of modernisation found its architectural manifestation specifically in the patient room. Therefore, Aalto's creation was socially more radical than other hospitals built in the same period. The architecture of the public institution served all tuberculosis patients, regardless of their level of income. In Finland, where the public sector funded the sanatorium, the term used for the subject was 'patient'. In the United States, where private hospitals were common, the term would have been 'consumer', in line with the Fordian ethos. Aalto was conscious of the role of the user of healthcare services, the patient-consumer, and placed this individual in his design focus. However, the rationalist theory or the minimum apartment did not, as such, emphasise the individual experience.

The architecture of Paimio Sanatorium prioritised the experience of the patient and mundane, but symbolic actions, such as hand washing. Hand washing was a symbolic ritual that helped maintain good hygiene. Each patient had their own, large washbasin in the small patient room. On the one hand, the arrangement protected the privacy and dignity of the patient, and on the other hand, it also provided isolation to prevent bacteria from spreading. The patient room was designed around the needs of the patient: they could look out of the window while resting on the bed, the lighting was designed not to disturb the patient, and the radiator installed on the ceiling emitted even, comfortable warmth. Aalto's architectural office team drew an extensive number of designs for the patient room, such as the window, the washbasin, the spittoon and the metal frame of the door. Aalto treated the patient room as a minimum apartment, which from the perspective of the discourse was a highly relevant concept. He increased its functionality. Examples of this include the bedside table that could be pivoted over the bed, a reading lamp that could be hung above the bed or placed on the table, curvilinear wardrobes, splash-free washbasins and the desk in front of the window, with a curving, heated floor underneath. Aalto repeated this identical room 120 times throughout the building, but with his unconventional solutions, he created a sense of individuality to enrich the everyday environment.

In the light of the present study it would appear that, in his design for the patient room, Aalto was inspired particularly by the problematics of small dwellings. He applied the new, radical ideas that had emerged in the field of housing construction, which he became familiar with through CIAM at the time of the Paimio Sanatorium project, to the design of the patient room. Naturally, the patient room also represented a key room type in a specialist hospital, but here Aalto's ambitions were not in any conflict with the principles of high-standard care. If we take into account that the treatment was mainly based on regular daily routines, good hygiene, rest, fresh air and nutritious meals, the patient room had no highly specialised medical functions to fulfil. Therefore, the patient room in the sanatorium, where patients spent seven months of their lives on average, and the modernistic minimum dwelling were paradigmatically related. The similarity of the two space types was manifest in the spatially economical, light-weight furniture, and their manufacturer, Huonekalu- ja Rakennustyötehdas (Furniture and Building Work Factory), did in fact market them to private, wealthy and highly educated customers. The differences were evident in the washbasins and the glass spittoons which both received a highly tectonic treatment. Huonekalu- ja Rakennustyötehdas marketed the patient room wardrobe as a suitable choice for private homes and public buildings alike. [995]

995 Huonekalu- ja Rakennustyötehdas (1932?) s.a.

The medical experts influenced the design solutions at the competition stage and when the actual design work began by giving quite detailed instructions on how the architectural designs needed to be changed. However, Aalto took only some of these demands on board, as he was able to argue in favour of his own opinions based on the very rationale behind the doctors' recommendations and translate their interests, as happened with the case of the suspended intermediate floor in the dining hall. Medical experts seemed to support Aalto at critical stages of the construction process, and Aalto in turn relied on their expertise to sway the opinion of the Building Board. Time after time, Aalto managed to persuade the State Medical Board to back his proposed solutions. Apparently, the medical experts were impressed by Aalto's competence. Their opinion of Aalto was partly influenced by the fact that Jussi Paatela, Aalto's colleague, was head of the building department of the State Medical Board Hospital Unit from 1930 onwards. [996]

A successful furnishing of the patient room, in the way the architect hoped, speaks of Aalto's ability to operate in a social context and to direct the other actors' actions and even, when necessary, to exceed the limits of his own role as an architect. Through these trials, Aalto as the innovator succeeded in steering the process and translating the interests of the Building Board to persuade them to favour his ideas. The client reached its goal, which was to save costs as much as possible, while achieving sufficient quality. For the Building Board, this justified the means, so they gave Aalto considerable latitude to manoeuvre, which enabled him to bring in, one contract at a time, his old business partners to the hospital project as suppliers. In this way, Aalto in his role of innovator created a highly viable hybrid in which know-how and collective experience came to fruition. Aalto's pursuits were both aesthetic and ethical. By appealing to aspects that were considered important by the Building Board, he managed to push through his own design goals. In other words, the furnishings in the patient room were not manufactured because the Building Board considered them superior for their design but because they met the quality criteria and were the least expensive option. Representatives of the state supervisory body, the State Medical Board, found it easy to support Aalto's solutions, which were justified by medical factors. Their approach also confirms that, architecture in Finland was seen as forming part of the treatment of tuberculosis and that the architect was highly aware of this and utilised this as leverage to achieve his own goals.

Based on my observations on Aalto's media tactics, Aalto was highly aware of the architectural press as a domain for creating meanings. Aalto's article published on New Year's Day in 1928 in *Uusi Aura* (New Dawn) newspaper owed much to Le Corbusier, particularly in the polemic choice of illustrations and their contrast with the copy. Soon, however, Aalto's articles took on a less agressive tone and he began to use foreign words that gave the text a scientific air. In autumn 1932, Sven Markelius commented on Aalto's draft of the article "Bostadfrågans geografi" (The Geography of the Housing Problem) suggesting that Aalto should use scientific-sounding vocabulary, but also to explain the concepts, so that "profanum vulganus" would also understand what was being discussed.

996 Henttonen 2009, p. 343.

Markelius' letter reveals how deeply aware the two authors were of the power of concepts, and the defamiliarising effect of foreign words. Why, then, did Aalto end up using such language in his texts? Finnish historian Timo Myllyntaus, who has studied the electrification of Finland, has paid attention to the fact that the Finnish language has a word for electricity, sähkö, that is not derived from Greek or Latin. He argues that being able to use a Finnish-sounding word for the concept made it easier to spread electricity technology.[997] It would appear that Aalto and Markelius had no intention to communicate their ideas about technology to the public, and instead they may have wished only to underline their own expertise and distinction from the public. Through their actions, Aalto and Markelius built and maintained their reputation as experts.

Aalto adopted various ideas and argued in favour of the economy of serial production in the project descriptions published on the Turku Fair. If we pause for a moment to ponder the verity of his claims, we will not be able ultimately to ascertain their truth. We only have the architect's view, with no deliberation. Serial production was, however, so powerful as a proposal that it became true for the readers within the domain of the article. Latour's theory allowed for interpreting Aalto's text as an attempt to translate the attitudes of the readers, in this case Finnish architects, in favour of serial production. He again posited himself as an expert of technology. In Latour's terms, the question was about the translation of interests and the enrolment of the target group. *Arkkitehti* (The Finnish Architectural Journal) magazine was for Aalto a channel, which strengthened his authority. The expert status that Aalto had created for himself through social means gave him authority and helped him translate the interests of other stakeholders, actants, in building projects.

Although Aalto used the concepts of rationalist management methods, he left his inspirers unmentioned. Walter Gropius and Le Corbusier used similar tactics to legitimise their own thinking through another discourse, the rational management methods. Aalto did not explicitly refer to rationalist methods, but his thinking was clearly based on rationalist ideals. The reason why he did not directly mention, for example, Fordism, although Ford cars and all cars in general were highly admired at the time, was probably down to his reluctance to adhere to a single theory. An alternative analysis is that he operated intuitively and could not consciously credit the sources of his ideas. The basic tenets of Taylorism included the observation of how people performed their tasks and the identification of the least expensive way to complete a certain stage of production. In a similar vein, Le Corbusier emphasised the importance of observing human action inside the home, as a biological phenomenon. For him, architecture was about human activity within a static structure, a reinforced concrete frame. Aalto's line of argument in his article on the minimum apartment, "Asuntomme probleemina" (The Dwelling as a Design Problem) followed this model. For him, biological equalled dynamic, as it was the polar opposite of the static, more precisely the static frame. In this conjunction, he used the phrase "biodynamic". This dichotomy reveals that Aalto understood architecture, and thereby construction, to be simultaneously a social and material process, something that took place at the interface

997 Myllyntaus 1991, pp. 80–81.

between humans and objects. The fact that in his other article he considered the reinforced concrete frame to be an inspiring design task [998] indicates that he also saw the load-bearing structure as part of architecture, although in this particular instance he described the frame as a static entity. In other words, the innovator-designer realised that the building was not a static entity, although the end result may appear so, as Latour has stated.

I have also analysed the message in three articles Aalto wrote about Paimio Sanatorium, which were assembled by combining text, photographs and diagrams. The aesthetic, perhaps even the ethical, hygiene of Paimio Sanatorium was eagerly embraced in the architectural media from its early construction stages, when there were only diagrams of its interiors to show. As we know, the building later became canonised and the hospital came to be held as a veritable model hospital as photographs of the interiors were published after its completion, in the international architectural media. In the construction phase, nowhere was it discussed, however, whether the environment was genuinely better for curing patients than other tuberculosis sanatoriums.

The 1933 article by Nils Gustav Hahl, a business partner and spokesperson of Aalto, published in *Domus,* was an accomplished piece presenting the interiors of Paimio Sanatorium and showcasing the joy and the new vibrant outlook associated with Modernism. There was the theatrically lit forest as the backdrop to the large lounge windows, the perky yellow of the lobby floor, the modern double-glazed windows with a space in between for plants - usually never seen in care institutions - and the pipe systems, each painted a different colour to give a touch of modern decorativeness to the space.[999] As a skilful writer, Hahl managed to create highly positive and strong impressions.

The presentation of the Paimio Sanatorium patient room windows in the press, and the cultural meanings assigned to them, link them integrally with the international architectural discourse. Wooden windows were the tradition in Finland and steel windows a novelty. Aalto developed an unconventional window system for the patient room: the ventilation window, known as the "health" window, only turned on its side, with two steel profiles necessary to support its structure. This window system, though usually installed vertically, was typical in Finland at that time. Turning the structure on its side gave the architect a reason to talk about a "horizontal health window" and, by adding a couple of steel profiles, about a "hybrid window". Beatriz Colomina has drawn attention to the significance of Le Corbusier's gaze in architecture and to architecture as a tool for seeing. The vignette image in Aalto's competition proposal was an asymmetrical steel window with a section reaching down to the floor. After a series of developments, he had to abandon both the asymmetrical shape and the material. The medical experts had rejected the idea of a window reaching to the floor as unhygienic, and steel windows had proved several times more expensive than wooden windows. Aalto's solutions were nonetheless a resounding rhetorical victory, as the horizontal orientation was the feature that had been showcased both at the CIAM exhibition of horizontal sliding windows in Zurich as well as in Le Corbusier's theoretical deliberations.

998 Aalto 1928a, p. 11.
999 Hahl 1933.

As the example of the patient room window shows, Aalto succeeded in redefining the cultural concept of the window, in this case, the horizontally oriented health window in a patient room. The architectural press was an ideal forum for devising such new meanings. He faced trials in the realisation process, however, and his original idea as the architect-innovator to have the windows made exclusively from steel profiles completely changed. Latour has voiced his concern that technological systems are explained through social rationale. Latour claims that: "'Society' has to be composed, made up, constructed, established, maintained and assembled. It is no longer to be taken as a hidden source of causality which could be mobilised so as to account for the existence and stability of some other action or behaviour." In his view, a social scientist has to explain society "through the presence of many little things that are not social by nature, but social in the sense that they are associated with one another".[1000] Various distinctions, as in the case of windows - the definitions of the traditional wooden structure and the modern structural hybrid - were material facts associated with, for example, different production techniques. The window was associated with various social definitions that had to do with health and the way of things are seen. To apply Latour's idea: the window of the patient room does not as such explain anything, but instead we have to explain the "complex ecology" of the static-looking object.[1001]

Aalto used the media as a domain to publicise his analytical design method. The best example from the period is perhaps his article for the Danish *Kritisk Revy* journal (The Critical Journal) on the design of a cinema. The article features section diagrams illustrating the reflection of sound waves. In his articles on Paimio Sanatorium, Aalto also focused attention to rationalistic qualities in his diagrams, of which the section drawing of the B wing is especially noteworthy, since this illustration was useful in successfully persuading the medical experts on the decision-making bodies of the virtues of its unusual ceiling construction. Aalto also used section drawings as a tool for the sundeck wing, the tectonics of which evolved throughout the competition stage both as a rational and artistic process during which he accumulated knowledge and the design achieved its final shape, which was eventually very different from the initial designs. It is also interesting to note that even when there already existed finalised structural calculations determining the requirements of reinforcements, completed by a structural designer, the architectural media published diagrams drawn by the architect based on the drawings of the structural designer, presenting idealised models of the outcome. Architectural media wanted to see one hero, one innovator-architect and closed its eyes to the collective nature of the process. Aalto's own actions endorsed the media's intention as he omitted to mention the structural designer in the project descriptions of all his other projects from his period in Turku in *Arkkitehti*, except for the Paimio Sanatorium project. Similarly, overlooking the state-of-the-art medical technology in his descriptions of Paimio Sanatorium helped emphasise the role of architecture as the

1000 Latour 1999b, pp. 112–113.
1001 Latour and Yaneva 2008.

most important aspect of tuberculosis treatment. The Latourian innovator overshadowed the collective, on whose work his own achievements were based. At play are also cultural rules and the renegotiation of power structures. There has been a tendency to give credit for collective effort to strong (white, male?) individuals, which has thus acted as a way to reinforce their position of strength in culture. In this respect, Aalto was no different from Louis Pasteur, whose achievements Latour has analysed.[1002]

Aalto's architectural focus was on non-medical technology. As an example, the hood collecting grease vapours in the kitchen of Paimio Sanatorium was featured in the press as early as 1932, in a diagram in an article for *Byggmästaren* (The Master Builder) journal. Similarly, the well-appointed institutional kitchen had represented a location for the application of Taylorist management principles in hospitals in Canada and the United States, where meals were delivered on trolleys through tunnels and lifts and were served from ward kitchens. Similar efficient principles were applied in the hospital laundry.[1003] The internal communications within Paimio Sanatorium and its kitchen were well thought out from the very beginning. The minimum apartments in Frankfurt had also emphasised the role of the kitchen as a well-equipped and well-designed unit. By showcasing the Paimio Sanatorium kitchen through photographs and diagrams of its ventilation system, Aalto created an impression of being a pioneer of institutional kitchens as well as of increasing electrification in housing. Rafael Blomstedt's comments on Aalto's kitchen appliances featured at the Minimum Apartment Exhibition in Helsinki were praiseful, even if he regretted that the goods were imported from abroad, which speaks volumes of how exceptional such modern comforts were in Finland. The kitchen was one of the first units in the household to benefit from electrification. The modern hospital kitchen served as a model for private homes in Finland, as electricity consumption was still low compared to electricity production capacity.[1004]

In my view, Aalto's electrical competence was selective. For example, he showed no interest in electrical motors or new low current systems. Instead, light fittings, lifts and kitchens, which were central to the rationalist discourse, were of great importance to him. In his articles, he decided to focus on issues that the international discourse dealt with.

Aalto used his position in the media to prove that he was aware of the role of acoustics, as shown in his diagram of the curving corner of the patient wing corridor in *Byggmästaren* in 1932. Le Corbusier had acknowledged the necessity to abate noise in blocks of flats and the need of residents for privacy in his paper delivered in Brussels in 1930. In his article, Aalto showed his Swedish colleagues that he was aware of the issue and through his diagram presented one, aesthetically rewarding, solution to the problem of sound insulation. In loose connection, it is worth bearing in mind that Sven Markelius was musically very talented and his design for the Helsingborg Concert Hall was about to reach its completion in the autumn of the same year. It is therefore likely that Aalto's understanding of the importance of acoustics had also developed through his dialogue

1002 Latour 1988.
1003 Adams 2008, pp. 124–126.
1004 Myllyntaus 1991, pp. 96–97.

with Markelius. In reality, however, the patient wing corridor had never been intended to be built as a curving space. The related drawing does not exist in the Alvar Aalto Museum collection and it would appear that Aalto created it solely for the article in *Byggmästaren*. For Aalto, the crux was in the idea of a curving wall, rather than its possible execution. He wanted to demonstrate that he was up-to-date with the international discourse.[1005]

Gaining publicity for modern architecture was one of the key objectives of CIAM, and its members were expected to engage actively in the task. Based on the early correspondence between Giedion and Aalto, it would appear that the exchange of ideas was one-sided, because Aalto, as well as his Nordic colleagues, assumed a passive role in CIRPAC and did not offer to give talks at CIAM conferences. Furthermore, Giedion had to coax Aalto into submitting an article to the Bauwelt journal, materials for the horizontal strip window exhibition in Brussels, a paper on the sanatorium and reports on the activities of the Finnish CIAM contingent. We can only speculate what the reasons for Aalto's evasiveness were: cultural and temperamental differences, a lack of time, and a poor financial situation. In Aalto's case, the question was most likely not due to any lack of interest, commitment or ideas.

Aalto responded to the call by acting locally. Examining these few articles alone confirms that he was quite active in introducing the ideas raised within CIAM to the debate within both his professional circles and the mainstream press in his home country. Engaging with his professional circles took many forms: exhibitions, articles and talks. Collaboration between Swedish and Finnish colleagues promoted the integration of international architectural ideology locally.[1006] Generally speaking, Finnish professionals closely followed the developments in Sweden. Aalto's articles and the discussed exhibitions crystallised two of CIAM's key strategies: exerting influence and doing it through the media.

Annemarie Adams' research shows that adaptability was an important principle in North-American hospitals. Aalto was aware of this, and the idea was underlined in his close collaborator Hahl's 1933 article in *Domus*. However, he did not alter the dimensioning of the patient wing corridor as instructed by the medical experts to suit other purposes, such as that of a general hospital. Similarly, the dispersed system of risers in the patient wing proved immediately inflexible, even during the construction stage. The patient room, in turn, was so small that furnishing it in any other way would have been challenging. The frame of the building was no more adaptable, as the design solutions for each wing had been differently tailored for different uses. It would appear that Aalto had not taken the idea of adaptability very far. It is possible that he learnt to appreciate this aspect only during the process of construction. Aalto attempted to use his articles to advertise his own business and to position himself as an expert who adopted systematic working methods. His idea was to appeal to an audience who shared his thinking and, through establishing himself professionally, attain credibility as a leader of building projects.

1005 He adopted a similar tactic for the exhibition organised in conjunction with CIAM's conference in Brussels, which has been discussed in Section 2.7 "The Rational Site Planning".

1006 Rudberg 1989a, p. 49.

4.2 THE LOCALITY OF CONSTRUCTION

Eventually, my research question became: how did Aalto manage to reconcile international ideology and local building culture in a country where the degree of industrialisation in the building sector was relatively low? Many of Pamio Sanatorium's technological solutions that clearly had a bearing in overall expression, such as the reinforced concrete frame, evolved during the period between the competition win in 1929 and the inauguration of the building in 1933. The process by which the solutions evolved, particularly their critical points, was of particular interest for this study. However, I am aware that an architectural idea may merely emerge without it ever being realised as a physical construct and without any input from others.

My intention was to follow the process of construction and pay special attention to the central role of the architect, the innovator of the building process. In line with Latour, the technological process will either stand or fall with its innovator, who initiates action and attempts to steer the technological process. I argued that the architect had to convince other stakeholders of the viability of his solutions, and that the process of realisation, the interaction with the other stakeholders, had an impact on his designs. I also argued that the architect learnt from the process. I focused my attention specifically on the process rather than the outcome, which, as we know, is a fabled masterpiece of modern architecture. My research question was: how did Aalto manage to steer the process so that it enabled him to realise his architectural vision, and, furthermore, was the outcome entirely, genuinely, in line with his vision? In the empirical discussion, I described the construction of the concrete frame, the windows, the patient room and the installation technology.

From the perspective of architectural history, my research design was conventional, as it was limited to the birth of the building with an emphasis on the architect himself. What was new about my approach is the acknowledgement and analysis of the interaction between the actors, including both the social and material ones. As has been shown in previous research, modern hospitals were the result of bringing into play the influences of many stakeholders, and the role of physicians' discourse, in particular, has been stressed. The input of other contributors, such as designers, contractors and building part manufacturers, and the direct impact of the budget on the design solutions and the architect's actions during the construction stage have not been previously examined to the same degree. I excluded the patients and the staff from my analysis because these two groups played no active role in the design stage. In the Building Board, their views were represented by doctors and architects to the best of their ability. However, I have explained the role of the State Medical Board and discussed the direct participation of medical experts in the building process. Emphasising certain angles, I have naturally also ruled out others. I have introduced the organisation behind the building project and aimed to shed critical light on the mutual contacts and collaborations of the builders participating in different projects.

The main task of the Building Board appointed by the participating local authorities was to manage the building project. A major part of their attention was focused on raising the funds and controlling the budget. Aalto's role was to represent the highest expertise in building. Representatives of the State Medical Board were consulted only at the beginning of the project and at certain cirtical points later on. In addition, the Building Board appointed a physician to serve a medical advisor for the duration of the work. The influence of medical experts was limited to a number of special areas, in which the Building Board was uncertain to pass decisions independently.

The reinforced concrete frame was developed in collaboration between designers. The major role was played by a person who used the initials "H.H.", who was either Harald Wildhagen or Hugo Harmia; there is no certainty as to his identity. His drawings showed the evolution of the final character of the reinforced concrete sundeck wing. The reinforced concrete structure of Paimio Sanatorium as a whole is quite tectonic in nature and scholars such as Banham have paid attention to the discontinuity of expression.[1007]

Aalto's building frame is both structurally and aesthetically complex. For example, the round load-bearing columns in the lobby of B wing form part of the wall, resulting in undulating forms in the lobby walls, a structure that served the purpose of aesthetic hygiene. On the other hand, the structure at the eastern end of B wing has been accentuated with beams protruding from the building envelope and joined to rectangular pillars. Casting the concrete frame in situ was also the biggest single sub-contract in the process, which the Building Board elected to outsource. Aalto influenced the selection of the contractor in the role of contract negotiator in order for Arvi Ahti, his close collaboration partner, to win the contract in such an invasive manner that a legal advisor was required to resolve the matter.

The empirical investigation of the concrete frame also led me to pay attention to traditional concepts of architectural theory, namely rationality and tectonics. Contemplating the power of expression in a structure as part of the poetics of architecture propelled me to ask: were not modern installation technologies similarly part of the tectonic expression of architecture, if the architect approached them on a conscious level?

A detailed enquiry into certain processes produced a wealth of new information about the main building and furnishings of Paimio Sanatorium. Furniture acquisitions particularly revealed the architect's tactics. He favoured the suppliers he had previously collaborated with. Aalto's strategy to launch the patient room furniture into serial production, was something that previous research had already suggested and further confirmed by the present study. Aalto aimed to use standardised products for the hospital purchases, and at the same time to design the very standards to be applied, such as the washbasin in the patient room. Standardised products by other manufacturers were available but they did not meet Aalto's standards. His likely motive was to introduce his own designs into serial production, and he found the existing serially produced washbasins aesthetically unsatisfactory. Aalto's washbasin relied on basic aesthetic forms. Arabia manufactured the special washbasins for the patient room, but presumably their production costs were too high for the factory to be interested in their serial production.

The design contracts signed between Aalto and the Building Board did not guarantee that the interiors in general or even the patient room would be furnished with

1007 Banham 1957, p. 244; Porphyrios 1982, pp. 2–8.

pieces designed by Alvar Aalto and Aino Marsio-Aalto. The Building Board's decision to select them was not an aesthetic but an economic one. My study has produced new information about Aalto's professional strategies. The artistically accomplished designer was not successful merely because of his superior sense of the aesthetic. He succeeded, because he knew how to enact and realise his own strategy.

It is my understanding that Aalto and Otto Korhonen aimed to develop wooden furniture because Korhonen was well-versed in the use of this material and his factory owned the required machinery. In this case, the production technology available at Korhonen's factory, in other words, his previous investments, steered Aalto's design towards the use of wood. Assuming that Korhonen's previous investments did steer the direction of the technological process (in this case, towards using wood), this can be seen as an example of monotechnics, a concept used by the American architectural scholar Lewis Mumford in reference to characteristics typical of modern technological systems, such as the replacing of manual skills by machines or the concentration of power.[1008] Aalto and Korhonen's joint goal was to develop the wooden wardrobe for the patient room. A researcher is, naturally, compelled to ask, why had Aalto and Korhonen begun their collaboration in the first place? Did it begin because of Aalto's initial fascination with wood? Or was this collaboration the fruit of a realisation that by joining forces, each of the parties, designer, marketeer and manufacturer, stood to gain? Aalto did also expend some effort during the Paimio Sanatorium project on designing metal items, such as radiators and windows, so his competence was by no means limited to one material. Another noteworthy point is that, in the first sketches, the wardrobes were made of metal plate. In my opinion, the metamorphosis of the patient room wardrobe and the rounds of competitive tendering speak of Aalto and Korhonen's rational attempt to develop a new wooden product. It was not worth Aalto's while to verbally justify the use of wood to the Building Board, since using wood as a material for the wardrobes was not, as such, its goal. Emphasising the use of wood would not have helped the innovator-architect to translate the opinion of the Building Board. Instead, Aalto had to convince the Building Board of the high quality of the wooden wardrobe, that it was just as credible a choice as the metal wardrobes offered by competitors. He achieved this by having model wardrobes delivered on site. Producing models took time. Aalto, who was in charge of the furniture purchases, also had to convince the client of the lower price of the wooden wardrobes, which he could only achieve by interfering with the tendering process outside the scope of his remit. Korhonen's offer, which was only very slightly lower in price than that of the competitors, and the sample wardrobe arrived on the site after the tenders had closed. The Building Board accepted Aalto's actions because, in this way, they could achieve their own goals. Relying on Latour's set of concepts in my interpretation, I find that Aalto succeeded in translating the various conflicting goals of the Building Board, the furniture manufacturer to follow his view, and arrived at a consensus by persuading the other stakeholders to rethink and change their position to match his, through, in other words, Latourian trials.

1008 Mumford 1963 [1934], pp. 9–12; Rask 2000, pp. 94–95.

It was more natural for Aalto to treat the installation technology – the water, sewage, heating, ventilation and electrical systems – on the scale of the patient room, rather than on that of the entire building or district. Resolving the question of installation systems on the scale of the building or the district created difficulties, mainly because it had been assumed that the architect would be able to plan the building-level solutions on his own from the very beginning of the design process, and without the input of experts or discussion of the options to hand. In other words, the architect received no specialist support in this area until a later stage of the process. There was no readiness to identify any alternative ways of organising the installation systems until some of the decisions had already been made, narrowing down the remaining options. The installation systems, as distinct systems, were thus developed for the building as a whole without any architectonic treatment based on collective interaction, except for a few isolated cases of collaboration.

Aalto had established in his competition proposal certain basic solutions, such as the dispersed installation ducts in the patient wing, the separate building to house the district heating plant and the heating plant chimney. As Aalto had never previously designed anything on this scale or so demanding, some of the systems were, in terms of their basic solution, quite unrefined. The architect's skills were not sufficient to correctly dimension the sewage systems or to create a feasible model for the wastewater treatment system. Neither had he resolved whether the building would connect to the national grid, which was only just being built at that time in Finland, nor whether the electricity would be generated by the institution itself. Back-up systems, and making spatial reservations for them, were also partially neglected in the design. I find it strange that the cities involved in the project, and their public works authorities who had accumulated considerable experience in technicalities such as sewage, were not concerned about the lack of necessary expertise on the project from the very beginning. Besides funding problems, it was precisely this lack of competence in the water, sewage, and heating pipe and ventilation systems that delayed the completion of the project by one year. After the architectural competition, the role of the medical experts became more prominent as they were invited to give their opinions on the winning entry. What is noteworthy is that no such opinions were requested from infrastructure specialist.

This study shows that Aalto possessed adequate courage to turn his ideas into reality and that he could resolve his design questions as a result of any lectures he heard, conversations he had with his peers, and the buildings that he saw. He was someone who learned a great deal from personal experience. Furthermore, Aalto would also have greatly benefited from travelling to Brussels in October 1930, had he had the possibility to do so. Had he attended the Brussels conference, he would have heard Le Corbusier completely redefine the function of certain technological systems in construction. It is my firm belief that hearing Le Corbusier's presentation would have helped him gain a better grasp of the problems surrounding the mechanical air conditioning system at Paimio Sanatorium.

However, in the scope of the patient room, Aalto succeeded in integrating the installations as part of his architecture for the space. But even this was not that simple: for example, the drainage of the washbasin and spittoon were difficult to fit inside the small duct. The issue of the ceiling radiator was important for Aalto. The matter was resolved to Aalto's satisfaction, and the ceiling radiators were installed. Aalto was, again, able to convince the experts of the State Medical Board of the technical feasibility of this option and won over the Building Board by referring to the attitude of the State Medical Board. The initiative to use ceiling radiators came originally from the engineering firm Radiator, which was not finally selected as the contractor despite Aalto's great efforts. Aalto felt that morally he owed the contract to Radiator, as they had helped him by providing advice on the options for, and innovations in, various water, drainage and heating pipe and ventilation systems. The Building Board eventually selected another contractor based on a narrow price margin, which brought the fruitful design collaboration between Radiator and Aalto to an end. So the ceiling radiators installed were in the end those that were already available on the market, instead of having Aalto design his own radiators for that purpose. He had clear interest in concentrating his attention on the function of ceiling radiators. In this sense, the design solution was not holistic, a fact to which the Spanish researcher Mateo Closa has also previously drawn attention. The heating unit mounted on the ceiling was therefore unfinished in its architectural treatment.

In my view, this episode is a telling case that shows the importance of collaborative effort in a building project. Latour refers to strong networks formed by social and material actants that together possess the capacity to act. In this case, selecting the "wrong" contractor destroyed a viable collaborative pattern, in Latour's terms a hybrid, so the innovation process was interrupted and the new technological solution remained undeveloped.

The wavering position of the Building Board in initiating a robust design of the installation systems also proves the importance of interaction in the design and construction of a building. In the case of Paimio Sanatorium, the installation systems, for example the sewage system, was not developed concurrently with the architectural development of the building. A real ventilation plan was never devised, and it simply emerged as a side product of the heating system.

A technological process benefits from inspiring ideas that are tested and subsequently adjusted. The story of Paimio Sanatorium reveals that the water, sewage and heating pipe systems alongside the electrical and ventilation installations were relatively new to Aalto, and he lacked the capacity to manage their design without the input of specialists. More importantly, Aalto did not think to insist on engaging an expert in the process, who would have been familiar with district infrastructure systems at a sufficiently early stage. Demanding such expertise would have required, first of all, that Aalto himself would have understood the importance of these systems and, secondly, that he would have had sufficient authority to make such demands. Successful solutions require strong and viable hybrids. Not all of the blame can be put on the Building Board or a rigid organisation; Aalto was also guilty of undermining his own power to secure the contract with Radiator, having alienated the Building Board by taking such an intrusive role in the selection of the concrete frame contractor. Aalto had lost some of the Building Board's trust in his position heading his first major contract negotiations.

In my view, Alvar Aalto's activities as the mediator of the international architectural collective and Finnish society supports Karl-Erik Michelsen's point regarding the domesticators of technology. According to Michelsen's observations, technology transfer into Finland was not a national programme and instead the development was in the hands of companies, and individuals working within them, to pursue their own interests. These key groups of stakeholders wanted to bolster their own financial and social status, and one way to achieve this was to be up-to-date with technological systems that were being developed in Western industrialised countries.[1009] Aalto's drivers were naturally not primarily financial but artistic.

1009 Michelsen 1999, pp. 163–164; Hughes 1983, pp. 1 –17.

4.3 LATOUR'S CONCEPTS AT WORK

I approached the relationship between the architecture and technology of Paimio Sanatorium through the perspective of the French sociologist Bruno Latour's actor-network theory. Like Latour, I have understood technological systems as being heterogeneous, and not merely social or mechanical. Social actors, such as individuals, companies and institutions, are parts of technological systems, as well as the material world. Moreover, the social stakeholders represent different values and attitudes, which also form a part of technological systems. A building was approached as a technological system. It followed that the theory and ethics of an architect, which come to life through his activities as the innovator of the process, become a part of a technological system, that is, architecture.

One of the key issues in this study was to delimit the object of study. According to the definition of technology that I have adopted, the set of objects under scientific enquiry may contain any entities. Along with Latour, I have followed an anthropological approach, allowing the research object itself to direct me to the salient themes of study. By analysing Aalto's writings as well as his drawings, I have formed an opinion on which approaches were important for him from the perspective of architectural theory. In addition, I also tracked the decision-making process of the Building Board and identified a number of topics that it discussed intensely, and that caused conflicts. I followed these points of disconnect, which Latour has dubbed trials.

I also applied Latour's theory in a critical discussion of the delimitation of the research object and the nature of the groups affecting decision-making.[1010] My aim was to reveal the interrelations within the technological systems at Paimio Sanatorium to the extent that they affected the architectural solution. My intention was to reveal the movement of a building, how it constantly changed.[1011] However, the material posed certain challenges. The Building Board recorded most of the decisions it made, but only few debates or discussions were documented. In addition, there were several decisions made on issues that raised conflicts, and yet no discussion or decision has been recorded. An example of such an issue is the suspended intermediate floor in the dining hall, which the medical experts unanimously opposed in their statements in spring 1929, but which remained in the designs, from competition to execution. In this particular case, Aalto succeeded in translation, in other words, to persuade the physicians by way of his section diagrams, which showed daylight penetrating the room to the furthest corner of the space, a desirable feature from the perspective of health. Again, Aalto did not justify his design through aesthetic considerations, which nonetheless played a role in his highly tectonic solutions. By cross-referencing different sets of materials I could make conclusions on the course of events.

1010 In his work *Reassembling the Social*, Latour argues that, instead of preconceived theories and methods, researchers ought to pay attention to oppositions and uncertainties, the five most salient of which according to Latour are the nature of groups, the nature of action, the nature of objects, the nature of knowledge and the nature of sociological research. Latour 2007 [2005], pp. 21–22.

1011 See Latour and Yaneva 2008, especially pp. 85 and 88.

Latour's observations on descriptions of innovation, and the intertwining of forces as events that do not lend themselves to generalised concepts, form, in my judgment, a sound basis for electing a case study as my angle on the topic. Aalto absorbed international influences and applied them in practice in his home country, which was still deeply agricultural and struggling in the throes of economic depression. Construction work was local. In the case of Paimio Sanatorium, Finland was witnessing the emergence of a new building type (*typos*); at that time efforts were made to favour local or at least domestic products and producers; the producer organisation for the building, the architect and his vision were unique (*tectonic*); as was the location (*topos*). The above summary of my thought was based on Kenneth Frampton's theory of architecture emerging as a synthesis of these three factors.

Latour's theoretical thinking embodies the idea of general symmetry, in which the object is perceived as an active entity participating in the construct, and the significance of objects in human activity is taken seriously. The effect is not one-directional. Latour and Yaneva challenge architectural theory to tackle the "admittedly daunting task of inventing a visual vocabulary that will finally do justice to the "thingly" nature of buildings and, by contrast to their tired, old "objective" nature".[1012] In the field of architectural research, Annemarie Adams, among others, has stressed that doctors and architects both left an imprint in hospital design and that modern hospitals in turn shaped medical practice. As I have decided to limit my research period to the construction stage, I had no reason to investigate the time after the completion of the building and how the patient room shaped the daily routines of the hospital. In line with the theme of reciprocity, I have discussed in this study how the prevailing material reality affected the design solution.

On the issue of the concrete frame, my attention was drawn to how submissive the Building Board acted in front of the architect and his favoured contractor. First of all, it accepted a contract that was tens of percent higher than the most recent cost calculation Aalto had prepared. Secondly, it was clearly convinced of the demanding nature of the project and the imperative of a certain collaborative process, since it went on to select only the fifth lowest quotation. A reinforced concrete building represented new technology, which made decision-making more difficult. However, the Building Board never once questioned the feasibility of the reinforced concrete frame and, instead, they were convinced of the solution presented by Aalto. Aalto, as the innovator, in turn managed to develop a viable hybrid and achieved his ambitious target.

The standards that Alvar Aalto designed for Paimio Sanatorium can be interpreted through Latour's theory of the locality of scientific knowledge. Firstly, Alvar Aalto insisted on including the master drawings, cost calculations, work specification, working drawings and the standard drawings in his design contract,[1013] which shows that it was somehow necessary to establish the concept of the standard in relation to the client,

1012 Latour and Yaneva 2008, pp. 88–89.

1013 The contract signed between the Tuberculosis Sanatorium of Southwest Finland and architect Alvar Aalto, dated June 28, 1929. AAM.

as the concept was in all likelihood completely new to the latter in this context. The architect created a large number of standard drawings in conjunction with the design work for Paimio Sanatorium, a practice that the contract thus legitimised. Some of the standards were enclosed with the application addressed to the State Medical Board, based on which the state authority decided to grant the permit and funding for the project. Comparing the standards can be likened to the laboratory practice described by Latour, in which the problem is isolated and resolved in a protected environment, governed by the researcher alone.[1014]

Aalto's intention behind this course of action was to bring an interesting phenomenon into his own designer's studio and under his scrutiny, so that he could work it the way he wanted to and eventually design standards that could enter industrial production, an interpretation that has only grown more convincing in the course of my investigation into Aalto's tactics as the chief supervisor of Paimio Sanatorium acquisitions and purchases. Latour's thesis of the locality of knowledge and knowledge management seems to be highly accurate.[1015]

Although Aalto annexed the standards as part of the overall design, his aim was not, in my estimation, to create a standard sanatorium, as referred to by Göran Schildt. Aalto's standards were rather more linked with construction and housing on a more general level, and they could be adopted in a variety of buildings. Some of the standard drawings that Aalto designed as part of the Paimio Sanatorium project, especially those for the sash windows with German annotations, were never even intended to be used in the sanatorium, and were related to other, more general aspirations.

The winning competition entry showed that Aalto was capable of taking the objectives of the clients, that is, the federation of municipalities and the State Medical Board, which oversaw the construction work, and turn them into action in consensus with his own objectives. Aalto was keen to make sure that the progress of his hospital project was reported by the press in a positive light. A delegation from the 1932 Nordic Building Forum, held in Helsinki, also paid a visit to the hospital building site. Aalto became a the visible innovator, while the collective who had contributed in an essential way to the project did not actively appear in the publicity, although some of them were indeed mentioned. The project presentations in *Arkkitehti* (The Finnish Architectural Journal) did not include information about any other designer's innovative solutions for the hospital.

In a Latourian reading, the collective became visible through its innovator, which was enough for the audience. In this way, the modern reinforced concrete structure improved the value of Alvar Aalto's personal currency in the eyes of his peers. The other actors and the crucial input were forgotten. The credit for the success, which was the result of the work by the entire collective, went to Aalto alone.

Latour would talk about the achievements of the collective referring to the individual's name, while he would point out that the collective comprised of entities belonging

1014 See Latour 1999a [1982], pp. 141–170.
1015 Latour 1999a [1982], p. 167; Lehtonen 2000, p. 281.

to different ontological categories. In the case of Paimio Sanatorium, Alvar Aalto would stand as a reference to a collective formed by all social actors and inanimate entities together. In my opinion, Latour's description of the collective reveals something essential about architecture and is well-suited to the study of architecture, in which the role of the designer is traditionally, and often disturbingly assigned to a single individual, although anyone familiar with the field will know how necessary it is to view architecture as a collective and an applied undertaking. The dilemma is also present in the title of this dissertation.

Latour's concepts lend themselves to architectural research with relative ease, although his terminology might be foreign to the architectural research discourse. I would point out, however, that it is much easier to make the inanimate speak in the field of architecture than in many other disciplines – an aspect for which Latour has been criticised. For example, architectural drawings are an essential part of the development of ideas, as well as their ability to translate interests, if so wished. It is the architect's job to make matter speak.

Architects also participate in competitions by means of drawings. They have thereby been attributed an ability to act. The competition jury makes its own interpretations and decisions based on these materials representing the inanimate, and gives verbal justifications for them. The jury probably sees other dimensions in the designs than the author has intended. If the author manages to display qualities in the competition sheets that appeal to the jury, the former will be able to win over the latter. Precisely this type of process of translation, as referred to by Latour, was at play when architects Väinö Vähäkallio, who had only just completed the Elanto Cooperative headquarters, and Jussi Paatela, who was at that time working on the Kinkomaa Sanatorium and was well-versed in construction technology, rated Aalto's six-storey concrete building as the winner. Its features plausibly possessed all the qualities of modern architecture that they themselves were personally interested in. These two highly accomplished architects, whose own designs were a degree more traditional, could not resist this opportunity to see what kind of outcome could be achieved. I have also included in this work a discussion on the episode that took place during the competition, when Aalto received prior information from a medical expert of the State Medical Board who communicated his opinions to Aalto regarding a feasible sanatorium. Naturally, Aalto aimed to use his proposal to appeal to the medical expert of the State Medical Board, which was financing the project, but through different methods from those that he applied for the architectural members. The actor-network theory is interested in the processes within which actants mutually build and modify their respective operative situations and objectives.[1016] In his proposal for Paimio Sanatorium, Aalto knew how to address the very questions that the expert members of the jury would find interesting. In the competition stage, the goal of the architect was to win the competition. With his drawings and through his actions, he managed to translate the interests of the jury to

1016 Ylikoski 2000, p. 303.

support his proposal. He knew how to address the aspects that the jury held important. However my view of the role of the architectural drawings differs to some extent from the understanding of Latour and Yaneva.[1017] This research showed that, in a real project, the architect does not communicate merely through his drawings, a function which Latour and Yaneva emphasised in their joint article, and that everything "else" is equally significant. Aalto also learnt a lot from the other actants involved in the process, and they brought insights of their own fields of expertise.

Latour's view that a project will never amount to anything as long as its idea remains pure, is fascinating from the perspective of architecture. A project can only materialise if it is exposed to and intermingles with other elements through trials. Furthermore, only when the resulting machine or other artefact, in this case a building, becomes unquestionably established, so that this synthesis is forgotten, can an idea be perceived as "pure".[1018] For this reason, a building may seem a static entity, and its movement is indiscernible. Latour has aimed to provide theoretical tools to see beneath the static surface.[1019] When examining the relationship between architecture and technology, it would be unrealistic to remain exclusively in the domain of ideas.

Beatriz Colomina has, in turn, focused attention on Le Corbusier's idealised concept of architecture. According to Colomina, Le Corbusier was more interested in architecture in ink than in the site itself. My own research shows that Aalto, too, was highly aware of the media space and was able to exploit it with skill.

According to Latour's theory, the actants thus produced affect the nature of scientists, laboratories, external actors and thought by partly redefining them. This process of production is not one-directional. In my discussion of the architecture of Paimio Sanatorium in the light of this theory, I pondered whether the outcome was one Aalto had hoped for, and then arrived at the conclusion that in a way, it was not. At least, the sanatorium did not turn out the way Aalto had wanted at the competition stage, or in April 1930, when the master drawings were created and the State Medical Board approved them. Tracing back the evolution of design solutions exposes the transformation, adaptation or development of the architect's thought. Aalto, the architect-innovator in the Paimio Sanatorium project, trusted his own idea and that the idea would withstand the trials endured during the construction process. His confident appearance, for example, in Oslo in 1931 and on the pages of *Byggmästaren* in 1932 speaks volumes about his attitude.

For Alvar Aalto, the social dimension of the Paimio Sanatorium project was about contributing to the defining of the actor-network for the project and communicating with the network members. Attaching competent collaborators to the project was of decisive importance. The technological process of Paimio Sanatorium found its shape through Aalto's subjective vision, which was informed by international architectural discourse. Personally witnessing and participating in this discourse strengthened Aalto's confidence and courage as the project innovator. Aalto developed his vision through interaction, by

1017 Latour and Yaneva 2008, especially p. 84.
1018 Lehtonen 2000, p. 283.
1019 Latour and Yaneva 2008, pp. 80–81.

participating in exhibitions and expressing himself in writing. The sanatorium project developed simultaneously as a social and material undertaking, through trials. In other words, the heterogeneous actant was placed under constant testing. This process also served to change the line of thought for its innovator. For example, the concept of the minimum apartment, with which he was able to personally familiarise himself during the design work for the sanatorium, inspired him to develop the daily environment of the patient. In Paimio, the new type of consumer found a home in the patient room, which Aalto designed based on the international discourse he had embraced. The focal points of his interests were revealed through the successful integration of the different installations in the patient room, although these very systems proved a problem in a larger context. It is clear that he also learnt a great deal from the processes that he was unable to control, and the outcome of which was not architecturally sound.

The task of the researcher is to follow the actants and to register any changes in them and the impact resulting from these changes. As Latour points out, a social scientist cannot know before the fact what society is made up of. It is something that only the actants, both social and material, themselves can disclose. In a similar vein, an architectural researcher cannot know in advance what architecture is made of, as I myself learnt from this work. An idealised presentation of a building, as is often seen in architectural publications, does not emphasise the nature of architecture as an applied art, but rather an individualistic phenomenon detached from material and social interaction. Architecture is inherently material and collective. It was possible to make visible the "movement" of a building, that is, its transformation during the building process, by looking into the networks that formed the interactive context where the building took place.

More interesting than the knowledge that a specialist hospital was built in Finland in the early 1930s with a novel patient-centred approach, is the deeper insight into the prerequisites for successful architecture that the present study has provided. The most successful architectural solutions for Paimio Sanatorium, a demanding institutional building project, came into being in circumstances where the architect-innovator managed to create a strong and viable hybrid that merged collective competence with knowledge and expertise. Creating such circumstances today, when hospital design is strongly focused on patient experiences and hospital architecture is again understood as an element of treatment, could lead to successful innovation processes.

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In her study *Architecture and Technology: Alvar Aalto's Paimio Sanatorium* Marianna Heikinheimo, Master of Science (Architecture), Master of Arts (Fine Arts), analyses a building project, progressive for its time. She asks, how did Aalto manage to reconcile international ideology and local building culture in Finland where the degree of industrialisation in the building sector was relatively low in the early 1930s, and in what ways were the avant-gardist ideas translated into practical solutions?

This book examines what happens to architecture during the process of planning and construction when the outcome is affected by several contributors and local circumstances. The study, within the field of architectural history, presents extensive empirical evidence, unveiling the roles of the client, the design engineers, building part manufacturers and contractors, as well as the professional tactics to which the architect resorted to achieve his objectives.

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