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AERONAUTICS AND THE MYTHOLOGY OF SCIENTIFIC AND TECHNICAL RATIONALITY IN THE WORKS OF LE CORBUSIER, MOISIEI GINZBURG AND LUDWIG WITTGENSTEIN

AERONAUTYKA I MITOLOGIA NAUKOWO-TECHNICZNEJ RACJONALNOŚCI W TWÓRCZOŚCI LE CORBUSIERA, MOISIEJA GINZBURGA I LUDWIGA WITTGENSTEINA

Abstract

The objective of this study was to identify elements of the architectural work of Modernists to whom the airplane and aeronautics constituted a significant creative inspiration. Under a layer of declared scientific-engineering rationality and, using the historical-interpretative method, the presence of various forms of machine mythology was uncovered, which has belonged to Western culture since the industrial revolution. The significance of myth as a factor that organizes the discourse of Modernist architecture theory was also demonstrated.

Keywords: aeronautics, myth of the machine

Streszczenie

Celem badań było zidentyfikowanie przykładów twórczości architektonicznej modernistów, dla których samolot i aeronautyka stanowiły znaczącą inspirację twórczą. Pod warstwą deklarowanej naukowo-technicznej racjonalności, za pomocą metody historyczno-interpretacyjnej ujawniono obecność różnych form mitologii maszyny, należącej od czasów rewolucji przemysłowej do kultury zachodniej. Jednocześnie wskazano na znaczenie mitów jako czynników organizujących dyskurs modernistycznej teorii architektury.

Słowa kluczowe: aeronautyka, mit maszyny

1. INTRODUCTION

The functionalism of early Modernism tried to redefine the foundations of modern architecture while accounting for the scientific and engineering advances of the nineteenth and twentieth centuries. To architects, the machine was to become a model of the integrity of a work of architecture via the use of an objectivized design method that combined the function, structure and form in compliance with the requirements of engineering. However, the pursuit of principles and analogies for the new architecture in mechanical constructions

went beyond the borders of rationality, fetishizing the machine and embedding its myth in Western culture.

In the period under discussion, transport machines attracted a great deal of interest, with airships especially so, and were among the most resounding rhetorical figures in texts by Modernists. Meeting the rigorous requirements of the laws of physics and functional effectiveness, in addition to being a new and effective weapon of the First World War, the airplane was seen as an ideal of engineering pragmatism, free from aesthetic voluntarism.

In the 1920s, the airship became a modern machine and immense development potential was ascribed to it. After a pioneering period of exploration by singular inventors, the airplane achieved the level of advanced technology due to the organized efforts of scientists and engineers. Independently of the theoretical writings of architects, aeronautics and aviation also had an indirect effect on architecture due to the growing significance of science and technology in the twentieth century.

2. A RATIONALISED MYTH

In the paper, the myth is understood in the spirit of works by Mircea Eliade and Claude Levi-Strauss, to whom it became an inalienable element of culture. They changed the status of the myth, from a made-up story or “bad teaching,” gaining the status of expressing the deepest structures that integrate the activity of individuals and communities around fundamental senses, meanings, and their associated values. The need for myth to exist, alongside with peculiarly understood “prejudice,” which is not an “erroneous judgement” but a general and primal notional framework set in historical tradition that can initiate cognitive and investigative processes, was demonstrated by Hans-Georg Gadamer.¹ Ian G. Barbour situated myth alongside academic models and paradigms, and described as “useful fiction,” presenting its rationalized meaning as a narrative that structures fundamental attitudes towards reality.²

3. THE MYTH OF THE MACHINE

The myth of the machine had been the subject of Lewis Mumford’s works since the 1930s and was continued in the post-war period.³ According to this American scholar, the popular conviction that engineering is a sum of tools and process mechanization is an illusion. The essence of the machine was to be found much deeper, at the very foundations of civilization, as entire societies are mechanized machines, from ancient to contemporary ones. These megamachines function on the energy and resources that are people. Mumford’s studies

¹ According to Gadamer, escape from the myth, a peculiar type of “truth of prejudice,” is impossible. This points to the unsolvable conflict between Enlightenment and the harmful Romanticist myth as an explanation bereft of methodical proof, and Romanticism that criticizes Enlightenment for giving in to the mythology of rational thinking. H.G. Gadamer, *Prawda i metoda. Zarys hermeneutyki filozoficznej*, Inter Esse, Kraków 1993, pp. 256–272.

² I.G. Barbour, *Mity modele, paradygmaty. Studium porównawcze nauk przyrodniczych i religii*, Społeczny Instytut Wydawniczy Znak, Kraków, 1984.

³ L. Mumford, *Mit maszyny*, vol. 1, Wydawnictwo Naukowe PWN, Warszawa 2012.

led him to believe that the most essential source of engineering and practice of a machinist approach to the world is the human brain and its capacity for systemic thinking.

Reyner Banham, in his classical work *Theory and design in the first machine age*, demonstrated that the presence of the machine and engineering in Modernist architecture had the characteristics of a symbolic representation of mythologized technology.⁴ Had it been otherwise, Banham argued, had they become actual models of a method of producing an engineering design, they would have had a fundamental significance for the future of architecture. Consistently pursuing nothing but the logic of progress and dynamics of development, architecture – similarly to engineering – would have to cease to occupy itself with aesthetic or social problems. Thus, aesthetic values along with the notions of beauty, composition or symbolic meanings would disappear from the view of a radically rationalized architecture.⁵

The next stage in the development of the machine was documented by Shoshana Zuboff in her influential book *In the Age of the Smart Machine: The future of Work and Power*.⁶ It dealt with human work and power reorganized by mathematical machines, providing an intellectual stimulus for a discussion on the then-nascent concepts of an intelligent built environment. Many years of Zuboff's research led to the publication of the extensive *The Age of Surveillance Capitalism: The Fight for a Human Nature at the new Frontier of Power*⁷ in 2018, which was an attempt at unmasking the practices of giant tech companies which exploited the behavioral surplus of unaware Internet users and converted it into predictive products sold on commercial markets. The scale and scope of the surveillance system and the use of machine intelligence shares many features with Mumford's megamachine.

4. THREE DESIGNERS, THREE TYPES OF MACHINE

None of the designers discussed in this paper built an airport or airport terminal.⁸ Aeronautics and the logic of an airplane's construction remained a reference point for formal exploration or were generators of inspiring vistas for urban design solutions – as it was in the case of Le Corbusier – theoretical models of constructivist architecture – in Moisei Ginzburg's work – or indirect sources of a concept of aesthetic rigor by Ludwig Wittgenstein.

Each of these cases is different, yet it is a component of a certain whole that covers a complex phenomenon of fascination with engineering and the Modernist myth of the machine, which became concretized in an interest in transport machines.⁹ The figures of Le Corbusier

⁴ R. Banham, *Theory and design in the first machine age*, The Architectural Press, London 1960.

⁵ *Ibidem*, pp. 325–330.

⁶ S. Zuboff, *In the Age of the Smart Machine: The future of Work and Power*, Basic Books, New York 1988.

⁷ S. Zuboff, *The Age of Surveillance Capitalism: The Fight for a Human Nature at the new Frontier of Power*, PublicAffairs, New York 2018.

⁸ For order's sake, it should be noted that Le Corbusier produced several conceptual works associated with aviation. These included a theoretical landing strip for aerial taxis in the centre of Ville Contemporaine (1922) and in Plan Voisin (1925), a realistic airport layout that was the standard at the time, placed in a competition design for a housing district in Antwerp (1933), a horizontal airport in an open, flatland landscape (1946).

⁹ Le Corbusier and Moisei Ginzburg were linked by their profession, personal contact, and a documented exchange on the practical and theoretical plane. The work of Ludwig Wittgenstein remains an extraordinary and separate phenomenon, which escapes classification.

(1887–1965), Ludwig Wittgenstein (1889–1951) and Moisei Ginzburg (1892–1946) are linked by generational ties, being active during the second machine age, and an interest in aviation as a field of advanced engineering. Also significant is the time when they produced their most representative works that best exemplified their theoretical attitudes: the Haus Wittgenstein, built for his sister, Margaret, 1926–1928, the Villa Savoye by Le Corbusier, 1928–1930, and the Narkomfin House by Ginzburg, 1928–1930.

4.1. THE FUNCTIONAL MACHINE

Charles-Edouard Jeanneret-Gris, artistically talented and brought up in a community of renowned Swiss watchmakers, had contact with precise mechanisms since his youngest years. However, it was not the design of chronometers, but their decoration that became the first task of the future architect, who produced his first works as a visual artist specializing in engraving.

Le Corbusier's declaration of changing his position to that of an artist-engineer came in the form of publications in *L'Esprit Nouveau* (1920) and *Toward an Architecture* (1923). They fully manifested the architect's interest in contemporaneous forms of mobility. In *Toward an Architecture*, in a section dedicated to airplanes – between liners and cars – there were photographs of machines from the author's own iconographic collection. They included the heavy Farman Goliath, the successful Bleriot-SPAD S.33, and the triplane Caproni Ca.60 Transaero which, while incapable of flight, was impressive in terms of form and size. The photographs were accompanied by texts – mottoes. It is worth noting that the phrase that is a form of Functionalism's manifesto directly refers to a transport machine – the airplane: “The airplane is a product of high selection. The lesson of the airplane is in the logic that governed the statement of the problem and its realization. (...) ‘The house is machine for living in.’”¹⁰

To exemplify the phenomena under study in Le Corbusier's works, we must also investigate Plan Voisin (1925), whose name commemorates the figure of the architect's friend and the plan's sponsor, Gabriel Voisin. He was a technically gifted pioneer of aviation and a production organizer. He obtained a thorough education at the Faculty of Design of the Ecole des Beaux-Arts in Lyon. During the First World War, he produced thousands of bombers in several successful versions (Voisin models III to X) at his factory. After the end of the First World War, Gabriel Voisin began producing luxury cars at his company, Avions Voisin, and after the Second World War, he designed, among other things, a minimalist, affordable car, and prefabricated houses for areas damaged during the war. Voisin was a figure that the architect admired for his achievements as an engineer and industrial manager.¹¹

In 1935, commissioned by the British Studio publishing house, Le Corbusier wrote a richly illustrated book entitled *Aircraft: The New Vision*, in which he placed technically mature models of airships flying for regular interwar-period airlines.¹² The architect pre-

¹⁰ Le Corbusier, *Toward an Architecture*, Getty Research Institute, Los Angeles 2007, p. 160.

¹¹ Even before engaging in cooperation with the Vichy government in Nazi-occupied France, Le Corbusier sympathized with fascist-leaning, syndicalist movements. He was aware that authoritarian power acting in tandem with technocrats and industrialists was required to realize his concept of mass housing and Functionalist urban planning. He saw Fordism and Taylorism as organizational models of not just production, but for all of society. The individual and the collective, due to architecture, among other things, were to act effectively and precisely, like a well-designed machine. More on this subject can be found in: de Jarcy X., *Le Corbusier, une fascisme français*, Albin Michel, Paris 2015.

¹² Le Corbusier, *Aircraft: The New Vision*, London, New York 1935, <https://www.bl.uk/collection-items/aircraft-by-le-corbusier> (access: 1.10.2021).

sented the airship as a product of industry, while also presenting broader social and cultural aspects of aviation. The publication featured aerial photographs of cities and drawings from the author's sketchbook depicting the growing scale of human activity and its close relationship with the natural environment. In the book, Le Corbusier presented the following thought:

Clearness of function. The world's miseries are due to the fact that functions are nowhere defined or respected. A stock of old functions, anachronistic or confused – residue of a civilisation in the throes – clogs the wheels and slows down the joyous and productive impulse of the new machine-civilisation.¹³

4.2. THE CONSTRUCTIVIST MACHINE

Intensive industrialization of mostly agrarian Russia, performed using totalitarian-state methods, was an important part of the revolutionary plan to reorganize society in the Bolshevik country. The machine was elevated to the rank of a symbol of communist ideology and was to be the start of the period of Constructivism – constructive thinking and acting in all spheres of life, whether social or economic. This vision was shared by artists and engineers involved in the renewal of art and architecture which were pressed into the service of the working masses.

Moisei Yakovlevich Ginzburg, a leading representative of Constructivism, a theorist of the movement and a practicing architect, highlighted the positive role of the machine in contemporary civilization, seeing in it the beginning of a new style of an industrial age. According to Ginzburg, in similarity to Le Corbusier, the machine was to be a model of the scientific design method, to which function, based on calculations, is to have a fundamental significance, while form was the logical consequence of calculations and the workings of objective laws of nature. His book *Style and Epoch*, published in 1924, became a theoretical foundation for Russian Constructivism in architecture. Published a year after Le Corbusier's *Towards an Architecture*, the book is often mentioned alongside it and compared to it. As observed by Jean-Louis Cohen in the foreword to the English edition of *Toward an Architecture*, Ginzburg carefully chose alternative views of the same buildings Le Corbusier featured in his work.¹⁴

Ginzburg studied in Milan, among other places, where he had the opportunity to familiarize himself with the technological achievements of the most industrialized regions of Western Europe, hence his work featured photographs of aviation plants and airplanes from Italy.

On the cover of the first edition of *Style and Epoch* there was a graphically distinctive, stylized silhouette of a machine – a triplane, a Caproni Ca.4 heavy bomber from the First World War, and the photograph of this model opened the first chapter, entitled: *Style. Elements of Architectural Style. Continuity and Independence in the Change of Styles*.¹⁵ In chapter four, entitled: *The Machine. The Influence on Modern Art of the Static and Dynamic Properties of the Machine*, a discussion on the clarity of the structure of a machine devoid of any redundant elements, the logic of its components that cooperate in a planned and organized manner, is illustrated by an airplane produced in the Turin-based Ansaldo

¹³ *Ibidem*, text above picture 2.

¹⁴ J.L. Cohen, *Foreword* [in:] Le Corbusier, *op. cit.*, pp. 53–54.

¹⁵ M. Ginzburg, *Style and Epoch*, The MIT Press, Cambridge–London 1982, pp. 35–36.

factory.¹⁶ Chapter six, *Industrial and Engineering Organisms*, is opened by a view of the Ansaldo production plant, filled with tens of machines during serial assembly.¹⁷

The journal *Modern Architecture*, published in the years 1926–1930 by Russian Constructivist architects grouped in the Organization of Contemporary Architects, was a platform for an exchange of ideas on architecture in Soviet Russia. It was edited by Moisei Ginzburg and the Vesnin brothers, and its volumes included publications by Russian and Western European authors who promoted integrating architecture with engineering and industry. The line of the journal was expressed in an article by an aviation engineer, entitled *The Form of the Airplane and Methods of its Design*. Written in a distinctive language of ideological persuasion, it reflects the spirit of revolutionary times in both content and form:

When building a new life, creating new forms, we lay the foundation for scientific thought. We are sufficiently strong, and our goal is too concrete to decorate modern design with the pretentiousness and artificiality of beautiful forms.¹⁸

Apart from an explanation of the basics of aeronautics and formulas from physics, the article included slogans of ideological instruction that called people to think in the categories used by airship constructors, such as: “Architect! You too should remove every gram of material if it does not bear any static load.”¹⁹

4.3. THE PHILOSOPHICAL MACHINE

Ludwig Wittgenstein, one of the most important philosophers of the twentieth century, the co-author of Haus Wittgenstein built for Margaret Stonborough-Wittgenstein in Vienna, was an engineer by education and specialized in aviation. During his stay at a university in Manchester, he designed an original engine and propeller structure, at whose ends he placed jet nozzles (the so-called tip-jet layout), and a variable-volume combustion chamber that cooperated with the engine. The design of this innovative device led to a stage of development that allowed for its patenting. Despite significant achievements, Wittgenstein abandoned aeronautics and dedicated himself to philosophy, while his work on the design and construction of the villa was a short episode of his overall activity. The philosopher entered into a partnership with the author of the initial conceptual proposal, architect Paul Engelmann, but ultimately came to dominate the design and converted it into his own original work. From a composition of cuboid masses, without decoration as demanded by Adolf Loos’s postulates, he produced a unique statement of radical Minimalism.

The architect-philosopher composed layouts of wall and ceiling surfaces, the apertures, the color scheme and textures for plasters and floors, linking them into a system of sophisticated harmonic dependencies. He also designed a series of devices to function as the building’s utilities and fittings. They included knobs, levers, locks and door and window hinges, as well as heavy metal louvres – with swing leaves seated in hinges and curtains that were

¹⁶ *Ibidem*, pp. 84, 86.

¹⁷ *Ibidem*, pp.104.

¹⁸ K. Akachev, *The Form of the Airplane and Methods of its Design* / Contemporary Architecture, 1926, no. 3, 1926, 3, pp. 65–66 [in:] *tehne.com*, <http://tehne.com/event/arhivsyachina/arhiv-steklo-v-sovremennoy-arhitekture-forma-samoleta-i-metody-ego-proektirovaniya-1926#plane> (access: 1.10.2021).

¹⁹ *Ibidem*.

vertically extended from the floor. We also know of very slender and thus non-rigid mullions of the windows and doors, as well as proprietary angled heaters. Wittgenstein designed all elements with great precision, attention to detail and proportions. He uncompromisingly supervised their manufacture so as to ensure they were made in compliance with his intent.

These solutions were not always subordinated to the available production techniques. Certain requirements were not based on function, but instead transcended contemporary construction capabilities and bore the risk of incorrect functioning. The dimensioning regime the tradesmen were placed under, less tolerant than typical construction standards, was difficult to follow, and what is more – it did not improve the utilitarian value of the elements. It was a type of extraordinary struggle to realize sophisticated technical and aesthetic values in the form of proportions expressed in numbers. In this sense, the work of the philosopher-engineer became an expression of a mythologized, idealistically understood rationality and precision that ignored the practical approach of engineering that allowed for dimensioning tolerances in construction and machine assembly. The mathematical precision present in every part of the building was to define the mystical dimension of the whole and express an absolute truth of art based on the statement: “(...) Ethics is transcendental. (Ethics and aesthetics are one).”²⁰

One can search for an explanation of Wittgenstein's approach as an architect in both his philosophical and engineering works. His philosophical writings can be divided into two main periods, represented by *Tractatus logico-philosophicus* and *Philosophical Investigations*, respectively. These works are different enough that they can be described as representing engineering accuracy and artistic freedom. Classified as belonging to rationalist analytical philosophy and irrational hermeneutic philosophy, they are evidence of a certain duality and extraordinary dialectics of Wittgenstein's creative stance.²¹ Despite an evolution in his views, the problem of the logical reflection of language and the world remained at the center of the philosopher's interests. It can therefore be said that learning a universal language of communication: technical drafting, and the principles of visualizing machine designs that he had proficiently used in aviation projects, had a significant impact on his construction practice and philosophical discourse.²² To Wittgenstein, the machine was not a synonym of dehumanization. On the contrary – it was a system that allowed one to record and transfer information. In his *Philosophical Investigations*, he wrote:

We use a machine, or the drawing of a machine, to symbolize a particular action of the machine. For instance, we give someone such a drawing and assume that he will derive the movement of the parts from it. (Just as we can give someone a number by telling him that it is the twenty-fifth in the series 1, 4, 9, 16,...).²³

²⁰ L. Wittgenstein., *Tractatus Logico-Philosophicus*, Harcourt, Brace & Co. – Kegan Paul, Trench, Trubner & Co., London–New York 1922, Thesis 6.421, <https://www.gutenberg.org/files/5740/5740-pdf.pdf> (access: 7.05.2021).

²¹ B. Wolniewicz, foreword [in:] Wittgenstein L., *Dociekania filozoficzne*, Wydawnictwo Naukowe PWN, Warszawa 2012, p. XVI.

²² Prior to leaving for Manchester, Wittgenstein studied at the Technical University in Berlin. During the first industrial revolution, when the precepts of the language of technical design were being born, this place was where the foundations for this contemporary scientific and technical language were laid. More on this subject can be found in: Bremer J., *Ludwiga Wittgensteina teoria odwzorowania: w filozofii, mechanice, muzyce i architekturze*, Wydawnictwo Naukowe Akademii Ignatianum, Kraków 2018.

²³ L. Wittgenstein, *Dociekania*, op. cit., pp. 114–115.

5. CONCLUSIONS

The research performer as a part of this study demonstrated that engineering is present in architecture at multiple levels, taking on the form of specific design tools and material and structural solutions, in addition to theoretical discussions, which often go in the direction of mythologizing specific terms or phenomena. Despite their apparent irrationality, “mythic truths” are necessary, strongly inspiring elements of theoretical and built architecture, as they create notional frameworks for them and give them a dynamic of exploration and transition.

The findings can also provide an impulse for further study on the current state of the architecture–technology relationships. Due to constant scientific and engineering progress, the reflection on these relationships must be kept continuously up to date.

Based on surviving accounts, one can assume that a hundred years ago, aeronautics and aviation played a similar function to those of information technology in its infancy: they were both highly innovative, dynamically developing branches of technology and attempts were made to have them work for architecture by mimicking them and incorporating them in various ways into the circle of ideas that fuel theory and practice.²⁴

Looking from a historical distance at the processes that took place in Modernist theory during the second industrial revolution should aid us in maintaining a greater cognitive reservation towards current phenomena that are sometimes called the third modernity or the technical revolution 4.0. It appears that there exists a need to develop a more reserved and critical position towards concepts such as the Smart House or the Smart City, which are mostly based on a one-sided, optimistic version of technical determinism. It is possible that the vision of a general participation of information machines and machine intelligence in the creation and management of the human built environment is another version of the techno-myth in architecture.

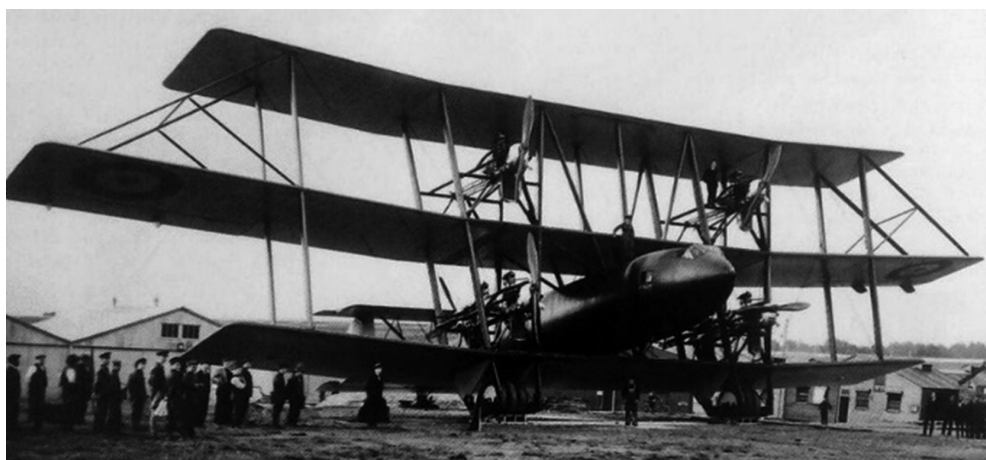
²⁴ This refers specifically to the 1950s and 60s and the beginnings of calculation architecture, the first CAD/CAM software, and texts by, among others, Nicholas Negroponte, or Christopher Alexander on computer-aided design.



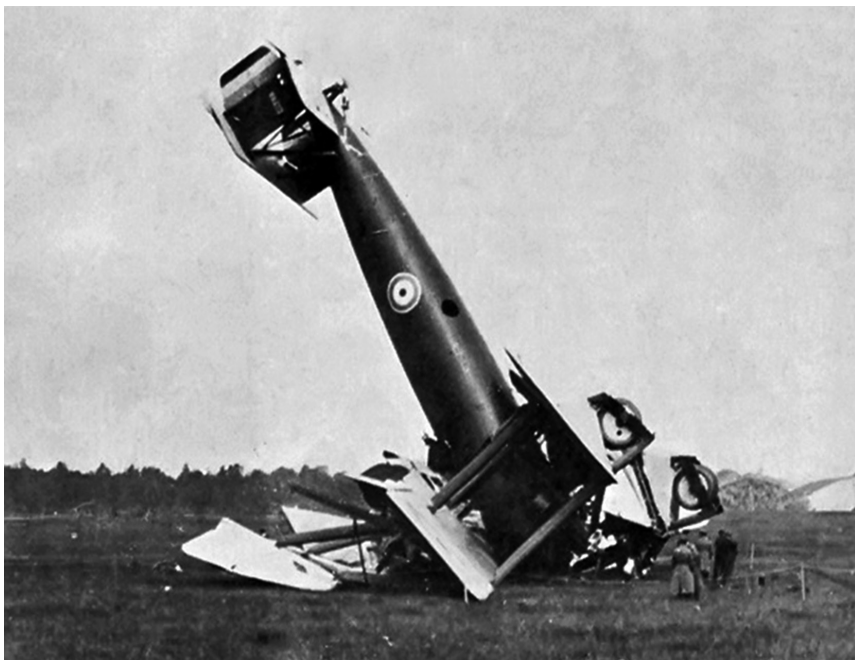
Ill. 1. Villa Savoye, Le Corbusier, author's collection.



Ill. 2. The Farman Goliath. Source: Le Corbusier, *Toward an Architecture*, Getty Research Institute, Los Angeles 2007.



Ill. 3. The Tarrant Tabor F1765 Triplane, 1919. The architecture of the wings and engines of the English triplane is disturbingly eerie and inelegant. Source: The sole Tarrant Tabor F1765 pictured in 1919 [in:] Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Tarrant_Tabor_1.jpg (access: 1.10.2021).



III. 4. Tarrant Tabor F1765 pictured after its crash in 1919. Source: https://commons.wikimedia.org/wiki/File:Tarrant_Tabor_3.jpg (access: 1.10.2021).

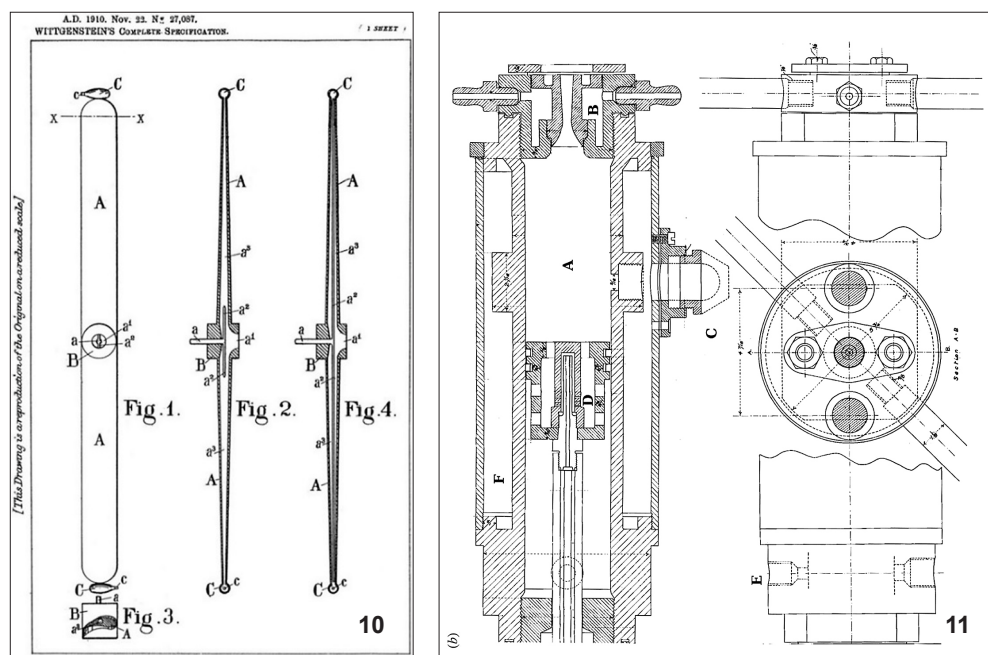
The Modernists described the airplane as a model of a perfect structure, obtained based on scientific laws of nature and mathematical calculations, while mostly ignoring its difficult development path. The history of aviation engineering is one of risky experiments, numerous and often erroneous and fatal assumptions and structural and material faults. We should keep in mind the immense number of conceptual, unsuccessful and abandoned proposals that were produced despite the application of rigorous research procedures, and which ultimately proved ineffective, dangerous or too harsh on the environment.



III. 5. Narkomfin House, Moisei Ginsburg, Ignatius Milinis, 1928–1930, Photo by Svetlov Artem. Source: https://commons.wikimedia.org/wiki/File:Narkomfin_building_2020-07.jpg (access: 1.10.2021).



III. 9. Haus Wittgenstein, Ludwig Wittgenstein, 1926–1928. Source: photo by Thomas Ledl, Wohnhaus, Haus Stenborough-Wittgenstein [in:] Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Kundmannngasse_19_Ansicht_1.jpg (access: 1.10.2021).



III. 10. Wittgenstein's British Patent No.27,087 "Improvements in Propellers Applicable for Aerial Machines", 1911. Source: Lemco I, Wittgenstein's aeronautical investigation, Notes and Records of the Royal Society, 2006, no. 61(1), pp. 39–51, <https://doi.org/10.1098/rsnr.2006.0163> (access: 1.10.2021).
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- III. 12. Doblhoff WNF 342, Prototype of a small helicopter propelled by jet engines placed at the ends of propeller blades, making use of Wittgenstein's proposal, engineer Friedrich von Doblhoff, Wiener-Neustädter Flugzeugwerke, Austria, 1943. Source: Helicóptero experimental: Doblhoff WNF 342 [in:] FDRA – Fuerza Aérea, 31.01.2019, <http://fdra-aereo.blogspot.com/2019/01/helicoptero-experimental-doblhoff-wnf.html> (access: 1.10.2021).
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