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# THE FORSSMAN TRI-PLANE, THE LARGEST AEROPLANE OF WORLD WAR I

# FORSMANA TRIJPLĀKSNIS – LIELĀKAIS AEROPLĀNS I PASAULES KARA LAIKĀ

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(1) Villehad Henrik Forssman (1884–1944) had grown up in Libau (Liepaja) in the province of Courland. He attended both primary and secondary school in this city before enrolling at the Riga Polytechnic Institute in 1903. Seven years later, in 1910, Forssman graduated from the institute as mechanical engineer. He moved to Germany that same year, where he constructed a soft-type dirigible for the Russian military at the balloon factory of August Riedinger in Augsburg. The maiden flight of this aircraft took place in January 1911. [1] Between 1911 and 1916 Forssman lived in Berlin-Johanisthal, operating a technical consultancy bureau. His services included helping constructors to register their inventions with the patent office, working together with firms in solving technical issues, and working as a teacher for various flight schools at the Johannisthal airfield. In 1914–15, Forssman was employed by Prince Sigismund von Preussen, an avid aviator, as technical adviser. During that time he constructed his first fixed-winged aeroplane, the Forssman Bulldogg. [2] Shortly after the outbreak of World War I, Forssman got employed by the Siemens-Schuckert Werke in Berlin, where he constructed two more of his Bulldogg monoplanes as well as one of Germany's first 4-engine biplanes. [3] In spring 1916, Forssman left Siemens, moving to Hanau in Bavaria where he started to work for J. Brüning & Sohn, a plywood manufacturer.

(2) In summer 1917, Forssman met the Swedish naval attaché in Berlin, Commander Cl. Lindström. Lindström was shown both drawings and photographs of a large aeroplane that, according to Forssman, was under construction at the firm Brüning in Hanau. Lindström was impressed. In addition, the evidence shown by Forssman clearly demonstrated that Forssman did not exaggerate. Lindström concluded, "There is no reason to question engineer Forssman's information." He later included an account of this meeting in one his regular dispatches to Stockholm. [4]
According to what Forssman told Lindström, Brüning was building a number of his large tri-planes (how many was notdisclosed) for the German Navy. These planes were to be employed as heavy bombers against targets in England. With maximum fuel, the plane was able to stay airborne for 48 hours. Was flying time reduced to 13 hours, or enough time to fly back and forth from Germany to the Orkney Islands, the plane was able to carry 20 tons of bombs, including sixteen mega-bombs each weighing 960 kg. Attacking Paris, with a flying time of seven hours, 26 tons of bombs could be carried. The Forssman tri-plane, according to its constructor, was a strategic bomber, the most advanced in the German arsenal. This was also readily apparent to Lindström, "Compared to this giant, the latest army aeroplanes used in the attacks against London are merely small fry." [5]

The tri-plane was not only able to carry a large amount of ordinance, it was also heavily armed with two machine canons and a large number of machine guns (42 were mentioned). This turned the Forssman tri-plane into a veritable flying fortress, the first of its kind in aviation history.
The tri-plane was powered by ten engines, two working in tandem on each of five propellers. The tri-plane was equipped with an ordinary landing gear having large wheels (diameter 2.5 m). The fuel was to be kept in 130 separate tanks; each one of these could be discarded separately, meaning that weight could be decreased during flight if needed. A reserve engine was planned to be carried along on each flight, as well as spare parts. The wingspan of the middle wing-pair was 64 metres, the span of the upper and lower pairs being shorter by some 10 metres. The total length of the plane was 40 metres, its height 17 metres.
Summarizing what Forssman had told Lindström in summer 1917, the following picture emerges regarding his large tri-plane:

1. the tri-plane was to be employed as a strategic bomber against targets in England;
2. the project was organized under the auspices of the German Navy, whereby an undisclosed number of planes was to be built;
3. the plane had an operational range of 48 hours; staying airborne for 13 hours, it could carry 20 tons of ordinance;
4. the plane was heavily armed with both machine canons and machine guns and had a crew of 35 men
5. 10 engines connected to five propellers;
6. wingspan 64 metres, length 40 metres, height 17 metres.

A number of basic specifications for the tri-plane were not mentioned in Lindström's report, for example data about the aeroplane's weight or engines. It can be assumed, though, given planned operations, that engines similar to ones installed on German so called Riesenflugzeuge were to be used, meaning Mercedes D.IVa or Maybach MbIVa.
Lindström's report to Stockholm about the Forssman tri-plane did not elicit any response from the side of the Swedish military. Given the aeroplane's extraordinary dimensions and performance parameters, one can assume, though, that many officers surely must have been rather astonished.

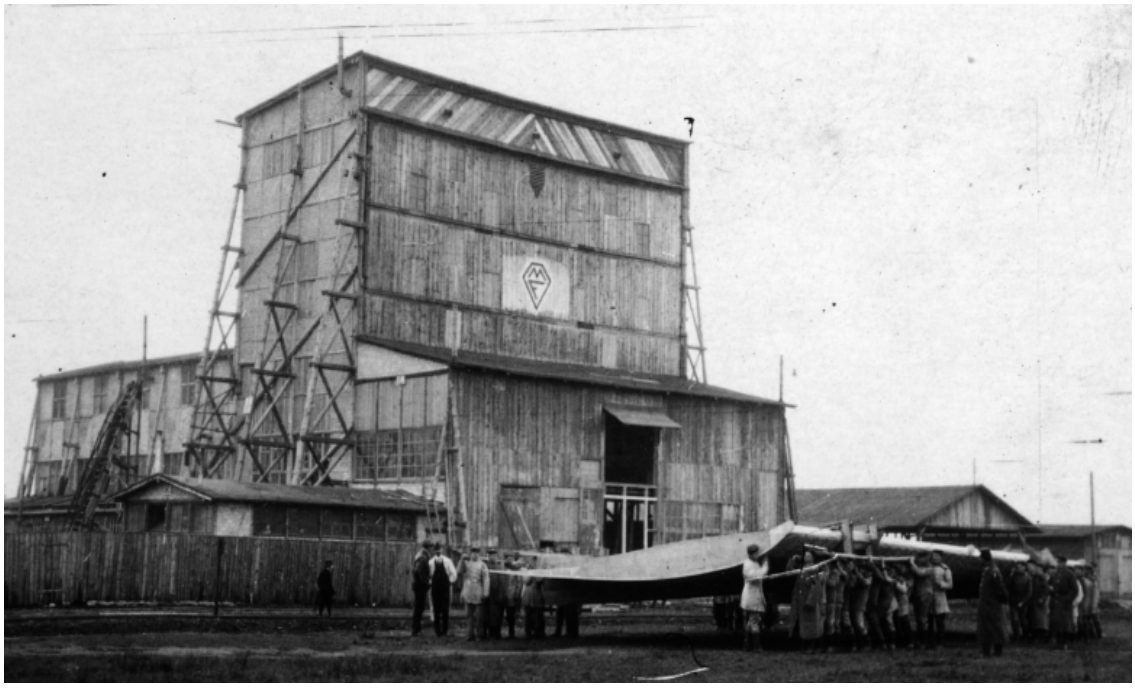
(3) The Forssman tri-plane has received limited attention by historians so far, mainly due to the paucity of historical sources. The only ones who published original contributions about the tri-plane are Peter M. Grosz and Gebhard Aders. [6]
Grosz, when collecting material for his monograph about German Riesenflugzeuge (R-planes), had personally met two former eyewitnesses, Waldemar Roeder and Georg Krupp, who had visited the construction sites of the Forssman tri-plane. Roeder, a military officer, had visited the workshop in Kahl in 1918. Roeder was impressed by what he saw, being confronted with "clean workmanship" and elegant design details like engine nacelles. [7] Krupp, in turn, had visited the factory in Köln-Westhoven in 1918. Regarding the construction of large bombers, Krupp was a highly qualified military expert. In 1917 he headed training detachments for R-planes at both the Staaken and Siemens-Schuckert factories. In 1918, together with a reorganization of the Inspectorate of Flying Troops (Inspektion der Fliegertruppen, or Idflieg), he was appointed to command Idflieg's technical department responsible for R-planes. [8] Grosz, unfortunately, did not provide any further information about his interview with Krupp.
Grosz, while searching in German and American archives, found a report issued by the Seeflugzeug Versuchs Kommando (research unit of the German Navy) in Warnemünde dated 4 September 1917, about a visit by Navy representatives to Brüning in Hanau: Besichtigung des Brüningschen R.-Flugzeuges in Hanau. [9] This report mentioned the following about the Forssman tri-plane: "Hanau R.10 x 240 hp Maybach. The aircraft, taken under construction without recourse to any aircraft specialists from the Army or Navy, was designed to establish air communication between Germany and America. As a result, not military standpoints were considered. Because of a number of natural setbacks that materialize with this kind of new construction, construction time has doubled, and, according to the representatives from the RMA (Reichs Marineamt), from the front, and Idflieg, will take at least another year. For this reason, the company, which has started the project at its own cost and risk, only having obtained the engines from the Navy on loan, has approached the Navy for

financial support. The inspection showed that the machine in its present form cannot be used for any kind of military assignment. A reconstruction would lead to a substantial delay of the delivery date; the engines as well as other installations do not correspond to today's standards regarding R-plane construction. Furthermore, serious doubts have arisen regarding the strength; by the time all these mistakes are taken care of, the whole construction would be outdated and surpassed by the already at present more advanced 2000 hp aircraft airplanes. Despite that, the company should submit calculations; after examination, a decision shall be taken if the Navy shall support the project or not." [10]

Shortly after this visit to Hanau, in mid-October 1917, the Navy, according to Grosz, declined further participation in the project: "The company approached the Navy for funds, but the Navy declined because its interest was only of a technical nature. Mannesmann was ready to refinance the project, but the Navy considered it worthwhile to inhibit further construction due to the scarcity of material and labour." [11] The problem with Grosz's conclusion is that it is inconsistent with the documentation he used. In the letter sent by the Admiralty to von Bülow on 18 October 1917 the following is stated: "It would be inexpedient to inhibit continued construction under such circumstances; all material is already available and the number of workers is limited. In addition, the fact remains that the airplane tries to solve a highly interesting problem, the support of which lies in the interest of the Army and Navy, all the more considering that state finances will not be burdened." [12]

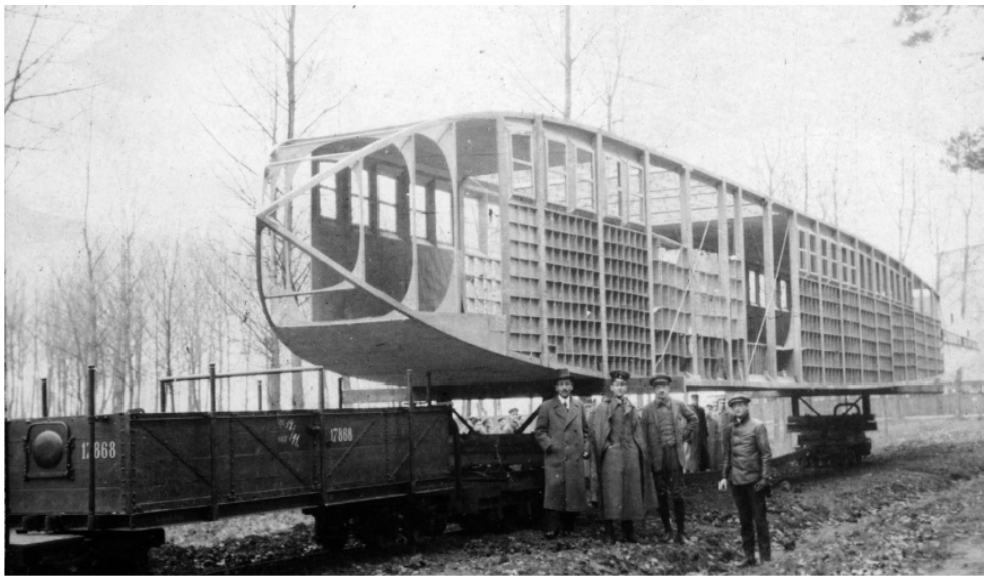
Grosz had simply misinterpreted the letter in question. The Navy did not want to stop construction of the tri-plane but felt that it would be inexpedient to inhibit going forward. Hence, after Mannesmann had entered the scene the Navy recommended continued development of the tri-plane.

In late 1917, Mannesmann took over the project from Brüning and moved construction to his workshop in Westhoven (see below). The specific circumstances of this take-over are unknown. What should be noted, though, is that this transaction would have been impossible without the acquiescence, if not full support, of the military. Construction of the Forssman tri-plane demanded manpower and material resources, factors which were under direct military control. In addition, moving the tri-plane from Hanau to Westhoven in spring 1918 was done by a group of 30–40 soldiers, commanded by an officer. [13]



Picture 1. Wings of the Forssman tri-plane are moved from the workshop of the Fahrzeugbau Brüning in Kahl to Mannesmann-Mulag in Köln-Westhoven, spring 1918
*Courtesy of Deutsches Technikmuseum, Berlin*

Grosz, in his monograph about German Riesenflugzeuge from 1972, levied harsh criticism against Forssman's character as well as against his 4-engine biplane built by SSW in 1914–15. This criticism was expanded to also include the Forssman tri-plane (Poll Giant, in Grosz's terminology). The construction of this aeroplane, according to Grosz, only showed "the designer's inexperience in aircraft design and fabrication". [14] Here is not the right place to meet Grosz's critique regarding Forssman's tri-plane. Suffice it to say that it is mostly unsubstantiated and afflicted with the same basic faults that mark his derogatory treatment of Forssman's 4-engine biplane. [15]



Picture 2. A small-gauge railroad and river-barge was used to transport the Forssman tri-plane to Köln-Westhoven. Forssman is standing second from the right
*Courtesy of Deutsches Technikmuseum, Berlin*

(4) Gebhard Aders traced Forssman first contacts with Brüning back to July 1915, when Forssman was supposed to have set up a technical bureau in Hanau. [16] At that time, Brüning operated a plywood factory at Langendiebach close to Hanau. Forssman, together with the Swedish engineer v. Carlsheim, had contacted Brüning and been able to convince the industrialist about their idea to build a large aeroplane able to cross the Atlantic. [17] One year later, on 4 August 1916, this eventually led to the formation of the company Fahrzeugbau Brüning GmbH, seated in Hanau. The firm's business was the "Construction, operation, and sales of all kinds of vehicles, establishment, participation and representation of like or similar enterprises." The stock capital was set to 500,000 Mark, while Eugen von Maltiz, a resident of Hanau, was appointed general director. Aders', and also Grosz's, information about the Fahrzeugbau Brüning is limited, consisting of not much more but a short notice from 1916 about the firm's establishment as well as an advertisement from 1917 published in the Zeitschrift für Flugtechnik und Motorluftschiffahrt. [18]
Aders' assertion about Forssman's first contacts with Brüning in 1915 is in all likelihood incorrect. [19] In summer 1915, Forssman was still working for Siemens-Schuckert in Berlin, being directly involved in modification work related to his 4-engine biplane.
The date of establishment of Fahrzeugbau Brüning in summer 1916 coincides in time with Forssman's attempts to get the Fokker Flugzeugbau in Schwerin, a major supplier to the German air forces during the war, interested in a new type of all-wooden wing designed by Forssman. A number of prototype wings were built by Brüning and sent to Fokker's workshop where they were installed on the Fokker V.1 and on other types. In the end, though, Fokker declined to have Brüning-Forssman supply serially produced wings. One reason, apparently, for setting up the Fahrzeugbau Brüning had been to produce aeroplane wings, maybe also other parts for aeroplanes, the other was to build the Forssman tri-plane.

As was pointed out by Aders, Brüning is not mentioned in the literature as supplier to the German military during World War I. Neither was the firm included among the 227 suppliers of

aviation equipment listed by the IAACC in 1923. [20] Nevertheless, that Brüning had been engaged by the military is shown by a list of firms contracted to build seaplanes for the German Navy. This list, issued on 14 June 1917 by the War Ministry, includes a "Flugzeugbau Brünig Grossenhaim a.M." [21] Had Brüning been added to this list because it had been a subcontractor, or because it supplied plywood, the main construction material used for aeroplanes? Probably not: had this been the case, the list would have been much longer and included hundreds of firms. The only reasonable explanation why Brüning was put on this list is the fact that it was building the Forssman tri-plane, a project that enjoyed naval backing.

During World War I, Brüning turned into a major supplier of special plywood used in aeroplane construction. In summer 1915, it had filed a patent for special plywood used for this purpose: Verwendung von aus kreuzweise verleimten Schichten bestehenden Sperrholz für Flugzeugteile u.dgl. (Use of crosswise glued together layers of plywood for airplane parts etc.). [22] It is quite possible that Forssman, given his experience with patents, something he had extensively dealt with in Johannisthal between 1911 and 1916, had helped Brüning to register this invention. Possibly it had been in this connection first contacts were established between Forsman and Brüning. It is even possible that Forssman had been the actual inventor, not Brüning. This option was later suggested by Erich Niemann, a military officer, who had met Forssman that same year: "I got to know Mr Forssman at that time, first as chief-constructor of the airplane department of the firm I. Brüning in Hanau/Main; the firm was building a Riesenflugzeug made of special Forssmanholz, invented by Forssman and patented under his name." [23] Niemann, writing 30 years later, possibly no longer remembered the exact details of what had happened in 1915–16. Forssman's special plywood, the so called Forssmanholz, was not patented before 1921.

Aders, similar to Grosz, levelled harsh words against Forssman and his large plane. According to Aders, it was close to charlatanry to propose to design and build an aircraft in 1915 that was supposed to fly for 80 hours back and forth across the Atlantic. That Forssman had found sponsors for his idea was attributable to his ability to convince people. It was simply incomprehensible, according to Aders, how one could imagine building a plane of such gigantic proportions, given the ongoing war, scarce resources, and a lack of technical prerequisites. Yet, it had happened: "The history of the Forssman-giant is only one example among many of how a genial constructor is able to convince well-meaning sponsors that large profits can be made with airplanes, be it because the military administration was interested in them, or because civil employment was to generate profits." [24] Different from Grosz's diatribes against Forssman personally, Aders still acknowledged the geniality of the plane's design and also its constructor. What he saw were overwhelming practical obstacles.

Is Aders' analysis correct, or complete? Involved in the Forssman tri-plane were not only private financiers, as we have seen, but also military authorities, experts from the Navy and from Idflieg, officers who on a daily basis dealt with new aviation technology. The authoritative institution in Germany during World War I, having a thorough understanding of all aviation related issues, was Idflieg. It was Idflieg that examined new inventions, issued technical specifications and recommendations, decided on serial production of aeroplanes, assigned resources, controlled manufacturing, and examined the final products. Idflieg had been involved in the tri-plane project. A large project like Forssman's demanded not only finance but also machinery, skilled labour, and scarce raw materials. During the ongoing war, only the military had the power to assign these resources. One simple question Aders could have asked is: is it reasonable to assume that Idflieg would allow Brüning, later Mannesmann, to engage in this extraordinary venture in case it had felt it was useless, or that it would have allowed Brüning and Forssman to start this project in order to make money?

(5) Reinhard Mannesmann (1856–1922), already mentioned several times, had studied machine building and chemistry before entering the steel business of his family in Remscheid. [25] In 1884–85, he and his brother Max developed a special process (Schrägwalzverfahren) used for making seamless steel pipes in a rolling-mill. In 1890, the Deutsch-Österreichische Mannesmann-röhren Werke AG was founded. Already in 1893, caused by heavy financial losses, the two brothers had to sell their shares and leave the board of directors of the company, in 1895 they left the company altogether. After failed business activities in the United States and Morocco, Reinhard eventually returned to Germany in

1914 where he entered the Mannesmann-Lichtwerke GmbH, founded by three of his brothers in 1900. In the face of war the factory was restructured to produce weapons and ammunition and soon employed more than 2,000 workers. Another firm owned by members of the Mannesmann family when war broke out was Mannesmann-Mulag AG in Aachen, producing road vehicles.
Under what circumstances Forssman and Mannesmann had originally met is not known. In 1915, Mannesmann registered a number of aviation related patents: possibly it was in this connection Forssman had gotten acquainted with the industrialist, offering his specialized consultancy services. [26] The common denominator for all four of Mannesmann's inventions was large aeroplanes, a type that in 1915 was still uncommon in all countries except Russia. Forssman, on the other hand, was one of the pioneers in Germany regarding large multi-engine aeroplanes. One spinoff from these early talks could have been Forssman's future tri-plane project. Another concrete result from this early encounter, something that would materialize first in 1917–18, was the development of unmanned aerial vehicles. In any case, Forssman was employed by Mannesmann-Mulag at its Köln-Westhoven plant in late 1917. Some months later, the Forssman tri-plane was moved from its first workshop in Hanau-Kahl to Westhoven where a special hangar had been erected to house the plane. In addition to the tri-plane, Mannesmann-Mulag also engaged in other aviation related projects, with Forssman being chief engineer.
The Forssman triplane was not completed when the war ended in November 1918. The aeroplane never flew.

(6) Technical information about the Forssman tri-plane, apart from what Forssman had mentioned to Lindström in 1917, is restricted to a report from the Inter-Allied Aeronautical Commission of Control (IAACC) from September 1919. [27] What allied inspectors had found at Westhoven were remnants of Forssman's tri-plane, including main sections of the fuselage, all-wooden wings, struts, spars, and (wooden) landing wheels. According the report, the tri-plane was able to carry petrol for an 80-hours flight, operating with a speed of about 130 km/hr. The plane was believed to have been a long distance bomber, "allegedly" intended to bomb New York; from where this allegation had emanated was not mentioned. [28] No bomb throwing mechanism was found, however.
The main material used for building the aeroplane was wood and plywood. The centre wing was some 20 metres longer than both the upper and lower wing. All wing surfaces were covered with 3-ply veneer, with an additional thin layer of varnished muslin placed on top for protection. The wings were said to be heavily cambered, with ribs set wide apart, and with front spars placed unusually close to the leading edge. Two types of struts were used to stabilize the wings, one made of hallow steel tubing, the other of wood. The inspectors found the wing construction to be heavy, and disproportionally weak. Ailerons were fitted to the outer ends of the middle wing-pair. The rectangular shaped fuselage, said to be unduly heavy due to the extensive use of 3-ply veneer, was placed centrally around the middle wing. Longerons and cross members were made of beech, while sides, top, and bottom were covered with 3-ply veneer. The cabin interior was free of any bracings, while diagonal cable bracings were fitted to the sides, top, and bottom. Six windows were installed on each side of the centre section. No engines or engine mountings were found; neither was there any information regarding the type and strength of engines to be installed. Only remnants of the tail assembly were left, while control surfaces such as rudder and elevator were missing altogether. Regarding the landing gear, only one of the plane's huge wheels, made of wood, was found.
According to the inspectors, overall workmanship was good. Their main objection raised by the officers concerned the structural integrity of the plane's fuselage and wings. Basic specifications of the Forssman tri-plane, included in the IAACC and the Lindström report, are shown in Table 1.

**Table 1**

Basic specifications of the Forssman tri-plane

| | **IAACC report 1919 [29]** | **Lindström report 1917 [30]** |
|---|---:|---:|
| Main construction material | wood, plywood, veneer | |
| Length (m) | 45.7 (150 ft) | 40 |
| Height (m) | 14.6 (48 ft) | 17 |

| | | |
|---|---|---|
| Wingspan middle (m) | 50.3 (165 ft) | 64 |
| Wingspan other (m) | 31.1 (102 ft) | 54 |
| Wing chord (m) | 6.7 (22 ft) | 54 |
| Total wing-area (m²) | 753 | |
| Distance wings (m) | 5.5 (18 ft) | |
| Struts | 4 each side | |
| Wings | covered with 3-ply veneer | |
| Ailerons | middle wing | |
| Landing gear | 2 + 2 wooden wheels + tailskid | |
| Wheel diameter (m) | 2.4 (7 ft 9 in) | |
| No of engines | 10 | 10 |
| Total HP | 2,400 est. | |
| Propellers | 10 | 5 |
| Max speed (km/hr) | 130 | |
| Fuel (hrs) | 80 | |
| Fuel tanks | | 130 |
| Operations (hrs) | | 48 |
| Operational (hrs) with payload | | 13 hrs with 20 tons bombs |
| Arms | | 2 machine canons + 42 MGs |
| Bombs | | 16 x 960 kg bombs |
| Crew | | 35 |

(7) Given the paucity of sources, it is difficult to fill in all the details regarding the construction of the Forssman tri-plane. Still, the general lines of development are clear:

1. in 1915–16, Forssman designed a large tri-plane, representing a continuation of his previous work at Siemens-Schuckert with a 4-engine biplane;
2. in 1916, Forssman got Brüning and Deutsche Bank interested in the tri-plane project;
3. in 1916, the German military started to support the project, with the Navy providing aero-engines for tests;
4. in 1916, construction of the plane got underway at a special workshop in Kahl near Hanau;
5. in summer 1916, Brüning (possibly also other parties) formed a special company, the Fahrzeugbau Brüning GmbH; the company's aim was to build aeroplanes and aeroplane parts, including the Forssman tri-plane; the company's chief constructor (Chefkonstrukteur der Flugzeugbauabteilung) was Forssman;
6. in 1917, the Deutsche Bank withdrew its support, and Brüning asked the Navy for financial help;
7. in August 1917, a naval delegation visited Kahl to inspect the plane; however, in October 1917 the Navy declined financial support but encouraged the continued construction of the plane;
8. in 1917, Reinhard Mannesmann entered the project;
9. in early 1918, the aeroplane, still unfinished, was moved from Kahl to new facilities at Mannesmann-Mulag's Westhoven plant;
10. in 1918, Forssman became head of Mannesman-Mulag's Flugzeugwerk, where he continued to work with his tri-plane while also engaging in other aviation related projects.

(8) Looking at large aeroplanes that were constructed during the later part of World War I one quickly realizes that no other aeroplane, built in Germany or any other country, came anywhere close to the dimensions and performance criteria exhibited by Forssman's tri-plane.

The largest aeroplane next to Forssman's built in Germany during World War I, the SSW R.VIII, was completed only in summer 1919. During a test run of its engines on ground a propeller disintegrated and smashed into the fuselage. The R.VIII was not repaired, and subsequently never flew. Two more large aeroplanes from outside Germany can be used to highlight the extraordinary dimensions of Forssman's tri-plane: one is a tri-plane constructed by the Italian Gianni Caproni in 1917–18, the other one is a tri-plane built by the English manufacturer W.G. Tarrant Ltd in 1917–19.

Only few exemplars of the Caproni CA 42/ 48 were built, and mainly used for night bombings. [31] The "Tarrant Tabor", only one exemplar was built, crashed already on its maiden flight on 26 May 1919 at Farnborough and was not repaired. [32] Table 2 shows the main specifications of the aeroplanes just mentioned. As can be seen, the Forssman exceeded the other three large planes in all respects except engine power, where the "Tarrant" could muster more horse powers than Forssman's tri-plane. [33]

**Table 2**

Basic specifications of large aeroplanes compared to the Forssman tri-plane

| | **Forssman** | **SSW R.VIII** | **Caproni CA 42/ 48** | **Tarrant Tabor** |
|---|---|---|---|---|
| Engines no | 10 | 6 | 3 | 6 |
| Total HP | 2,400 | 1,680 | 1,200 | 2,700 |
| Wingspan (m) | 50.3 | 48 | 29.9 | 40 |
| Wing-area (m²) | | 445 | 200 | 460 |
| Length (m) | 45.7 | 21.6 | 13.1 | 22.3 |
| Height (m) | | 7.2 | 6.3 | 11.3 |
| Empty weight (kg) | | 10,000 | 4,000 | 11,226 |
| max weight (kg) | | 16,000 | 7,500 | 20,263 |
| kg/m² (max load) | | 35.0 | 39.0 | 44.1 |
| max speed (km/hr) | 130 | 130 | 140 | |
| Endurance (hrs) | 80 | | | |
| max altitude (m) | | 4,500 | 4,900 | 3,960 |

Questions remain about the Forssman tri-plane, about its aerodynamic characteristics, structural integrity, stability, flight performance, or manoeuvrability, but also its intended usage by the German military. What surprises is not so much the fact that construction of the plane had gotten started, but that the military did not show any greater interest in having construction of the aeroplane brought to its completion. On the other hand, new documents might surface in the future, throwing new light on this extraordinary plane and its constructor.

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17. Grosz, P.M. The Brüning – Forssman R-triplane, or the Poll Giant in search of an identity, 1975. (Manuscript, Deutsches Technikmuseum, Berlin, Grosz Collection)
18. Grosz, P.M. The Poll Giant in Search of an Identity // World War I Aeroplanes. – No. 56 (April 1976), P. 7.
19. Forssman's address in Hanau is found on a patent application for a "Flugzeugsteuer" he had filed in 1915. However, information about this filing, referred to by Aders, was published in 1917 in Zeitschrift für Flugtechnik und Motorluftschiffahrt (1917, H. 11–12, P. 106). Hence, the Hanau address refers to 1917 and not 1915, when Forssman was most likely still living in Johannisthal.
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22. Patentschrift Nr 302 481, J. Brüning & Sohn, A.-G. in Langendiebach, 1. August 1915 (publ. 21.4.1920).
23. Niemann an Behling, 24. Juli 1944. (Handwritten letter, Deutsches Technikmuseum, Berlin, Grosz Collection)
24. Aders, G. Der Riese von Poll // Rechtsrheinisches Köln. – Bd. 5 (1979), P. 184.
25. Neue deutsche Bibliographie, Bd. 16. Berlin, 1990, P. 62–63. Deutsche biographische Enzyklopädie, Bd. 6. München, 1997, P. 595.
26. Patentschrift Nr 320 843, 20. Februar 1915. Nr 320 844, 8. Mai 1915. Nr 318 431, 1. Mai 1915. Nr 314 140, 15. Februar 1917.
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***Sollinger G. Forsmana trijplāksnis – lielākais aeroplāns I Pasaules kara laikā***
*1916. gadā Kālā, tagadējās Vācijas federālās zemes Hesenes teritorijā, sāka būvēt īpaši lielu trijplāksni. Tā būves projektu finansēja saplākšņa ražotājs Brīnings un uzņēmums "Deutsche Bank"(Vācijas banka), savu atbalstu sniedza arī vācu militārās iestādes. 1917. gada vasarā„Deutsche Bank" savu finansējumu pārtrauca. Brīninga mēģinājumi saņemt finanses no Vācijas jūras flotes bija nesekmīgi. Projekta turpināšanu uzņēmās firma "Mannesmann-Mulag", trijplākšņa būve tika pārcelta uz Ķelni. Kad 1918. gada novembrī beidzās I Pasaules karš, aeroplāns nebija uzbūvēts. 1919. gada pavasarī sabiedroto valstu inspektori atrada minētā aeroplāna paliekas un par savu atradumu uzrakstīja ziņojumu. Citi dokumentāri pierādījumi par šo aeroplānu datēti ar 1917. gadu, kad tā konstruktors Vilehāds Forsmans Berlīnē satika zviedru militāro atašeju un pastāstīja viņam par aeroplānu. Ja Forsmana trijplāksnis būtu ticis uzbūvēts, tas būtu bijis pasaulē lielākais bumbvedējs, kurš piedalās kara operācijās. Tā darbības rādiuss un maksimālā nestspēja būtu pārspējusi visus stratēģiskos bumbvedējus – gan vācu, gan citu ražotos. Forsmans bija plānojis to pielietot kā stratēģisko bumbvedēju pret mērķiem Anglijā. Iepriekšējie pētījumi par Forsmana trijplāksni bija nepilnīgi un izskaidroja nepareizi gan aeroplāna attīstību, gan konstruktora kvalifikāciju.*

***Sollinger G. The Forssman Tri-plane, the Largest Aeroplane of World War I***
*In 1916, production of an extraordinarily large tri-plane got underway in Kahl in northern Bavaria. The Project was financed by Brüning, a plywood manufacturer, and the Deutsche Bank; it also enjoyed backing from German military authorities. In summer 1917, the Deutsche Bank withdrew its finances. Attempts by Brüning to get financial backing from the German Navy failed. Instead, the project was taken over by Mannesmann-Mulag, with production of the plane being moved from Hanau to Köln-Westhoven. When World War I ended in November 1918, the plane was unfinished. Allied inspectors discovered remnants of the aeroplane in spring 1919, writing a report about their finding. Other documentary evidence about this plane dates from 1917, when the plane's constructor, Villehad Forssman, met the Swedish naval attaché in Berlin, telling him about the plane. The Forssman tri-plane, if completed, would have been the largest aeroplane in operation worldwide. Its operational range and bomb carrying capacity exceeded the capacities of all other strategic bombers, German or other. According to Forssman, the aeroplane was to be as a strategic bomber against targets in England. Previous research about the Forssman tri-plane has been incomplete, and has misinterpreted the plane's development as well as the qualifications of its constructor.*

***Золлингер Г. Триплан Форсмана – самый большой аэроплан во время Первой мировой войны***
*В 1916 году в городе Кал, ныне на территории федеральной земли Гессен в Германии, началось строительство особенно большого триплана. Этот проект был финансирован производителем фанеры Брюнингом и предприятием „Deutsche Bank" (Банк Германии), а также немецкими военными учреждениями. Летом 1917 года „Deutsche Bank" финансирование прекратил. Брюнингу не удалось получить финансы от морских сил Германии. Проектирование продолжала фирма „Mannesmann-Mulag" и перенесла строительство триплана в город Кельн. В ноябре 1918 года кончилась первая мировая война, но строительство аэроплана не было завершено. Весной 1919 года инспектора союзников нашли остатки упомянутого аэроплана и об этом написали сообщение. Сохранились и другие сведения об аэроплане – в 1917 году конструктор Вилегад Форсман в Берлине встретил шведского военного аташе и рассказывал ему об аэроплане. Если триплан Форсмана был бы построен, он был бы самым большим бомбардировщиком, который можно использовать в боевых операциях. Радиус его действия и максимальная грузоподъемность намного превзошла бы возможности всех до того времени в Германии, а также в других странах, построенных стратегических бомбардировщиков. Форсман планировал использовать трипланы в качестве стратегических бомбардировщиков против целей в Англии. Прежние исследования о триплане Форсмана были неполными и неправильно осветили развитие аэроплана и квалификацию его конструктора.*