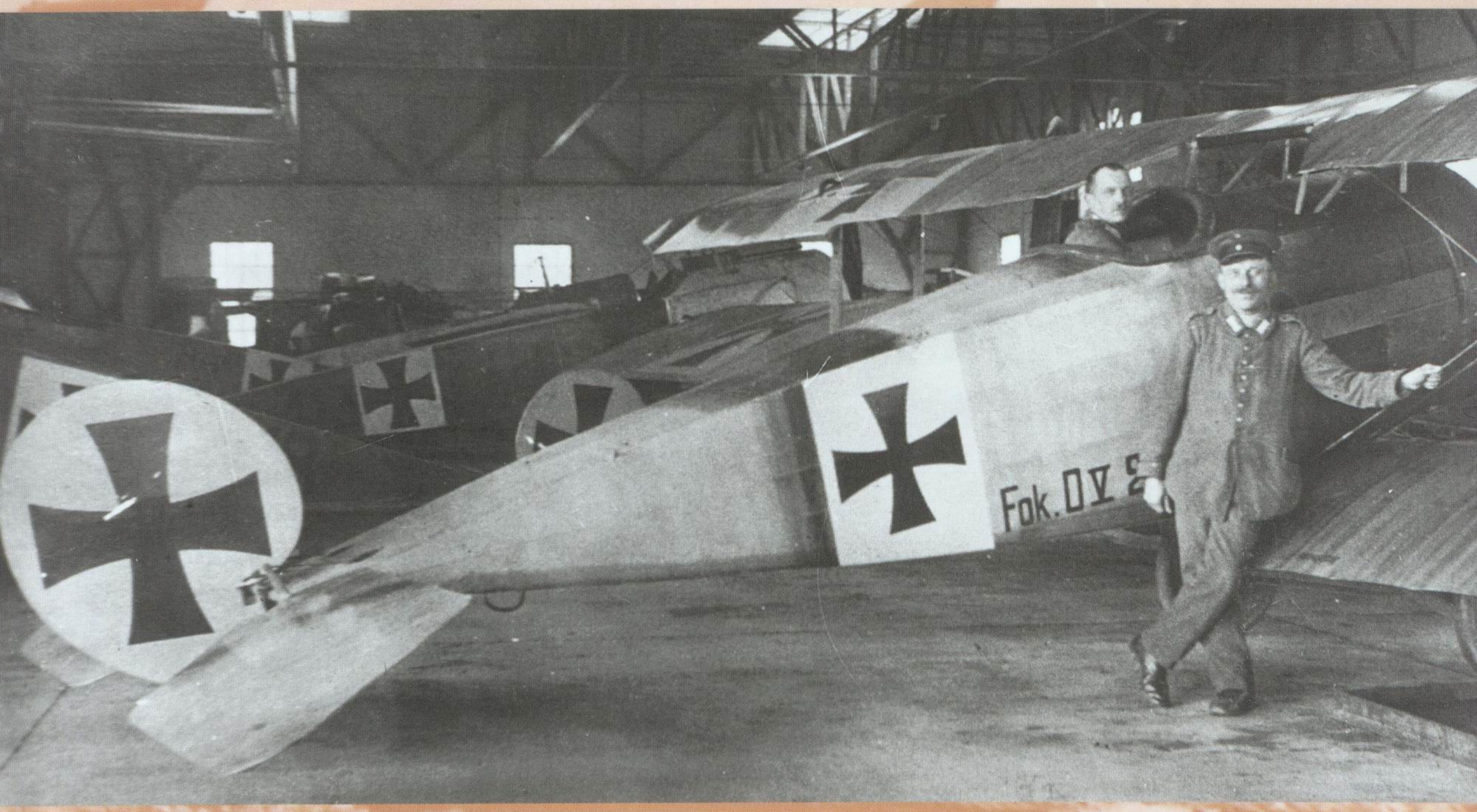
CROWOOD AVIATION SERIES

FOKKER AIRCRAFT of World War One



Paul Leaman

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FOKKER AIRCRAFT of World War One

Paul Leaman

The Crowood Press

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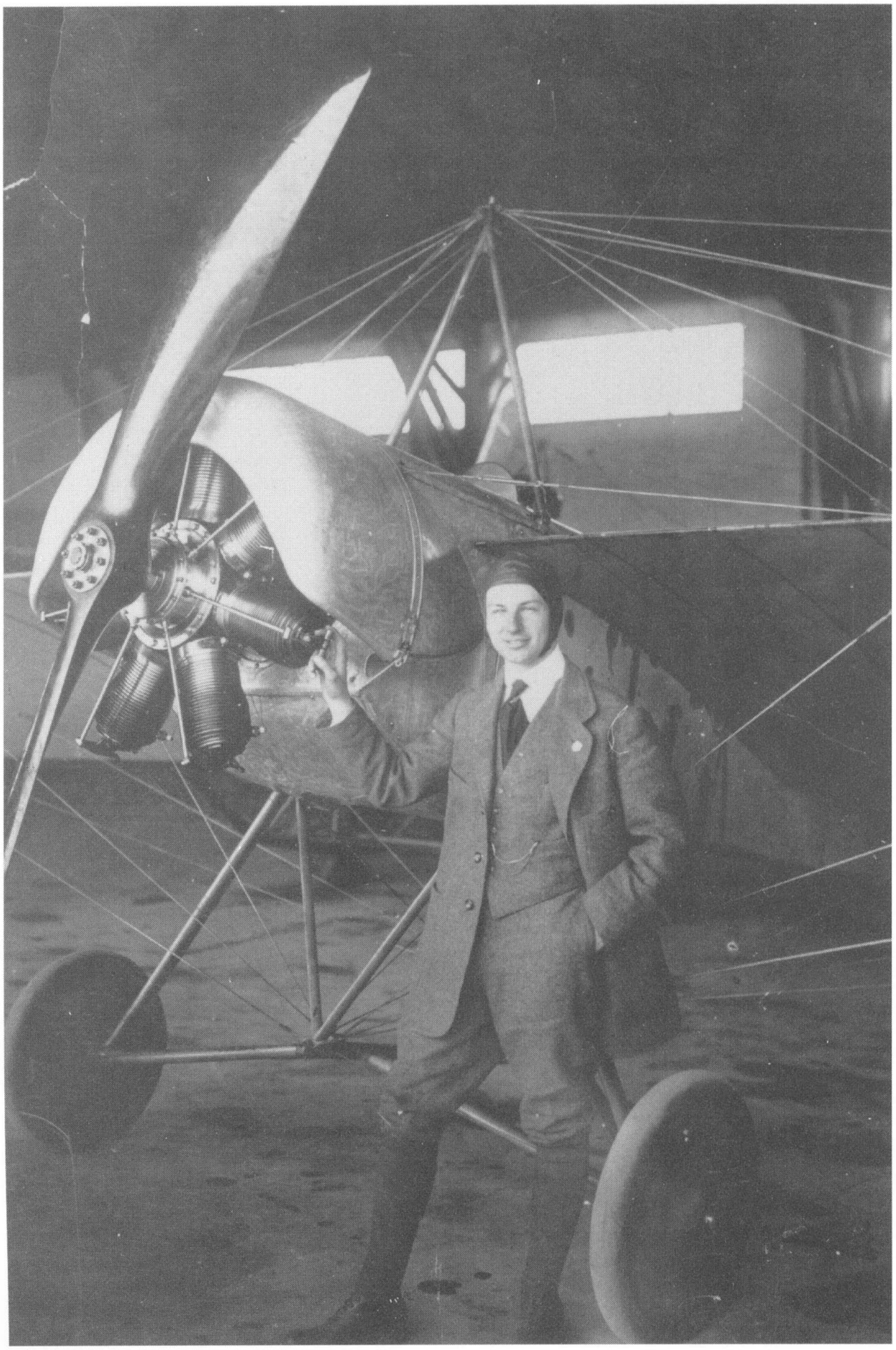
Introduction



Fokker with the M.5L in 1914. Greg Van Wyngarden

Mention of 'aeroplanes' and 'World War One' conjures up scenes of swirling 'dog-fights' fought between young pilots in flimsy machines over the muddy battle-fields of France and Belgium in the years between 1914 and 1918. On the German side, we think of the Fokker E.III *Eindecker* of 1915; various Albatros scouts from the D.I through to the D.Va; the elegant, but poorly performing, Pfalz D.III and D.IIIa; Fokker's Dr.I triplane of 1917; the Fokker D.VIIs of 1918 and, perhaps, the E.V/D.VIII of the closing days of the war. While the object of this book is to describe the fighting and training machines built by Fokker GmbH, it is appropriate that we first take a quick look at the man behind the company, Anthony Fokker, and how he came from birth on a coffee plantation in Java to be the head of a major European aircraft manufacturing company.

Fokker's path is not an easy one to follow. The truth has been obscured by time, and little that has been written on the subject has been without some bias. *Fokker – the Creative Years* has the benefit of being written by Alfred Weyl, a sound aeronautical engineer, but is marred by his personal animosity towards Fokker. Even *The Flying Dutchman*, Fokker's 'autobiography' written in collaboration with Bruce Gould and published in 1931, tells only those parts of the story that reflect well on Fokker, and is light on substantiated fact. With *Fokker – The Man and the Aircraft* by Henri Hegener we have a book that was written by a leading aviation journalist who knew Fokker and many of his contemporaries during the period 1919 to 1939, that presents a balanced account but is short on technical details. From these and a number of other sources, I have tried to extract the facts of Fokker's career and the aircraft he built and flew during it. I can only hope that I have not erred over much in the process.

Paul Leaman
July 2000

CHAPTER ONE

Beginnings

By 4 August 1914, as war spread across Europe, Anthony Fokker was an established aircraft manufacturer with a flourishing factory at Schwerin-Gorries in Germany, and running contracts to supply his products to the German Army. Anthony Herman Gerard Fokker was born on 6 April 1890 in the small settlement of Blitar near Kediri on the island of Java (now Indonesia), in what was then the Dutch East Indies. Herman Fokker, his father, was the owner of a profitable coffee plantation and, as a small child, Anthony was allowed to run wild with the children of the plantation, spending his waking hours playing with them in the jungle. He gained a splendid foundation of good health and became fit, agile and the possessor of quick reactions as well as a sharp mind. This idyllic lifestyle was to change in 1894 when his parents decided that plantation life in Java would deprive Anthony and his elder sister Katharina of a sound, European-style education. So, selling the plantation, the now-affluent family moved back to the Netherlands and settled in an imposing house on Kleine Houtweg in Haarlem, a small town on the banks of the River Spaarne, and Anthony went to school.

Through all of his time at school, Anthony was unhappy and a problem to his parents. Used to the freedom of the plantation, he was constantly at odds with his teachers and regarded time spent in classes as wasted. Partly because he was of slight build and apparently frail, but also because of his keen mind and growing creative ability, he tended to keep himself aloof from his fellow students and their, to him, childish pursuits. Rather, he preferred to spend his time in the workshop he established in the large attic of his home. As he grew older, he developed his technical skills, building steam engines, experimenting with electricity and perfecting his woodworking abilities. When he was twelve years old he built a wooden boat which he later fitted out with a mast, sails and outriggers. However, his academic

Anthony Fokker sporting the ribbon of his Iron Cross in his buttonhole. Alex Imrie

achievements at school were poor and his reports show that he scraped through most years with 50 per cent marks. He was moved up conditionally at the end of his first year after two re-examinations, spent two years in the second form and finally scraped through the third year to spend the rest of his time in the fourth year.

Despite his reluctance to join in activities at school, Fokker did find one kindred spirit amongst his fellow pupils. This was Fritz Cremer, whose father was later to become the Dutch Ambassador in Washington. Anthony and Fritz shared an early enthusiasm for technical matters and together came up with an idea for a 'punctureless' rubber tyre. With financial support from their parents, they carried out a number of experiments, racing the Cremers' Peugeot car equipped with tyres of their design along the road which ran for twelve miles beside the Haarlem–Amsterdam railway track. Their experiments ended when a lawyer engaged by their parents found that an existing French patent nullified their design rights. A major result of all this was that Fokker left school to spend time on his work and never returned. The year was 1908, Fokker was eighteen years old and had nothing to show for his last five years of schooling.

Called up for military service, Fokker was sent to the 9th Company, 2 Regiment, Garrison Artillery in the old fortress town of Naarden. Again, he was not happy and, with a series of malingering deceptions, managed to be discharged.

The next months were spent amusing himself in Haarlem, sailing on the river in his boat and working to suit himself in the local smithy where he learned to operate the lathe and to work the forge. Again his father intervened, this time to send him off with a companion on a steamer up the Rhine to Bingen in Germany, where it was planned he would take a course in automobile engineering. Fokker found the course to be a disappointment and less comprehensive than the brochure had led his father to believe. The premises were poorly equipped, with few machines or vehicles, most of them aged and unroadworthy. From a 'graduated' student of the school Fokker learned that he had already achieved the practical standards required for the government certificate he was seeking and that theoretical tuition available from the school was limited. He felt that to stay on would be a waste of money so he moved on. His initial shyness overcome, he travelled on his own and discovered a school for chauffeurs situated at Zahlbach near Mainz that also offered a course in aeroplane construction.

The Zahlbach Aviation School

Fokker's interest in aviation was not a new thing as, while still at home, he had experimented with model aeroplanes and often stated a wish to learn to fly, a longing his

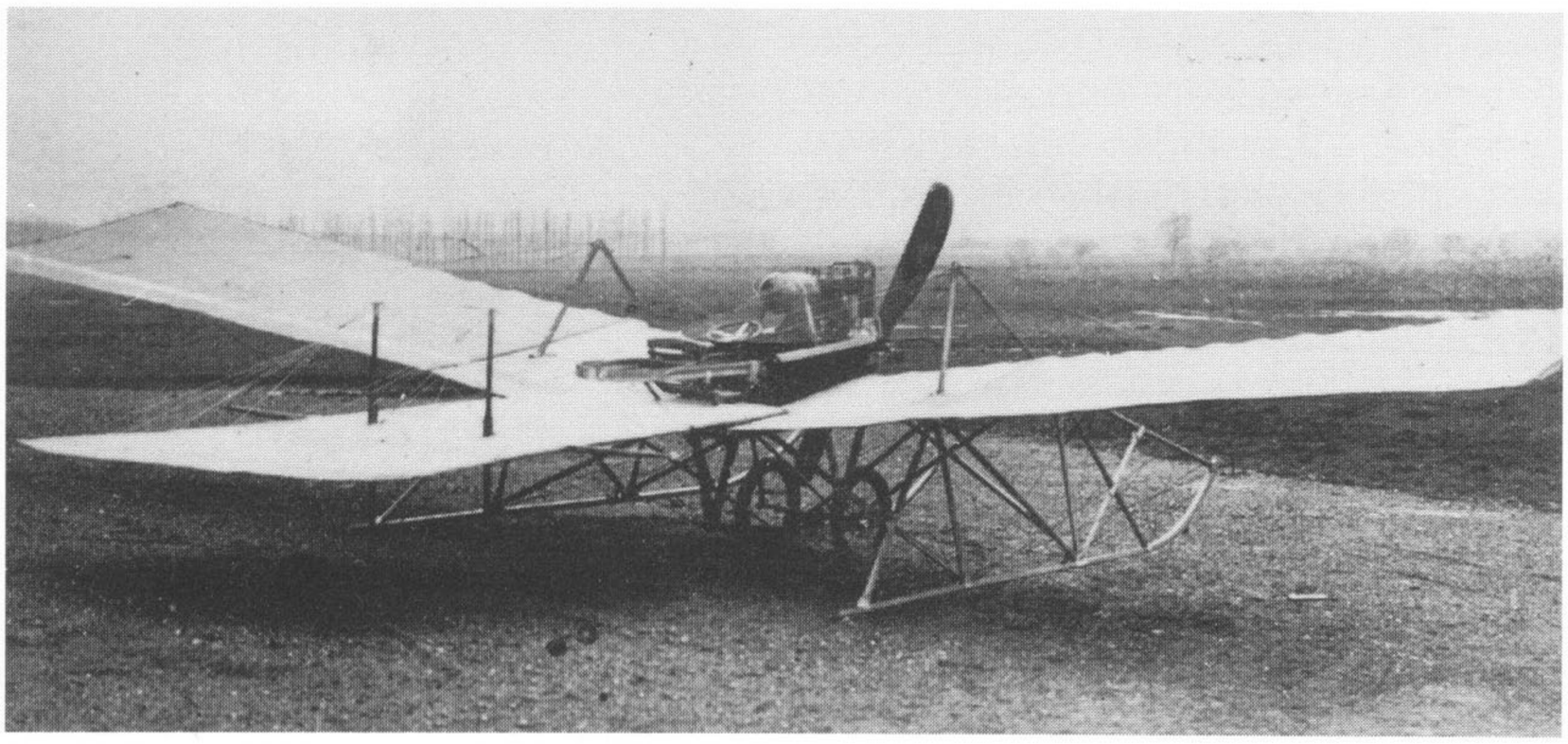
father had strongly resisted. So he immediately wrote to his parents explaining that the automotive course was a waste of their money but that he wished to remain in Germany to wait the start of the aviation course at Zahlbach – in the meantime, he said that he would explore the area and return home before committing himself to the course. It is doubtful if he did so as he was still writing of coming home in October 1910 when the course was due to resume.

Students at the aviation school had already built one aeroplane, but this had proved too heavy for flight. They were in the process of constructing a lighter machine using an engine that was being bought by a backer who wished to learn to fly. The new aeroplane was a conventional (for the time) biplane with the pilot seated between the wings and with the nose elevator and the rear rudders carried on booms in front of and behind him. For the first flight of this machine, the pilot was to be Bruno Buechner, one of the pupils, who claimed to have learned to fly in France. In fact, although he had been involved in a flying accident, Buechner had never actually piloted a machine himself and was really quite inexperienced. Not surprisingly, the first 'flight' ended in disaster. Buechner succeeded in taxiing at speed but could not leave the ground. He also failed either to bring the machine to rest or to turn at the end of his run. The result was a devastating crash at the end of the field. Though Fokker's hopes for early flying experience were thwarted, Buechner went on to become a proficient pilot and Fokker to design and build his own aeroplanes.

Birth of the *Spinne*

Fokker's next move was to form a loose partnership with Oblt von Daum with the object of building an aeroplane of Fokker's own design. Von Daum was a fifty-year-old ex-military officer and a fellow student on the ill-fated course, with great confidence in Fokker's enthusiasm and ability. He provided funding for purchase of a 50hp Argus aero-engine and was also able to find a suitable location for the work, the Zeppelin shed at Baden-Baden, which was empty and available for use as an erection area. Fokker's contribution to the partnership was some 1,500 Marks, his knowledge and his practical ability.

As a young man Fokker had conducted experiments with a series of model gliders dropped from the window of his attic workshop. He had watched with keen interest as they fell and compared the distance each travelled with the shapes and attitudes of their wings. His first aeroplane design was thus based upon what he had learned from these model experiments. It was a relatively simple monoplane with swept wings of pronounced dihedral intended to give it inherent stability. It is clear that Fokker undoubtedly provided the concept design in sketch form for this machine, but lacked the academic technical training needed to complete the design of the structure and components. It is possible that this work was done for Fokker by Jacob Goedecker, a professional engineer and ship builder with an engineering workshop nearby and practical experience of building flying machines. Some of the necessary metal components were manufactured by the Automobile-Fachschule in Mainz and others probably by Goedecker. Work on the machine started in the autumn of 1910 and was completed in October of that year.



Fokker's first *Spinne*. Frank Cheeseman

The 'fuselage' (for want of a better word) was a robust wooden structure based upon two longerons that were joined in the horizontal plane by cross members. All of these items were fashioned out of ash, the sides of the longerons being spindled out to reduce their weight. The means of assembly of these components is not known but, as they were made by a local carpenter's shop, it is likely that they used glued mortise joints.

The engine was mounted directly onto the front end of the longerons with two large, flat cooling radiator panels mounted one outside each beam. A small cylindrical gravity petrol tank was mounted above the fuselage on V-shaped wooden cabane struts and the sole item of instrumentation, a fuel-level sight glass, fitted behind it. The pilot's seat was a slatted wooden chair mounted just above the fuselage beams. Control of the machine in flight was by means of a wheel mounted at the top of a tubular steel column upon which the ignition switch and throttle control for the engine were also mounted.

The wings were based on two spars, one of which formed the leading edge and the second, at two-thirds of the wing chord back from it, an anchor point for the ribs. The wing spars were each made of three steel tubes of diameters that diminished from the wing root to the wing tip, providing strength where needed and lightness where strength was not the main requirement. The tubes were joined by the smaller-diameter tube being inserted into the larger and clamped in place by bolts passing through both tubes. No additional strengthening to compensate for the holes was provided at any of these clamping points. The clamping bolts were also used as attachment points for rigging and control wires. The cambered front ends of the wing ribs were formed from short, bent, steel tubes that were bolted to the front wing spar. The rear part of each rib comprised a straight bamboo cane inserted in the rear end of these

tubes and fastened to the rear spar by straps and bolts. The covering fabric was secured to each rib by means of sewn pockets. The tips of the wings were formed by straight steel tubes attached to both front and rear spars, the covering fabric being sewn into place around these. The trailing edge of the wing was formed by a single strand of wire which, when the fabric shrunk by being doped, was pulled in to provide the scalloped edge that later became typical of Fokker's wartime products. The fuselage ends of the wing spars fitted into tubular sockets that were attached to the undercarriage structure.

The flat, narrow, fan-shaped tailplane was built in a manner similar to the wings, though with straight bamboo ribs clamped to a leading edge steel tube, and was again covered with a single strong fabric covering.

The main undercarriage was constructed from ash struts with two long ash skids intended to protect the propeller in the event of a rough landing. It was attached to the fuselage longerons by means of aluminium castings and braced with copious quantities of piano wire. A pair of motorcycle-type wheels fitted on a tubular steel axle were bound to this using elastic cord to provide springing. A further set of larger, more complex, skids was mounted outboard of either side of the fuselage, their structure providing the king posts for the wing warping control system above and below the wings, as well as location points for the bracing wires.

A tail skid fitted with a crude claw device that acted as a brake was fitted. The front end of this ash skid was fastened to the centre of the undercarriage axle and the rear end fastened to a strut, the top of which was fastened and sprung from the fuselage structure by elasticated cords. Simple and effective though this brake was, its tendency to 'dig in' made manoeuvring the completed machine by engine power on the ground very difficult indeed.

Control and bracing wires for Fokker's earliest machines were simply that, single-strand steel piano wires. As his aircraft designs and construction methods were improved, these gave way to the use of multi-strand steel cables for control systems. None of Fokker's early machines used welded joints – those were to come later. Where clamping was necessary, tube-to-tube or bamboo rib-to-tube, this was done either as described above, by sleeving one tube into another of greater diameter, or by the use of thread-ended 'U' bolts. The result was a structure that was easy to build or dismantle and simple (and hence cheap) to repair or modify.

Fokker named his machine the *Spinne* (spider) because, when seated in the pilot's seat with the masses of wires around him, he felt like a spider in the centre of its web.

Because of Fokker's conviction that his design was inherently stable and that all the control that was required could be achieved by warping the wings, no rudder or elevators were fitted. Inevitably, 'flight trials' – in this case taxiing and 'hopping' – brought modifications. Control by just wing warping proved inadequate and the tailplane was also made to warp to improve controllability. At a later stage, a rudder was added in the search for further controllability. This took the form of a pair of tubular steel triangles covered with a single surface of doped fabric, one above and the other below the tailplane.

By the end of 1910, Fokker had made a number of satisfactory test hops across the field. He was ecstatic and went home for Christmas, leaving von Daum in charge. Although he owned a considerable stake in the machine, von Daum had not been allowed at the controls for any of the pre-flight experiments, Fokker having invented reason after reason why he should not do so, saying that the machine needed further adjustment or that it wasn't ready through one cause or another. No doubt von Daum was as eager as Fokker to fly it, and Fokker's return to Haarlem for Christmas gave him the chance. It is probable that Fokker was barely out of sight before the frustrated von Daum was seated at the controls and running up the engine. Carried away with the enthusiasm of the moment, he opened the engine up fully and attempted to take the machine off the ground. Unfortunately, his experience wasn't up to this and all he succeeded in doing was to hit the only tree in the field and wreck the machine. Fokker was told of the mishap in Amsterdam, and it was with great difficulty that his parents managed to restrain him and stop his immediate return to Germany to assess the damage. When finally he did return, he found that the structure of the machine was a total wreck and beyond economic repair, but that the Argus engine had survived unscathed.

Specification – Fokker *Spinne* (1910)	
Engine:	50hp Argus
Weights:	Not known
Dimensions:	Span 11.00m (36ft); length 7.75m (25ft 5in); height 1.30m (4ft 3in)
Performance:	Not known
Armament:	None fitted

Fokker Takes to the Air

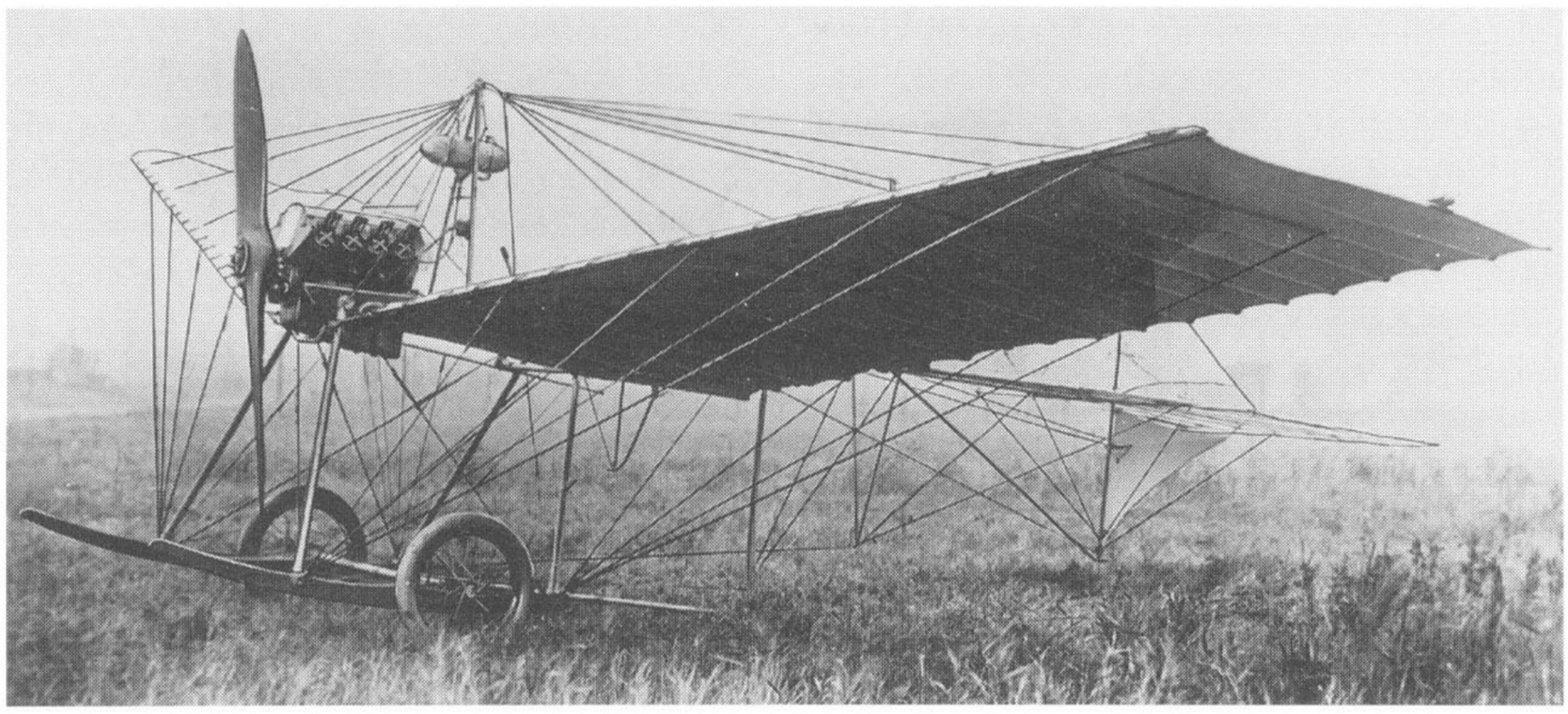
No doubt frustrated by the setback, they moved on to their next venture, a modified and improved *Spinne*. This was built in workshops at Nieder-Walluf, on the Rhine, belonging to Jacob Goedecker. Goedecker was a qualified engineer with a small business mainly building boats but, more recently, constructing flying machines. He was keenly interested in aviation and anxious to learn to fly.

Based upon the same concept as his first machine, Fokker's second *Spinne* bore a close family resemblance to it. However, Fokker had learned from his mistakes and had improved upon the earlier design in a number of areas. Whoever had carried out the structural and detail design for the first machine, there is no doubt that Jacob Goedecker was deeply involved with the second, and techniques that he had proven with his own machines were used to provide *Spinne* II with a firm engineering foundation. Fokker was still in partnership with Franz von Daum at this stage and 'his' 50hp Argus engine was thus available to be fitted to the new machine.

While *Spinne* I was a relatively simple machine, *Spinne* II was simpler. Its basic layout was similar: the fuselage was still based upon the twin wooden longitudinal beams and cross members, with the engine mounted above it at the front, cooling radiators mounted on either side and a cylindrical petrol tank behind and above the engine. Its main differences from the first machine lay in its control system and the layout of its undercarriage.

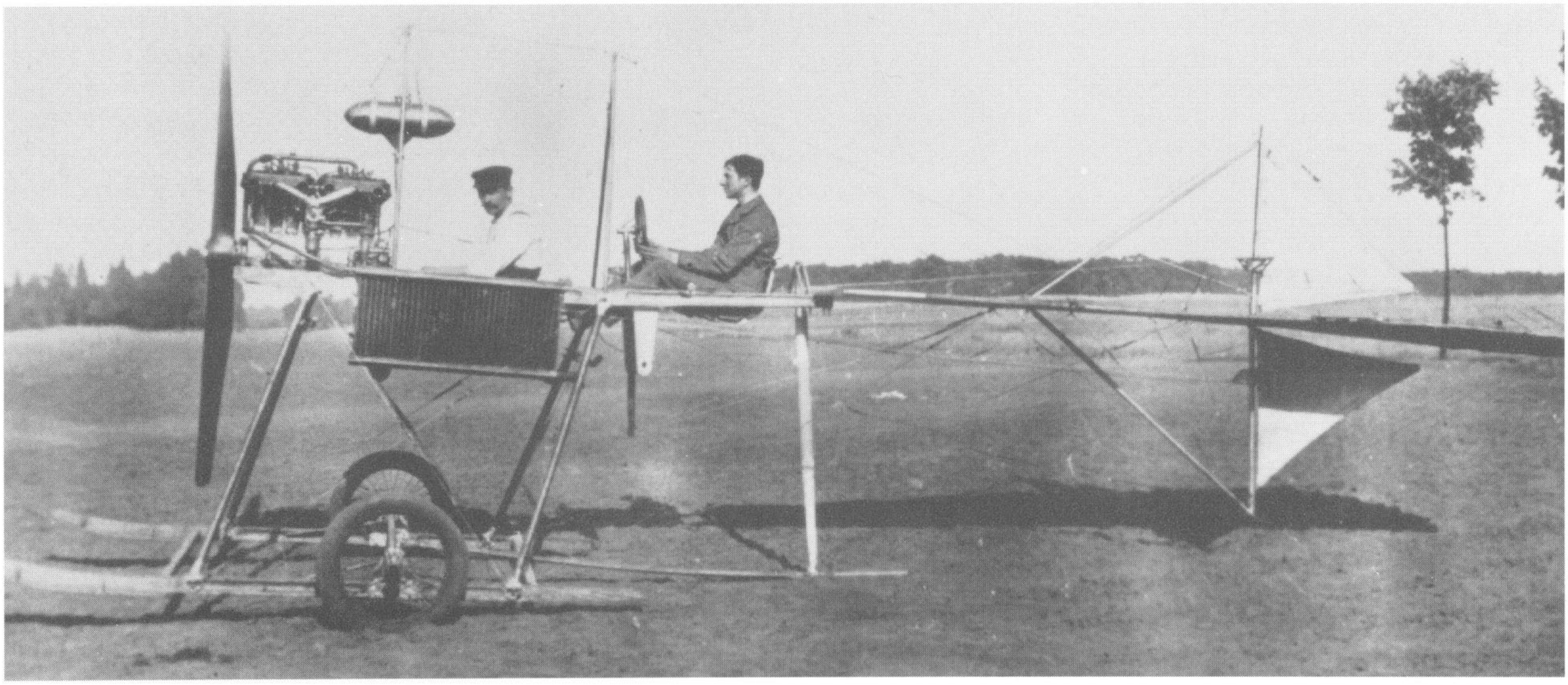
With *Spinne* II Fokker dispensed with wing warping and fitted ailerons to the wings and a rudder to the tail assembly. With no need for the king posts required by the wing warping system, the undercarriage was simplified to a wide structure entirely mounted below the fuselage and fitted with both skids and elastic-cord sprung wheels.

Spinne II was completed in early 1911 and used by Fokker to teach himself to fly. He started with simple curving manoeuvres on 11 May over the Grosser Sands at Gonsenheim and, on 12 May, confidently took von Daum up for his first flight. On 16 May 1911, Fokker presented himself to the German Aeronautical Association (the



The second *Spinne*. Harry Woodman

***(Below) Spinne* II without its wings.** Cross and Cockade International



Wing Warping and Ailerons

In the earliest years of aviation, constructors (and aviators) were happy simply to have a machine that would lift off the ground and fly in a more or less direct line for a short distance. Stability in flight was everything and control of direction was of secondary importance. Aeroplane structures were mostly kept as light and simple as was felt to be safe. As flight generally became more achievable and of a more predictable duration, the emphasis shifted from the simple desire to fly to that of wishing to fly from one place to another. Control of the direction and attitude of the aeroplane in flight became essential. Two control systems developed more or less in parallel.

One involved the fitting of ailerons to wing surfaces, these being auxiliary horizontal surfaces capable of controlled partial rotation. They are cross-connected so that downwards rotation of the aileron on one wing is accompanied by the upward rotation of that on the other wing. When operated, they effectively alter the camber of the wing to give more lift but, in so doing, give more drag, especially on the downward moving aileron. This causes the wing to slow down and to lose lift, exactly the opposite of what is intended. (In practice, this can be counteracted by use of the rudder, but this also produces drag.) Further, as an aileron is moved, the forces on it may cause the wing structure to compensate by twisting in the opposite direction. To overcome this, the wing structure needs to be made stiffer (and heavier) than would otherwise be the case.

On some very early machines, the ailerons were mounted as 'flaps' on the trailing edge of the wing requiring that component to be substantial (and so heavy). Later practice was to let the aileron into the wing profile and hinge it from a sound structural member. This in itself presented problems in that the aileron had to be made as a separate item and fitted into the completed wing, adding expense. Control of ailerons requires a complex run of cables, pulleys and levers routed in such a way that they will provide sufficient leverage to move the aileron against the force of the airflow. Some of these problems were overcome by the fitting of 'balanced' ailerons at the tips of wings. These had a small area in front of the hinge line which, when the aileron was moved would catch the air flow and compensate for the forces resisting the movement of the main aileron area.

The second system involved the warping (or twisting) of the wing surface by control wires fastened to strategic points in its structure and actuated through a pulley system by a control column and wheel. The great advantage of this system was that the wings could be kept simple with light structures and their weight at a minimum. It was cheap to produce and, while aircraft speeds remained low, the forces required to operate it, though greater than those required for ailerons, were not too great.

The fitting of ailerons did not lend itself readily to simple wing structures with single layers of fabric covering. Wing warping, on the other hand, could readily be applied to either simple or complex wing structures.

Deutsche Luftschiffe-Verband) to be tested for his flying certificate. The examiners were Oblt Selasinky, president of the Mainz Aero Club, and Heyne, the association's assessor. Fokker performed the necessary five figure-of-eight turns and met the requirement to land with his engine cut off within a distance measured from an indicated point. On 7 June 1911, he was issued with German Flying Licence Number 88 by the association.

Fokker's arrangement with von Daum had been that the latter would be given ownership of the machine as soon as Fokker had gained his flying licence but, again, Fokker tried to put von Daum off, his reason being that he had received an invitation from Haarlem to put on a flying demonstration on the Queen's birthday and he was worried that the machine could be wrecked before he could do this. But von Daum was not to be put off and insisted on flying lessons. Initially, these went well until, forgetting what he had learned, von Daum dived into the ground from a height of 10m (33ft). The second of his two disastrous crashes cured von Daum of desire to fly, and indeed of his interest in aviation.


Fédération Aéronautique Internationale (F.A.I.)

Deutschland No 88

Die unterzeichnete von der F.A.I. für Deutschland anerkannte Sportbehörde erennt hiermit

Herrn H. G. Fokker

Haarlem i/Holland

geb. zu Kediri, Java, den 6. IV. 1890

nach Erfüllung aller von der F.A.I. vorgeschriebenen Prüfungsbestimmungen

Flugzeugführer

für Eindecker

am 2. Juni 1911.

Deutscher Luftschiffer Verband

Der Vorstand

Nous soussignés, pouvoir sportif reconnu par la F.A.I. pour l'Allemagne certifions, que

ayant rempli toutes les conditions imposées par la F.A.I. a été breveté

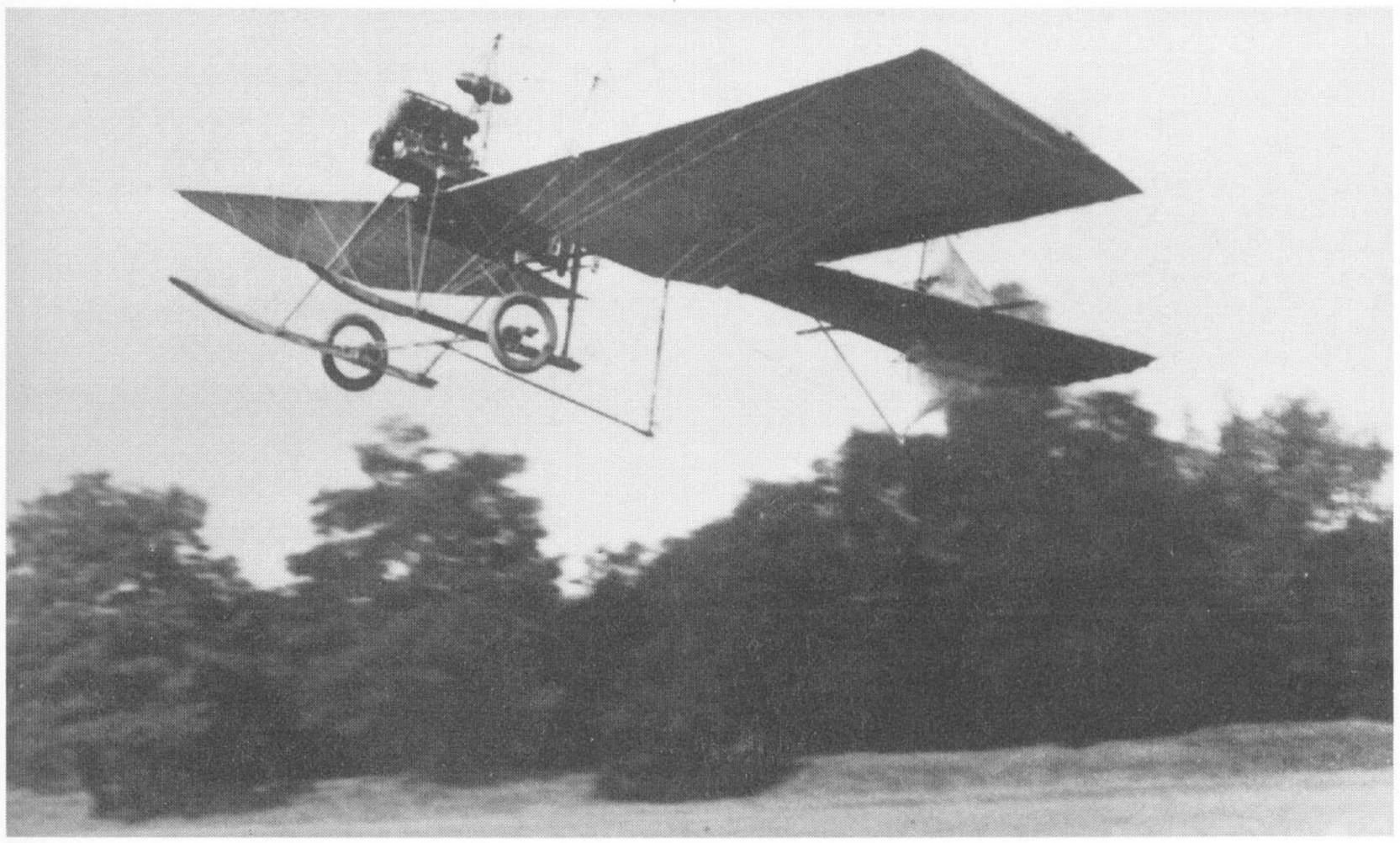
Pilote aviateur

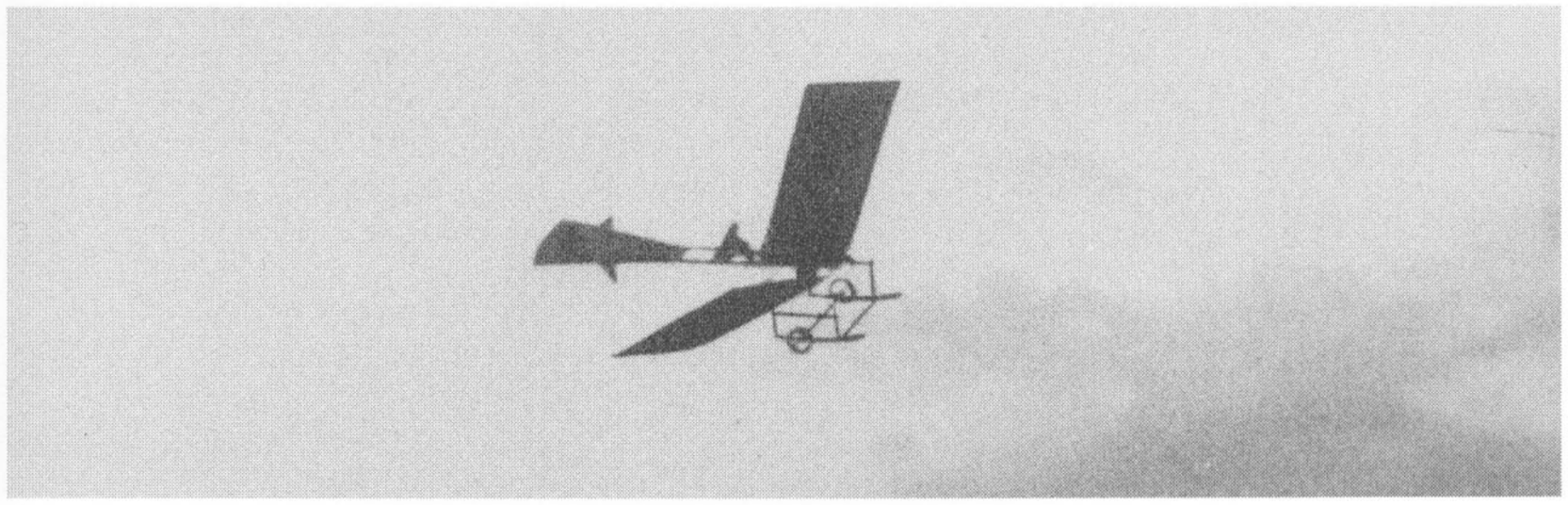
pour monoplan

Unterschrift des Inhabers

A. H. G. Fokker.

Fokker's flying licence – German Number 88.
Thijs Postma





Jacob Goedecker

Jacob Goedecker, a boat builder by profession, was a qualified engineer and had taken an early interest in aviation. He had spent five years at university reading engineering and naval architecture, and taken a postgraduate course with Professor Junkers at Aachen University.

His interest in flying started in 1902 when he studied the (then) new science of aerodynamics. From this he went on to practical experiments and, in 1909, he built his first monoplane at Gonsenheim, near Mainz. The first of Goedecker's monoplanes had a cantilever wing that could be swivelled about a vertical axis to steer the machine. It was capable of taxiing and making short hops, but was too heavy to fly.

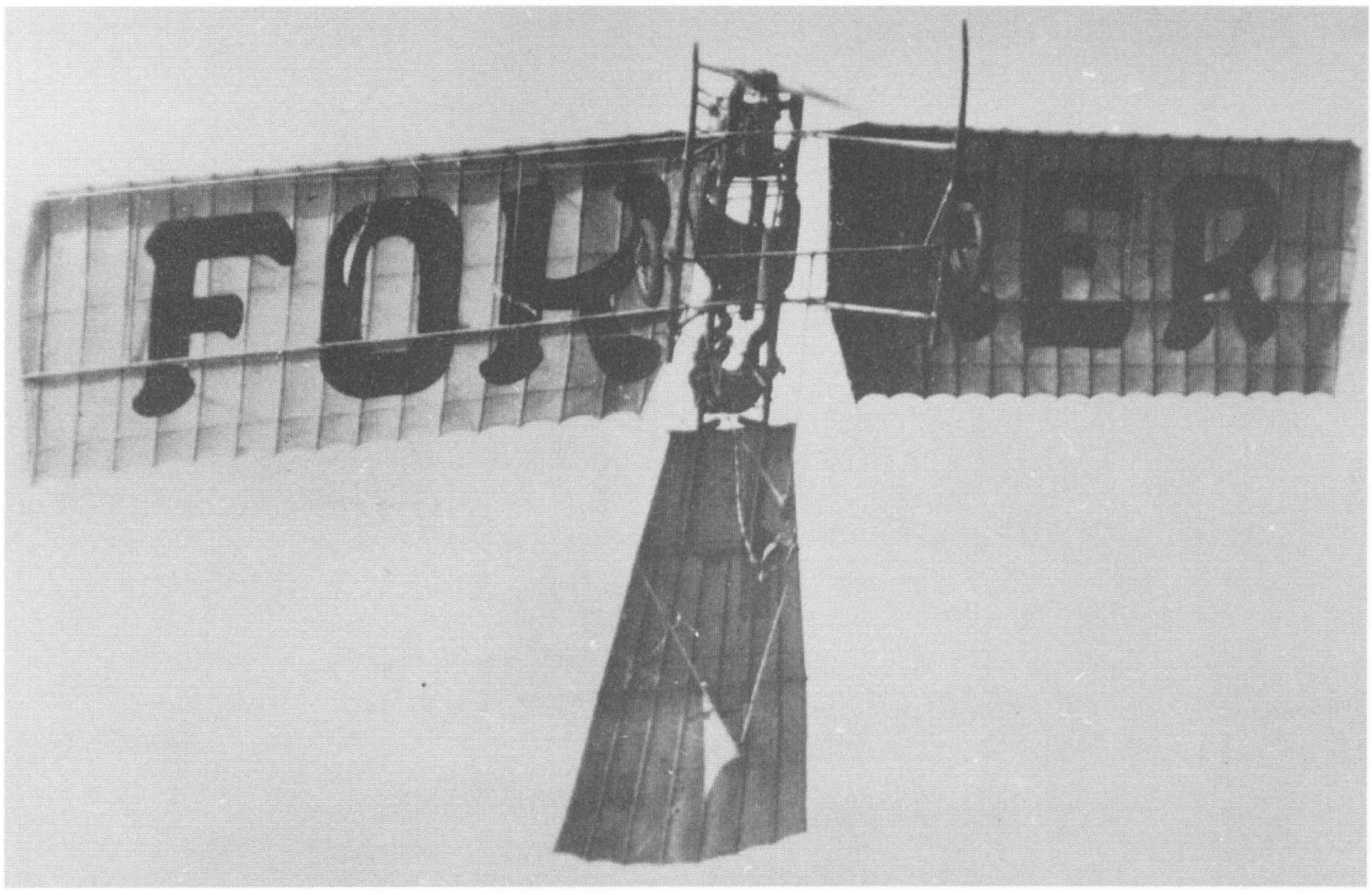
Goedecker progressed to the design of a second machine in 1910. This followed the lines of the successful Etrich *Taube* (dove), having a similar wing shape (like the seed leaf of the *Zanonia macrocarpa*) and was intrinsically stable. The Goedecker *Taube* had flown a circuit of the Grosser Sand parade ground near Gonsenheim on 24 April 1910 while Fokker had been working at the Automobile-Fachshule, and was the first aircraft that Fokker had seen flying. Goedecker built a modified version of his *Taube*, replacing wooden construction with lighter steel tubes. He had no great ambition in aviation but remained in Mainz building three more *Tauben* and opening a flying school.

***(Above left)* The *Spinne* used by Fokker in his Haarlem demonstration in 1911.** Cross and Cockade International

***(Left)* The *Spinne* in flight.** Cross and Cockade International.

***(Above)* A formally dressed Anthony Fokker, probably taken after the celebrations of the Queen's birthday in Haarlem in August 1911. In the soft hat next to Fokker is thought to be Bernard de Waal.** Frank Cheeseman

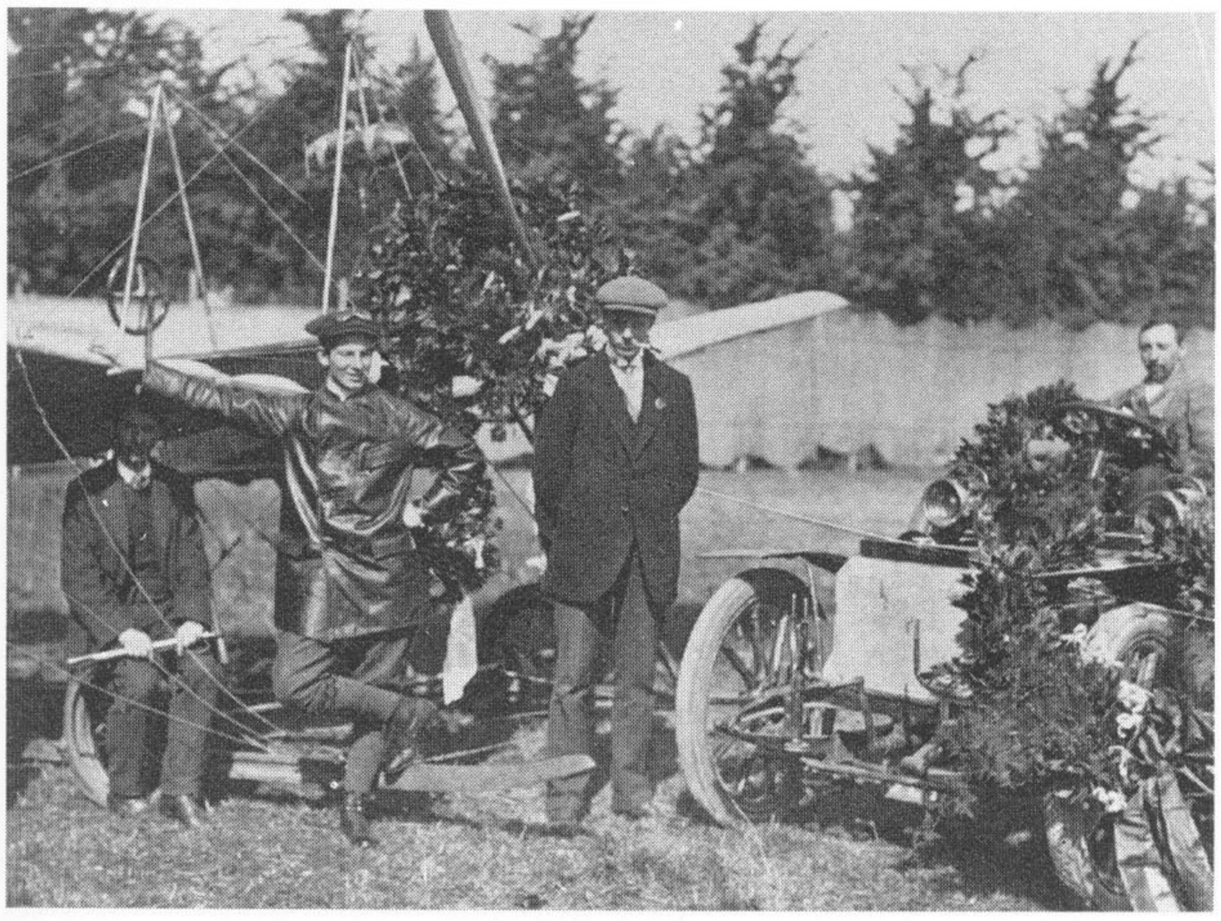
Fokker's 1912 *Spinne* in the air. Harry Woodman



Allowing Fokker to buy him out of the partnership for 1,200 Marks, he disappeared from the scene. Fokker now became the sole owner of the wreckage, the most significant part of which was the Argus engine that had again survived the crash.

Because it had been agreed that *Spinne* II would become the property of von Daum after being proved by Fokker and used by him for his flying licence tests, he (Fokker) had started construction of a third machine at Goedecker's works. This was to be of lighter construction than the earlier versions and have other changes to its configuration but, in general, many of its features and component parts were similar in shape and design to those used previously.

The significant changes were that *Spinne* III was smaller and lighter. The span of the wings was decreased from 13m to 11m, the pilot's seat was moved to the rear and the tail skid was moved forward to a position just under the pilot. *Spinne* III could carry a passenger and fly for twenty minutes at full power. Because Fokker had found *Spinne* II to be extremely stable, he dispensed with ailerons for this machine and reverted to wing warping. Work on *Spinne* III was completed by August 1911 and, having proved it in flight, Fokker dismantled it and took it by rail back to Haarlem.



Anthony Fokker (left) and Fritz Cremer (right) in front of the *Spinne* after the Haarlem demonstration. Thijs Postma

Fokker in the rear 'cockpit' of his third *Spinne* with Fritz Cremer in the front and Th. Reinhold standing. The engine is the 50hp Argus. Frank Cheeseman

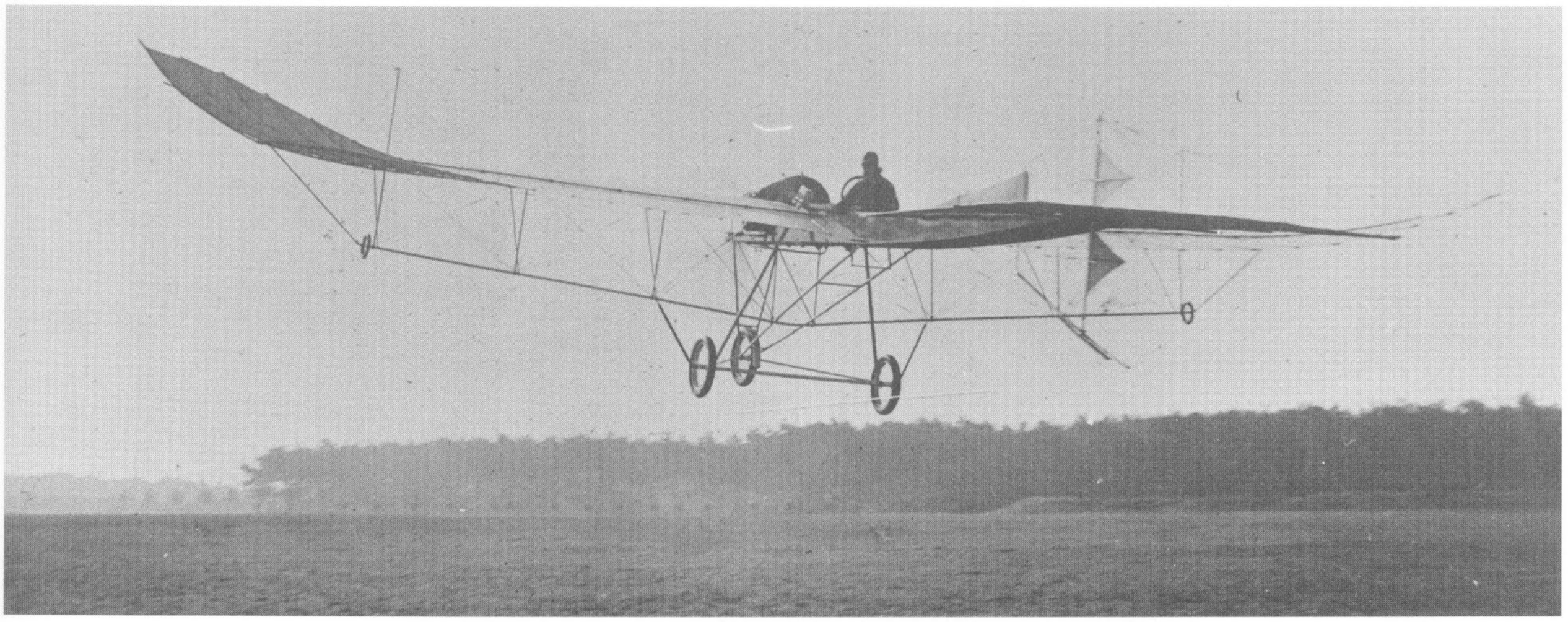
By now Herman Fokker was more or less reconciled to the fact that his son's career was to be in aviation and, as a member of a local committee, he helped to organize a flying demonstration to be held in Haarlem. Between 31 August and 3 September 1911, Anthony gave flying demonstrations to an enthusiastic crowd, making graceful turns over the crowd, circling the steeple of the church, St Bavo, and climbing to a height of 120m (400ft). Fokker, who had left Haarlem as a failure, had returned as a hero but, although the event created a local sensation and did much for his self esteem, it did little to help his income and he was again faced with hard times.

Flying for Goedecker

Fokker returned to Mainz to earn his living from aviation: a contract with Goedecker had him flying Goedecker aeroplanes and acting as a flying instructor in his school. Financial assistance also came when his old friend Fritz Cremer arrived, seeking not just to learn to fly, but also to buy an aeroplane.

In August 1911, Fokker made the first test flights in the new Goedecker *Sturmvogel*, a machine of similar shape to the Etrich *Taube* and powered with a 70hp Argus engine. Flying for Goedecker, he took part in local military manoeuvres, carrying Ltn Salomon of a Pioneer Battalion as his observer. Writing in *Fluggeschichte*, Peter Supf later said that 'the pilot of the aircraft was Fokker. He followed the instruction so well that Jacob Goedecker received the Crown Order 4th Class.' His exploits during this period included an escape from a near accident when, flying over the River Taunus, he felt the rear of his machine shake. Turning around he found that the fabric covering, which should have been sewn to the rear

Fokker flying Jacob Goedecker's *Sturmvogel*. Thijs Postma



The third *Spinne* with Fritz Cremer in the front seat and Fokker in the rear at Goedecker's factory at Nieder-Walluf on the Rhine in the summer of 1911. Johann Visser via Harry Woodman

structure, had become torn. Had the tear continued, Fokker would have lost control but, as it was, the remainder of the lacing held and he was able to make a good emergency landing.

To Johannisthal

But Fokker's time at Mainz was short; lured by talk of Johannisthal near Berlin being the Mecca for German aviation, he felt the compelling urge to move on. In part this urge was fuelled by his relations with Goedecker. Fokker got on well with him at a social level, and owed most of what he knew about aircraft construction to him, but he felt stifled by Goedecker's refusal to accept the view that his (Fokker's) designs were superior. Subsidized again by his father and with Fritz Cremer as his companion, Fokker moved to Johannisthal in December 1911.

In 1912, Johannisthal was to Germany what Brooklands was to Britain, the centre of all things aviation. Here it was that the elite flew their machines and earned money from demonstrations and flying instruction. But for all that, Johannisthal was not an ideal location for a flying ground. Opened in 1909, it was south-east of Berlin, lying between the boroughs of Johannisthal and Adlershof with the Berlin–Goerlitz railway running down its eastern side and with the Teltow Canal to its west. The flying area itself was quite large, being 7,350ft (2,250m) along its north-west/south-east axis and 4,350ft (1,330m) across its width, but it suffered from an irregular, sandy surface, described after the war as 'containing a most interesting formation of dunes'.

To make matters even more difficult, between the railway and the flying area was a belt of tall pine trees; towards Johannisthal railway station was a pine wood; and there were a number of buildings in the flying area, including two airship sheds, one for non-rigid Parseval types and the other (the largest at that time in Germany) built to accommodate two Zeppelins. The flying area proper was surrounded by a low fence built to separate the spectators from the aviators and their machines, and the whole area by a fence 13ft (4m) high, built to keep non-paying visitors from seeing the displays.

Fokker's reception at Johannisthal came as an anticlimax. Initially, he was regarded by the veteran aviators as something of an outsider with little to offer. His machine, with its lack of ailerons, was considered crude and impractical. This attitude was to change in January 1912 when Fokker made his first public flight there. In this he demonstrated both his ability and his machine's airworthiness: flying in a strong, gusting wind at an extremely low height, he performed a series of daring turns and an extremely narrow figure-of-eight that amazed all. The paper, *Berliner Zeitung am Mittag*, spelling his name as 'Focke', reported that his flying was 'amazingly sure' and the manoeuvres he performed were 'simply splendid'. On 15 January *Avia* reported that 'Fokker has flown at Johannisthal with great success ... the fact that Fokker was able to fly under such conditions, and perform beautiful flights, pays tribute to the pilot and to his product.' Anthony Fokker had arrived.

CHAPTER TWO

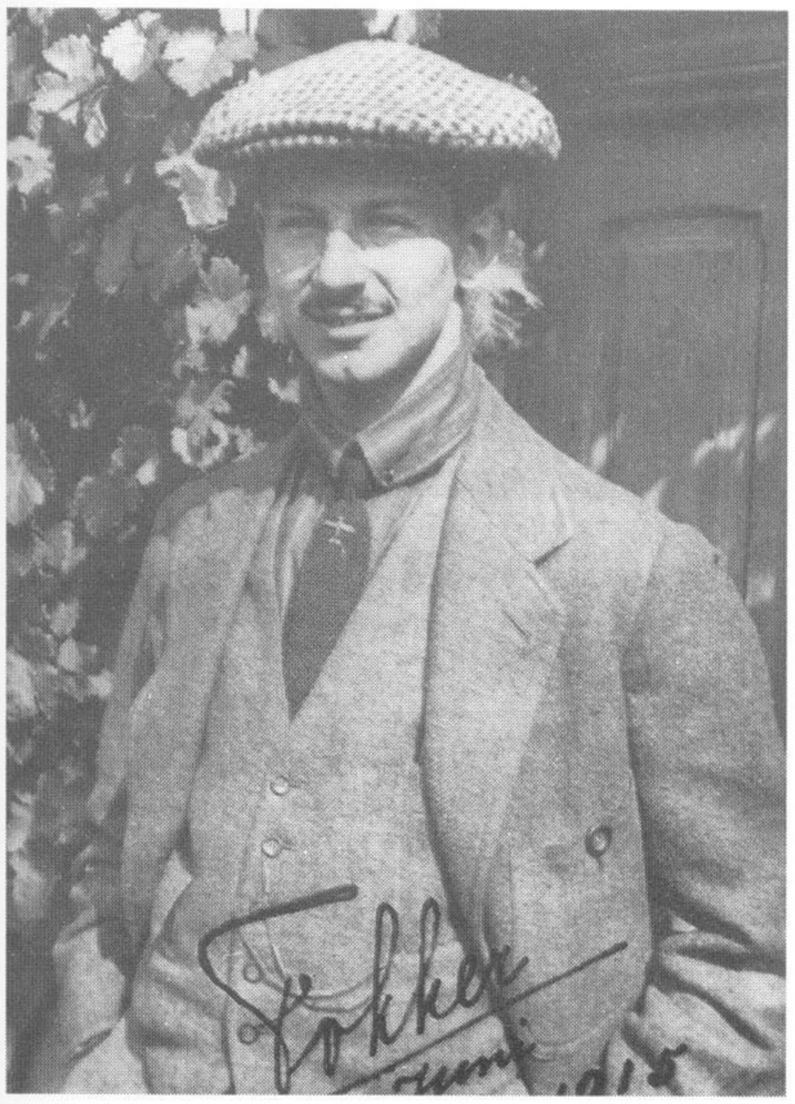
Expansion

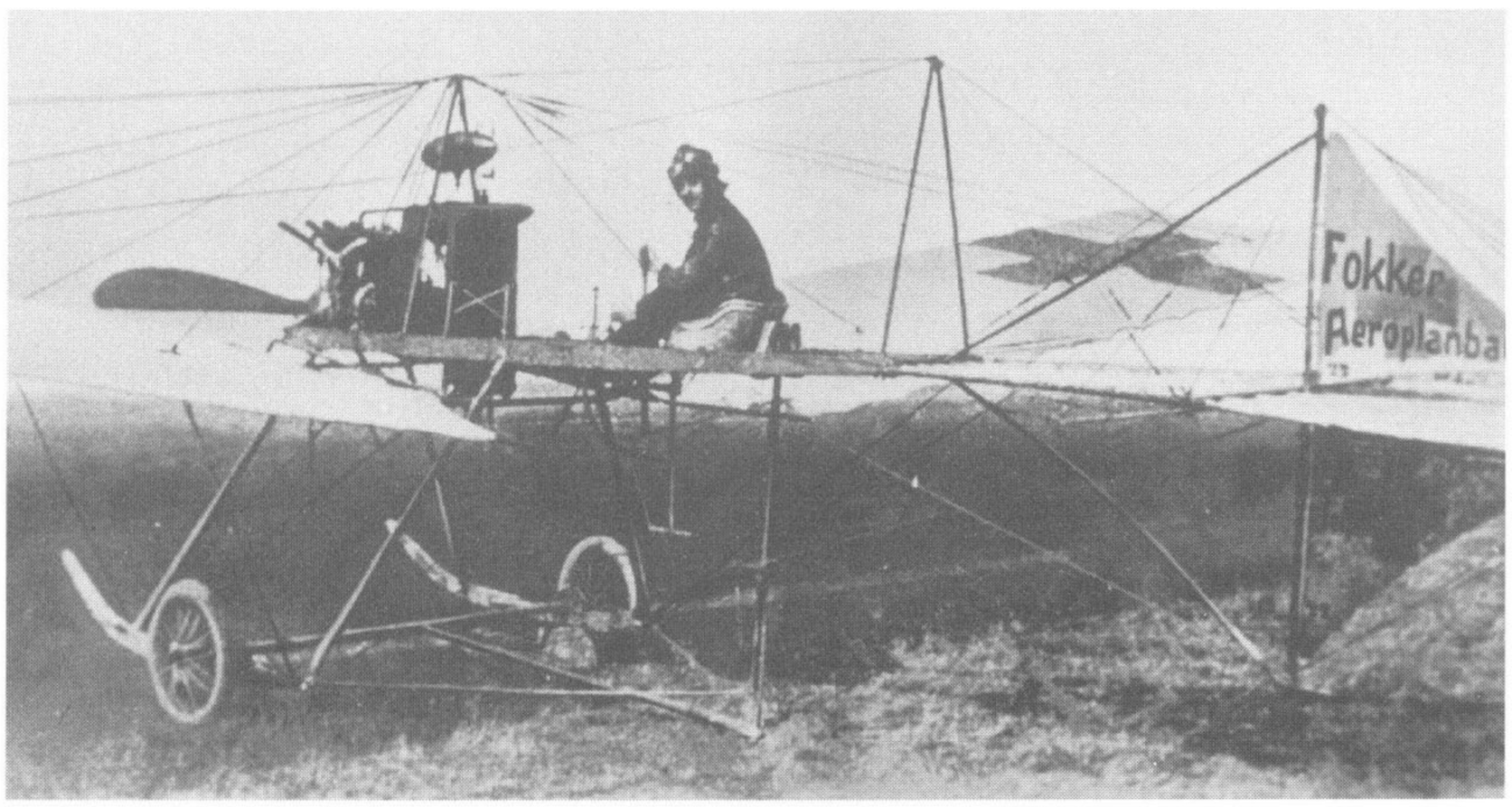
Whilst Fokker was always pleased to be known as a daring pilot, his ambitions now lay well above this level. On 22 February 1912 he entered the name of Fokker Aviatik GmbH in the records of the Trade Register in Berlin, giving the company's location as Charlottenburg (a suburb of Berlin) and its capital as 20,000 Marks. However, this name was never used in business as, from the beginning, the company's letterhead read 'Fokker Aeroplanbau, Berlin-Johannisthal, Alter Startplatz, Schuppen 10, Berlin-Johannisthal, den Parkstrasse 18'. During the subsequent war years, the name was to be changed again to the more familiar Fokker Flugzeugewerke GmbH.

Despite the resonance of his company title, Fokker was still living a hand-to-mouth existence, earning money as and when he could from flying instruction and demonstrations, but with nothing substantial in the bank to allow him to expand his business. He still relied upon his father for loans when need arose, but found that each request was greeted with scepticism and any money forthcoming was reluctantly given. He would have liked a stand at the Berlin aeronautical exhibition in April 1912, but was unable to afford it. He had approached his father for support for this but was rebuffed in no uncertain terms – and he correctly felt that he was missing out on opportunities to publicize his products.

Spinne III formed the basis for all future development of Fokker's 'spiders', each of which was really a variant of the original theme rather than a new model. The first significant variant was that of 1912. In this, the side radiator panels were replaced by a

The third variant of the *Spinne* III in 1911, fitted with a 70hp Renault engine.
Frank Cheeseman





Fokker seated in the first variant of his 1912 *Spinne*. Cross and Cockade International

***(Left)* Anthony Fokker in a relaxed mood. This photograph was taken at Schwerin in June 1915.** Frank Cheeseman

Fokker's Subordinates

It is difficult to establish just who was employed by Fokker in his early years. Initially it was basically himself with, probably, the assistance of a mechanic (or two) and use of others' workshops and factory facilities. As success came his way he needed money for expansion; the person who helped him with this was Hans Haller, who brought capital with him when he became Fokker's business partner in 1911. Haller managed Fokker's business affairs for some time; his original loan was repaid in 1915, but it is thought that he remained with the company after that date.

Another who joined Fokker at Johannisthal was Fritz Cremer. Fokker's association with Cremer went back to his school days in Holland and then to their unsuccessful venture into 'punctureless automobile tyre' design. In 1912, Cremer came to the Fokker school at Johannisthal for flying lessons. Having succeeded in this, he joined Fokker as a pilot and, shortly afterwards, became Fokker's 'Chief Flying Instructor'. He also was to remain a part of the expanding Fokker company.

When Fokker left his post as a flying instructor with Jacob Goedecker to strike out on his own, he had been replaced by a fellow Dutchman, Bernard de Waal. Seeking to release himself from the routine work of running his flying school, Fokker offered the post to de Waal and enticed him away from Goedecker. Like Fokker, de Waal was an excellent pilot with the added advantage that he had a pleasant personality and tremendous patience. Although principally a pilot (after Fokker, he was first to test any new aeroplane), he took on a number of roles within the expanding company and remained loyal until his early death through illness in July 1924.

Fokker never employed a nominated 'Chief Designer', probably because, whatever the truth, he claimed that role for himself. However, in the first few years, a series of men were employed to lead Fokker's design team. The first of these was an enigmatic figure of whom we know only his surname, Palm. Herr Palm seems to have joined the company some time in early 1912; his qualifications for the job remain unknown but it is thought that he may have been an engineering draughtsman with an interest in aircraft design. He was to be responsible for a number of designs culminating in that of the M.4 monoplane. Fokker summarily sacked him when this proved to be inadequate, and replaced him with Martin Kreutzer, who had been his assistant.

Martin Kreutzer was born on 12 June 1891 and had studied mechanical engineering at a technical school in Bingen (or possibly Mainz). He probably joined Fokker in either late 1912 or early 1913. With the departure of Palm, Kreutzer inherited a design department that, other than himself, comprised one technician and three draughtsmen. What he lacked in aeronautical knowledge was initially provided by Fokker's intuitive eye for aircraft 'design'. With his firm footing in mechanical engineering, he became a reliable designer of aircraft and well able to take Fokker's schemes and turn them into practical flying machines. He trained to became a pilot, taking his licence on 8 April 1914, and was to remain with Fokker until he was killed in a flying accident on 28 June 1916.

On Kreutzer's sudden death, Fokker responded by recruiting a qualified engineer with neither theoretical knowledge nor practical experience of aircraft design. His tenure of the post was short and, sacked, he departed without leaving his name behind him. He was quickly followed by a similar engineer about whom all we know is his surname, Moser. Herr Moser also lasted just a short while before he was sacked and, once again, Fokker was left with a post to fill that was vital to his survival in business. The man who offered to step into this breach was Reinhold Platz, an expert welding technician who was then running Fokker's experimental workshop.

Reinhold Platz was born on 16 January 1886, at Cottbus near Berlin. He had completed his apprenticeship as a welder at a time when the Fouche oxy-acetylene fusion welding process was being introduced in Germany, and had become highly skilled in it and in other techniques, including the flux-free welding of aluminium alloys. His employers had recognized his ability and, using him as a demonstrator, had sent him to visit companies around Europe. In this role he gained yet more experience and developed a unique level of skill. He joined Fokker as a welder in 1912 and, gaining useful experience in all of the other skills needed to build aircraft, progressed to control of the experimental department. During this period, he worked closely with Kreutzer on a number of occasions and was responsible for the re-engineering of a Nieuport fuselage from wooden to welded steel-tube construction. Platz had seen 'designers' come and go so, when Kreutzer died, he considered the situation carefully and then volunteered his services as the replacement. Recognizing his worth, Fokker accepted him for the post.

It is virtually impossible to know how much of the design work that followed can be attributed to Platz and how much to Fokker or others in the design team. It is probable that 'schemes' for new machines came from Fokker, either in the form of rough sketches or simply by verbal instruction. The translation of these schemes into practical prototype aircraft would be Platz's responsibility. Fokker would then call for modifications either after he had flown a new machine or from his assessment of it as it was being built. Once he was satisfied with the design, production drawings would be produced by the team of draughtsmen. Although nominally the 'designer', Platz was kept at shop-floor level during the war years. Any technical discussion of prototypes with the Flugmeisterei or Idflieg engineers was handled by Fokker with Platz almost never being directly involved. He was also kept remote from any technical correspondence or memoranda sent to Fokker at Schwerin. This way, any requirement for modifications made by the authorities reached him by way of Fokker. Neither Fokker nor Platz was a qualified aeronautical engineer, but each was gifted with a flair that complemented that of the other. Fokker's came from his flying ability and from his eye for what was right and what was wrong with any aircraft, Platz's from his metal-working skill and inherent knowledge of what was right or wrong with a fabrication. In one area they were unanimous: both liked the resulting aircraft to be structurally simple. Whatever might have been gained by the deeper inclusion of Platz in the whole process, by and large the system worked well as it was and Platz was to continue as the 'designer' until the end of the war, latterly adding production management to his responsibilities. After the war, Platz joined Fokker in Holland and continued as production manager and designer. He retired in March 1931, by which time the increasing sophistication of aircraft design had left him behind.

single unit mounted between the pilot and the engine, and the column-mounted steering wheel was replaced by a control stick mounted on a universal joint. Another significant change was the move of the rear wing spar from below the wing ribs to a location above them, the spar being enclosed in a fabric sleeve stitched to the single layer covering. The wingspan of this version was increased to 5.5m (18ft).

In some later versions engines of greater horsepower were installed and a seat for a passenger fitted in front of the pilot. With this arrangement, Fokker returned to the use of side-mounted radiators. One version of the 1912 model was fitted with a nacelle enclosing the lower part of the engine and both passenger seats. This comprised top and bottom sections each fabricated from thin aluminium sheet and attached to the fuselage longerons. This version was larger than the first 1912 model. The side-mounted radiators were retained for most models of this version, though at least one (probably a single-seat version) was fitted with an in-line radiator.

The St Petersburg Trials

Early in 1912, Fokker learned from a Russian student at his school of an international competition to be held in St Petersburg by the Russian government. The object of this was the selection of an aeroplane suitable for use by their army, and the winning machine was expected to be awarded a contract for six aircraft. All competitors were to be given 2,000 Marks towards their expenses in transporting the aircraft and personnel to the event.

Always anxious to sell his aeroplanes and expand his business, Fokker travelled to St Petersburg in July 1912 taking with him one of his 1912 *Spinne* machines fitted with a 100hp Argus engine and with its two seats neatly faired. He was accompanied by Jan Hilgers, a young Dutch friend who had learned to fly at the Blériot school in France. The intention was that Hilgers would share the demonstration flying with

Fokker, freeing him to concentrate on his sales activities.

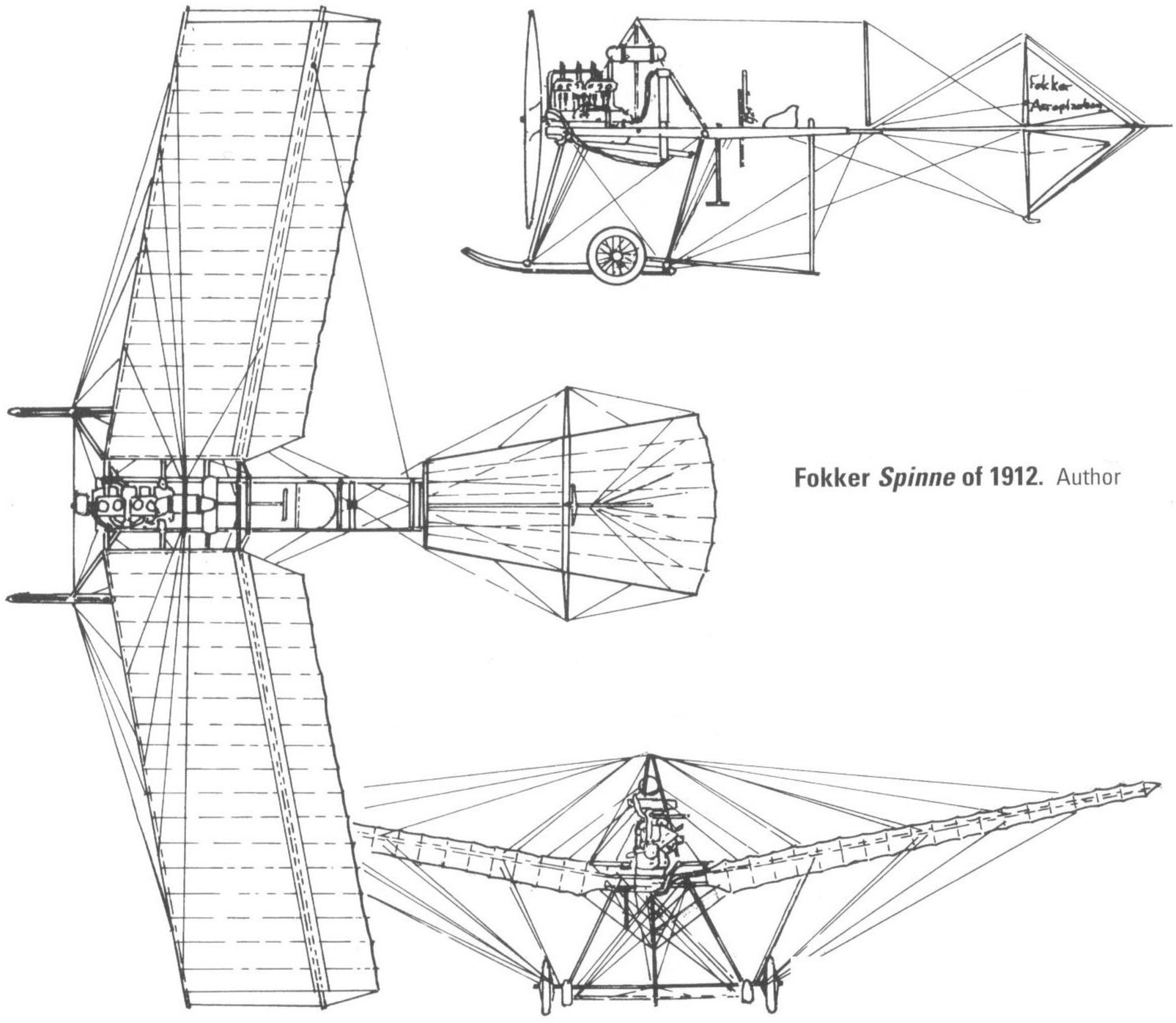
In St Petersburg he found a total of fifteen other aeroplane manufacturers, also anxious to win the competition and whatever orders might come from it. Unfortunately for Fokker, all of his competitors were more experienced in international competition than he was and amply provided with funds to buy influence with the numerous government bureaucracies concerned. Fokker, as ever, was short of cash and although he committed what money he could to gain the interest of officials, it probably was not sufficient. Both he and Hilger gave convincing displays of the *Spinne's* capabilities. Fokker climbed to 500m (1,600ft) in seven minutes carrying a load of 200kg (440lb) and came down in a spiral glide, making steep turns in the process while Hilger flew the machine for six minutes with his hands off the controls.

It was all to no avail. When the results were announced, the winning aircraft was the machine from the German Wright Company; a large twin-engined biplane built by Igor Sikorski came second and Fokker's *Spinne* was placed third. This may have been because the *Spinne* and Fokker's demonstration of it failed to impress the adjudicators – or it may have been because of his lack of funds and failure to buy influence amongst them. As a result, the contract for six aircraft for military use was awarded to the German Wright Company.

The trip to St Petersburg was not a total failure. One of the Russian pilots who flew the *Spinne* was Ljuba Galanschikoff, a most attractive female pilot who rejoiced in the nickname of *Pushka* (cannon), meaning 'ace'. Fokker was greatly taken by her and she was certainly impressed by his *Spinne*, if not by him. After the competition she followed him back to Johannisthal and bought one for her own use. In November she flew it to 2,133m (6,993ft) and established a new woman's record. She eventually left aviation behind her and emigrated to the USA where she ran a beauty salon in New York City.

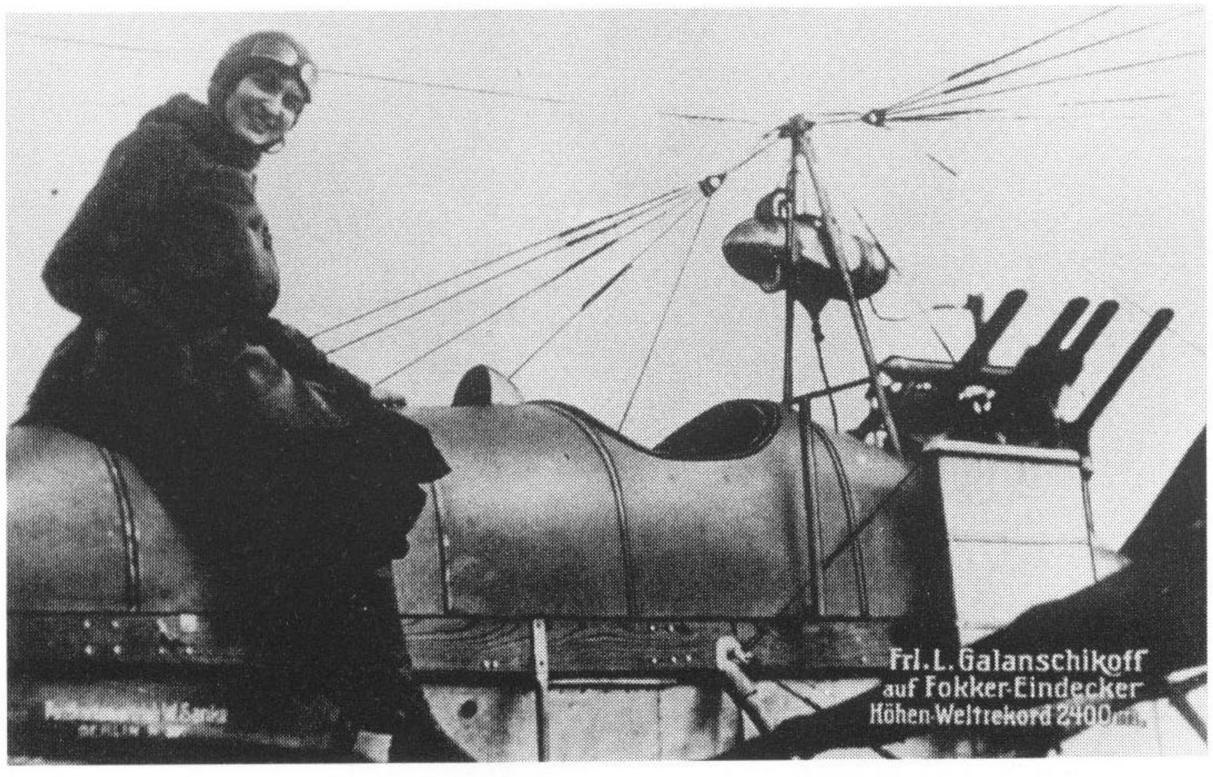
Back to Johannisthal

Fokker had been impressed by the performance of a number of the Gnome rotary-engined machines competing at the St Petersburg trials. On his return to Johannisthal he arranged to borrow a 50hp Gnome and had it fitted to a *Spinne* from his flying school. The considerable reduction in weight at the front of the fuselage

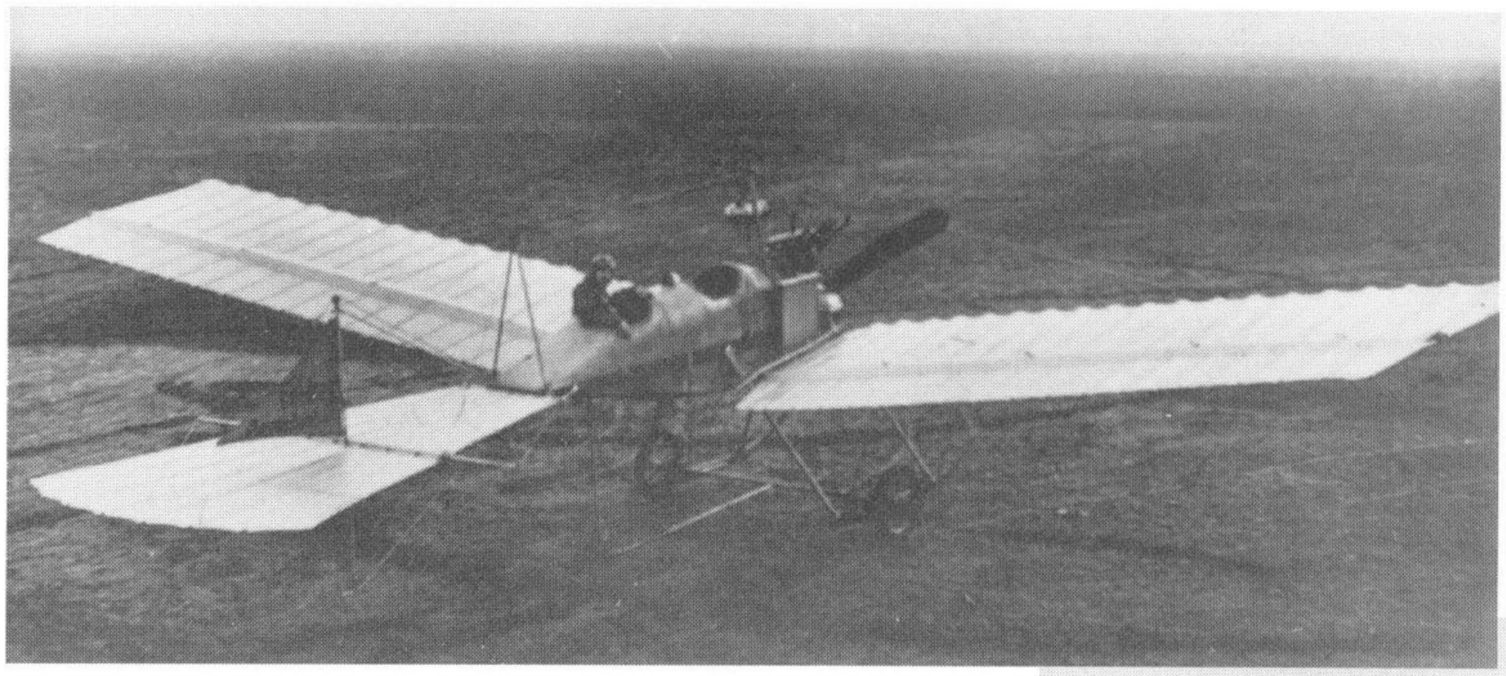


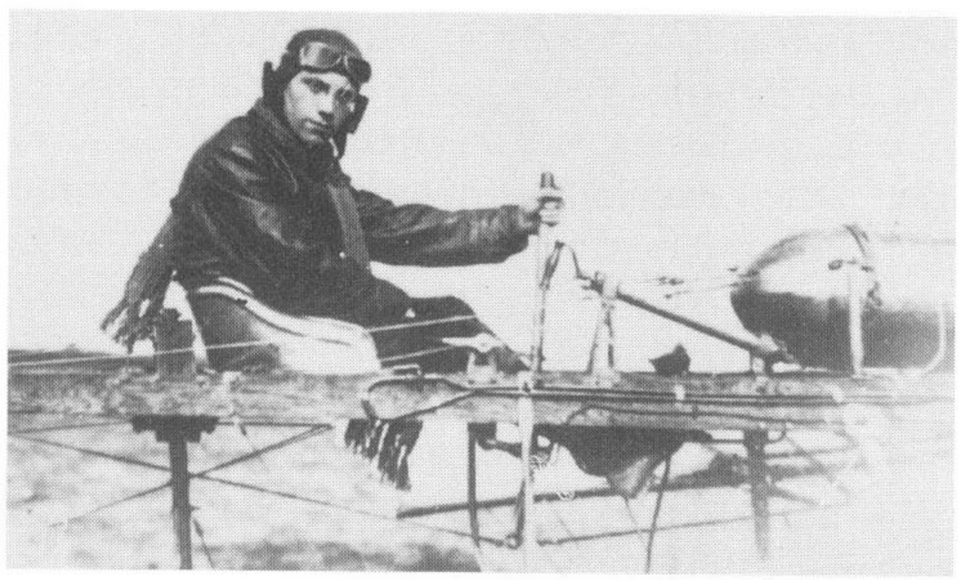
Fokker *Spinne* of 1912. Author

Fokker in the rear cockpit of his *Spinne* at St Petersburg during the August–September 1912 trials. The lady in the front cockpit is not identified. G. Petrov via Harry Woodman



Ljuba Galanschikoff seated astride the *Spinne* in which she set a woman's world height record of 2,133m in November 1912. Cross and Cockade International



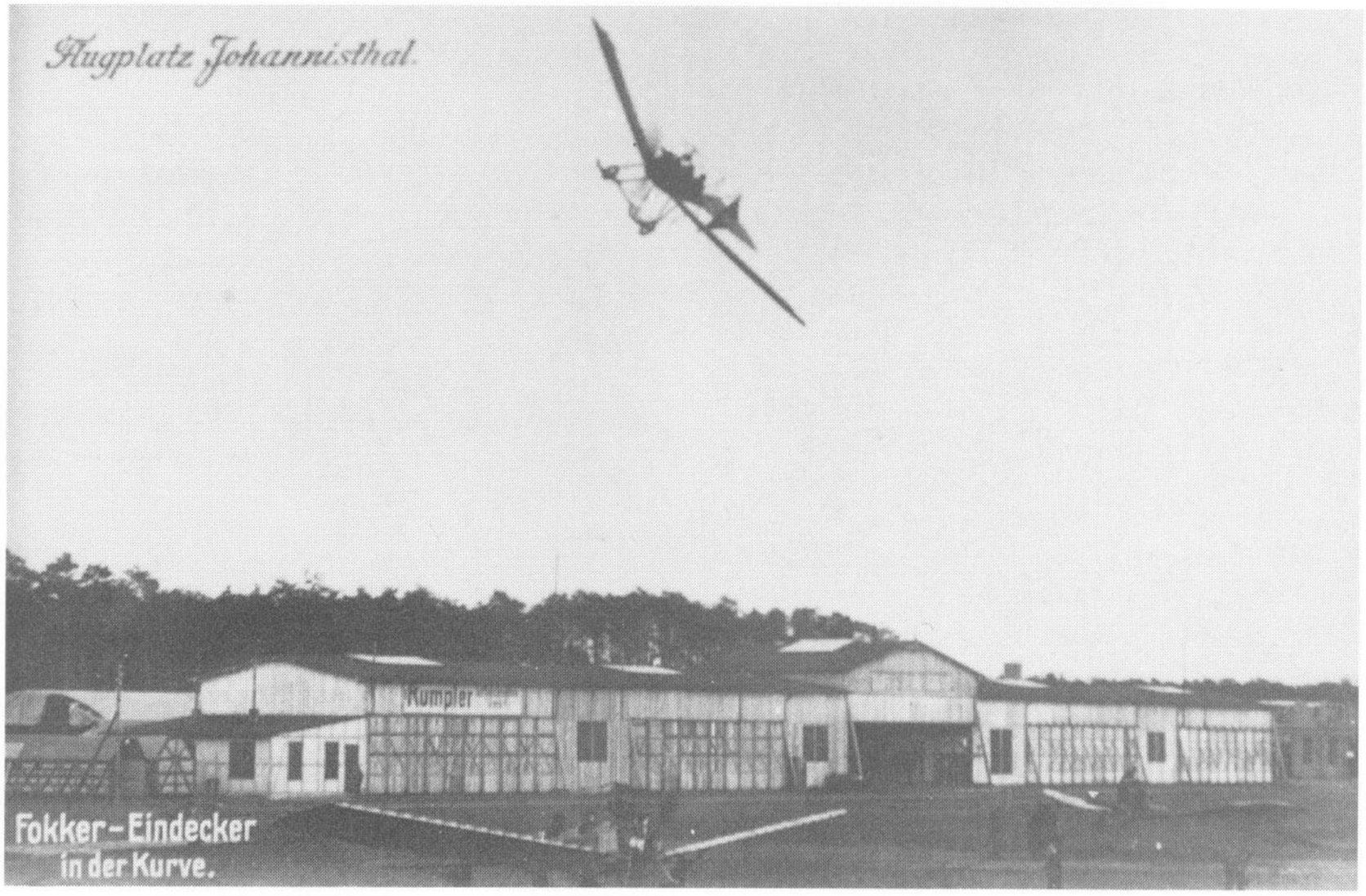


***(Above)* Fokker's *Spinne* at Johannisthal in 1912.** Cross and Cockade International

***(Above right)* Unidentified pilot in the cockpit of an early *Spinne*.** Cross and Cockade International

***(Right)* Fokker's students in front of his hangar at Schwerin.** Cross and Cockade International

***(Below)* Fokker performing his daring *Kurve* at Johannisthal.** Cross and Cockade International



caused by this – the air-cooled rotary engine being much lighter than the water-cooled engine it replaced – moved the machine's centre of gravity to the rear and adversely affected its lateral control, making it difficult to handle. Fokker was disappointed by this and returned the Gnome to its owner, losing interest in rotary engines for the moment.

At the end of 1912 Fokker made a further attempt to sell his aircraft abroad, this time to the Dutch government. Failing to interest them in Holland, he sent two *Spinnen* to the Dutch East Indies, hoping that a demonstration there might convince the government that aviation was the solution to transport problems. One of these was fitted with a 100hp Argus engine and the other with a 70hp Renault. The Dutch Army was not impressed and the trip was a failure, this time resulting in the loss of 40,000 guilders, a sum that Fokker could ill afford. The aircraft were not brought back to Europe, but were probably sold off in the Indies.

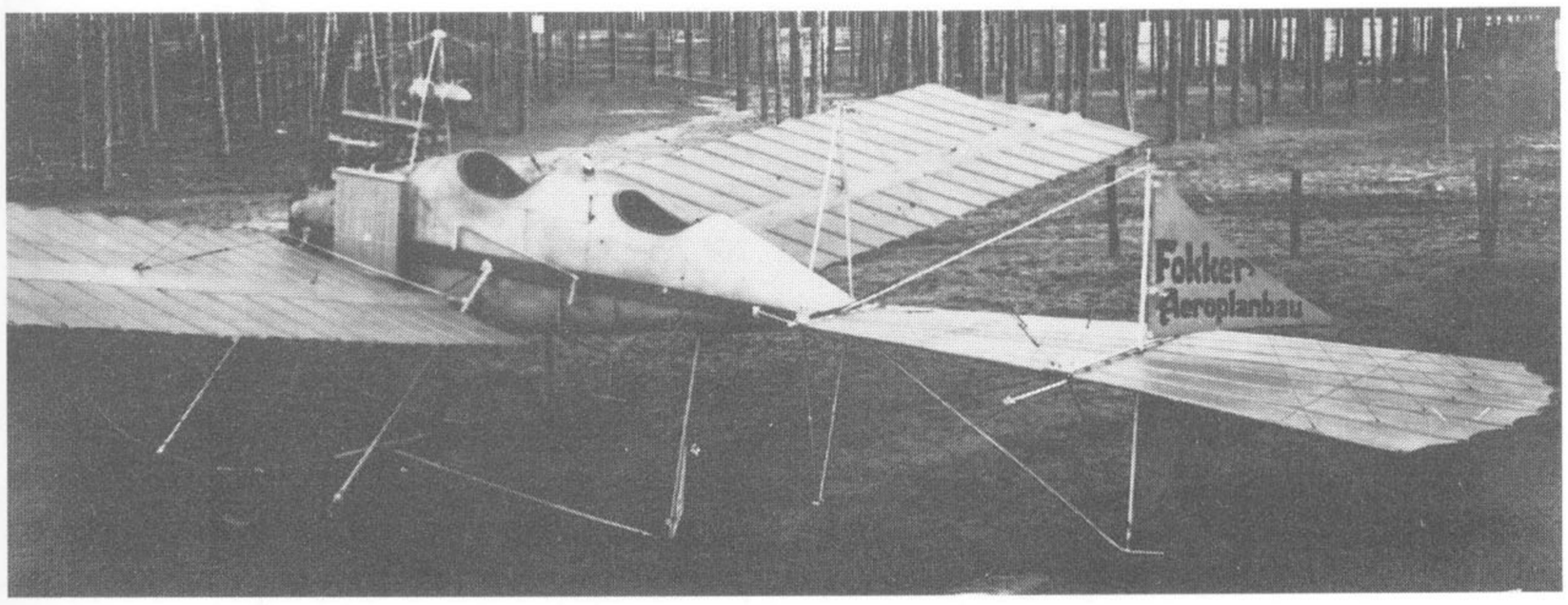
The next significant variant was the first 1913 model. This was similar to the first of the 1912 models but was longer and lower than that machine. It was fitted with either

Fritz Cremer in the rear cockpit of a *Spinne* with a student in the front. Cross and Cockade International

an air-cooled 70hp Renault, removing the need for the side radiators, or a 70hp Argus, in which case side radiators were again fitted. This version had a seat for a passenger in front of the (main) pilot's seat and a second control stick for his use. It was therefore well suited to a training role. It also had a pylon added below its rear fuselage.

The second 1913 model returned to the use of an aluminium nacelle enclosing pilot and passenger. It was larger and heavier than the similar 1912 model and was powered by a 95hp Mercedes water-cooled engine. This normally had side-mounted radiators, though at least one may have been fitted with an in-line radiator. Because of its greater weight and the problems that this could cause on the fairly soft grass surfaces used for flying, this and subsequent models were fitted with double wheels on each side of their undercarriages.

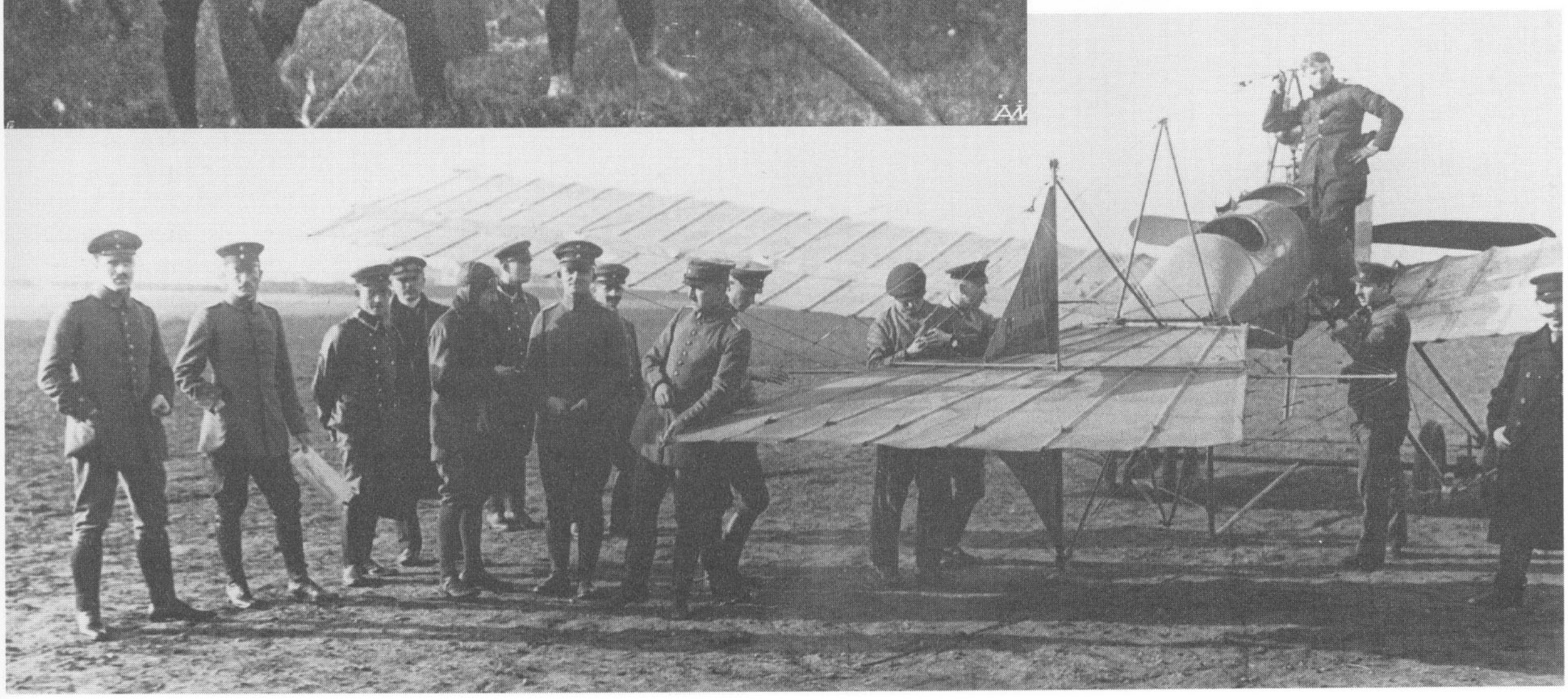
For himself, Fokker preferred not to enclose the pilot and passenger, feeling that simplicity was best. But he was anxious to secure a foothold in the German military aviation market and was forced to acknowledge the requirements of military crews. They were expected to make long-distance cross-country flights, navigating with the use of maps, to observe activity on the ground, and to write reports on their observations. To do this they needed more protection from the elements than Fokker's open-fuselage machines could offer, so he was forced into first adding the nacelles and then, at a later date, totally enclosing the fuselage structure. A point in favour of Fokker's *Spinne* design was that, unlike the monoplanes offered by other manufacturers of the period, *Tauben* by Etrich, Rumpler, Gotha, Albatros and



A *Spinne* fitted with a 100hp Argus engine. Stuart Leslie

***(Left)* Fokker and de Waal with what appears to be a British Army officer, possibly the Military Attaché during his visit to Johannisthal in 1912.** Thijs Postma

***(Below)* German Army trainees gather around a *Spinne* at Schwerin in the autumn of 1913.** Cross and Cockade International



many others, it offered good downward and forward vision through the wide gaps between the wing roots and the fuselage sides, though it has to be said that this same gap was aerodynamically unsound.

The third 1913 model was a 'sports machine' intended for use by wealthy aeronautical enthusiasts. It was powered by an air-cooled 70hp Renault V8 engine and had seats for the pilot and a passenger. Its basic structure was similar to the earlier models but there were significant differences. Unlike its predecessors, its aluminium nacelle extended only as far as the front cockpit. The rear fuselage, built up from formers and stringers, was covered in fabric. There were no pylons for the wing warping control cables as their runs were now within the covered fuselage. The rear end of the tail skid was fitted with a coil spring immediately below the fuselage.

Flying Boats

By this time a number of events had drawn Fokker's attention to the possibility of his manufacturing a flying boat. Successful flying boats had been designed and flown in France by Donnet-Leveque, in the USA by Glenn Curtiss and in England by Thomas Sopwith. In 1912 the German Navy had held a competition aimed at providing such a machine to meet their needs. A number of manufacturers had built machines to designs provided by the navy for the purpose, but none had proven suitable. In addition, a magnificent trophy was being offered by Jacques Schneider (son of a wealthy French armaments manufacturer and a keen aviation enthusiast) for the winner of a competition for water-based aircraft which was to be held at Monaco in April 1913. Ever watchful of the possibilities for publicity, with a long-established interest in sailing boats and the intention of securing a contract from the German Navy, Fokker saw an opportunity that was not to be missed.

The origins of the design he chose are shrouded in mystery. Neither Palm nor Goedecker had any part in it, but it is possible that it was given to him by the German naval engineers who had provided the designs for the 1912 competition.

Whatever the design's provenance, work on the new machine started on 2 January 1913. When completed, W.1, as it was designated ('W' signifying *Wasser* – water), was a flying boat with wings of unequal span. Its wooden hull was neat and streamlined. Based on a structure of longerons and formers, it was covered with narrow cedar planks sanded and polished in the best boat-building tradition. Construction of the hull was most likely carried out by one of Berlin's lakeside boat builders. An interesting feature of the hull was its adjustable 'step'. This was made in fabric and held by two spring-loaded levers. Fokker held a patent for this mechanism that, it was claimed, would soften the impact when landing on water and give wider planing surfaces.

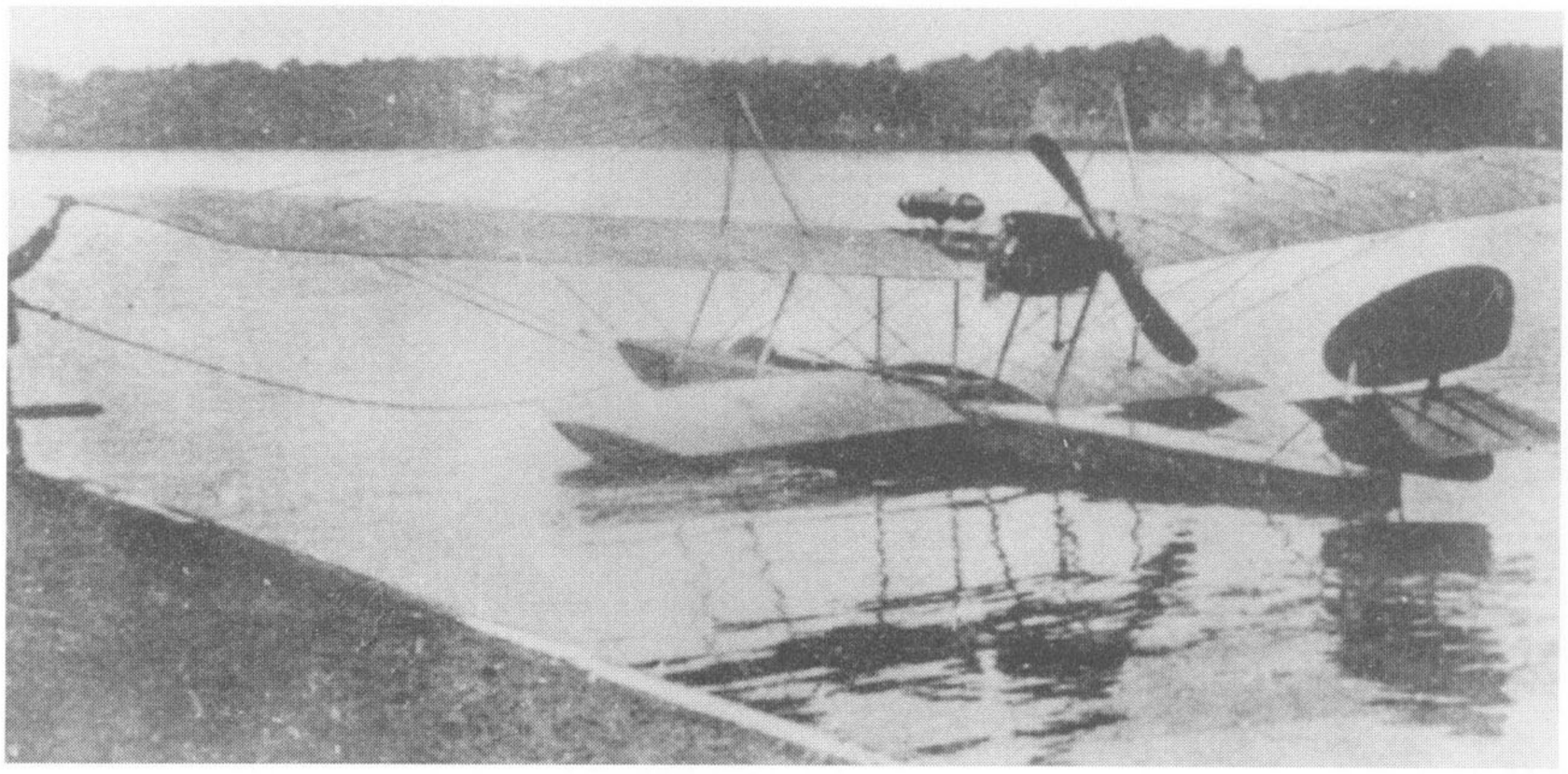
Both wings were built on wooden spars with slim wooden ribs providing the airfoil section. Unlike the *Spinnen*, both surfaces were covered with fabric. The short lower wing was of a plain rectangular shape with neither sweepback nor dihedral, and was mounted directly on to the hull's upper longerons behind the crew compartment. The tips of this wing were fitted with small wooden floats. The shape of the longer upper wing was similar to that of the *Spinnen*, having both pronounced sweepback and dihedral. Its centre section was left uncovered, providing access to the engine and fuel tank. The upper wing was mounted on a pair of ash beams which were carried above the fuselage by wooden struts. Extensions of these beams behind the wing's trailing edge provided a mounting for the engine. Neither wing was fitted with any means of lateral control. Bracing wires ran from a pair of king posts that were extensions of the upper wing support struts.

The tail assembly comprised an elevator, but no fixed tailplane, and a two-part rudder with one part above and the other below the elevator. Both were hinged from a tubular steel structure above the rear end of the hull.

W.1 was intended to be powered by a 100hp Renault engine but, for its first flight, Fokker fitted a 70hp Renault engine that he had available. This was mounted as a 'pusher' on the framework behind the upper wing with its fuel tank mounted on the ash beams in front of it. To meet a naval requirement, the engine could be started from the cockpit by means of a crank handle near the passenger's seat. This was connected to the engine crankshaft via a system of chains and sprockets.

From its appearance it was obvious that W.1 was tail-heavy so, for his first test run and a series of 'hops', Fokker carried a mechanic plus 60kg (130lb) of ballast in an attempt to bring the centre of gravity forward. The tests confirmed his worries and some modifications aimed at bringing the centre of gravity further forward were carried out. With these completed, and still carrying the mechanic and ballast, Fokker attempted a flight from the Dahm river near Köpenick. Running at full power Fokker was able to control the machine but, as he throttled back, the elevator lost its effectiveness and the tail dropped. He opened the throttle up again and attempted to land by making a series of stalled descents with the stick fully forward and judicious use of the throttle. This resulted in a final stall from a low height, and impact with the water buckled the front of the hull. Fokker was thrown clear but his mechanic was less fortunate, being carried under with the wreckage. Upon resurfacing he narrowly missed being injured by the propeller, as the engine was still running.

This crash was a major setback for Fokker, who had entered W.1 in the seaplane



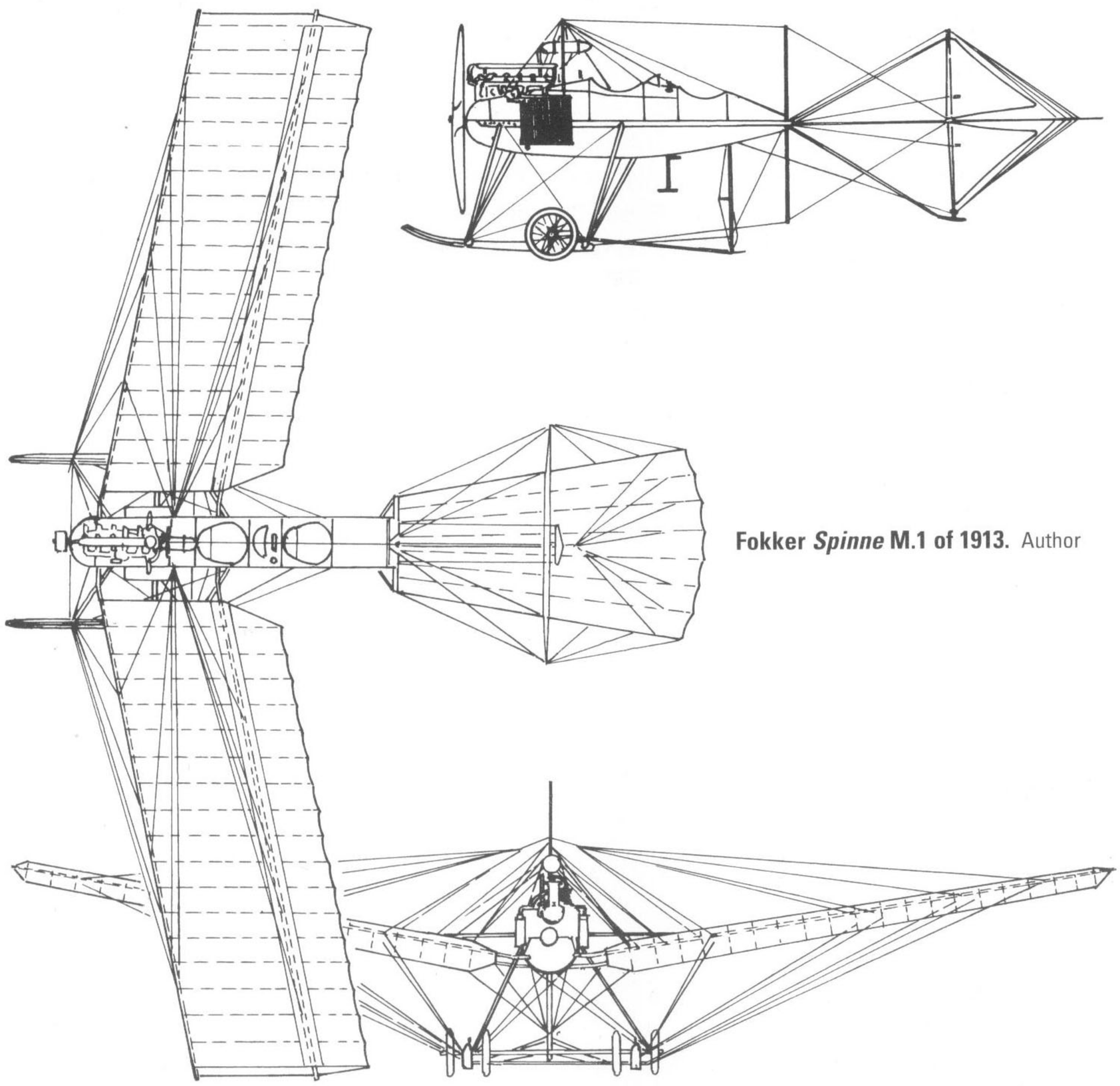
W.1 at rest on the water. Cross and Cockade International

contest at Monaco. In March 1913 he announced that he had a second flying boat under construction, but there is no evidence to suggest that this was ever actually started. A second announcement in April said that 'owing to urgent commitments on military orders' Fokker Aeroplanbau was unable to take part in the seaplane contest.

The M.1

Early in 1913 Fokker received orders from the German Army for two *Spinnen*. One of these was to be powered by a 100hp Argus engine and the second by a new development by Mercedes, a 95hp six-cylinder in-line engine. In line with a new Army specification which required that all aircraft should have a manufacturer's designation, Fokker called these aircraft type M.1, where 'M' indicated *militarisch* (military) aircraft. His earlier flying boat, designated 'W.1' where 'W' stood for *wasser* (water), already conformed with this requirement.

The 100hp Argus-powered M.1 was completed first and test flown by Fokker who climbed it to 600m (2,000ft) in nine minutes, carrying a total load (including

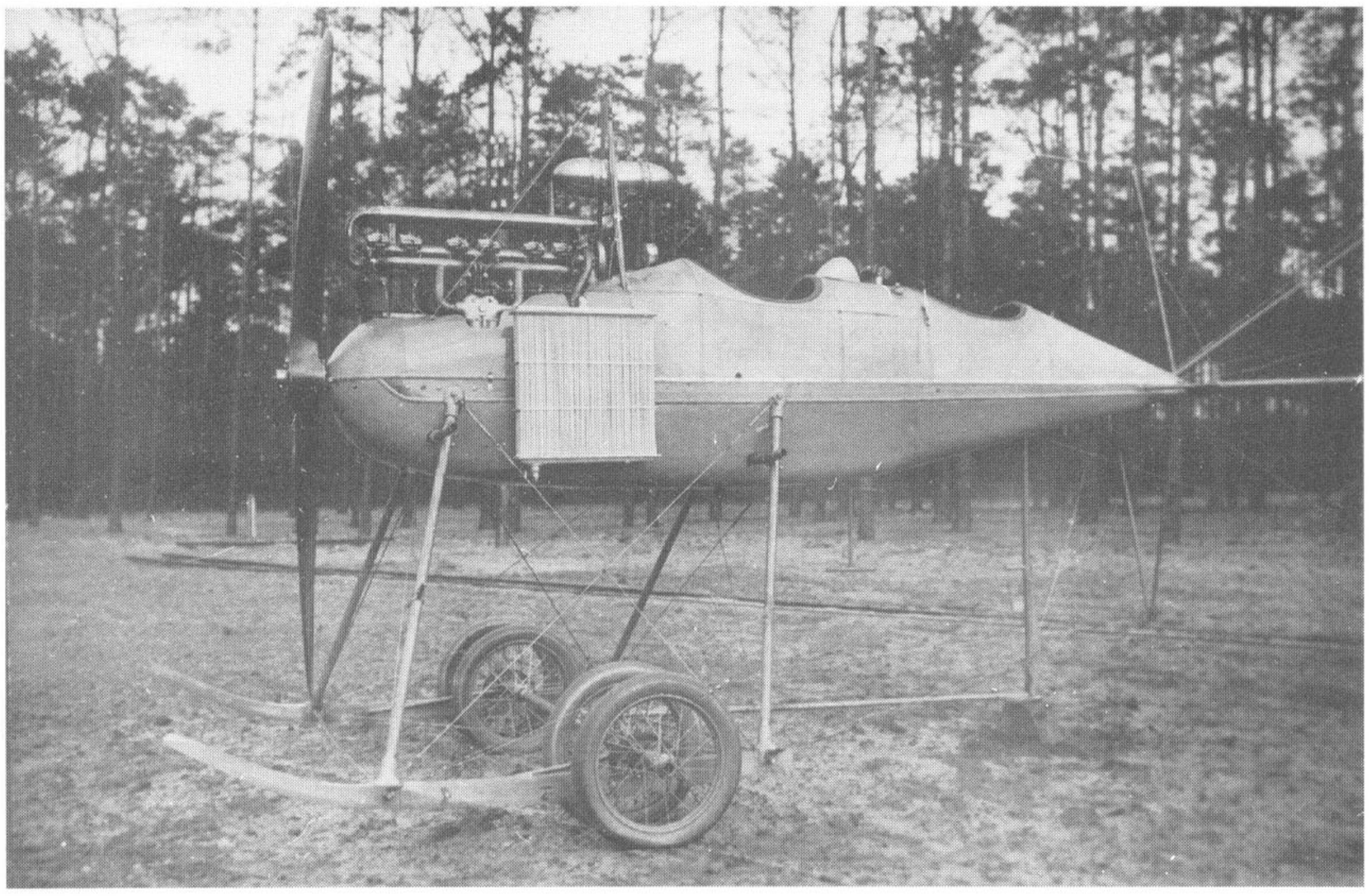


Fokker *Spinne* M.1 of 1913. Author

Fokker's M.1. Frank Cheeseman

Specification – Fokker *Spinne*/M.1 (1912)

Engine:	95hp Mercedes
Weights:	Not known
Dimensions:	Span 13.20m (43ft 3in); length 8.60m (28ft 2in); height 3.00m (9ft 10in)
Performance:	Maximum speed not known; Rate of climb 600m (2,000ft) in 9 minutes
Armament:	None fitted



The second version of the M.1 fitted with a 95hp Mercedes engine. This machine became A.38/13.
Cross and Cockade International

***(Below)* The 100hp Argus-engined *Spinne*.**
Stuart Leslie

fuel sufficient for three hours' flying) of 200kg (440lb). Its take-off run on this occasion was 61m (200ft). On 2 March 1913 it was delivered by air by Ltn Muehlig-Hoffman, who flew it from Fokker's factory to the trials centre at Döberitz.

Completion of the second M.1 was delayed by the late delivery of its 95hp Mercedes engine. The demand for this was such that Mercedes' production struggled to manufacture the numbers required and Fokker's engine did not arrive until the end of March. After completion of the aircraft at the end of March 1913, Fokker test flew it and then delivered it himself to Döberitz, making the journey in just 12 minutes with the help of a tail wind. This machine was given the Army's designation A.38/13.

With a view to attracting further orders, Fokker had quoted a low price for the two M.1s and so made little profit on them. After evaluation, the Army concluded that, in its present form, the M.1 was unsuitable for operation from small fields in other than the best of weather conditions. With its lack of lateral control, the M.1 was badly affected by gusty air, making it unpleasant for the observer and difficult for him to concentrate on his job. Although accepting that the M.1s were sturdy machines, the Army was unhappy with Fokker's method of attaching the wings' lift cables to the undercarriage which, they thought, made them vulnerable to damage. Consequently, no further orders for the type were placed by the Army.

The M.2

Fokker's next prototype was something of a departure from his *Spinne* format. He had come to accept that even the later variants of his basic *Spinne* design lacked speed and were unsuitable for uses other than training, and knew that there was an urgent need for drastic improvement.

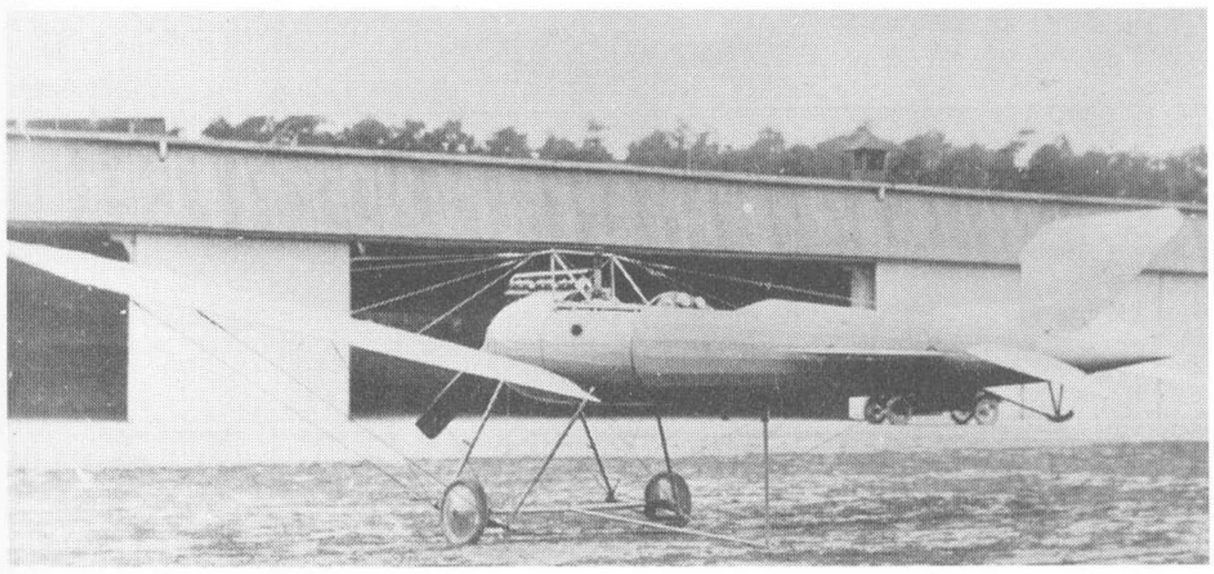
At the time, one of the most successful aeroplanes flying at Johannisthal was the Kuhlstein *Torpedo*. This had been designed by Max Court and built by Kuhlstein, a Berlin company specializing in building coaches and carriages. It had wings with a rectangular planform similar to those of the *Spinnen*, but its fuselage was of torpedo shape with a near-circular cross-section. Its propeller was faired by a ogival-shaped spinner and, with triangular fins and rudders above and below the fuselage and triangular tailplanes and elevators, its design appeared ahead of its time. The cross-section was achieved by the use of longitudinal stringers mounted on circular formers. In keeping with its coach-building origins, Kuhlstein used wood for these components. Consequently, although the *Torpedo* was undoubtedly fast, it was heavy and its fuselage structure complicated and costly to build. It was also liable to deform in certain conditions. While the *Torpedo*'s shape appealed to Fokker, he recognized weak points in its design and sought ways of improving upon it. Inspiration was soon to come his way.

Behind Fokker's buildings lay the workshops of Emile Jeannin, who built

monoplanes with welded steel-tube fuselages. While Jeannin's initial designs had not been successful, his later *Taube*-based machine was, and examples of his *Stahltaube* remained in Army service until as late as 1915.

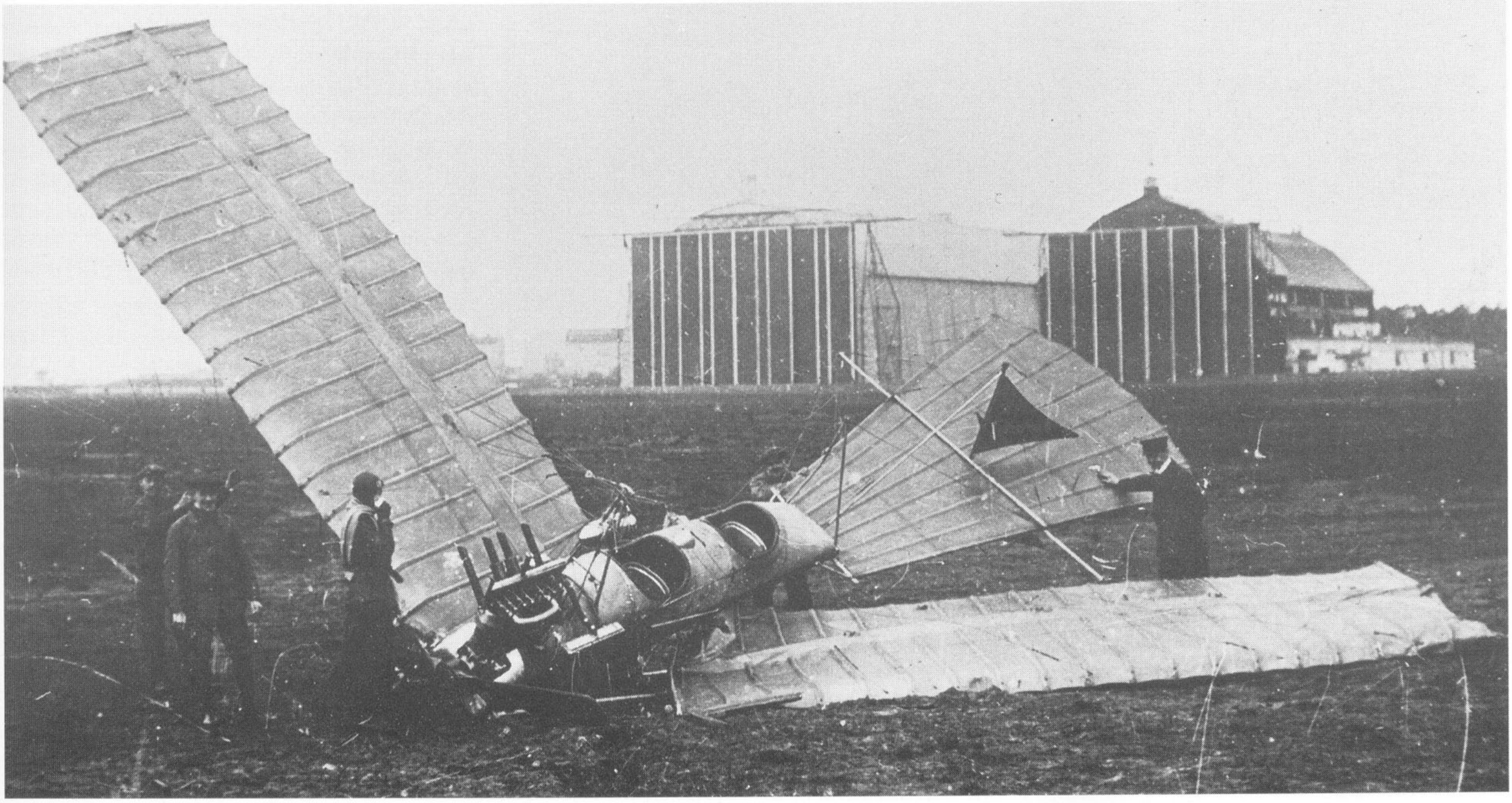
By some means, which he preferred not to discuss, Fokker acquired one of Jeannin's discarded slab-sided welded fuselages and gave this to Platz as the basis for the design of the basic fuselage structure of his next machine, M.2. Platz produced a square, welded steel-tube structure to which were fitted light circular wooden formers and light wooden stringers. Covered with fabric, this gave a circular cross-section fuselage similar to that of the *Torpedo* but appreciably lighter. The engine was faired into this with shaped aluminium panels leaving the cylinder heads exposed. Its two side radiators were curved to blend into fuselage contour. Four sockets were welded to the lower longerons to provide mounting points for the wings. These differed from early *Spinne* wings in having wooden spars carefully spindled out to reduce their weight. The wooden ribs were of similar profile to those of the French Nieuport monoplane and were lightened by elongated holes. The completed wing structure, stiffened by steel piano-wire bracing wires, was totally enclosed inside two layers of fabric. The tailplane was a modified version of that fitted to the earlier *Spinne* but was fitted with divided elevators. There was no tail fin but a single balanced rudder was fitted above the fuselage. All of the tail-assembly components were made in welded steel tube and totally enclosed in fabric. The undercarriage was similar to that fitted to the *Spinnen* even down to the attachment of the lift bracing cables to the skids. The *Spinne* tail skid was also retained.

Through his contacts, Fokker learned that a competition for the supply of military



The Fokker M.2. Cross and Cockade International

***(Right)* Fokker in front of the M.2 that gained him his first order, for ten of the type.** Johann Visser via Harry Woodman

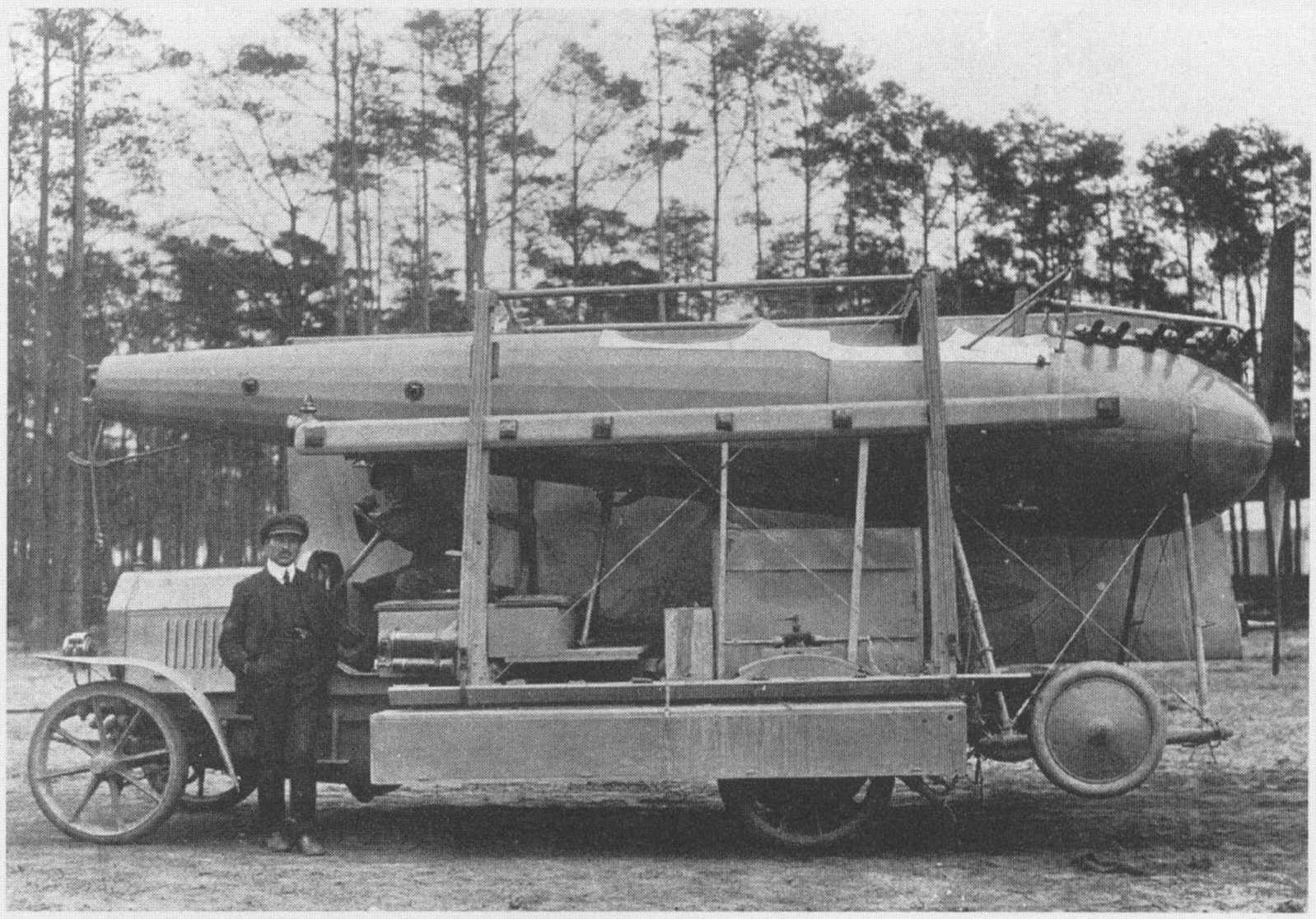


The *Spinne* III after being landed cross-wind by Leitner (one of Fokker's pupils) at Johannisthal in 1913. F. Gerdessen via Harry Woodman

Specification – Fokker *Spinne*/M.2 (1913)

Engine:	100hp Mercedes or Argus
Weights:	Not known
Dimensions:	Span 13.20m (43ft 3in); length 8.50m (27ft 10in); height not known
Performance:	Maximum speed 100km/h (62mph)
Armament:	None fitted

Dismantling the *Spinne*



The M.2 dismantled and stowed for travelling on the adapted Daimler lorry. Thijs Postma

The M.2 *Spinne* had been designed with rapid dismantling and re-assembly in mind. Its wings were located on spigots protruding from the fuselage sides and held in place by the rigging wires. Of these, the lower ones hooked into the undercarriage whilst the upper ones were secured and tensioned by two turnbuckles. Thus, unfastening of just these allowed the wings to be removed. Re-assembly was equally easy and fast. In most cases, Fokker's early machines were designed so that wings, tools, fuel and any spare parts could be fastened onto the fuselage top or sides. The whole could then easily be towed by a motor vehicle. While this clearly had its military applications, it must also have been an asset to the sporting pilot of the day.

aircraft for the German Army was to be held at Döberitz in August 1913. The specification for these machines stated that they should be capable of carrying a crew of two and should be easy to dismantle for transportation. The dismantled aeroplane, with any necessary spare parts, fuel and oil had to be carried on a single motor vehicle. For the purpose of the competition, the dismantled aeroplanes should be driven from Johannisthal to Döberitz on its transport and then assembled and flown. Always a skilled self-publicist, Fokker specified the time at which he would arrive at the site and that his aeroplane, an M.2, would be ready to take off within ten minutes of arrival.

With financial support from his father, Fokker bought a vehicle from Daimler that had been adapted to carry a dismantled M.2 aeroplane plus all of the other specified equipment. Dismantling of the aeroplane for transportation was kept to a minimum. As the other competitors each used a combination of towing vehicles and trailers, Fokker's single vehicle gave him better road performance, enabling him to out-distance them and to arrive on the trials site at his specified time.

Fokker claimed that, as a result of his success in this competition, he had been awarded a contract worth 182,800 Marks for four M.2 aeroplanes with their transporters and equipment. This, he said, was followed a month later by a contract for a further six aeroplanes at 19,500 Marks each, bringing the total contract value to 299,800 Marks and providing him with the capital he needed for expansion. There seems to be some doubt as to the facts behind this. No record of M.2's performance remains but, as its engine was of less horsepower than that fitted to the Kuhlstein *Torpedo*, it is probable that it was not up to that machine's 145km/h (90mph). Muehlig-Hoffmann tested the M.2 on behalf of the establishment at Döberitz and reported that he considered that it was directionally unstable, that it lacked adequate rudder control and that it was useless for military purposes. Fokker's reaction to this was to modify the tail assembly, replacing the divided elevators with a single long unit and fitting a second rudder beneath the fuselage. Even so, the design was not a success and was not continued. All of the Fokker aircraft that were on strength were earlier models serving in a training role and there is no record of ten M.2s in Army service. None were included on the list of mobilized equipment in August 1914, so the truth of the matter remains a mystery. Fokker's additional funding may in fact have come again from his father.

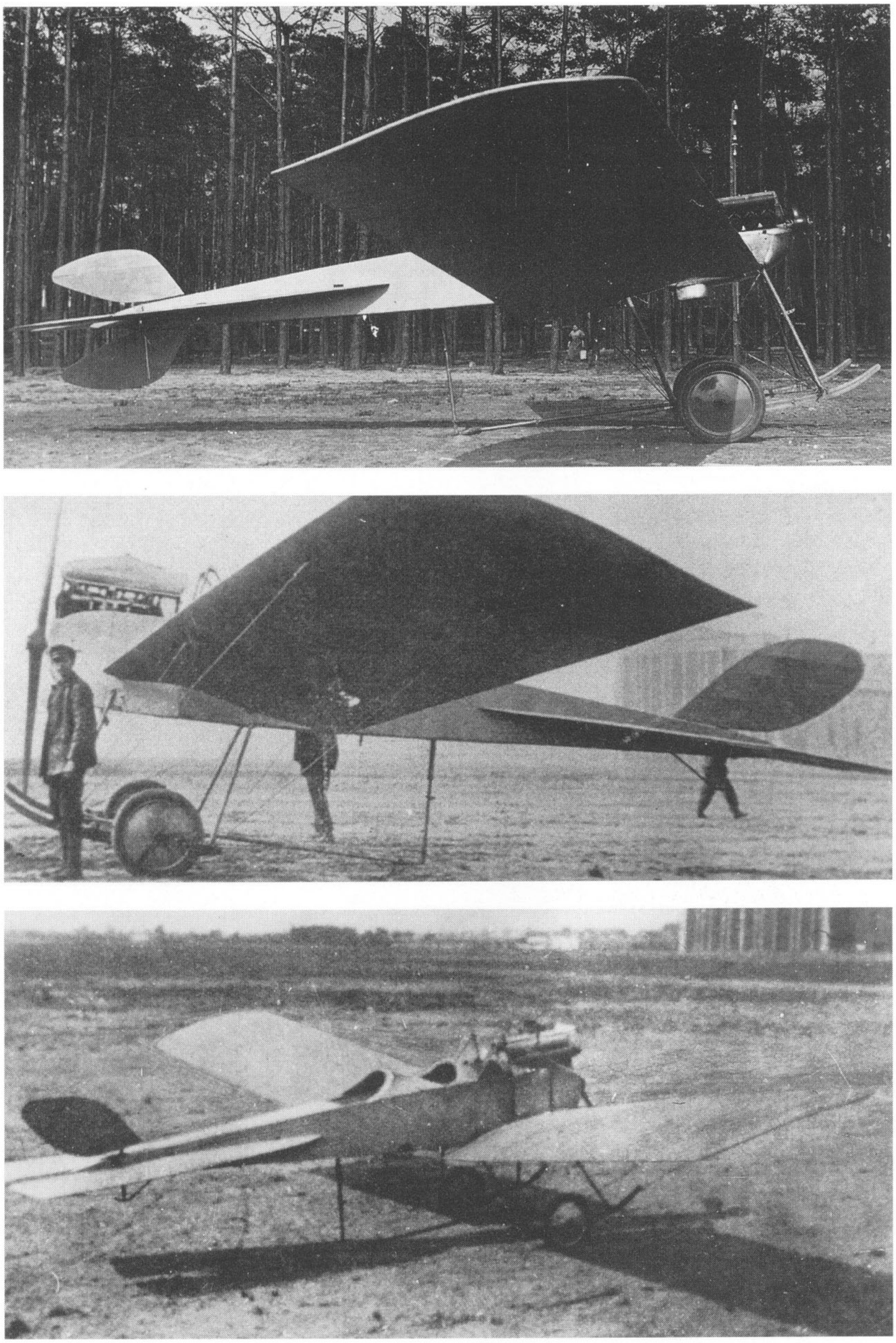
The M.3

On 13 July 1913, a Morane-Saulnier Type H flown by a French pilot, Leon Letort, landed at Johannisthal. It had covered the 920km (570 miles) from Paris non-stop in just 8¾ hours. The Type H was small, light, of neat appearance and powered by an 80hp Le Rhône engine. Letort remained at Johannisthal until 27 July when he flew back to Paris and, in this time, anybody interested (and Fokker definitely was) had ample opportunity to examine the machine in detail. This was not the first Type H that Fokker had examined, as another of the type had been brought to Johannisthal by road by a Swiss pilot, Edmonde Audemars, who aimed to be the first to fly from Berlin to Paris. During its

time at Johannisthal, it had been unloaded into the LVG workshops where it was to be assembled. Using his excellent contacts amongst the LVG workforce, Fokker had been able to examine it closely and had sketches of its details made before he was discovered by LVG management and asked to leave. Examination of these two aircraft, plus a detailed report on the type which was published in *Flugsport*, gave Fokker considerable food for thought.

Fokker (and most of the other pilots present) was also greatly impressed by the aerobatic performances of Adolphe Pegoud in his Blériot Monoplane at Johannisthal. These had included a demonstration of a 'loop', a manoeuvre only recently originated by Pegoud and firmly established as his trademark. Fokker appreciated that the structural strength of his own designs was inadequate for this purpose and set about blending what he had learned from his visual examination of the two vastly different types to produce his next prototype, the M.3.

For this, Fokker abandoned the complicated system of formers and stringers that had streamlined the M.2 and settled for a basic rectangular sectioned fuselage built up from welded steel tubes in the manner used by Emile Jeannin. The main part of the 95hp Mercedes engine was cowled with aluminium panels, leaving the cylinder heads exposed. Another new feature was that engine cooling was by means of a Windhoff radiator mounted directly on it. Pilot and passenger cockpits were provided with a short decking and the remainder of the fuselage was fabric-covered. The wings and tail unit were similar in construction to those of the M.2, as was the undercarriage with its long tail skid and attachment points for the wing lift bracing wires. The frame of the balanced rudder and light ribs was made from welded steel tubes. Fokker's first flight in M.3 was at Johannisthal on 26 September 1913, and he continued to fly it during the Johannisthal 'Autumn Flying Week'. It was not an easy machine to fly and was probably never submitted to the military for approval.



Three views of the Fokker M.3. Cross and Cockade International

M.3A, a variant of the M.3 fitted with the 70hp Renault engine that had powered Fokker's wrecked W.1, followed. Though structurally similar, it varied in a number of ways: its wings were placed lower than those of the original M.3; its rear spar fixing was below the fuselage; and in an attempt to improve its handling, it was fitted with a divided rudder. However, it proved extremely difficult – even dangerous – to fly. It was sold to a private Russian purchaser who apparently never flew it and then, at the start of the war, it was was given over as a trainer in which role, to everybody's relief, it was destroyed in a crash.

The Move to Schwerin

Through general expansion of German aircraft industry, Johannisthal had become overcrowded. Official policy dictated that manufacture should be decentralized and that constructors should move away to

other locations. As a result, it was suggested that Fokker should move to a site at Schwerin-Gorries in Mecklenburg. He was offered a contract guaranteeing orders for further aircraft and an annual throughput of thirty trainees for his flying school. To add to the attractions of this proposal, the local council at Schwerin offered him a most tempting package including the leasing of ground for an airfield for a nominal sum plus construction of factory buildings at 10 per cent of the cost with the option of purchase at a later date. Fokker's move to this site and the establishment of his first factory took place in the autumn of 1913. At this time the size of the building was just 49 × 118ft (15 × 36m), plus a small annexe.

Despite the generosity of the terms for the move, Fokker was again desperately short of the capital necessary to buy equipment and to cover immediate running costs. This was overcome by the founding of a limited company, for which Hermann Fokker, Anthony's uncle Edward and Fritz Cremer's father each supplied money. The original assets of this company were stated as 300,000 Dutch florins, a further 100,000 florins being added six months later. Their faith was justified when the Army ordered a further twelve machines and a number of civil orders were also received. The workforce, twenty-five at the beginning of the year, had now grown to fifty-five men including designers, draughtsmen, technicians, craftsmen and flying instructors. There was every sign that 1914 would be a profitable year.

The M.4

M.4, Fokker's next design, completely abandoned everything that had gone before. Its shoulder-height wings had no sweepback and only slight dihedral. Their planform was rectangular, but with raked tips. Ailerons with a curved trailing edge were inset into wings with hinges mounted at an angle, giving the wings the suggestion of a *Taube* shape. The wings were built entirely in wood, the main spars being ash beams spindled out locally to reduce their weight. The contour of the leading edge was provided by a shaped plywood strip. The aerofoil section was deeper than that of the previous models and, while this may have achieved greater lift, it did so at the cost of longitudinal stability. Fokker did retain the gap between the wing roots and the fuselage of the previous models, intended to give the crew a good view downwards.

The fuselage was a rectangular welded steel tube structure similar in design to that of M.3 but with a number of detail improvements suggested by Platz. It was powered by a six-cylinder 100hp Mercedes engine fitted with a Windhoff radiator. It had a roughly rectangular rudder welded from light steel tube and mounted at the end of the fuselage on the tail skid structure, and a large tailplane with split elevators. Despite its wooden wings, M.4 was named *Stahltaube* (steel dove) in emulation of the Jeannin *Stahltaube* that also had all-wooden wings and was proving popular with Army pilots.

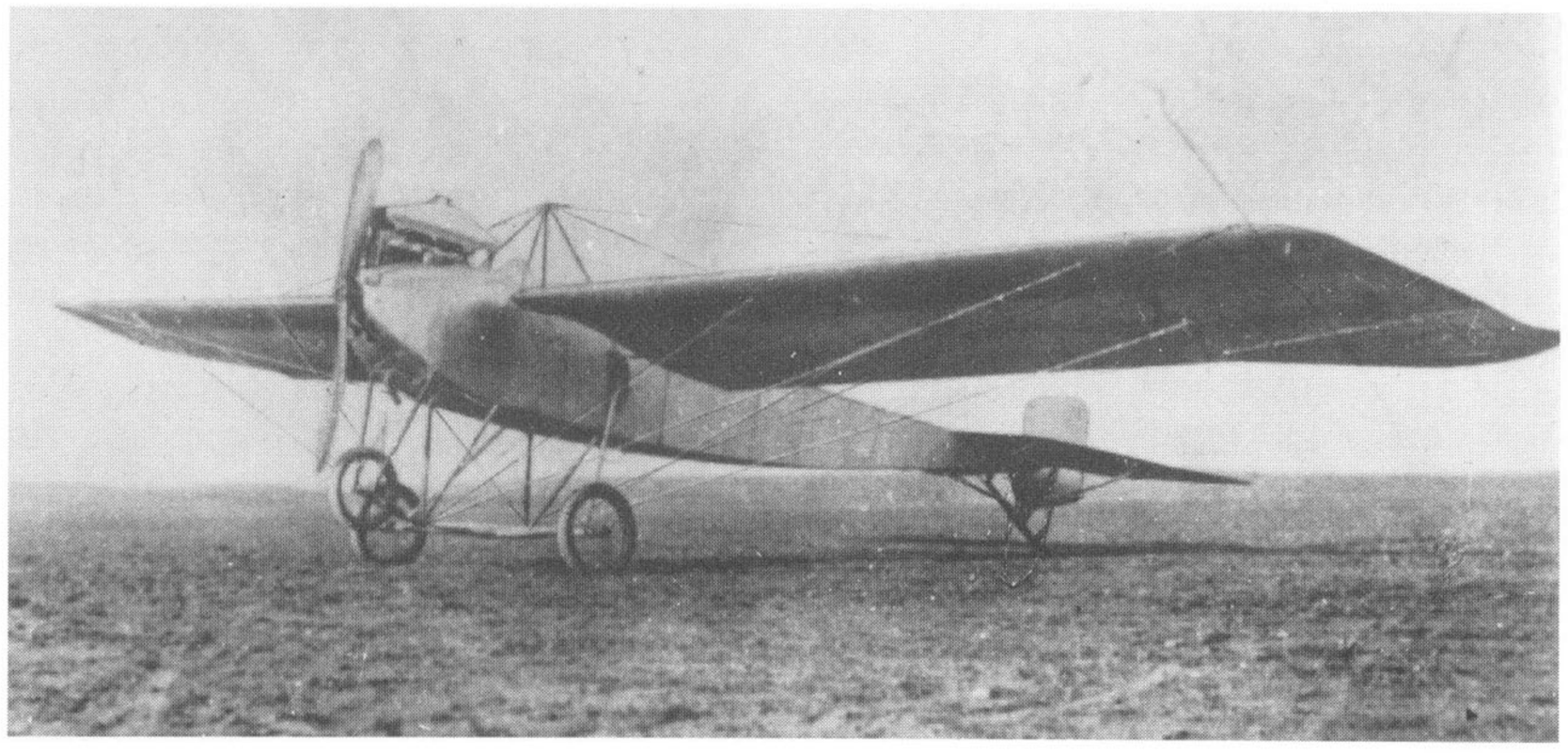
With M.4, Fokker at last abandoned the archaic, long, undercarriage-mounted tail skid of his preceding machines and fitted conventional tail skids similar to those used on most other designs of the period. With M.4, Fokker also abandoned the undercarriage skids and, at the suggestion of the Army, fitted a nose wheel in their place. The wing bracing wires were now fastened to the central member of the undercarriage that, in turn, was rigidly fixed to the fuselage. Unfortunately, the new undercarriage proved to be a problem and was unsuccessfully modified a number of times.

M.4 made its first flight at Schwerin in November and proved difficult to handle. Despite being subjected to a number of modifications, it remained unstable with a lower performance than aircraft from the other German manufacturers. It was suitable neither for use in the field nor as a training aircraft, so it was quickly scrapped. Palm, who had been responsible for the design, was sacked.

The W.2

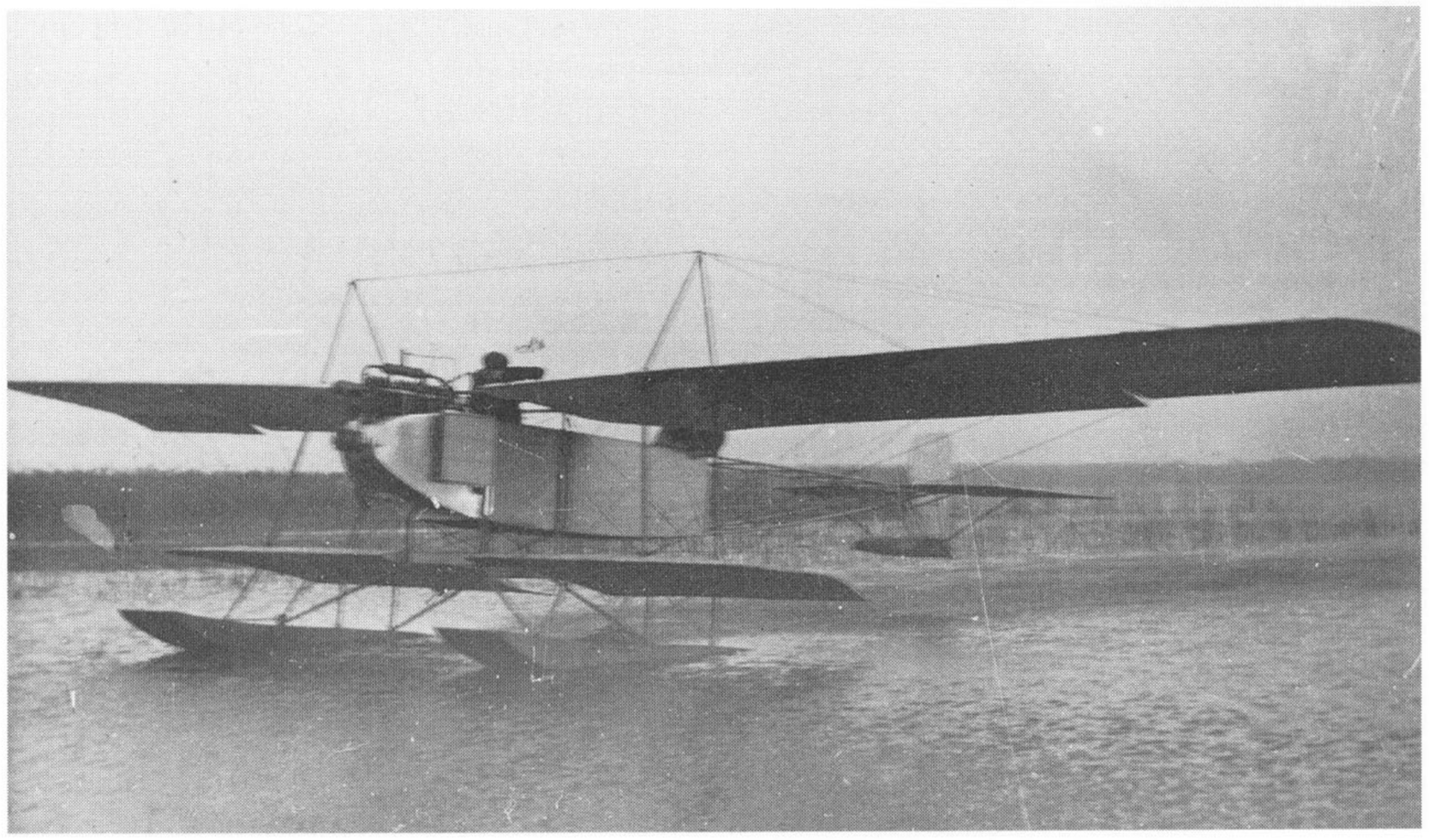
Palm had also been responsible for the design of Fokker's second venture into seaplane design. The new machine, designated W.2, was intended to meet a German Naval requirement for a two-seat, twin-float biplane for use in a reconnaissance role. A competition to select a suitable design was to be held at Warnemünde in August 1914 and large sums of money were expected to be paid for successful machines, with a contract for supply of aircraft to follow. W.2 was a sesquiplane, that is, the upper wing was of a substantially larger span than the lower wing. Both wings were continuous wooden structures with uncovered centre sections. Only the upper wing, which was twice the span of the lower wing, was fitted with ailerons. The upper wing was mounted just above the level of the top of the fuselage, and the lower wing below the bottom of the fuselage. Two tall king posts were fitted to the upper wing to support the bracing wires required by that wing's long overhang.

The fuselage was a slab-sided, tubular steel welded structure similar in appearance to that of M.4, but its fabric covering extended only to the rear of the pilot's cockpit at the back. It was powered by a 100hp Mercedes engine cooled by a pair of large radiators mounted below it on the fuselage sides. The wide undercarriage was intended to provide stability on the water and comprised a pair of flat-bottomed floats mounted on struts below the lower wing, plus a third float mounted beneath the rear of the fuselage. The balanced rudder, tailplanes and elevators were welded



Fokker M.4. Cross and Cockade International

W.2 taxiing. Cross and Cockade International



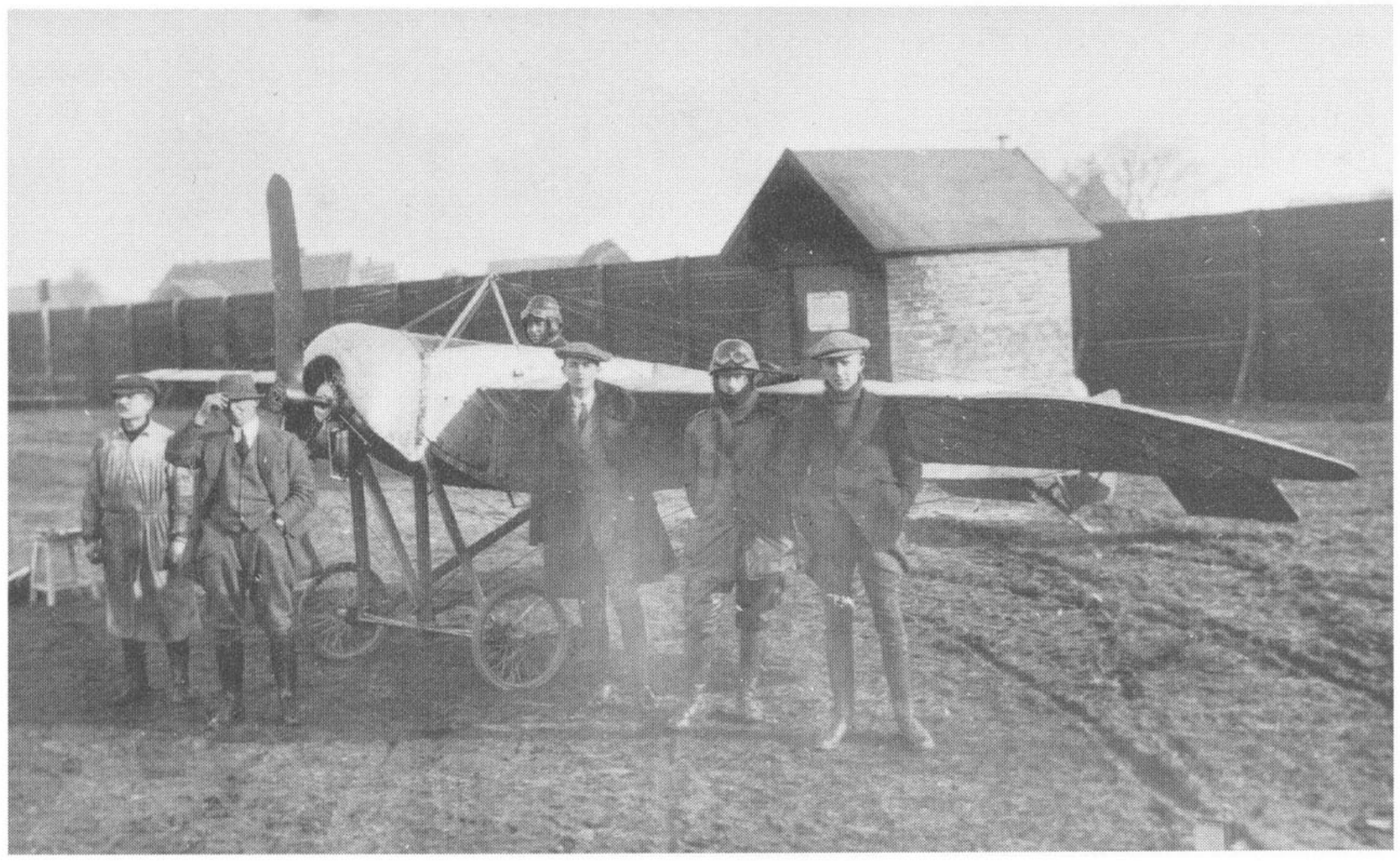
tubular steel structures, and appear to have been similar to those fitted to M.4.

Fokker entered W.2 in the *Nordischer Seeflug*, a competition due to start on 21 August 1914. Participants were required to fly the 1,030km (640 miles) from Schwerin across the sea to Oslo in Norway. It was intended that de Waal would pilot W.2 but, after Fokker had test-flown the machine from the Schwerin Lake on a number of occasions, it was decided that, like M.4, it was a failure. Its component parts, fuselage and floats were converted for use as a hydroplane. Fokker's efforts with W.2 were not entirely fruitless, though, as they brought his name to the attention of the German Navy, resulting in his being added to their list of manufacturers to receive contracts for prototypes.

The M.5

By the end of 1913 Fokker's business was in a difficult financial situation, with debts mounting. The money he had committed to the building of his numerous prototypes had been wasted as none had been successful. His flying training schools, which had once provided the money for his experimental work, were no longer in profit, mainly because a number of new schools equipped with more modern aeroplanes had opened up and were attracting what potential pupils there were.

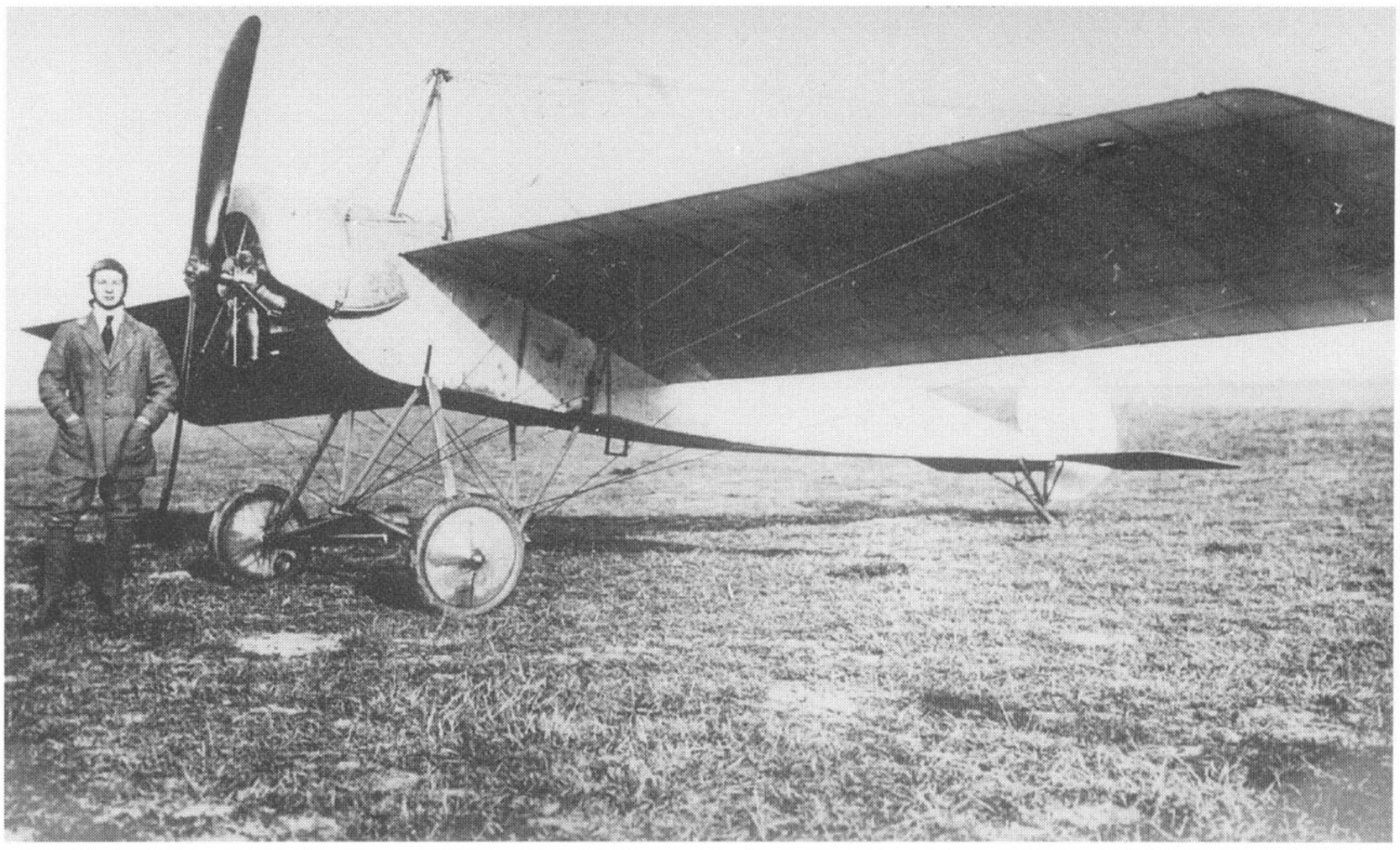
Fokker fully appreciated that, to bring both enterprises back into profit, he needed a new, successful, prototype. He had not forgotten the Morane-Saulnier Type H monoplane he had examined, and he appreciated that it was better than anything that German manufacturers could offer. The opportunity to manufacture such a machine would get him back on his feet. Being Fokker, he would not consider spending money on a licence to manufacture from Morane-Saulnier, neither would he wish to buy a new sample from them. Instead he set out to acquire a second-hand sample as cheaply as possible. Accurate details of just how he managed this are not known but, at the end of 1913, he visited Paris and returned with a Morane-Saulnier Type H that had cost him just 500 Marks. While it was an early-model Type H and fitted with a 50hp Gnome rotary engine, it had the sprung undercarriage of the 1913 model. It is probable that, after being damaged, it had been sold for scrap, but despite its condition, the work that it would need to restore it to flying condition and the fact that it lacked any supporting technical handbooks, it was perfect for Fokker's purpose.



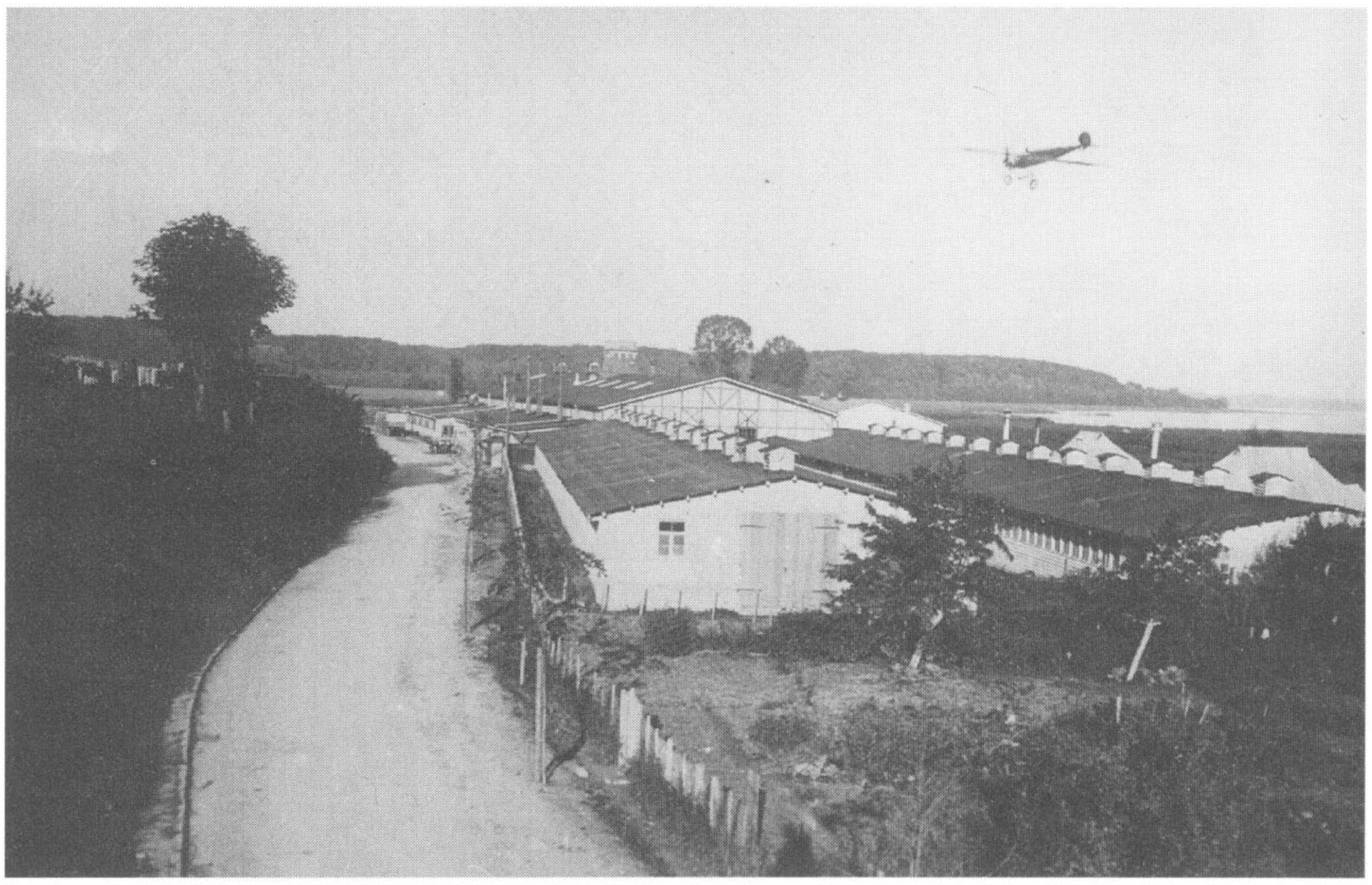
Fokker seated in his restored Morane-Saulnier Type H at Schwerin.
Cross and Cockade International

Fokker placed it in a secure building where it would be out of sight from his main workshops at Schwerin and set about repairing it to flying condition. This was achieved early in 1914 and the repaired machine was flown, initially by Fokker and then by de Waal and others. With its light, positive control system it was totally different to the *Spinnen* that they had been used to, but the techniques needed were soon mastered and its manoeuvrability explored. All who flew it were delighted by the experience.

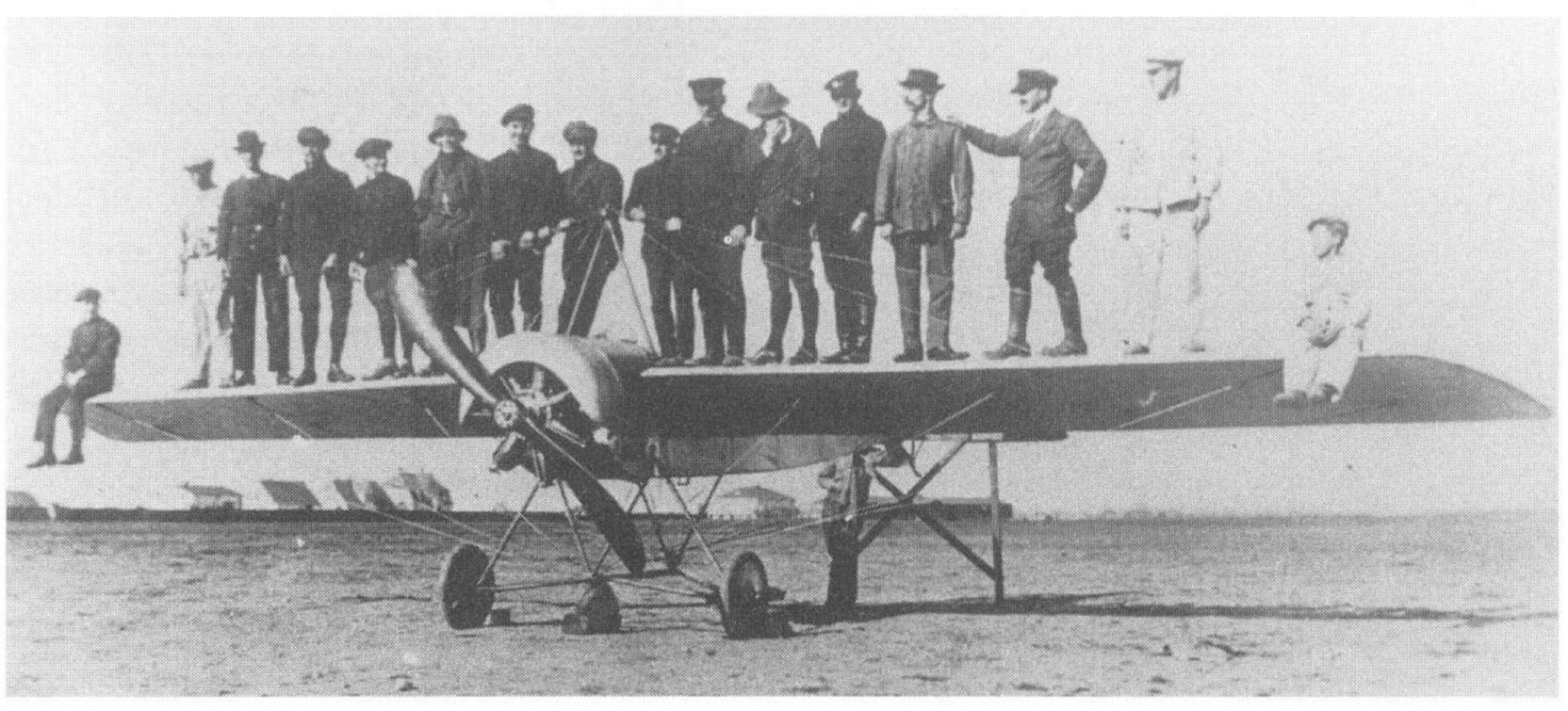
Fokker realized that here he had the basis for his next design. It would not be a direct copy of the Morane but would certainly be based upon what could be learned from it. He had it stripped and, in discussion with Kreutzer, considered each feature, deciding upon which would be retained for their new machine. A set of working drawings were produced as the result of these discussions, and work upon



Fokker in front of the M.5L in 1914. Harry Woodman



The M.5L flying over the Fokker factory at Schwerin-Gorries in May 1914.
Harry Woodman



The demonstration of wing strength that became a standard publicity ploy for Fokker with the M.5L and his future designs. de Waal is standing fifth from the left and Kuntner second from the right.
Cross and Cockade International

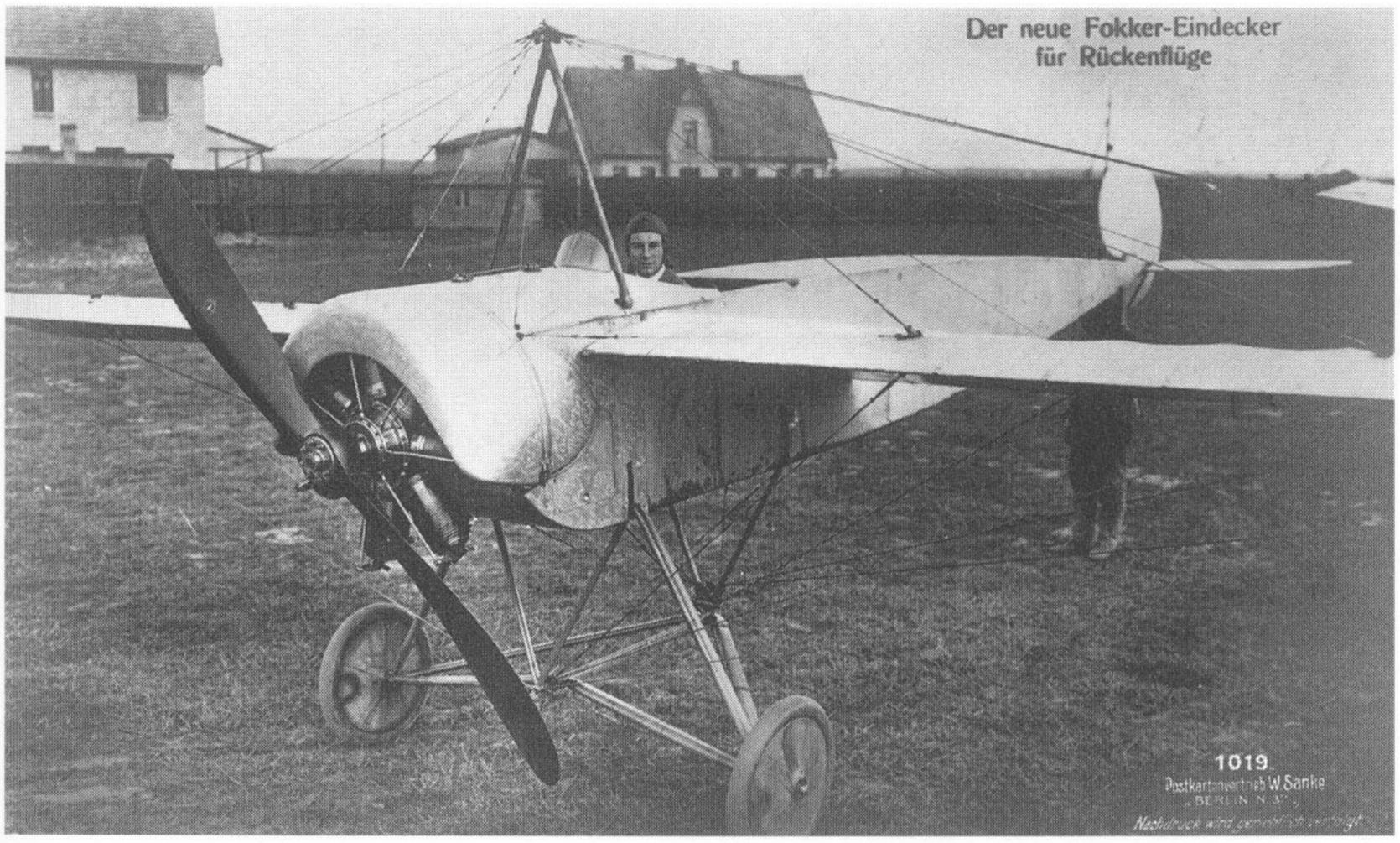
the prototype of what would be the M.5 commenced.

The Morane's fuselage had been built in wood in the traditional fashion. The M.5's fuselage was shallower in profile and of a lighter steel construction: a welded tubular steel structure ending in a horizontal knife edge. Its four longerons of reducing diameters were strengthened by the addition of cross-bracing steel tubes in its first four bays and wire bracing in the remainder. The bracing wires were of single-strand steel piano wire looped at each end around bent steel tube lugs welded into each corner of the bays. These wires were fastened into a turnbuckle which was used to tension them. This was Fokker's first use of a simple but effective system he was to continue to employ for the next twenty-five years.

The M.5's wings resembled those of the Morane and were also built in wood. But there the resemblance ended, as Fokker's wings enjoyed an improved (deeper) aerofoil section, deeper spars, more wing ribs with riblets between them to maintain the leading edge profile, and spanwise tapes over and under the ribs to prevent them from twisting under pressure from the doped fabric covering contracting as it dried. The features that added strength to the design also added weight so that, inevitably, the M.5's wing was heavier than that of the Morane. This was not a problem as this increase in weight was offset by the reduction in weight from the simplified, all-steel fuselage.

For lateral control, Fokker retained the wing warping system of the Morane but improved it by adding hinged end joints to the wings' compression struts, allowing them to flex more readily. The elevators were of balanced profile and connected by their main tubular steel spar. The rudder was that previously used on the earlier M.4. Rudder and elevators were of light tubular-steel welded construction and covered with fabric.

The M.5's undercarriage was both taller and wider than that fitted to the Morane and differed in other ways, too. The M.5's was an ingenious flexible arrangement of struts with a divided axle (further back than that of the Morane) carrying the wheels.



Fokker seated in the M.5L. Frank Cheeseman

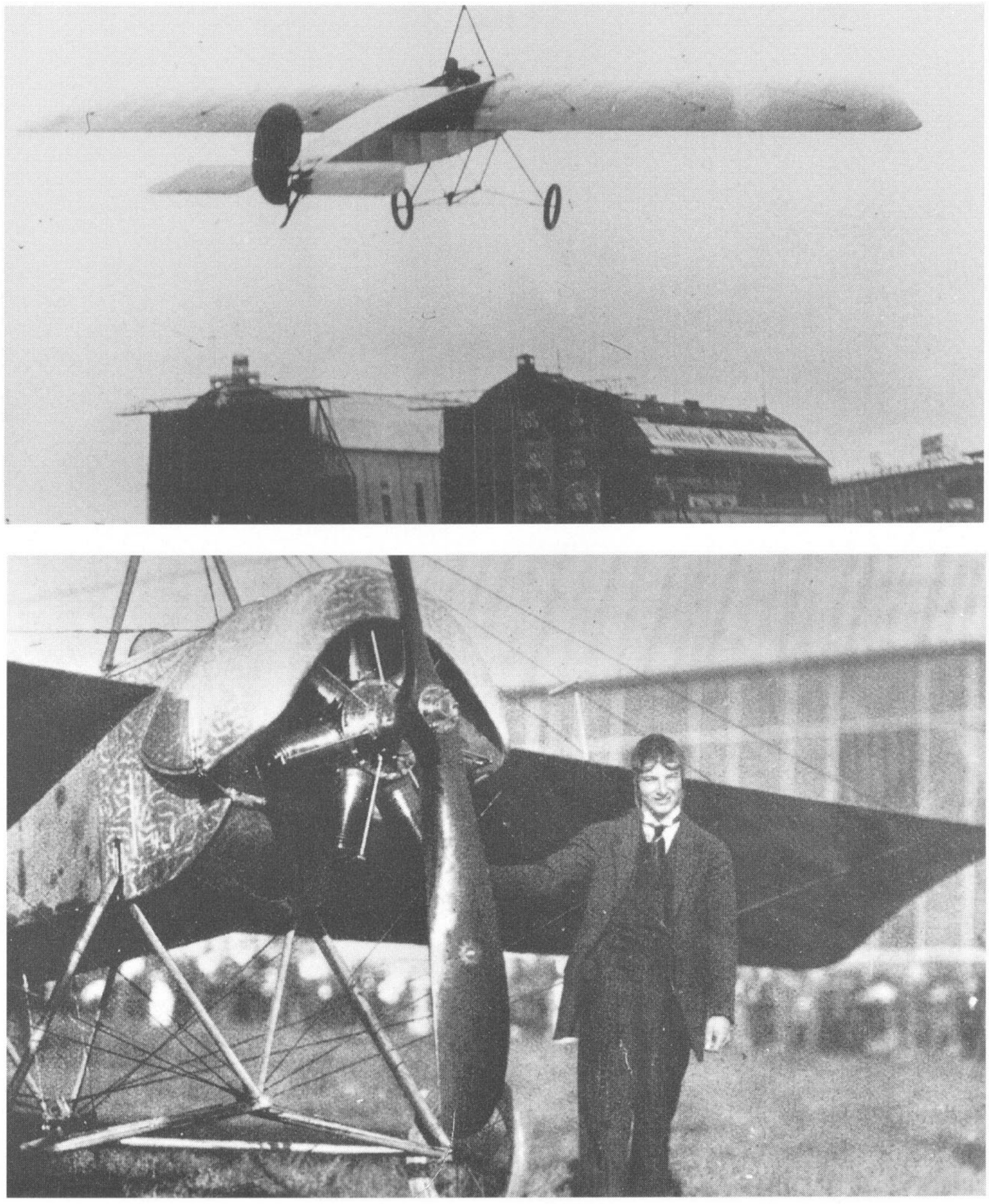
***(Below)* Fokker taking off in the M.5L at Johannisthal.** Cross and Cockade International

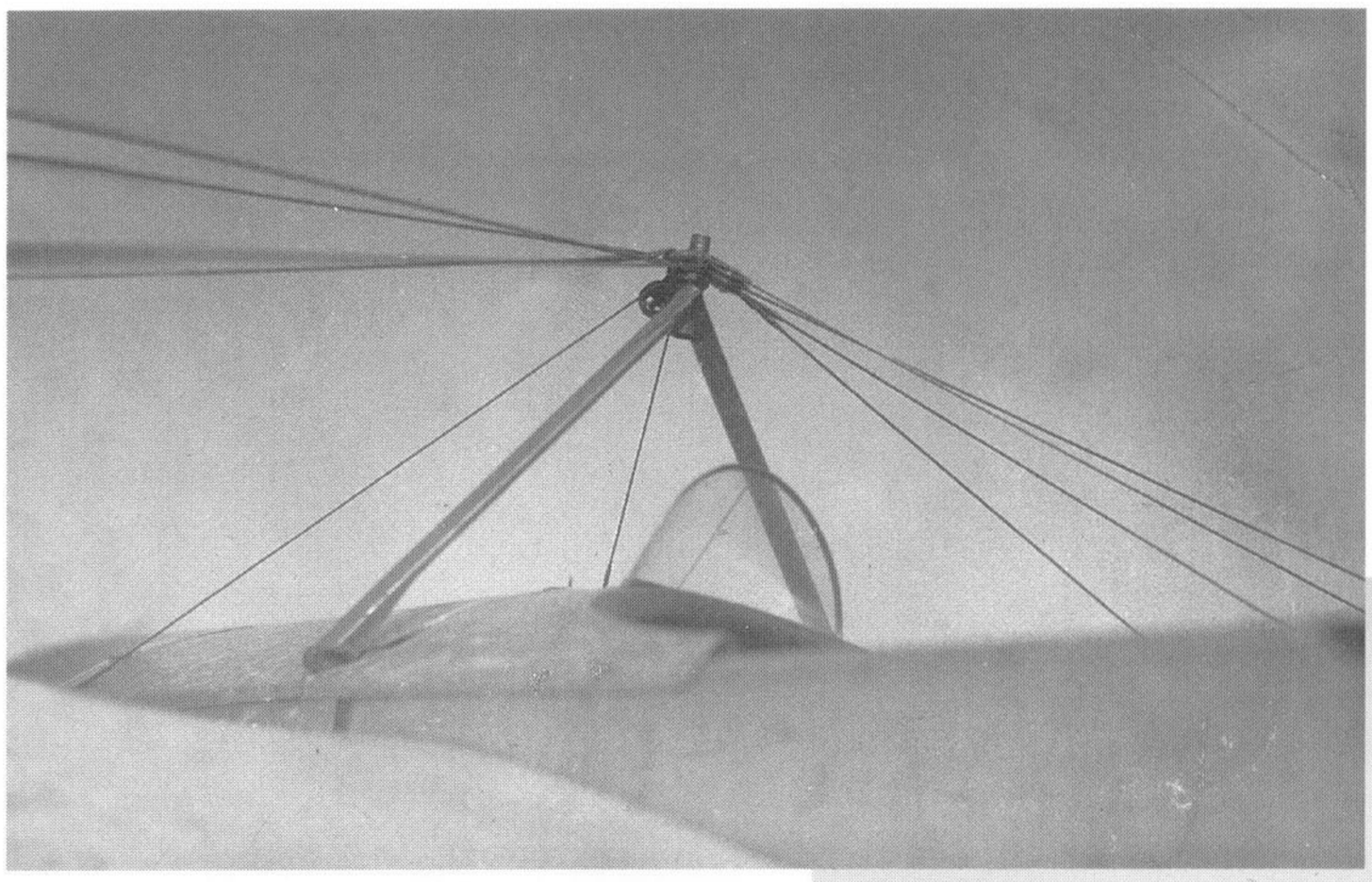
***(Bottom)* Fokker with the M.5K.** Greg Van Wyngarden

Each wheel was free to rise under pressure but was restrained by rubber-ring springs at the tops of the front legs. The Morane also had a divided axle, but this was carried on rigid struts and springing of the wheels was achieved conventionally by elastic cord wrapped around the axles behind the wheels. Apart from the two bracing pylons under the fuselage, that were made with a streamlined cross-section, all undercarriage members were of circular tubular steel onto which wooden fairings were taped.

The undercarriage was to prove a problem in service as its strength was not really up to the treatment it would receive in the field, where it frequently collapsed. Also, although the rearwards location of the axle had been intended to allow the tail to lift more quickly on take-off, it was also responsible for a series of crashes where the machine nosed over on landing. As a result, the undercarriage legs were redesigned and axles on later models were returned to a forward location.

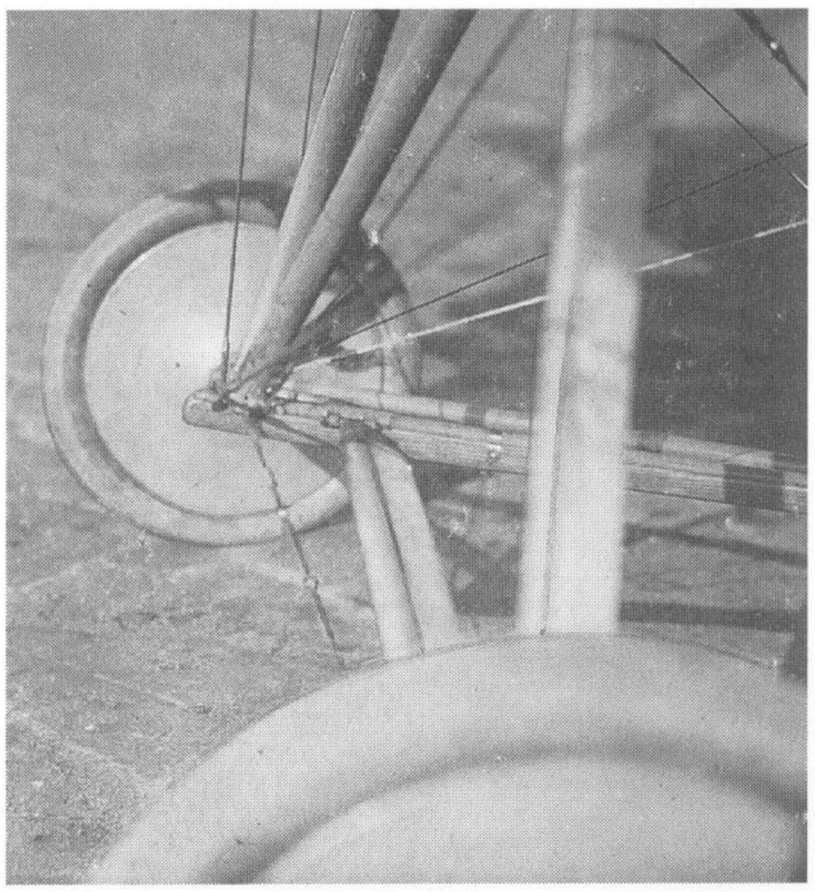
While the Morane had been powered by a 50hp Gnome engine, Fokker had German Army contracts in mind, so designed for the installation of an Oberursal copy of the 80hp Gnome rotary engine. This he mounted on an overhung steel-tube pyramid that was a direct copy of that fitted to the Morane. The engine was enclosed in a neat horseshoe-shaped cowling that was again a direct copy of the Morane unit (despite existing Morane patents covering this feature). Fuel for the engine was carried in a cylindrical tank mounted immediately behind the engine and in front of the cockpit. This was divided into two



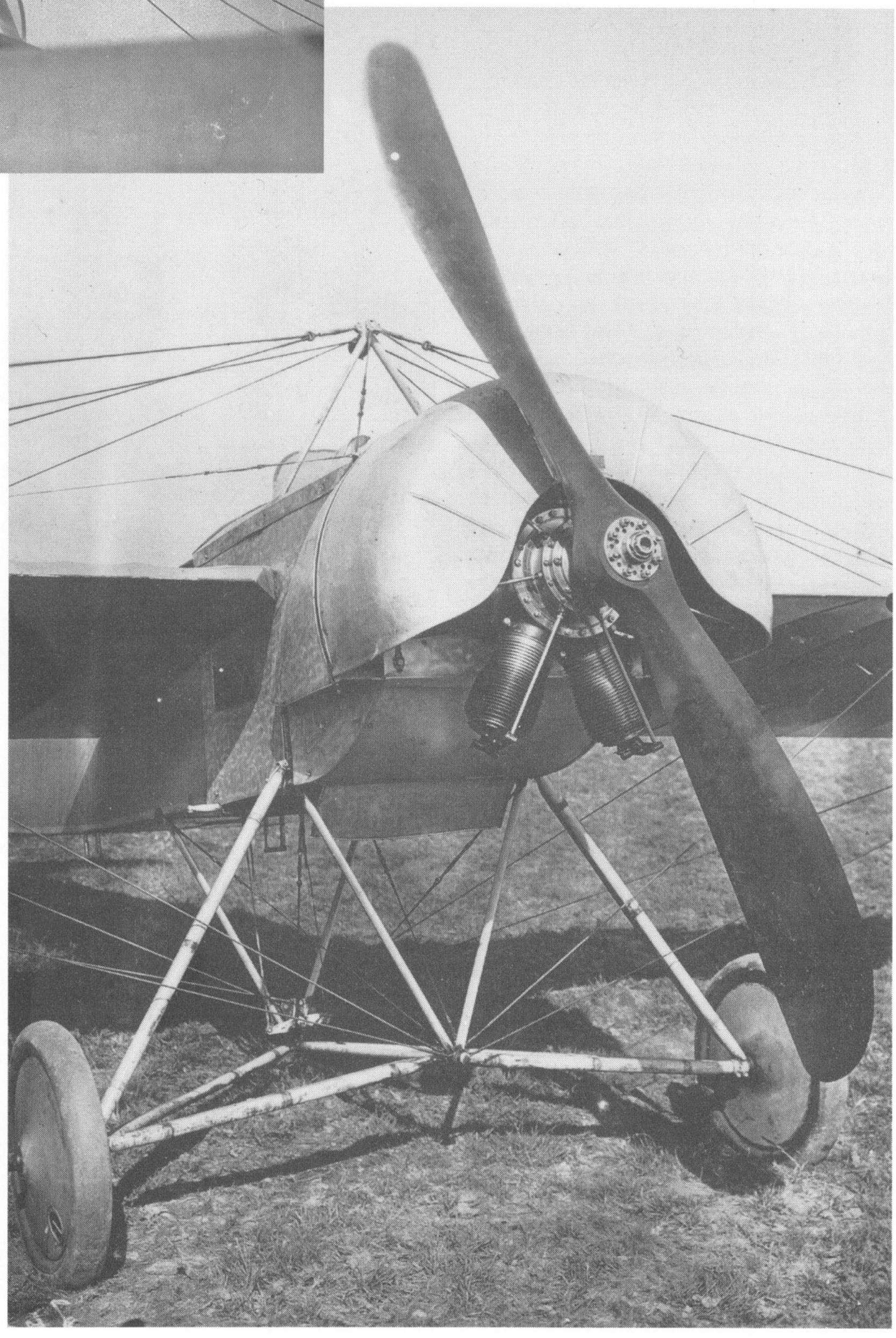


***(Left)* Close-up of the king post with control wires of the M.5.** Cross and Cockade International

***(Below left)* Close-up of the undercarriage of the Fokker M.5.** Cross and Cockade International



***(Below)* The Fokker M.5.** Cross and Cockade International



sections, one for fuel and the other for the castor oil lubricant necessary for a rotary engine. These were fed to the engine by gravity, but could be augmented by the installation of a further tank behind the pilot that could be pressurized by means of a hand pump.

Confident that the M.5 would be a great success, Fokker authorized the building of two complete prototypes plus components for five additional fuselage frames simultaneously. Although the prototypes were originally to have been identical, soon after launch the decision was made that one would be fitted with large wings of similar area to those of the Morane and the other with a shorter wing of less area. The first (M.5L) was intended as a long-range version also suitable for aerobatics, and the second (M.5K) as a fast scout.

So, although based closely upon the Morane-Saulnier Type H, the M.5 was not

a direct copy and featured a number of details all of its own. Some of these were to continue as Fokker 'standards' for many years to come.

The Oberursal engine failed to be delivered in time for completion of the first of the machines, the M.5K, in mid-April 1914, so the 50hp Gnome was fitted. Test-flown by Fokker, its performance was a disappointment. Not only was it underpowered (it was heavier than the Morane-Saulnier Type H) but its rudder proved inadequate. Fokker therefore bought a 70hp Gnome engine of an older pattern and had a new, balanced, comma-shaped rudder fitted. Both proved a success. With the more powerful engine the performance was greatly improved and the new rudder did the same for control. On delivery, the two Oberursal engines were fitted to the two prototypes and performance was again improved. Both aircraft proved easy to fly though, predictably, the M.5K proved to be the faster.

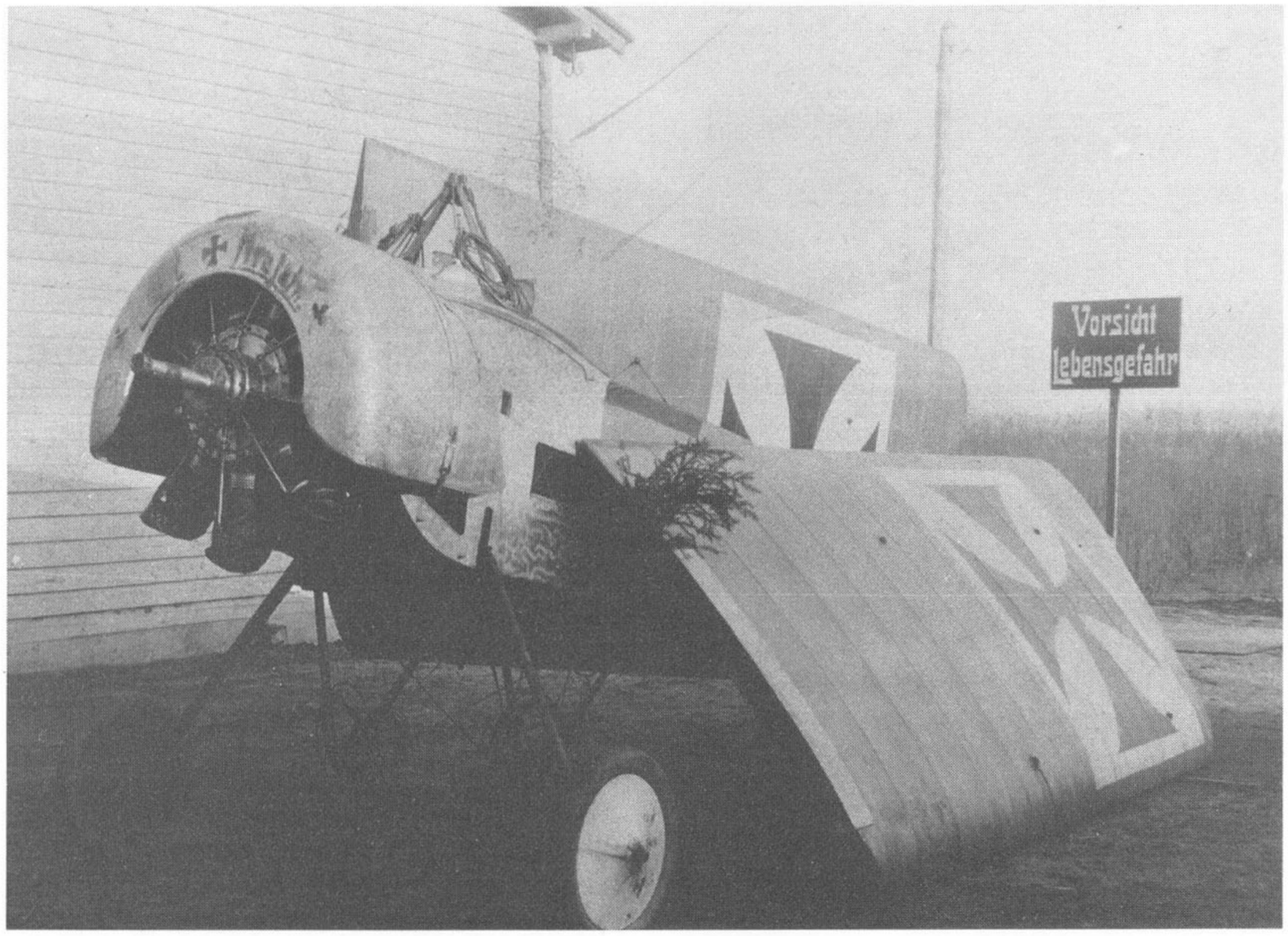
Fokker was quick to demonstrate his M.5 at displays throughout Germany, performing the loops that he had now mastered. Fokker was not the first pilot to demonstrate the loop in Germany – there may have been up to ten or so before him – but it was still a rare sight. Unusually, Fokker later had the grace to admit that it took him some time to overcome his initial fear of looping. Having done so, his was an electrifying performance that impressed spectators and fellow pilots alike. At Whitsun 1914, he gave a dazzling demonstration of his flying ability and his aeroplane's agility to an audience that included General von Falkenhayn, the German Minister for War, and his staff. This greatly impressed the general and helped Fokker immensely. Future orders were to result from this.

Although, by early 1914, as a result of the efforts of *Flugspende* (a national movement for aeronautics) a number of world records had been taken by German pilots, little of a technically innovative nature had been achieved within the German aircraft industry. In the main, this was committed to the heavy biplane types being manufactured by

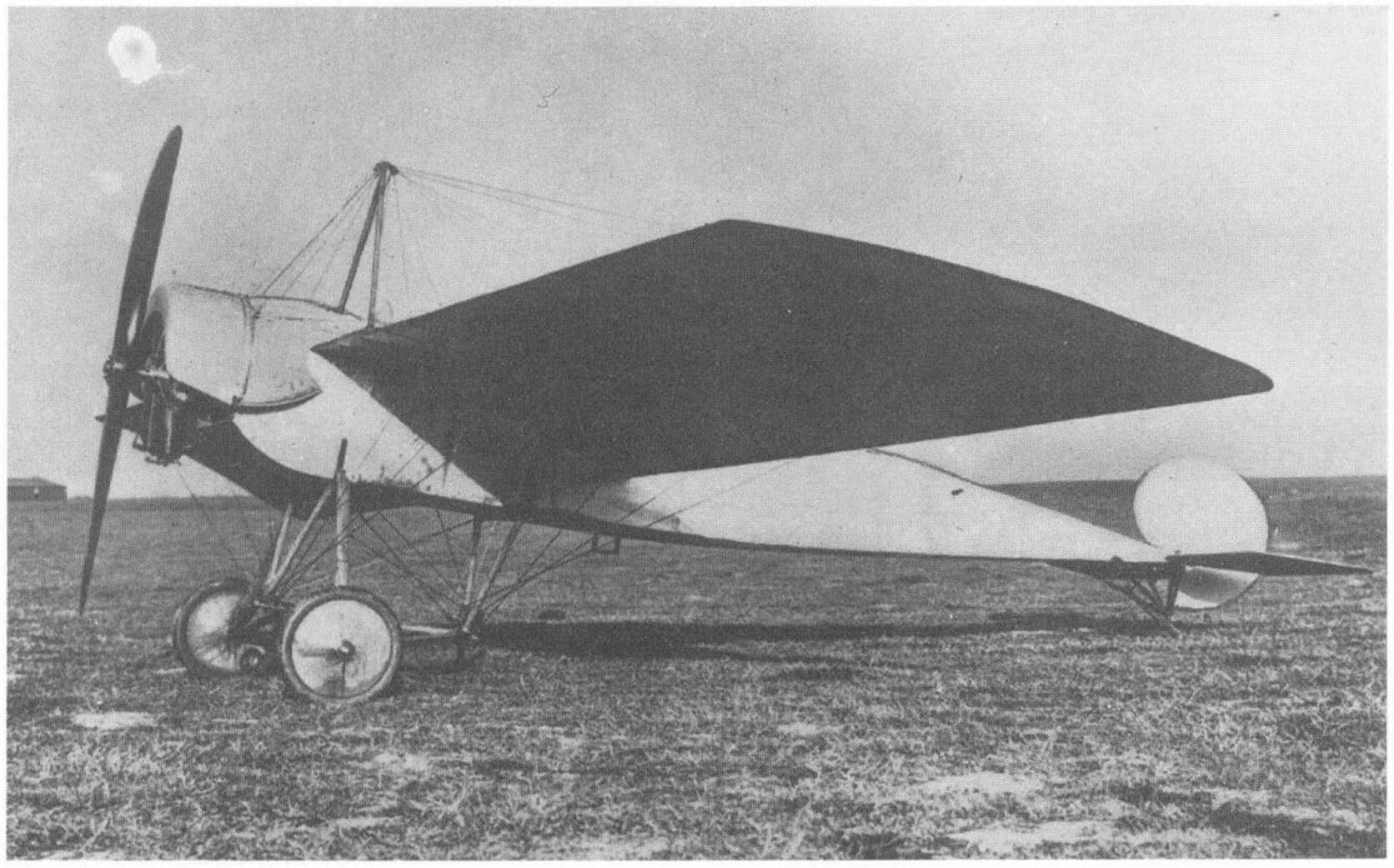
Nomenclature

Recent investigation of original Fokker Flugzeugewerke GmbH documents by historian Peter Grosz has revealed that at the time of their construction, no attempt was made to differentiate between the various models of each type of new aircraft. Thus, regardless of whether a particular aircraft had single-bay 'short' wings or double bay 'long' wings (or any other configuration) it was simply recorded by its generic number – M.5, M.17 or M.18, etc. Some time after Fokker moved to Holland, his photographer put together a photographic record of the various types that had been produced between 1912 and 1919. In order to clarify the listing of what he found, he classified the different variants of the M.18 design as M.18 Einstlg (from *einstielig* – single bay), M.18 *Flachenverw* (from *flaschenverwingdun* – wing warping) or M.18 *Klappenverw* (from *klappenverwingdun* – aileron control). During the renaissance of interest in World War One aviation that arose in the early 1950s, this system was picked up and expanded by an unknown enthusiast and was 'legitimized' by its use by historians such as Alfred Weyl, Heinz Nowarra, Peter Grey, etc.

Acknowledging that this system of nomenclature has no basis in Fokker's records, it has proved a useful means of differentiating between 'different' aircraft of the same basic type and thus avoiding some of the confusion that would otherwise result. After some considerable thought, I have decided to use it here – though I know that some would consider it wrong.



The M.5K dismantled and partially stowed for travelling. Colin Owers via Harry Woodman



Fokker M.5L. Cross and Cockade International

the Albatros and LVG companies. Even the beautiful Etrich *Taube* with its elegant wings was unsuited for the role in which it was intended to be used. The fact that the German forces had a total of 230 aeroplanes on their operational strength was no indication of what they could be expected to achieve.

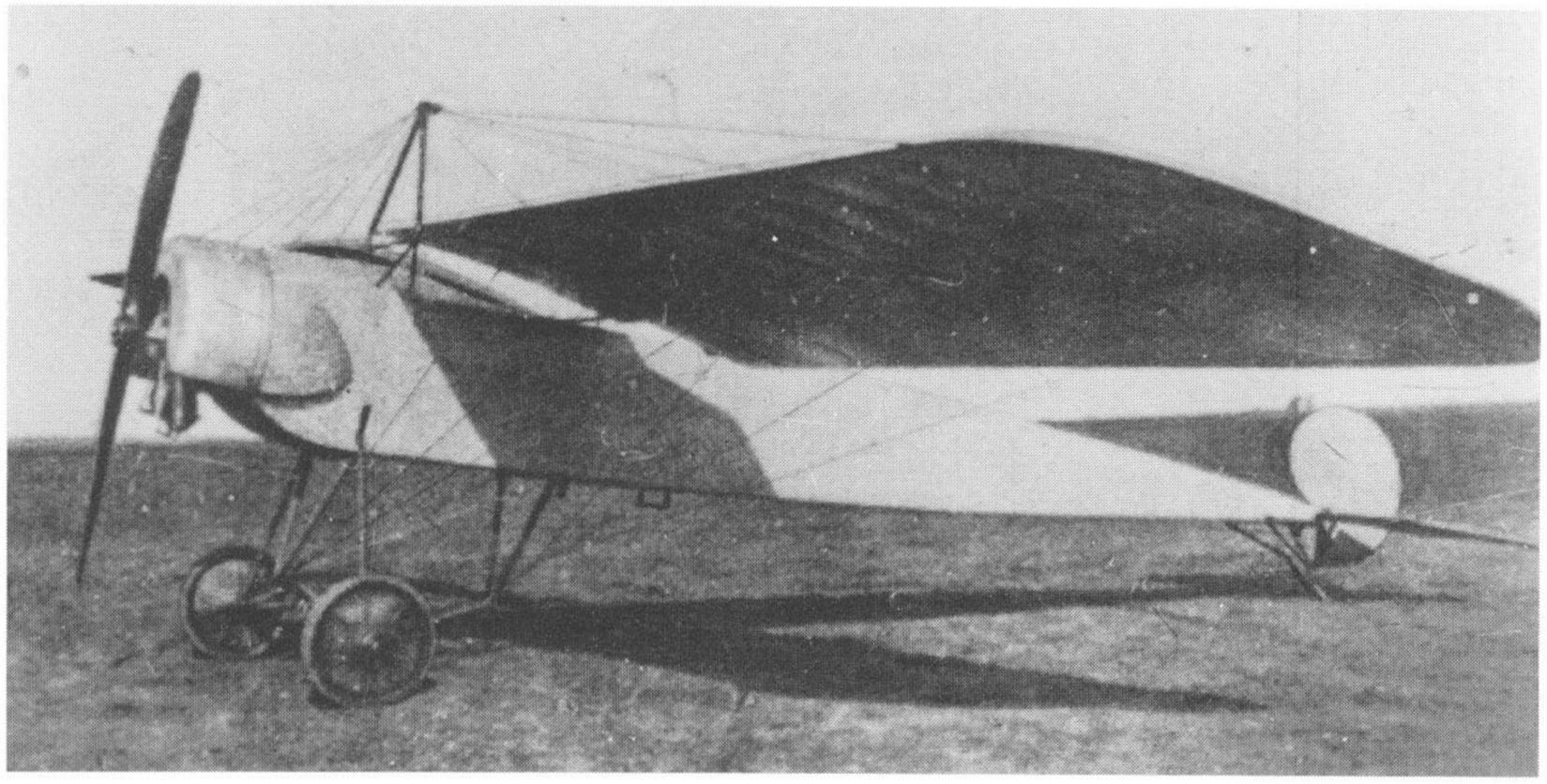
By August 1914, the Fokker Aeroplanbau was well established and Schwerin had become a centre for the training of military and naval pilots as well as an efficient production centre. Fokker actively sought more military orders and continued to give demonstration flights around the country.

The M.6

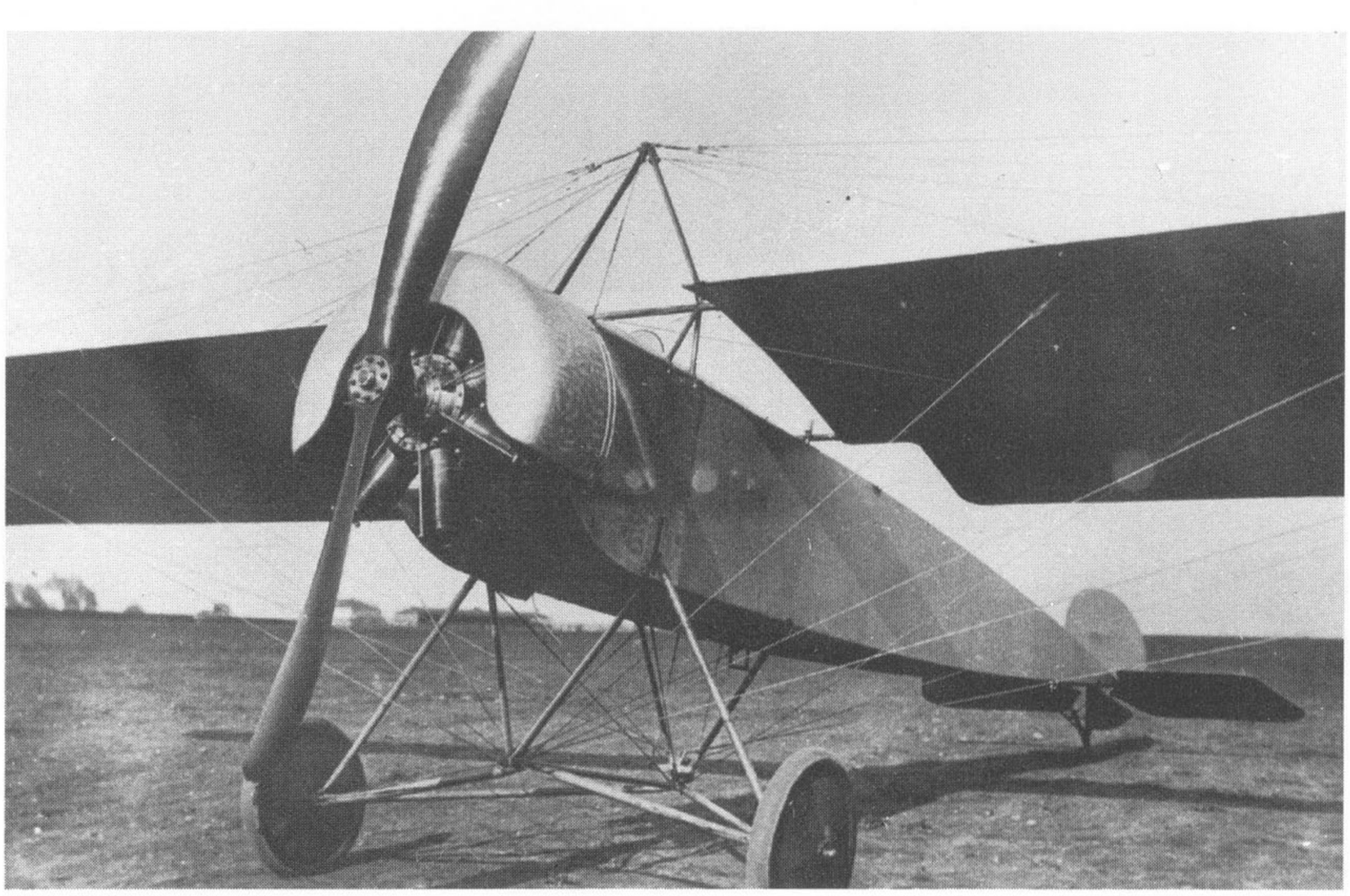
By August 1914, most forward-thinking European armies had come to appreciate the limitations of the fast single-seat scouting aircraft and to consider use of two-seat machines in support of their armies. With a two-seat machine the pilot could be confined to simply flying it, leaving all other duties to the passenger who was then free to navigate and to observe what enemy forces were doing.

required. This would need to provide the passenger with good downward vision and a protected space to allow him to make any notes or sketches required by what he could see below him.

The French had satisfied their requirement with the Morane-Saulnier Type L, a parasol-winged monoplane powered by an 80hp Le Rhône engine. Although not ordered by the French Army prior to



***(Above)* The Fokker M.6.** Cross and Cockade International



The Fokker M.6 showing the gap between the wings and fuselage.
Cross and Cockade International

examples that became available being used by 3 Squadron RFC.

Fokker had knowledge (and may have seen) the first Morane Parasol built under licence by the Pfalz Flugzeuge-Werke, that had been demonstrated to the Bavarian Army, and had ample opportunity to consider this configuration. He could appreciate the benefits of fitting the wing above the fuselage and the unobstructed downward view it provided. He was also aware that locating the centre of gravity of the fuselage so far below the wing could result in a slow pendulum motion, making flight uncomfortable for the crew.

To meet the new German requirement, Fokker modified the design of M.5 to accommodate them, and the result was M.6. The structure and dimensions of this closely followed that of the M.5, but the front spar of the wing was mounted some 400mm (16 inches) above the fuselage top longerons. The centre section of the wing was not covered and it retained the characteristic gap between its wing root and the fuselage side. The crew's downward vision was reasonable, but not as good as might have been anticipated. They sat in an elongated single cockpit divided by the wing's rear spar, which passed across the fuselage between them. Unusually, the pilot was seated in the front, giving him good forward and downward views. Although the fuselage was slightly longer than that of the M.5, the accommodation

Germany was no exception to this thinking and Idflieg suggested to German manufacturers that a true two-seat aircraft with a permanent passenger seat was

hostilities, those that were available were quickly commandeered and used to equip two squadrons. On arrival on French soil, the British also bought the type, the first

was cramped and uncomfortable and there was little room for the observer, with or without a camera. The M.6 was powered by an 80hp Oberursal engine, which would not have provided enough power for a really good performance.

Only one M.6 was built and this had a short life as, after evaluation by the Army, it was crashed by Oblt Kolbe who mistakenly turned off the three-way fuel cock while making his second flight in it. He tried to land in an allotment near Schwerin but crashed in the attempt, fatally injuring himself and fracturing the thigh of his passenger, Hptmn Ruff, in the process.

M.7 and M.8

Fokker's next prototype, M.7, was a light two-seat biplane designed originally to meet the requirements of the German Admiralty, who were very enthusiastic about it and ordered seven of the type. Pressure applied on Fokker by the German Army stopped all work on this until later in 1914, by which time he had been able to satisfy the Army's immediate requirements. The Admiralty were not impressed by this, but they were still anxious to obtain the type and tripled their order.

Fokker's final pre-war design was M.8, another monoplane. Its construction followed the pattern established with M.5 and followed by M.6: welded tubular-steel fuselage, tail assembly and undercarriage with wooden wings.

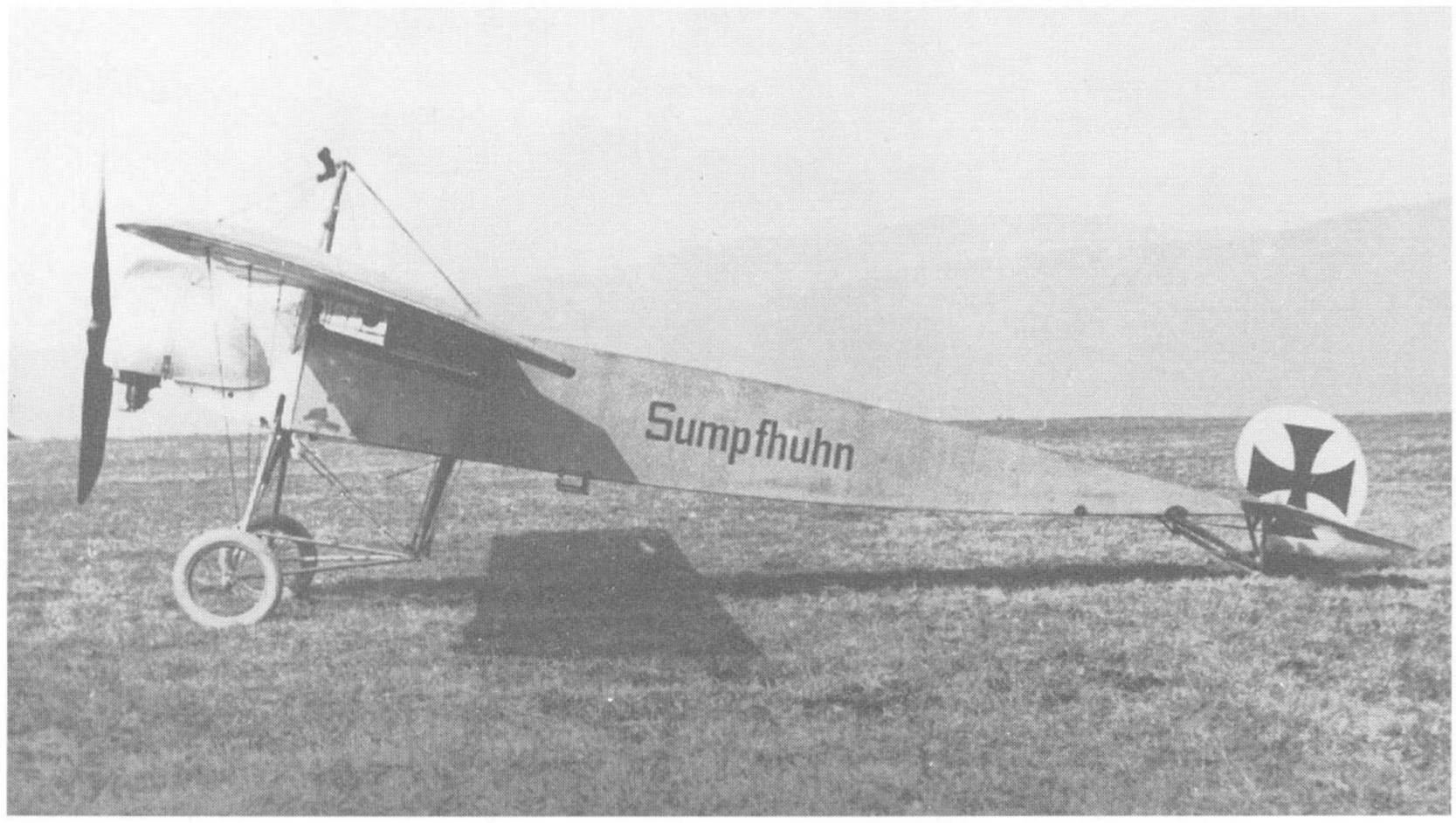
It was intended to fill the same role as M.6 but incorporated a number of improvements on the earlier design. These included a widened fuselage (nearly 40 per cent wider than that of M.5), which improved crew comfort, and wings of greater span and chord. The increased wing area gave it a wing loading similar to a single-seat M.5L.

Its wing was mounted directly upon the fuselage upper longerons. The crew of two was seated in tandem in a large single open cockpit in the centre of the wing, which was left uncovered at this point. To give them the good downward vision needed for reconnaissance and artillery observation, the upper parts of the fuselage sides beneath the wing were left uncovered. As the result of experience in service, later aircraft were fitted with transparent side panels to improve crew comfort.

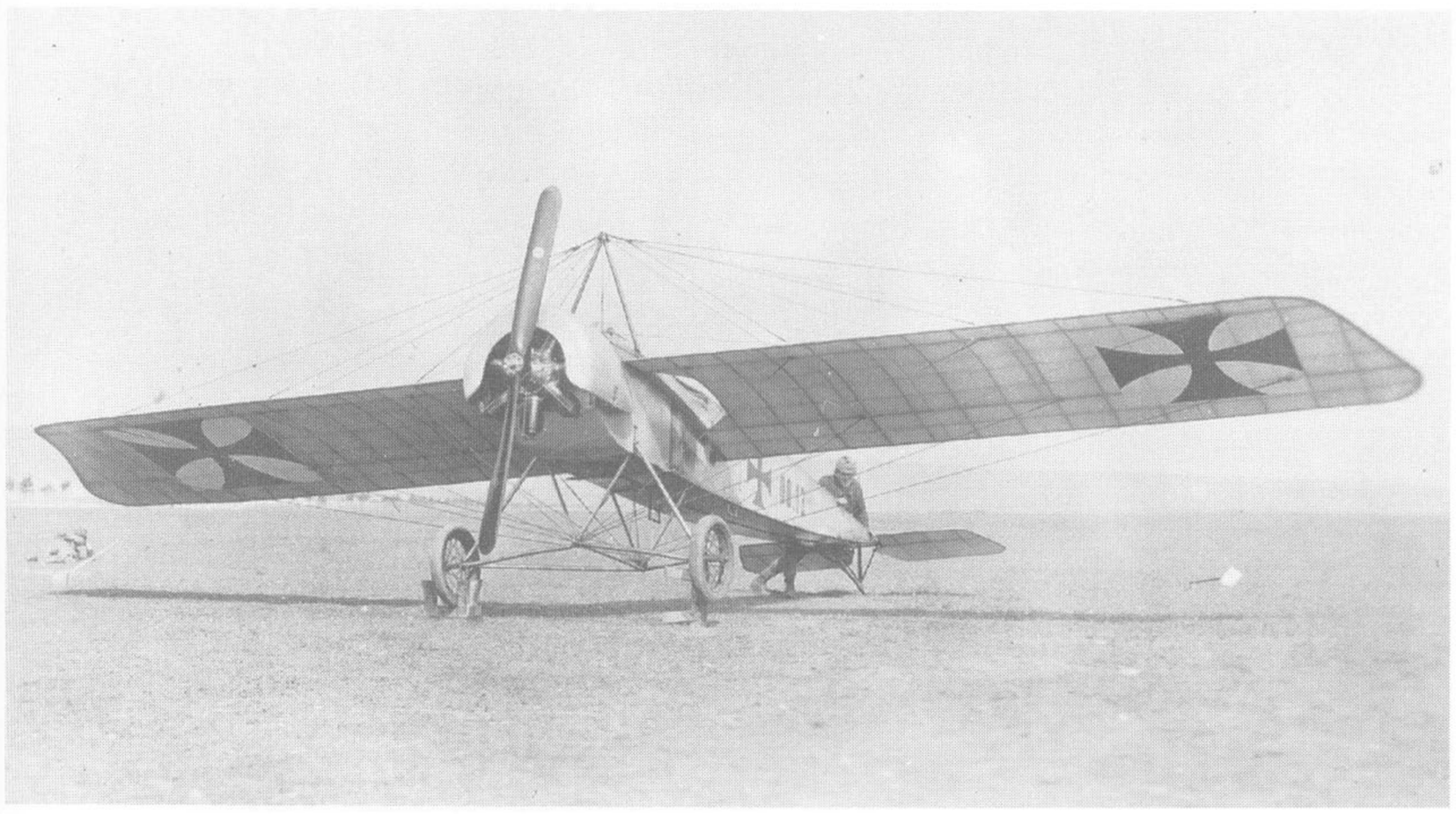
The M.8 was powered by an 80hp Oberursal rotary engine, fuel for which was contained in two fuel tanks. The main one, a gravity tank divided into compartments for both petrol and castor oil, was directly behind the engine with a sight glass visible to the pilot. A supplementary tank carrying just fuel was mounted behind the cockpit and pressurized by means of a hand pump. Both tanks were of oval section and fabricated from thin, soldered, brass sheet. At a later stage, the hand pump was replaced by a wind-driven pump, ensuring that pressure in the tank was not dependent upon the crew's memory of the need.

M.8 was fitted with a control column which introduced a two-handle grip with a 'blip' switch button fitted between the handles. This style of control column was to be fitted to all of Fokker's future aircraft.

German pilots found that flying the M.8 was a totally different experience to the German 'B' types to which they were accustomed. It had to be held in a bank by firm use of its warping wings but, in windy conditions, it was best flown with its controls held loosely. This allowed the wings to warp under wing pressure, and gave a smoother and more relaxed ride than the more stable 'B' types. Training in these characteristics was essential.

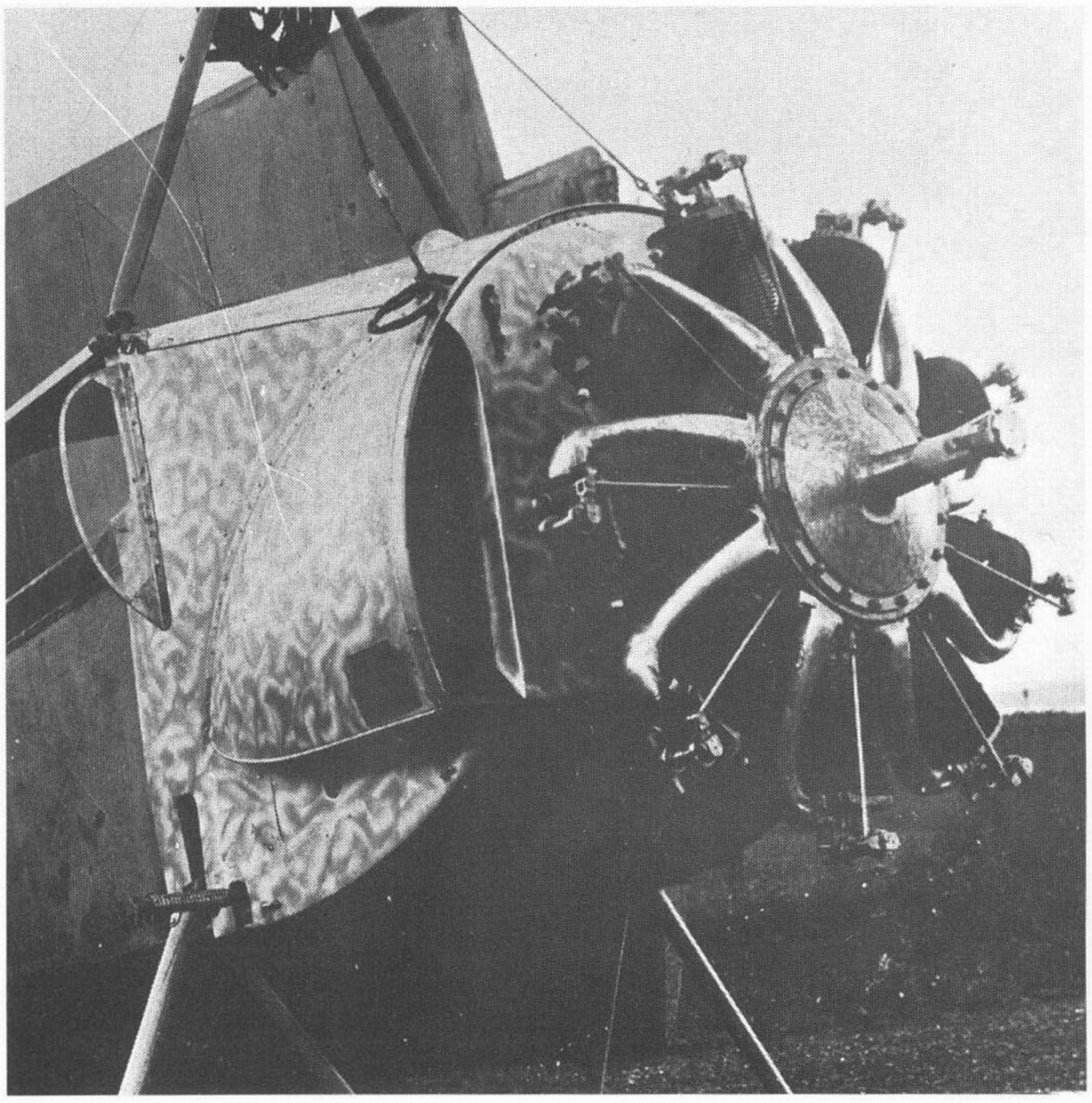


***(Right)* The Fokker M.8 (*Sumpfhuhn* = moorhen).** Frank Cheeseman



Austrian M.8 00.13. Cross and Cockade International

The Early War Years



***(Above)* Close-up of the nose of partially dismantled A.II A.210/14.** Cross and Cockade International

***(Left)* Oblt A. Muelig-Hofmann in front of his Fokker A.I A.195/14 in January 1915.** Cross and Cockade International

The Start of the War

August 1914 brought the outbreak of war and immediately Fokker received the orders he had been seeking for so long. He had the German Admiralty's order for seven M.7 biplanes and to this was added another firm manufacturing order for twelve of the same type from the Austrian government. On top of these, the German Army placed urgent orders for M.8 monoplanes direct from the drawing board. Fokker's flying school also received a boost, as thirty Army officers were drafted in pilot training.

Fokker happily accepted all orders for aircraft whilst ignoring the obvious facts: his production facilities were totally inadequate to meet the demands being placed upon them and could not possibly cope with the quantities and time scales called for by the orders.

Amongst the swarms of naval and military officers who visited Schwerin seeking Fokker's aeroplanes, equipment and training facilities for their own personal arm of the service was the Inspekteur der Fliegertruppen, Colonel Walter von Eberhardt. Without mincing his words, he lectured Fokker on his irresponsibility, pointed out the company's inadequacies and stressed the need to expand his factory's production facilities. For the moment, Fokker should concentrate on the production of the Army's aircraft and put experiments with new types to one side. In hindsight, this was a short-sighted policy but it must be remembered that nobody expected the war to continue beyond the winter of 1914. The German Army's rapid initial advance through France bore this out and, in anticipation that the war would be a short one, Fokker reacted shrewdly, if a little cynically. He took on more staff with the intention of completing the orders he held as swiftly as possible and to avoid the possibility of their cancellation when the war ended.

Fokker's machines, at this stage mainly the manoeuvrable early M-type monoplanes M.5K, M.5L and M.8 (designated A.II, A.III and A.I, respectively, by the Army), were enthusiastically welcomed by German pilots and, in December 1914, Ltn Oswald Boelke wrote saying 'The Fokker is my best Christmas present, in which I take great pleasure.'

To judge from the bands on their hats, this A.I training machine fitted with a nose wheel is at the Marine-Flieger Abteilung. Harry Woodman

German Front-Line Aeronautical Strength in August 1914

The German Army mobilized on 1 August 1914. At that date, the paper strength of the Fliegertruppen* was as follows:

30 Prussian Feldflieger-Abteilungen (Field Flying Sections)

4 Bavarian Feldflieger-Abteilungen

6 Prussian Festungs-Flieger-Abteilungen (Fortress Flying Sections)

1 Bavarian Festungs-Flieger-Abteilung

8 Prussian Etappenflugzeugparks (Home Aircraft Supply Units)

4 Prussian Flieger-Ersatz-Abteilungen (Aviation Replacement Sections)

1 Bavarian Flieger-Ersatz-Abteilung

The nominal strength of these was six aircraft for each Feldflieger-Abteilung, four for each Festungs-Flieger-Abteilung, and Etappenflugzeugparks were supposed to hold three reserve aircraft for each of the Flieger-Abteilungen. No figure is available for the strength of the Flieger-Ersatz-Abteilungen, but it can be assumed that, at this point, their function was to make up losses that might occur at a future date and thus they may not have held aircraft on their strength.

From the above we can see that the aircraft strength for the Fliegertruppen was an indicated total of 355 aircraft. It must be appreciated that these are paper figures and that the reality was something less, probably some 246 aircraft, a likely shortfall of some 109 aircraft. In addition to these there were balloon detachments, each with a nominal strength of three kite balloons, and five Army airships.

By the fifth day of mobilization, 5 August 1914, most of the Flieger-Abteilungen were more or less up to nominal strength – a remarkable achievement. Unfortunately, this absorbed all reserve aircraft and left none available for the vital task of training replacement aircrew.

There was no uniformity of the aircraft types available. Half of them were *Taube* types from various manufacturers and the others included parasol and other machines built by Albatros, Pfalz, Aviatik and Fokker. Few were in any way suitable for the war that was to follow.

* The name Fliegertruppen is used for convenience but, at this stage, was something of a misnomer. The various units were not a coherent air force with a central command, but individual units were under the control of Army commanders and their nominal commander, the 'Idflieg', or *Inspekteur der Fliegertruppen* (Inspector General of the Air Service) Walter von Eberhardt. He was located far away in Berlin with no immediate access to 'his' units, which were instead controlled entirely by the generals commanding the armies to which they were attached.

Oswald Boelke

Hptmn Oswald Boelke was born in Giebichstein, near Halle in Saxony, on 19 May 1891. He joined the Prussian Cadet Corps in March 1911 and served with No. 3 Telegrapher's Battalion at Koblenz. Interested in flying, he became a pilot in 1914, serving first with Flieger Abteilung (FA)13 in France and then with FA62. Flying an LVG C.I with that unit, he scored his first victory on 4 July 1915. His aggressive style led to him being given one of the unit's Fokker E.IIIs to fly and he rapidly built up his score. When Max Immelmann was killed in June 1916, Boelke was sent away from the front on a tour of the south-east. While away, he wrote a paper on fighter tactics and how 'fighting' units should be organized that led to a complete re-thinking of German tactics. He was recalled to France in July 1916, given command of the newly formed Jagdstaffel 2, and allowed to select a number of the pilots who were to man it. Those he chose included Manfred von Richthofen and most were to become 'aces' in their own right. He was killed when he collided with an aeroplane flown by Erwin Bohme during a combat on 28 October 1916. By this time his score stood at forty and his decorations included the Iron Cross 1st and 2nd Class, the Knight's Cross with Swords of the Royal House of Hohenzollern and the Orden Pour le Mérite. Jagdstaffel 2 was named 'Jasta Boelke' in his honour.

Hauptmann Oswald Boelke. Cross and Cockade International

The E.I

The German Army's decision to arm a number of their single-seat aeroplanes was prompted by the success achieved by the French pioneer pilot Roland Garros who, flying a Morane-Saulnier Type L monoplane, had shot down three unsuspecting German aircraft. Work on a means to allow a machine-gun to fire through a propeller arc had been done in a number of countries by a number of individuals for some time (*see* Appendix III). Most of the resulting devices were complicated mechanisms

A French Morane-Saulnier Type N fitted with steel wedges to protect its propeller from bullets. Cross and Cockade International

***(Below)* Fokker's first armed E-type in May 1915.** Frank Cheeseman

***(Bottom)* The first armed Fokker at the front seen here at Flieger Abteilung 62 near Verdun in May 1915. Fokker, by the right wing, is talking to the German Crown Prince.** Frank Cheeseman

needing further development, but one of those working on the problem, Raymond Saulnier, devised an interim solution. Instead of interrupting the firing of the gun, he chose to protect the blades of the propeller, deflecting the bullets away from it with metal plates. Fitted with this device, Garros's machine fell into German hands when Garros was himself brought down by a single rifle shot from the ground. His aircraft was seized upon as an example to be shown to all German manufacturers, who were to be urged to fit machine-guns and similar deflector plates to their machines.

Fokker was in an excellent position. His staff had developed a suitable interrupter mechanism and he had light and agile aircraft – the M.5K – to which it could be fitted. Loaned a Parabellum LMG 14 machine-gun by Army for the purpose, he successfully demonstrated the combination to the German staff at Döberitz. The initial demonstration was with the machine static on the ground but finally, to convince the staff, he flew it himself and attacked a ground target. Further flights by Army pilots convinced the staff and Fokker was awarded an order for thirty machine-gun and interrupter-equipped M.5K aircraft. Initially these were designated as M.5K/MG (for *Maschinengewehr* – machine-gun) but this was changed to E.I where the 'E' indicated that they were armed monoplanes (*Eindecker*). The LMG 14 had a relatively low rate of fire and was not considered really suitable for the purpose. Consequently, production aircraft were fitted with an air-cooled machine-

gun designed for use in the air. This was the 7.92mm-calibre LMG 08 that, in modified form, was to see service to the end of the war.

Powered by the same seven-cylinder 90hp Oberursal U.0 engine, Fokker's E.I aircraft differed from the earlier M.5K in a number of ways. Operational use of the M.5s had shown up a number of inadequacies. First of these was the gap between the wing root and the fuselage: while it provided a downward view for the pilot, it was aerodynamically unsound and detracted from the machine's climbing ability. This was now discarded and all E-series machines had wing roots that butted against the fuselage. To compensate for the loss of downward vision, and at the suggestion of Army pilots, a hatch that could be opened for the pilot to see downwards was fitted in the cockpit floor. Most E.Is retained a bench seat (that could at a pinch be used to accommodate a passenger), but some of the Army's machines were fitted with a more comfortable bucket seat.

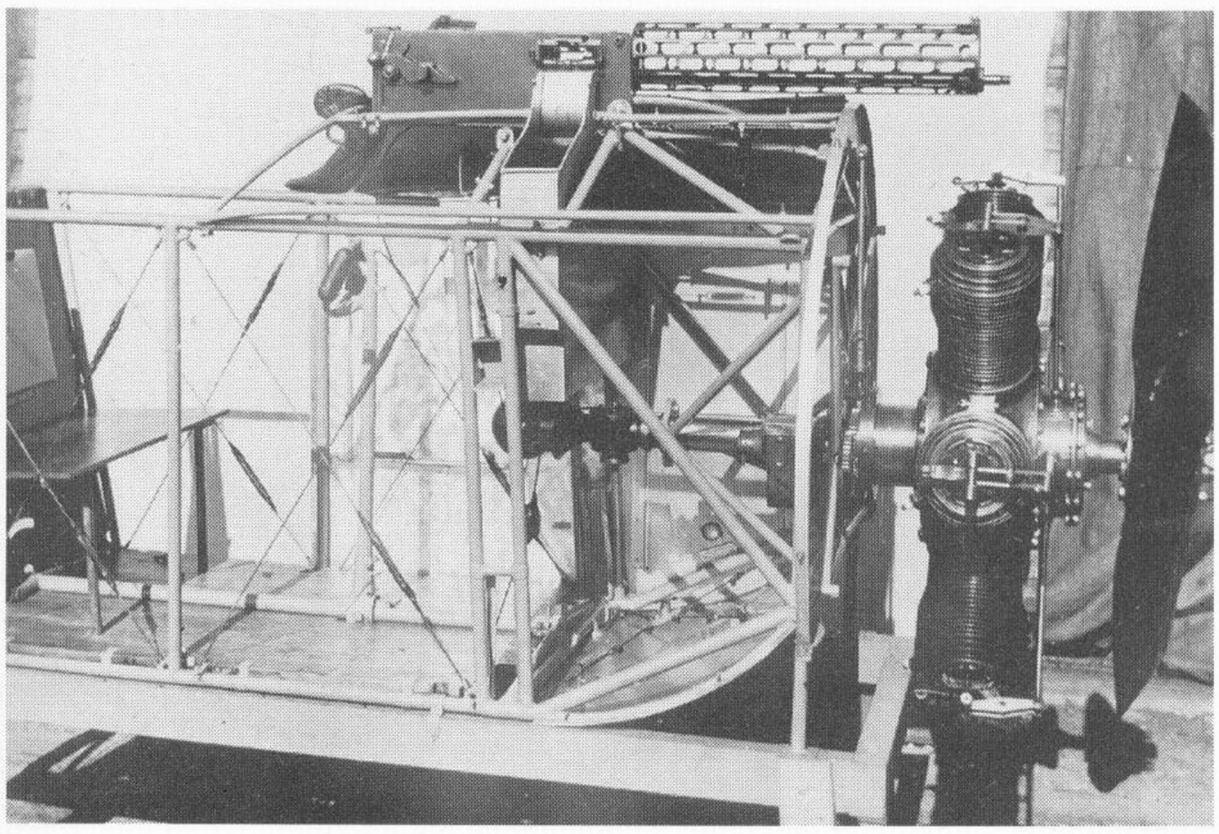
The total fuel tank capacity of the E.I was increased to 70ltr (15gal) of petrol and 16ltr (3.5gal) of castor oil, allowing a maximum of some two hours' flying time at economic airspeeds. This was contained in two tanks. The first, a gravity tank adjacent to the engine, was restricted in size by the need to fit a stowage tank for the gun's ammunition. A second, larger tank was installed in the fuselage immediately behind the pilot. The feed from this to the forward gravity tank presented problems that were overcome in a number of ways. Naval E.Is were fitted with a hand-operated pump that allowed the pilot to transfer fuel when needed. In some cases this was augmented by a small engine-driven pump that in turn required a pressure-release valve to ensure that pressure in the rear tank was held at an acceptable level. Over-pressurized fuel could result in an over-rich fuel mixture being fed to the engine, causing it to stop. Most other aircraft in the series were fitted with a small wind-driven pump attached to the front right-hand leg of the undercarriage.

The addition of the second fuel tank did have an effect on the E.I's centre of gravity, although to some extent it was balanced by the weight of the gun and ammunition. This effect was noticeable when the machine was taking off, but was insignificant in normal flight.

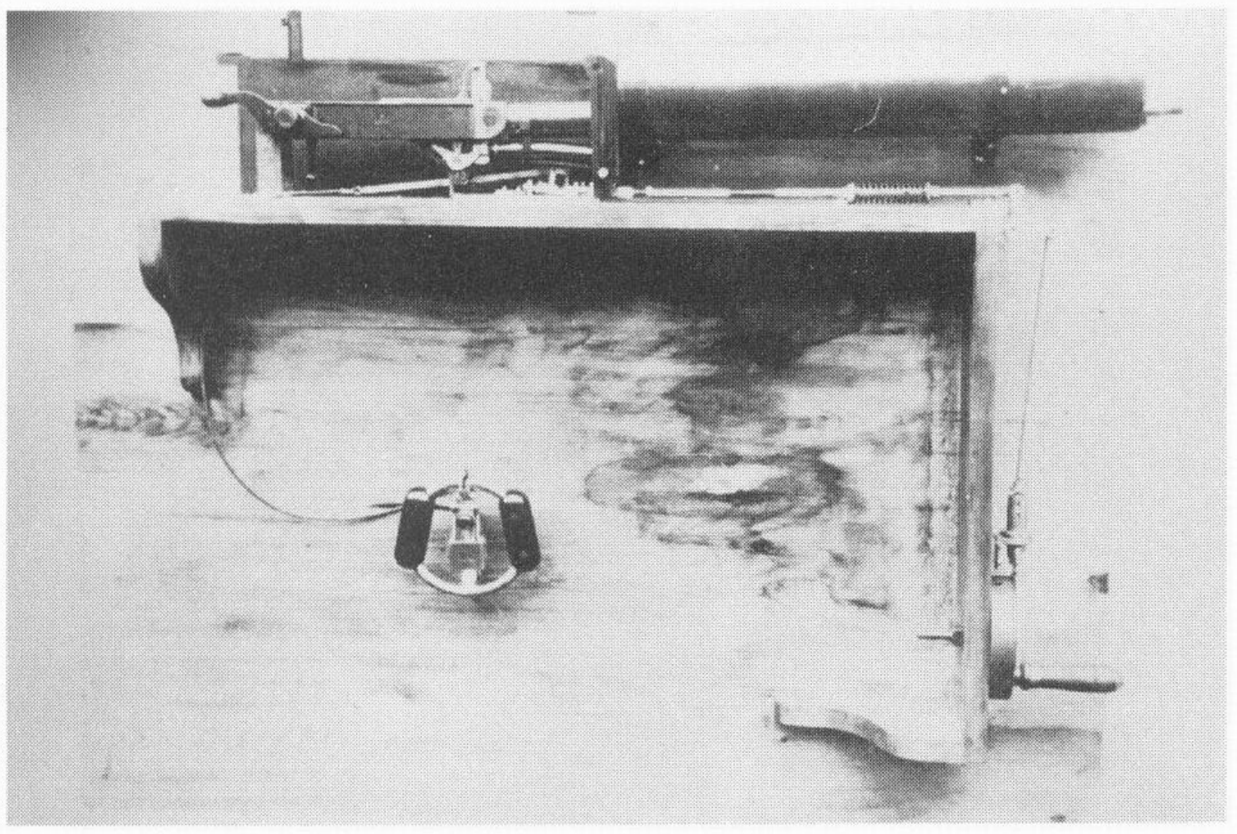
To ensure accurate sighting of the fixed machine-gun, the E.I was provided with a headrest mounted on a tripod arrangement behind the cockpit. This could be adjusted for individual pilots and its use ensured that the pilot's head was in the same position each time he fired the gun. This feature was fitted to all subsequent models of the E-series right up to the final E.IV but a number of pilots discarded it, preferring to use a ring and bead sight.

The E.I entered service in June 1915 but was not without problems. It was heavier than the rival Pfalz E.I and somewhat underpowered, with an engine that proved to be unreliable. In addition, its weapon system had problems of its own. The LMG 08 machine-gun, although designed for use in the air, was far from ideal for the purpose. Its grease lubricant had a tendency to solidify at altitude and in colder weather, and its hemp ammunition belt absorbed moisture and froze in the same conditions. Another problem was the unreliability of the pushrod-operated synchronizing gear. In the main, it would only work reliably at 'normal' flying speeds and, to add to the problem, contraction of the rod itself in colder conditions stopped operation of the trigger, the movement of which was small. Mis-feeds became common and pilots experienced the frustration of having to withdraw from combat to clear stoppages, clutching the control column between their knees while they did so.

A total of forty-eight E.Is were delivered to the Army, and the Navy took six.



Test rig for proving of interrupter mechanism. Cross and Cockade International

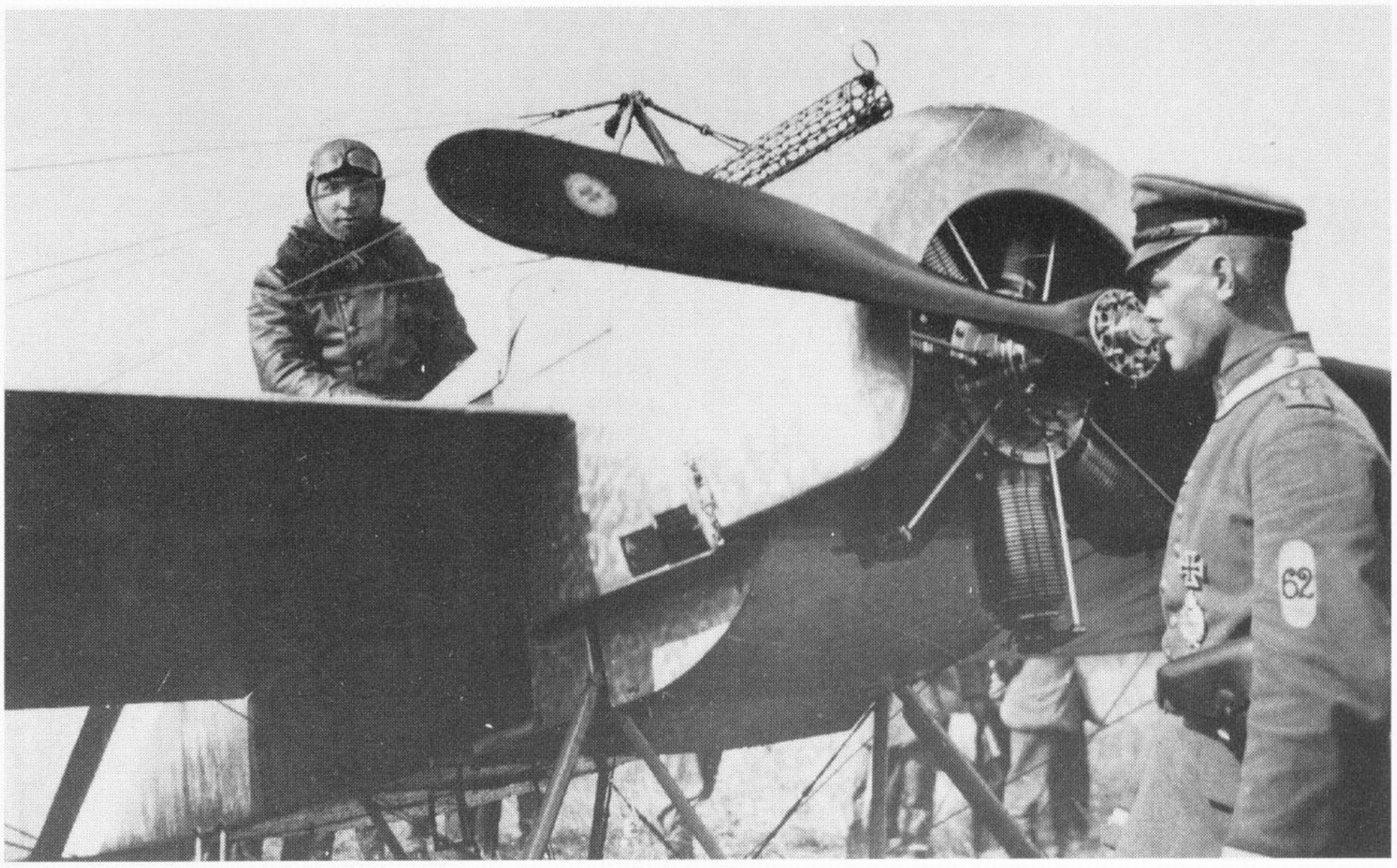


Demonstration rig for interrupter gear. Cross and Cockade International

The E.II and E.III

Having proved the concept of an agile, single-seat aircraft armed with a forward-firing gun, Fokker now needed to build upon his success and provide a true fighter aircraft. This meant that, instead of the compromise that had resulted in the E.I – an M.5 with a machine-gun simply 'bolted on' – the new machine had to be designed with a weapon system integrated with its airframe and had to be fitted with a more powerful engine. This was achieved by Martin Kreutzer with minimal modification of the existing E.I airframe. The factory designation for the new model was 'M.14': in service it became the Fokker E.II.

Structurally, this remained the same as the earlier model. The new engine, the

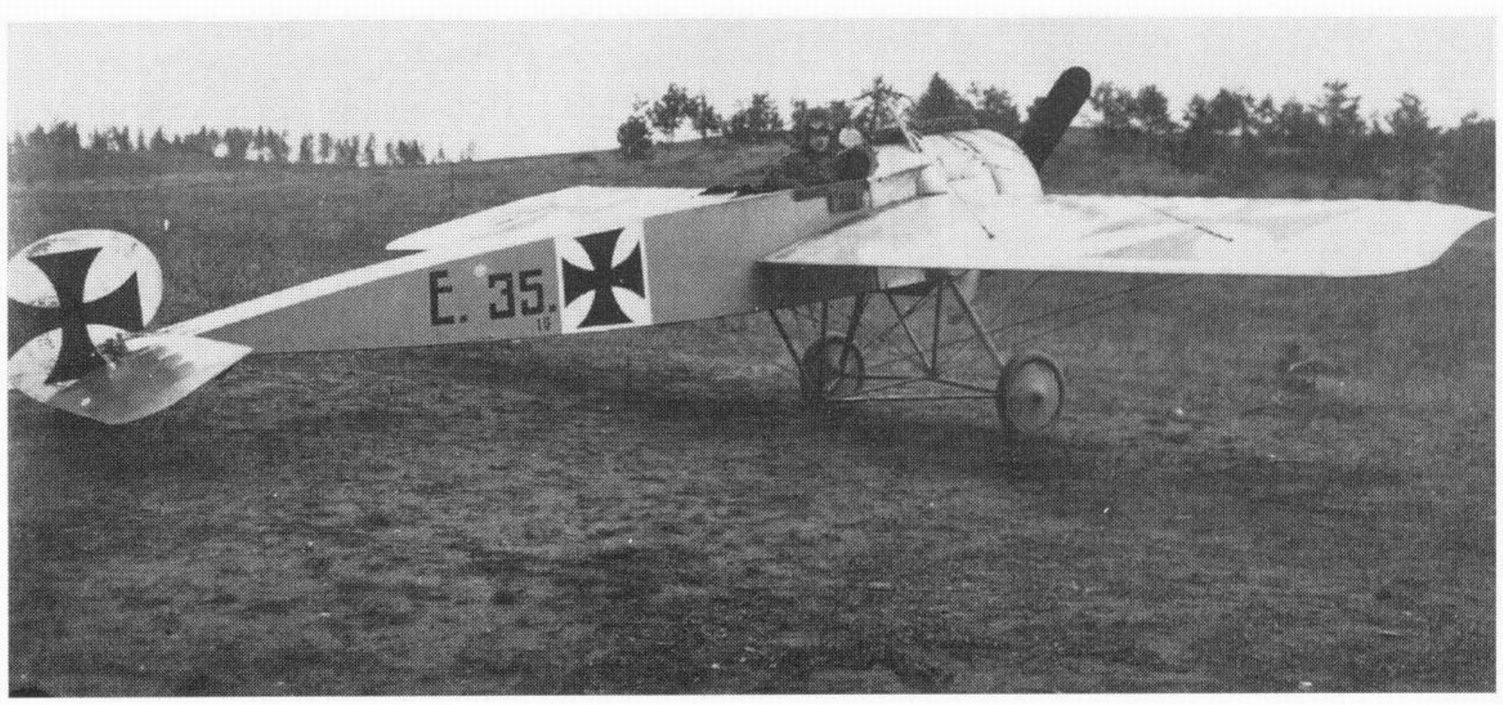


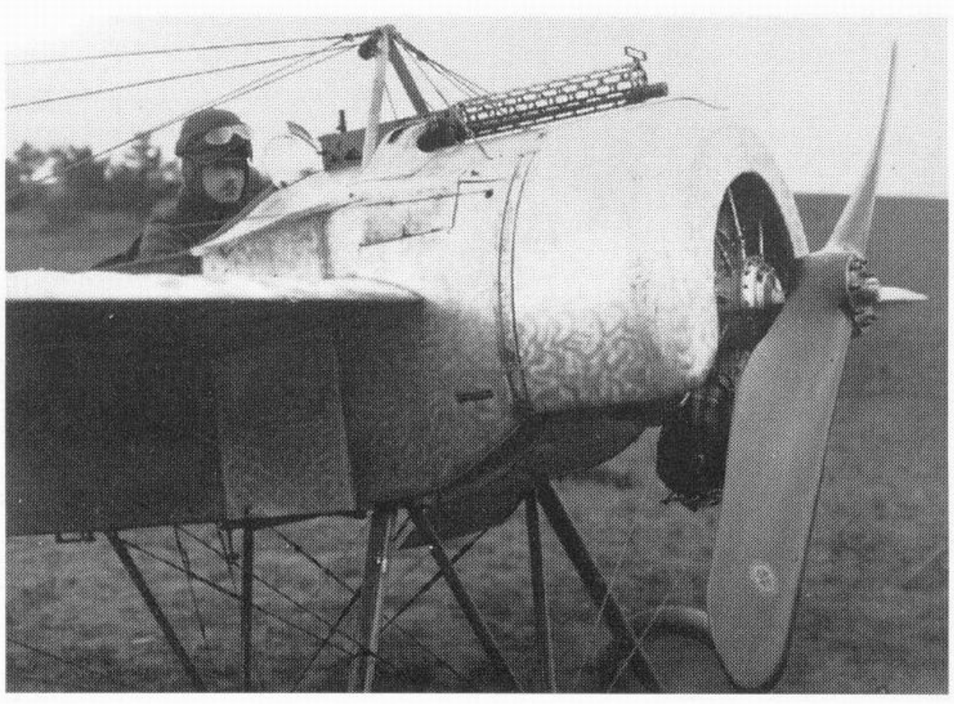
Max Immelmann seated in his E.I. Cross and Cockade International

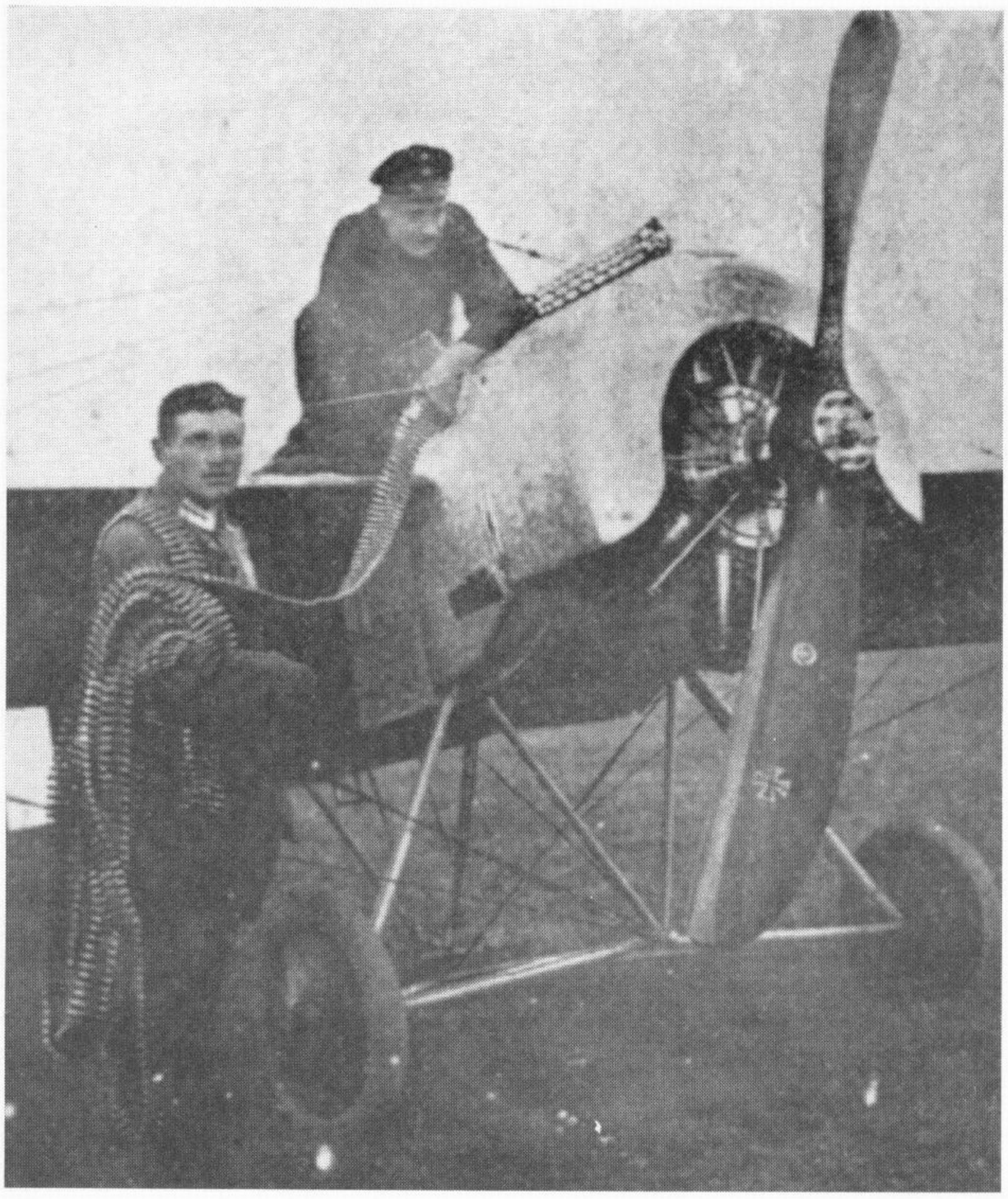
(Below) **The first E.I, E.1/15, fitted with a Parabellum machine-gun. This was the original M.5K/MG. The pilot is not known.** Harry Woodman

(Bottom right) **Fokker E.I, E.35/15 – pilot not known.** Cross and Cockade International

(Bottom left) **Another view of E.35/15.** Cross and Cockade International





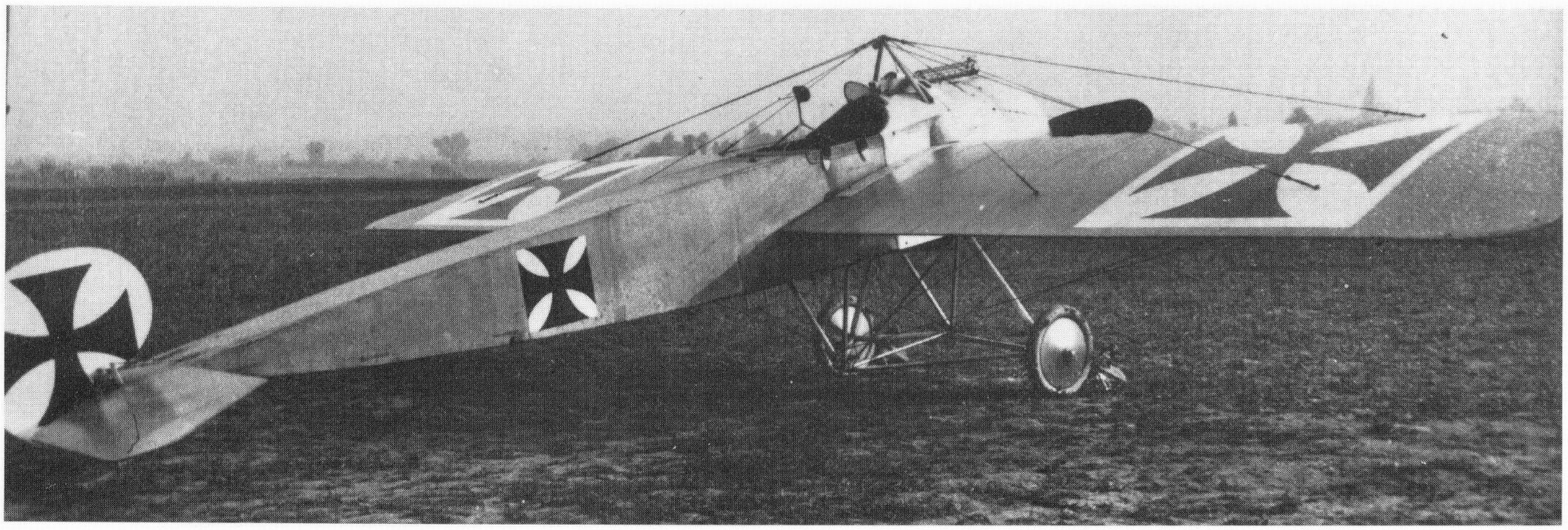


***(Left)* Replenishing the ammunition on a Fokker E.I.**
Cross and Cockade International

***(Above)* Flugmeister Boedicker in naval uniform in front of E.I, E.15/15 at the Kampfeinstitzer Schule, Mannheim.**
Cross and Cockade International

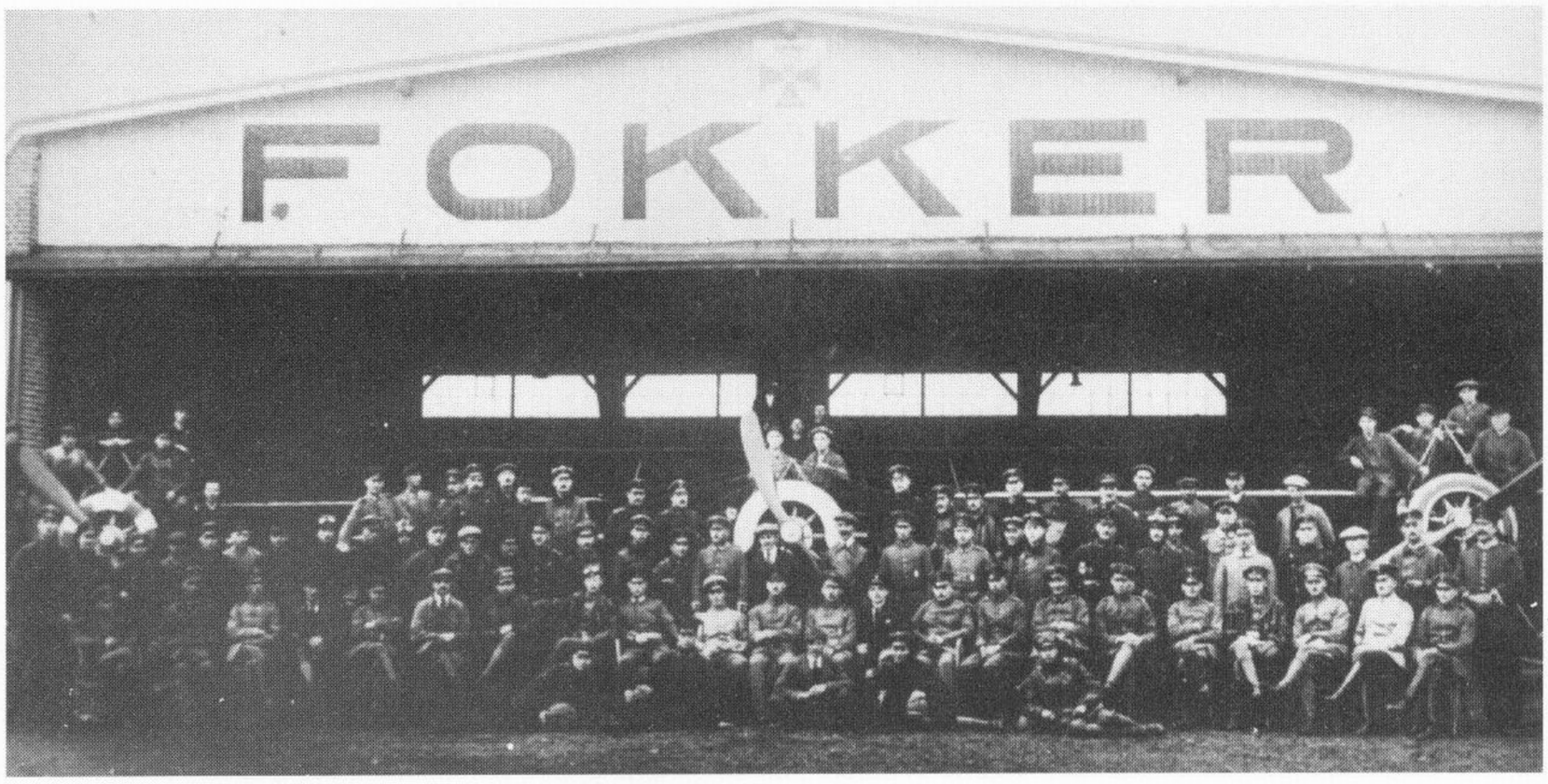
***(Left)* Flugmeister Boedicker of the 3rd Marine Landflug Abteilung in an un-numbered E.I. The lettering on the cowling reads *Huckcheu*.** Cross and Cockade International

***(Below)* Hans-Joachim Buddecke's E.I, E.36/15, in September 1915.** Jack Bruce



Specification – Fokker E.III

Engine:	100hp Oberursal UR.I
Weights:	Empty 349kg (770lb); loaded 604kg (1,330lb)
Dimensions:	Wingspan 10.04m (32ft 11in); length 7.3m (23ft 11in); height 2.49m (8ft 2in)
Performance:	Maximum speed 135–150km/h (84–93mph) Rate of climb 500m (1,600ft) in 4 minutes, 3,000m (9,800ft) in 20 minutes
Armament:	One LMG 08/15 machine-gun synchronized to fire through the propeller arc



Pupils and staff at Fokker's flying school at Schwerin. Cross and Cockade International

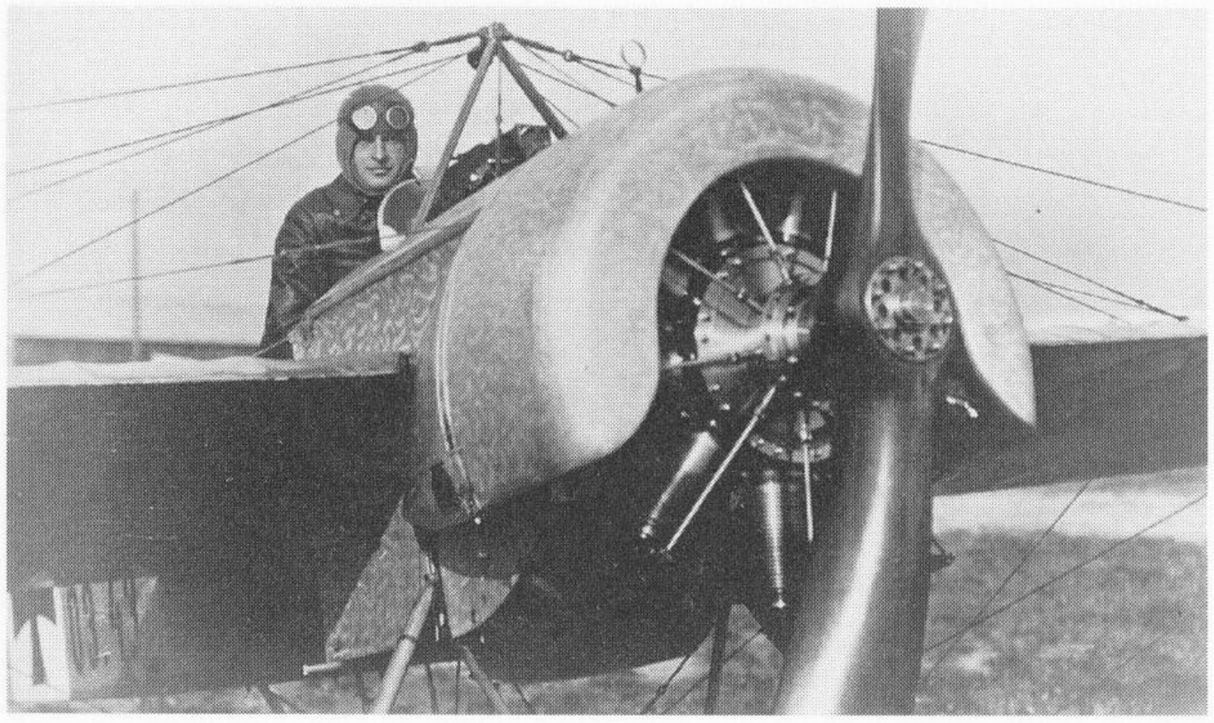
An unidentified pilot with an E.I of Flieger Abteilung 58 on the Eastern Front.
Cross and Cockade International

nine-cylinder 100hp Oberursal U.I, was larger in diameter than the 80hp U.0 and required both a larger-diameter cowling and some revision of the original mounting frame. The fuselage was lengthened to about 7.3m (24ft) and, in an attempt to match the speed of the Pfalz E.I, the wingspan was reduced slightly, to 9m (29.5ft). The wheels were moved forward to lessen the chance of a nose-over on landing. The capacity of the rear fuel tank was increased to maintain flying time for the larger engine, and the height of the top decking in front of the pilot was reduced. The height of the wing-bracing pylon was reduced, but it was constructed of heavier-gauge steel tube than before, giving increased protection to the pilot in the event of the aircraft turning over. In an attempt to compensate for the increased torque of the larger engine, early E.IIs were fitted with a small triangular fin in front of the tail skid. This was found to foul the rough surfaces of the airfields then in use, and was usually removed. Some of the E-series aircraft had the bottoms of their rudders 'flattened' for the same reason.

Modifications were made to the gun synchronizing system with a view to improving its reliability and increasing the rate of fire. Unfortunately, although improved, the system continued to be plagued by faults and a number of pilots, including Oswald Boelke, shot through their own propellers as a result.

The first E.II was delivered to the Army in August 1915. It was not the success that had been expected. The reduced wing area resulting from the shortened wingspan, and the reduced pylon height, caused control through the wing-warping system to need a lot of physical effort from the pilot. Also, despite the increase in horsepower, the loss of wing area had an adverse affect on the rate of climb, which proved to be only marginally better than that of the E.I. Only twelve E.IIs were delivered to the Army and none to the Navy

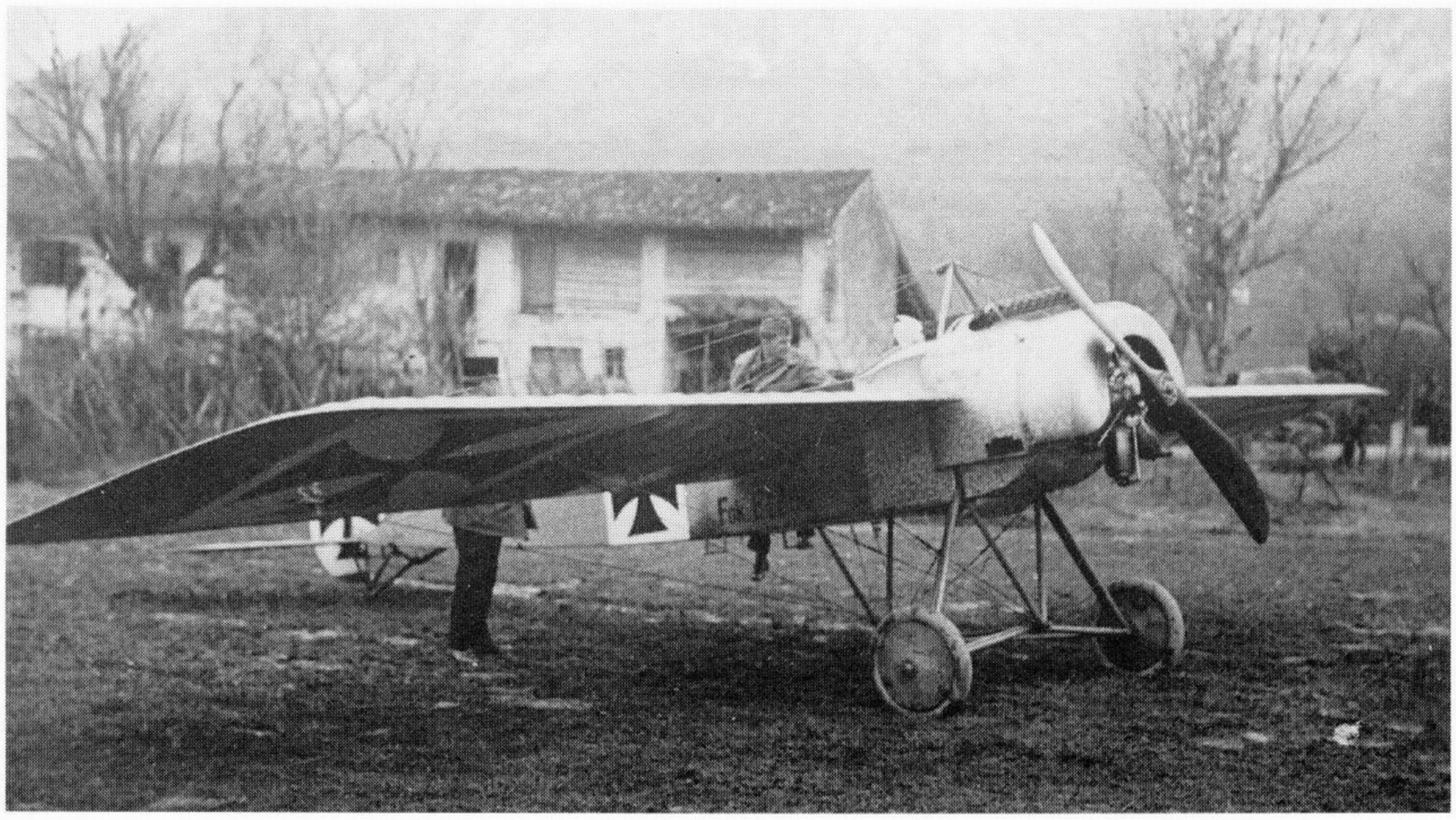
Prompt action was called for and a further variant of the M.14 resulted. This was given the factory designation of M.14v. It had wings of an increased span, 10.04m (33ft), and so a larger wing area. The size and fuel capacity of the gravity tank behind the engine was decreased to provide space for improved ammunition stowage. To compensate for this, the size of the fuel tank behind the pilot was increased, giving a total fuel capacity of approximately 100ltr (22gal). A tank and



Three views of Austrian E.I/A.III 03.43 of Flik 8/19, fitted with a Schwarzlose M7/12 machine-gun. Cross and Cockade International

***(Below)* Austrian E.I retaining its German serial, which is unfortunately in the shadow.** Cross and Cockade International

***(Right)* Fokker with Ltn Kurt Wintgens.** Alex Imrie



feed for the live ammunition rounds was fitted to the right side of the fuselage with a collection box for the empty webbing ammunition belt to the left.

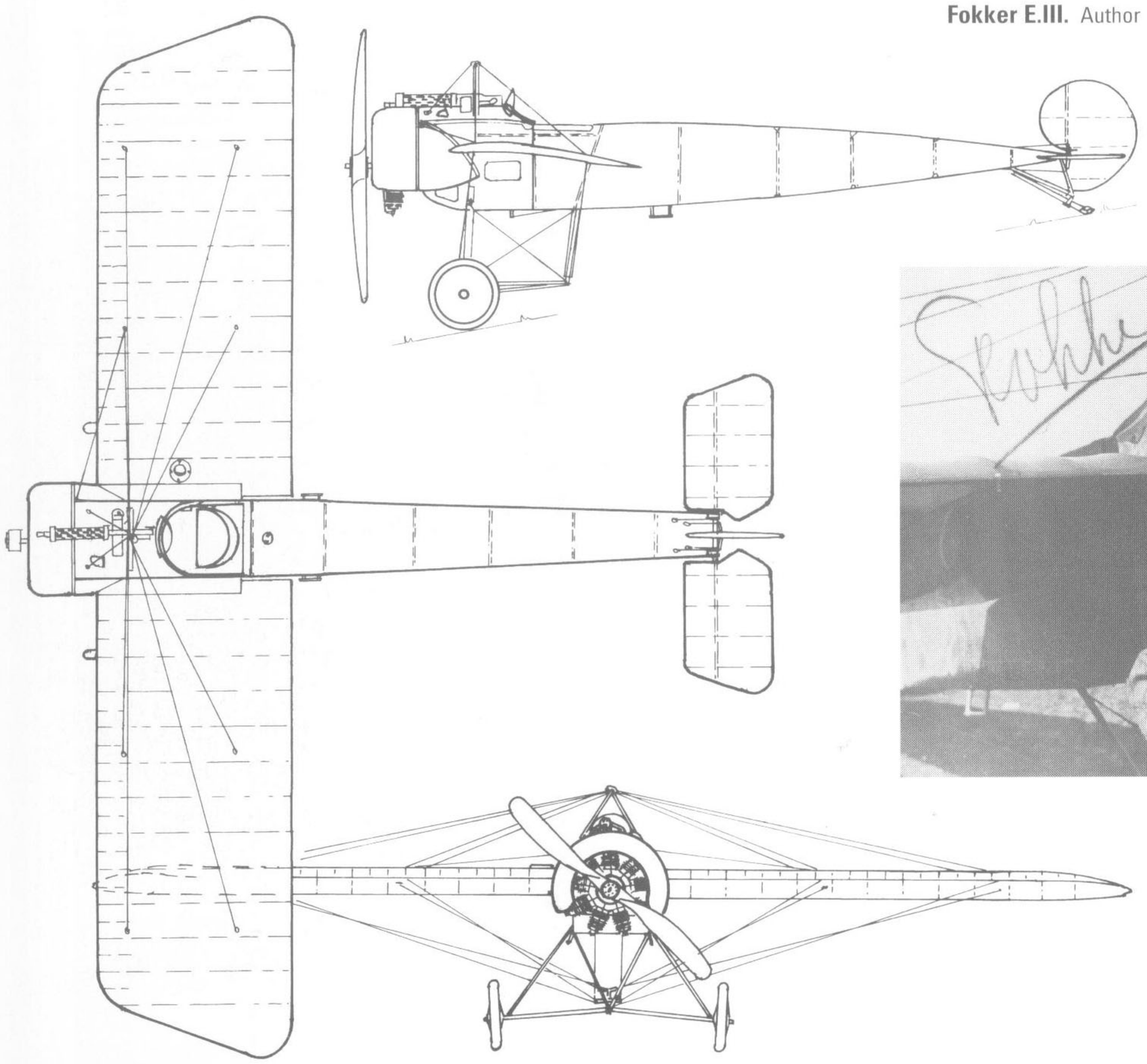
The modifications were a success and the first M.14v, now designated the Fokker E.III, was delivered to the Army just two months after the first E.II. It became the main production model, with 268 of the type being delivered to the Army, plus a further fourteen to the Navy. The E.III was also sold to the Austro-Hungarian air force, which bought a total of eighteen.

The E.IV

The final model in the series was the M.15. This was a larger and heavier machine, and was designed around the fourteen-cylinder, double-row, 160hp Oberursal U.III engine and intended to be fitted with three LMG 08/15 machine-guns. Its wingspan and chord were the same as those of the E.III, though its fuselage was lengthened to balance the engine. The heavier, longer engine required more support than was provided by the original tripod mounting, so additional members were added with bearings mounted in front of the engine. The additional weight of the engine required stronger undercarriage legs and, to allow for a larger-diameter propeller, these were lengthened at the same time. The upper wing support pylon was again strengthened. An aluminium top decking covered the guns' breeches and ended with a streamlined, removable, rear section that extended down the fuselage behind the pilot. Additional air cooling for the double row of cylinders was provided by six large slots cut into the front upper face of the engine cowling.

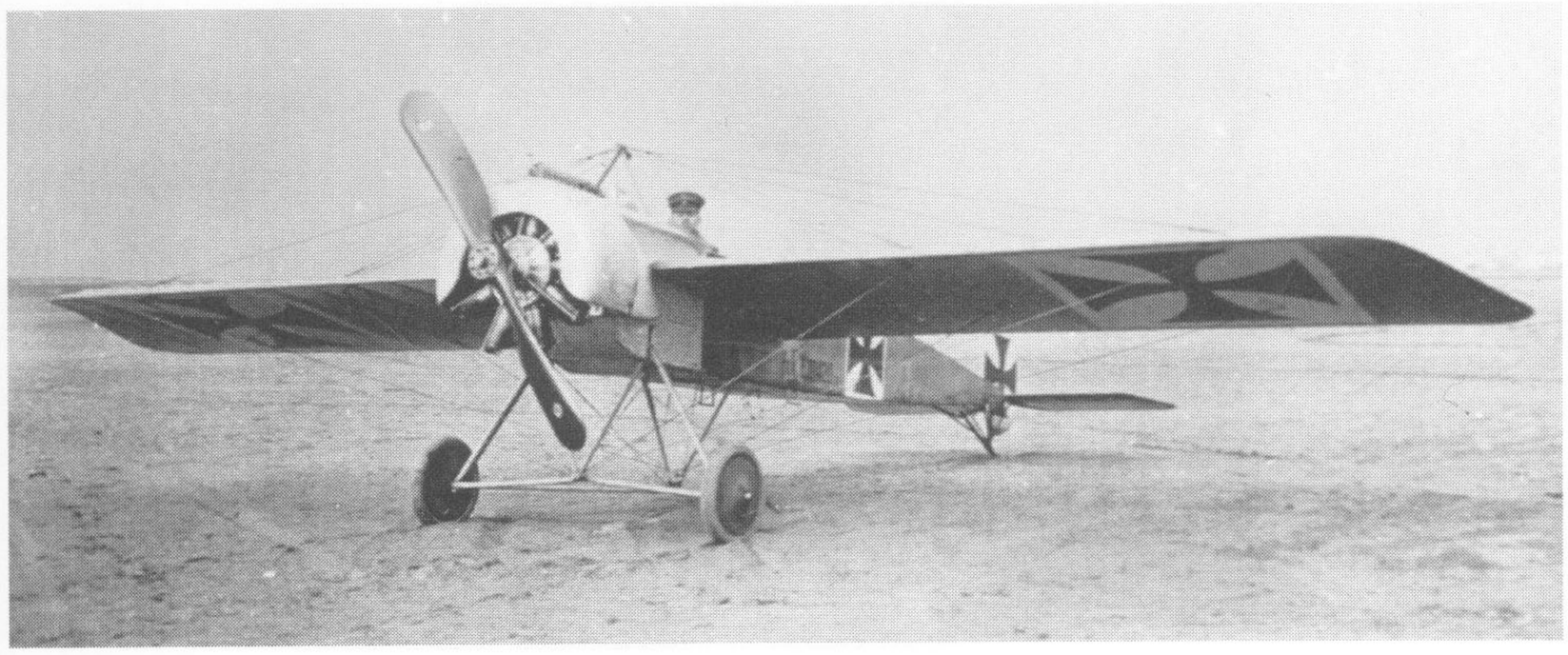
The prototype M.15, re-designated the Fokker E.IV and numbered E.122/15, was accepted on 15 September 1915 and shipped from the factory on 27 November. Instead of being sent to the Western Front, it was diverted to Essen where intelligence reports had forecast a raid by Allied aircraft.

Fokker E.III. Author

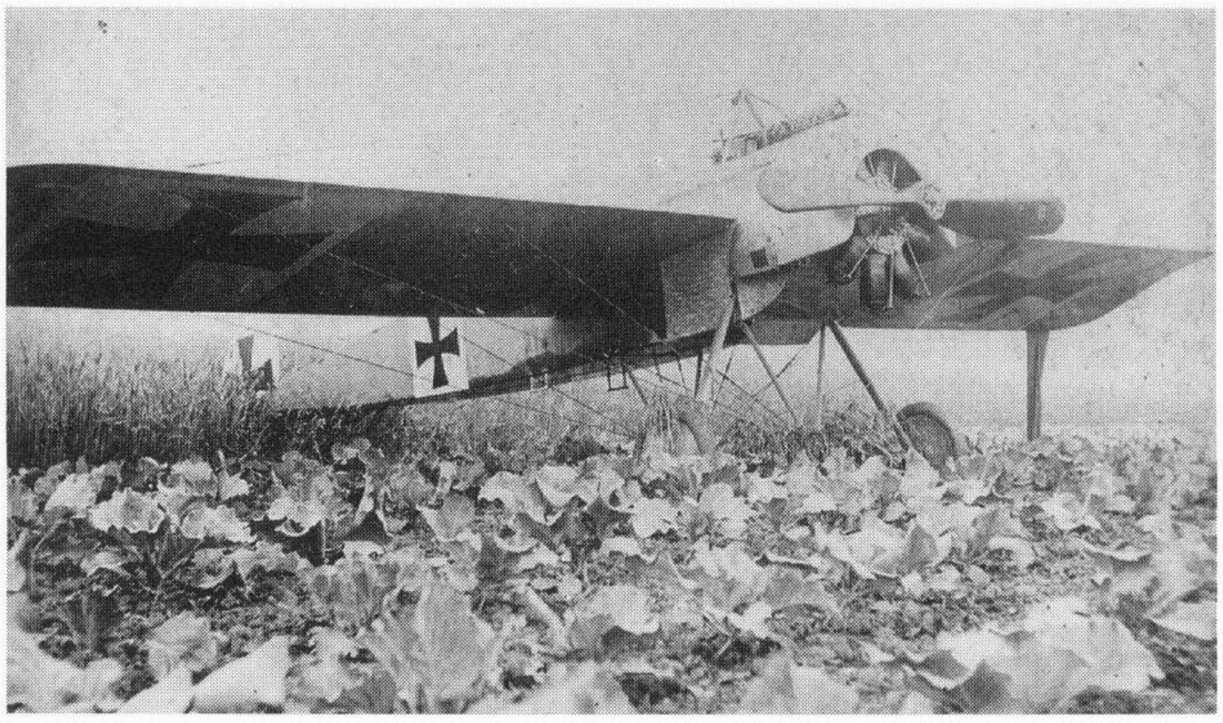


Anthony Fokker poses in front of the machine-turned cowling of an E.III. Frank Cheeseman

The raid failed to happen but, ever watchful of an opportunity, Fokker gave a display of its capabilities to the assembled German pilots and other officers present. Reports of the outcome of this conflict with one another. Fokker's says that he concluded his flying display with an impressive attack on a ground target using all three machine-guns. Due to a malfunction of the synchronizing system, this was cut short when he put sixteen bullets through his propeller, causing him to land abruptly. He claims to have hidden the damage from those present until a replacement propeller was fitted, and that the machine was returned to

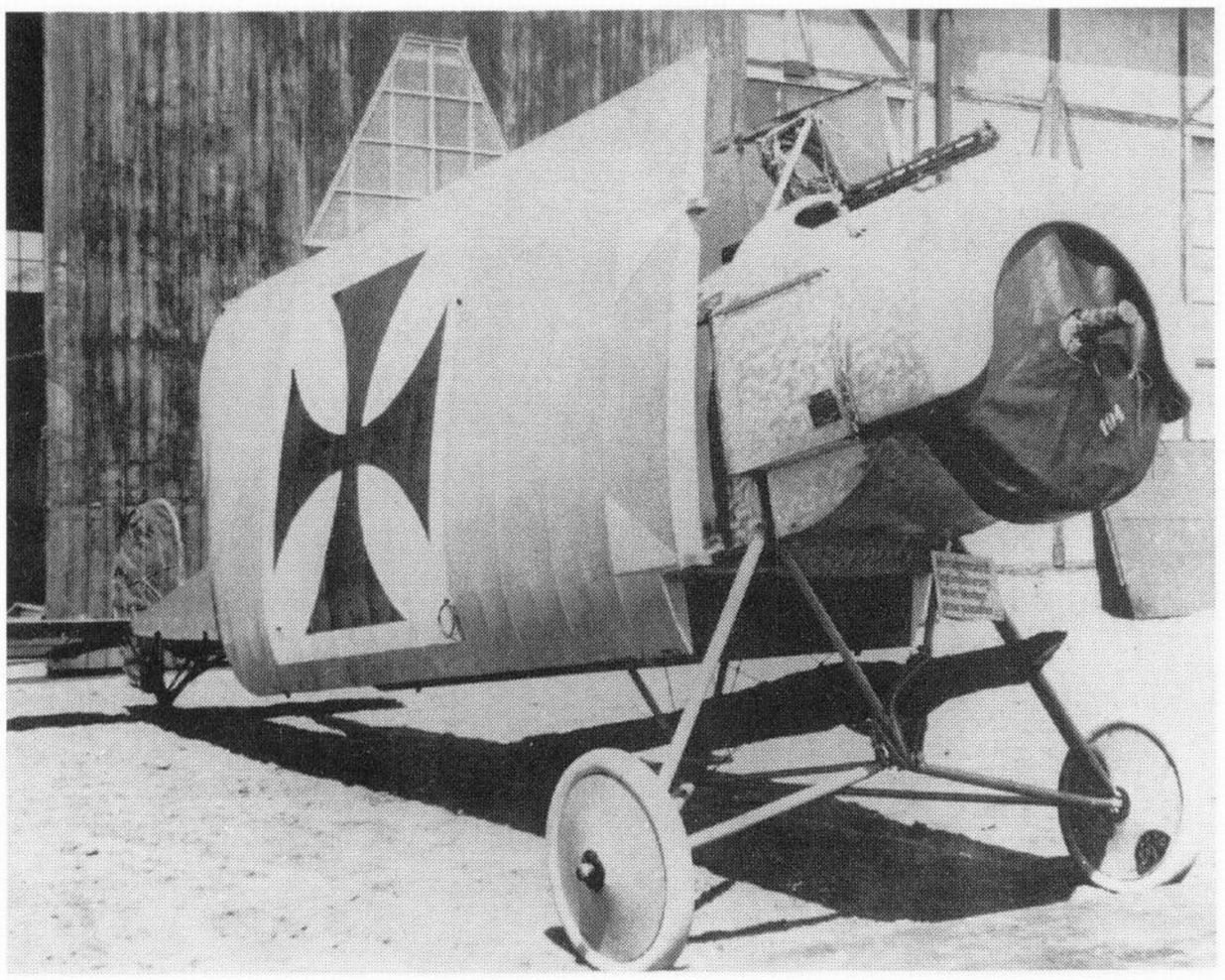


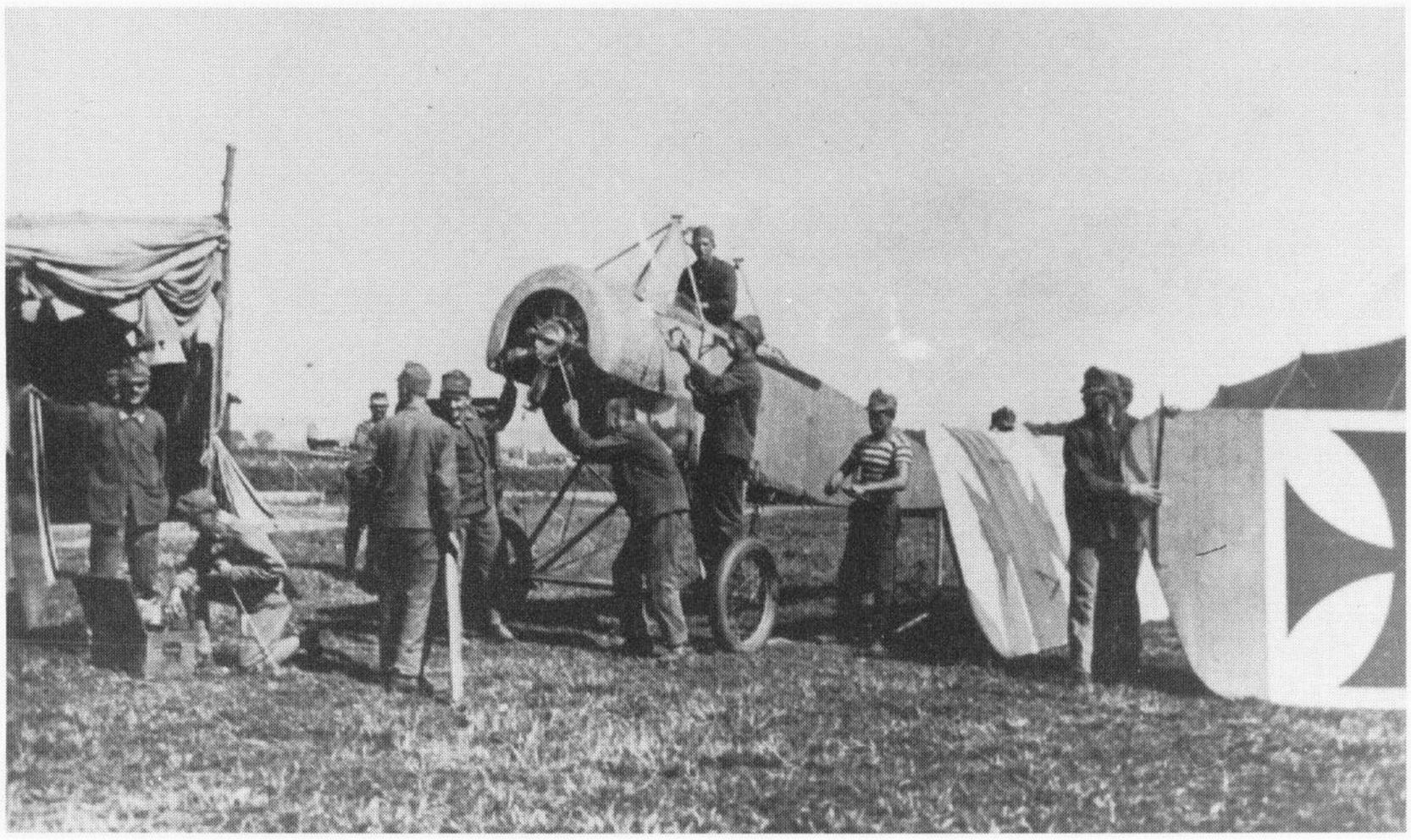
Fokker E.III 120/15. Cross and Cockade International



***(Above)* Fokker E.III 248/16, said to have been flown by Ernst Udet.** Cross and Cockade International

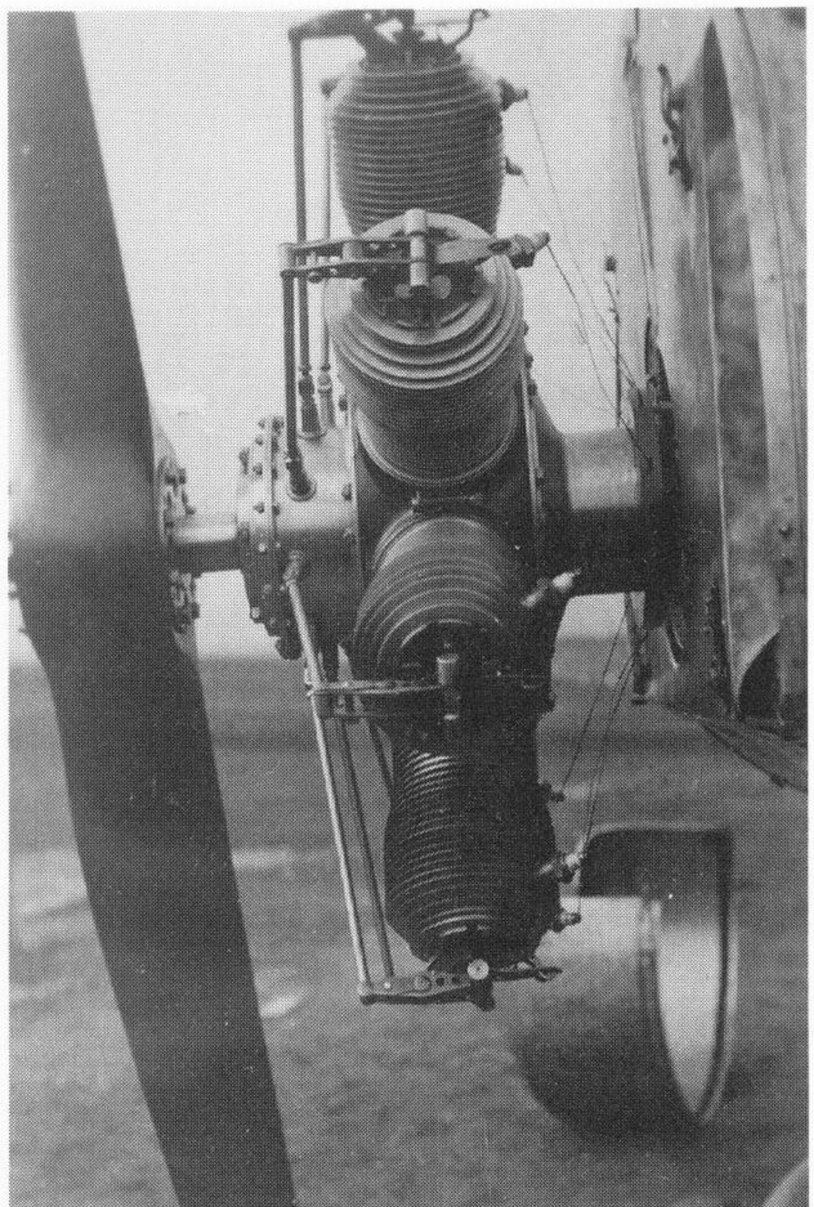
***(Right)* Fokker A.III 12/15 completely stowed for transportation: note the covers on the engine and rudder.** Cross and Cockade International





***(Above)* A Fokker A.III being either dismantled or assembled by Austrian personnel.**
Cross and Cockade International

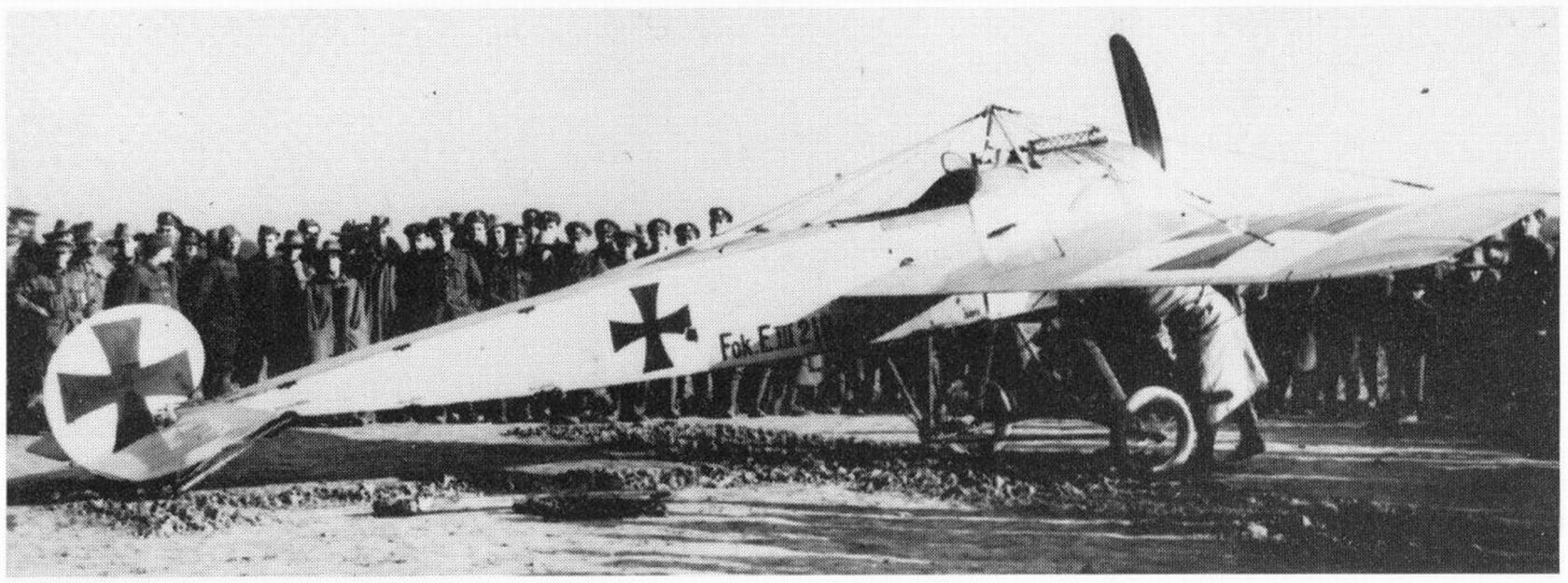
***(Right)* The Gnome engine installation on an Austrian E.III.** Cross and Cockade International



Schwerin and eventually issued to Oswald Boelke at the front.

Hptmn Hermann Heise, commanding Flieger Ersatz Abteilung 7 and in the process of forming Kampfstaffel 1 at Cologne, was present at this firepower demonstration. In a report written after 1945, he stated that Fokker destroyed a number of propellers on the firing range in his attempts to get the synchronizing system to work with the three guns. So, far from the problem being hidden by Fokker, it was apparently general knowledge at the time. It is difficult to know which report to believe, but Heise had no reason to give anything but a factual account of the events.

Returned to Schwerin, E.122/15 was despatched to the front on 20 October 1915. It is probable that by this time the third gun had been removed. At the front E.122/15 was flown by Oblt Otto Parschau, then commanding Fokker Staffel Nord with the German 3rd Army. Parschau, a pre-war pilot, was a friend of Fokker's and had earlier flown and reported upon the first Fokker E.I. In his report on E.122/15, Parschau says that its behaviour was different to that of the 100hp-engined E.IIs and E.IIIs. In climbing turns under full power it needed a great deal of physical effort to operate the wing warping control and tight turns had to be made blipping the engine (*see* box on page 46). The E.IV's speed made it difficult to judge the rate of approach to an enemy and he recommended that power be reduced when attacking from below or behind. He complained of oil fumes during longer flights, but acceded that the fitting of a fire wall on later machines would cure the problem. He also reported a loss of power above 4,000m (13,000ft).

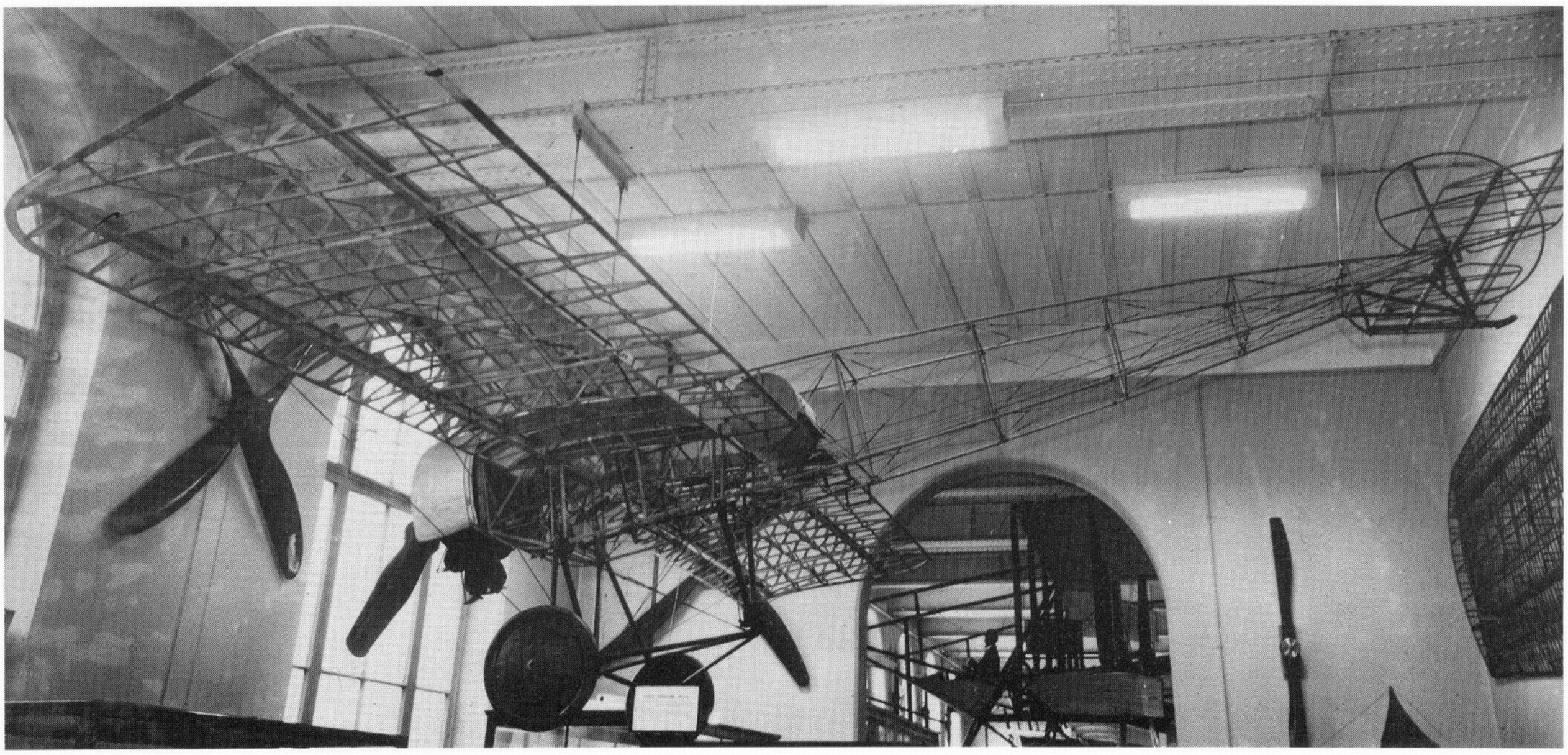


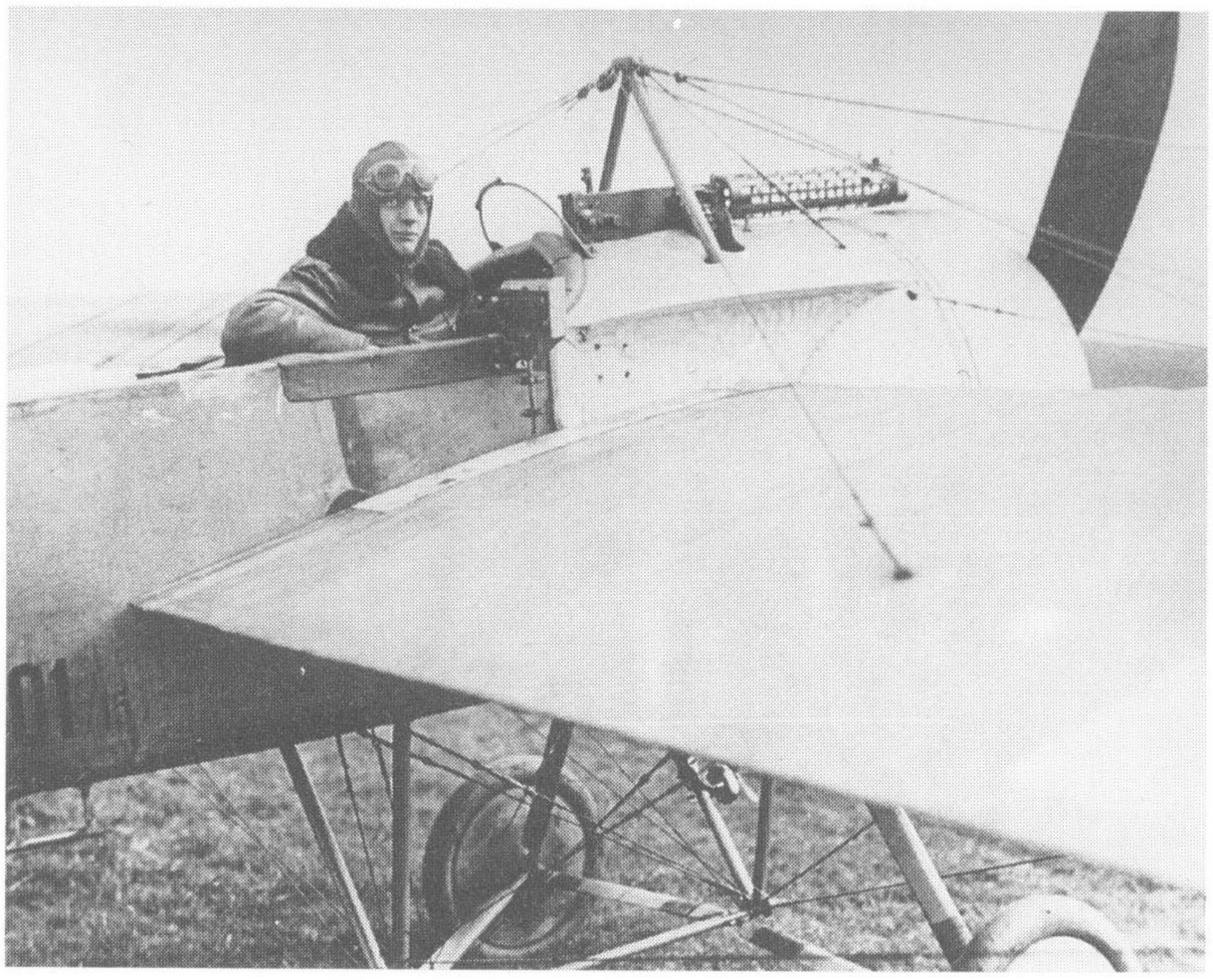
***(Top & above)* Fokker E.III 210/16 shortly after its capture. Extensively tested by the Royal Flying Corps, it now survives in the Science Museum in London.** Cross and Cockade International

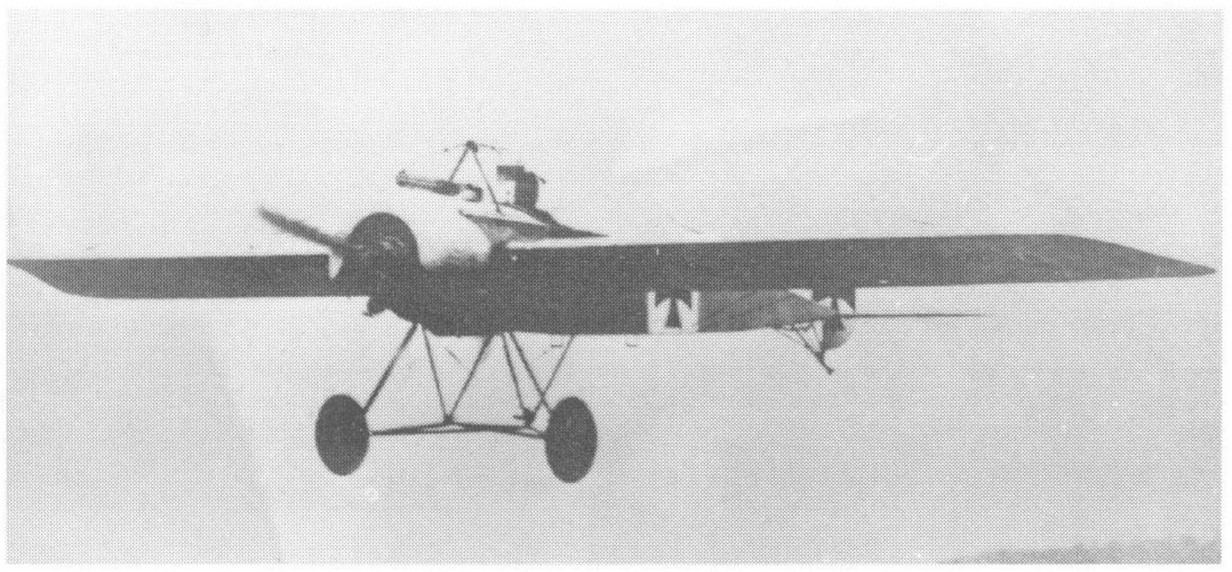
***(Right)* 210/16 in British markings.** Cross and Cockade International

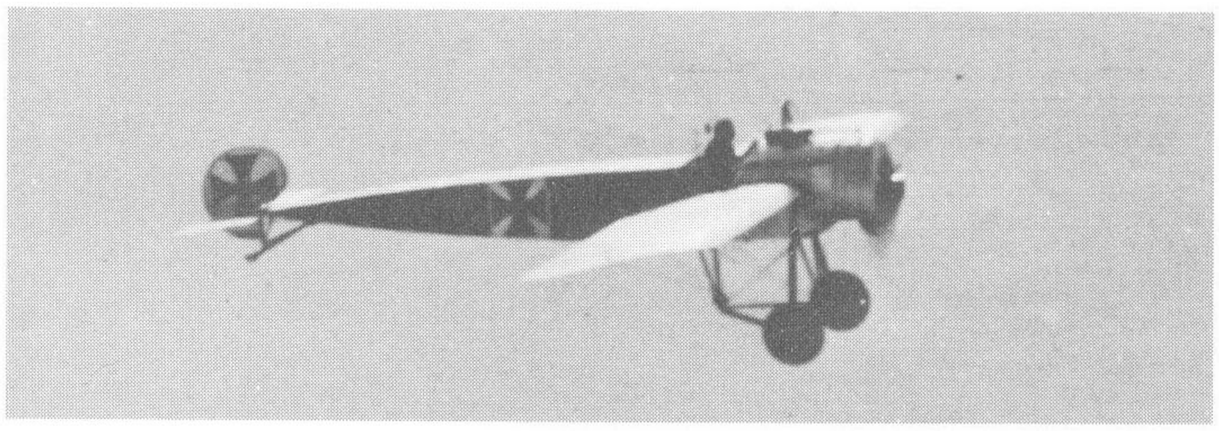
***(Below)* E.III 210/15 as exhibited in the Science Museum in London. It is the subject of an article in Volume 11, Number 1 of *Cross and Cockade International*.** Frank Cheeseman

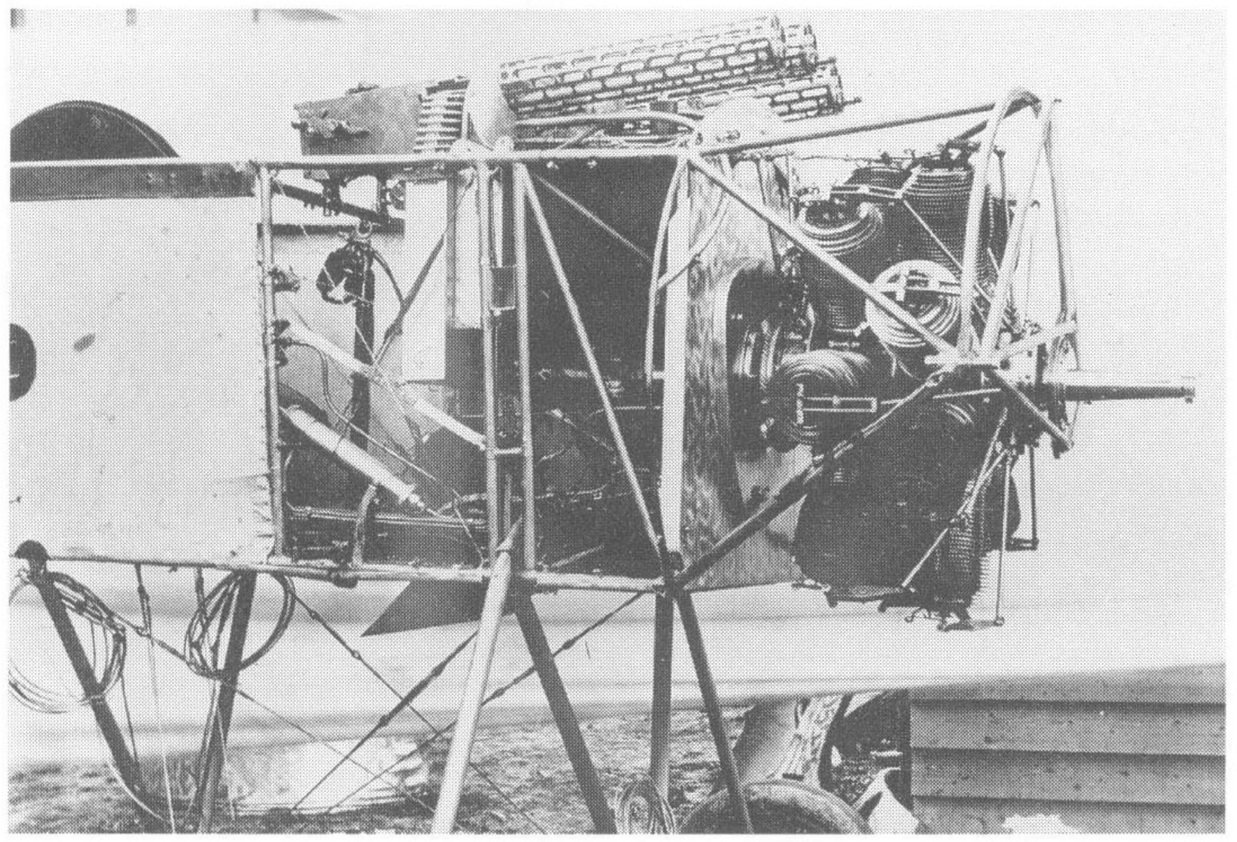
Ltn Oswald Boelke was another early pilot of the E.IV and enjoyed a number of successes flying the type, but suffered a number of engine problems in the process. In his report on it he said that while it met the requirements for speed in level flight, its loss of speed in a climb above 3,000m (10,000ft) was such that Allied types could climb away from it. Its manoeuvrability was inferior to that of the E.IIs and E.IIIs, partly due to the gyroscopic effect of the heavy engine and partly because of the effort required to operate the wing warping system. Blipping the engine to allow quick turns resulted in a loss of altitude that was highly undesirable in combat. He found no use for the tilted alignment of the guns on the early machines (set at 15 degrees to allow attack from behind and below) as he maintained that, in his experience, most











***(Top left)* Ltn Helmuth von Zastrow of Flieger Abteilung 60 seated in E.III 401/15.** Cross and Cockade International

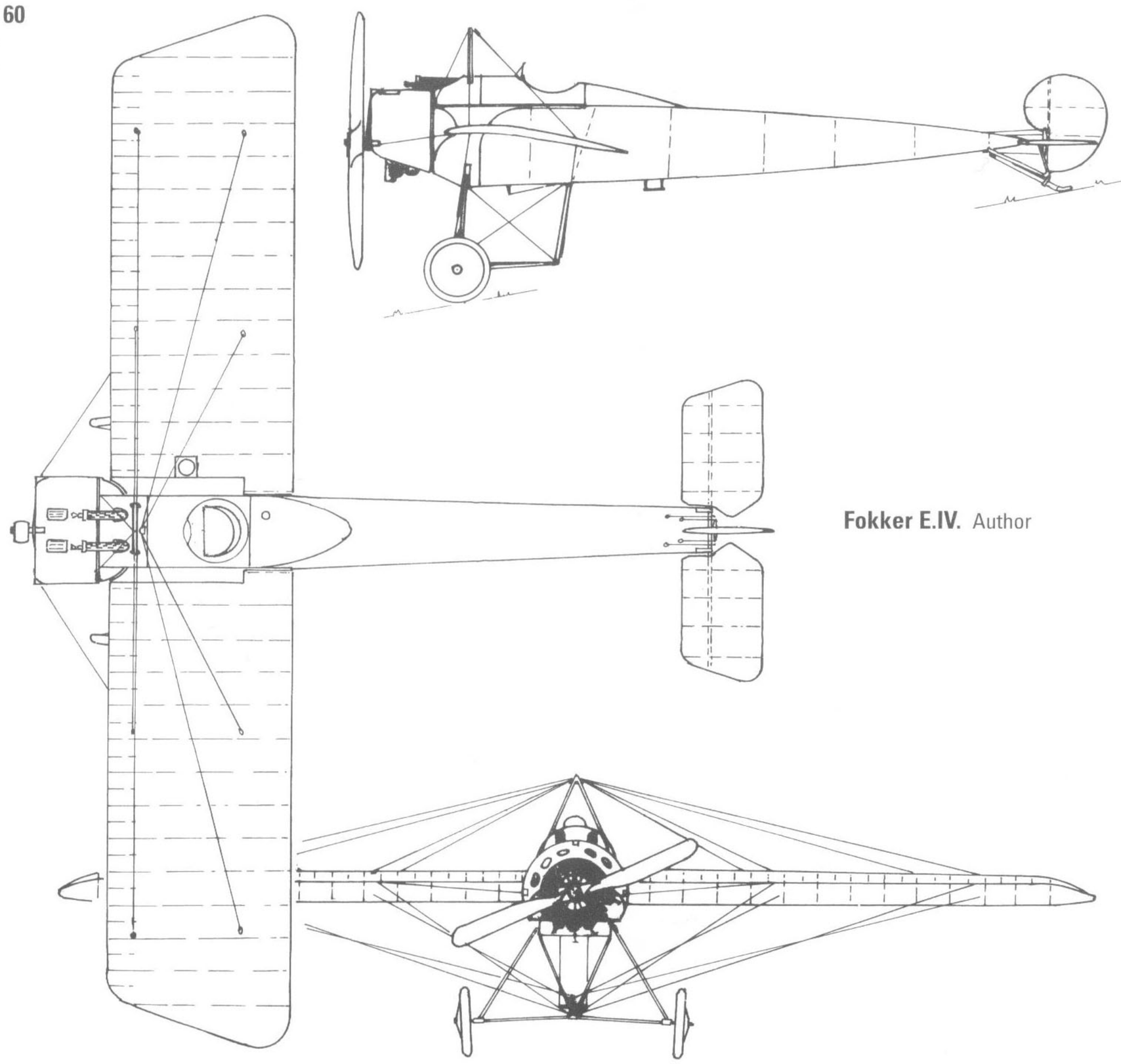
***(Top right)* An E.III comes in to land.** Cross and Cockade International

***(Above)* A Fokker E.I in the air.** Jack Bruce

***(Above right)* Close view of the engine and three-gun installation on a Fokker E.IV. The guns are set at 15 degrees' elevation.** Frank Cheeseman

attacks were made from behind and above. While Boelke is popularly said to have used a 'three-gun' E.IV, no record exists of the type ever having been used in combat.

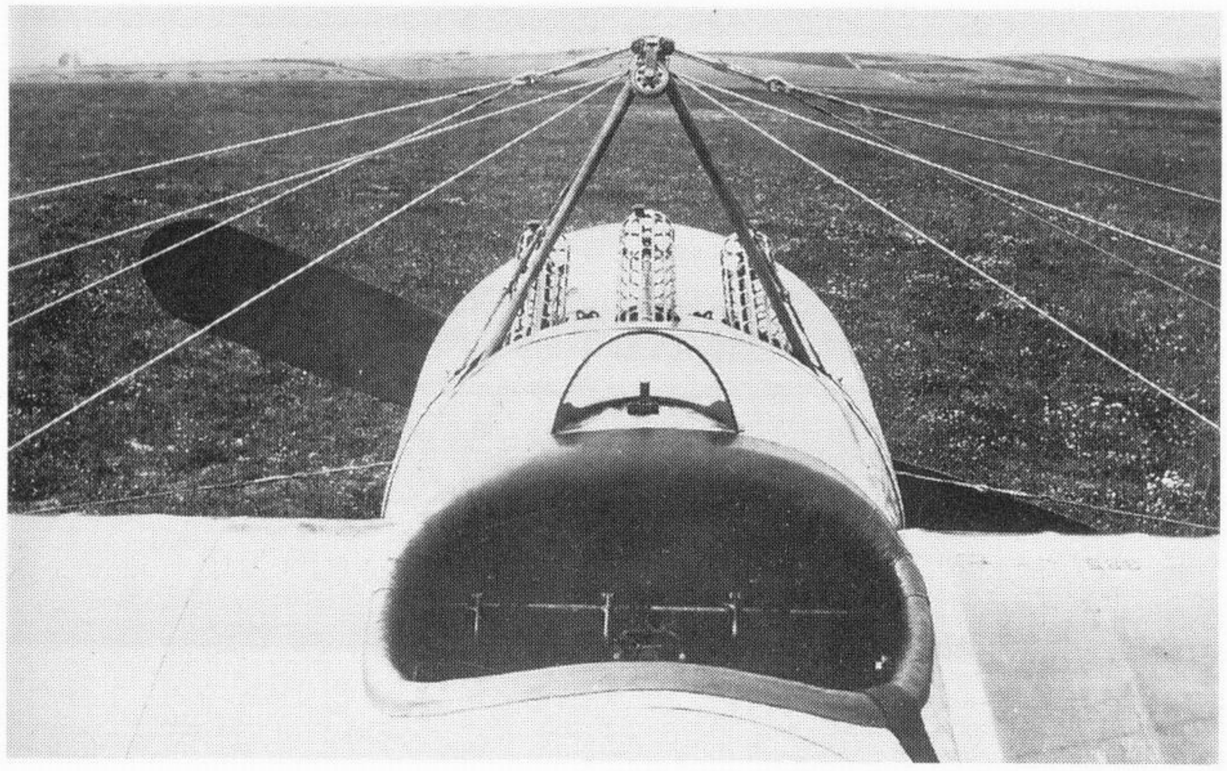
Boelke's report on the type did it no favours. In addition to the points he made it suffered from the unreliability of its 160hp engine. This required extremely careful maintenance after each flight, with paraffin oil to be squirted into each cylinder to loosen carbon deposits and the spark plugs, slip ring and carbon brushes carefully cleaned and replaced. The total number of E.IVs delivered to the Army was forty-nine. By the time it was available for delivery, the new D-type biplanes were available and the day of this series of Fokker monoplanes was over.



Fokker E.IV. Author

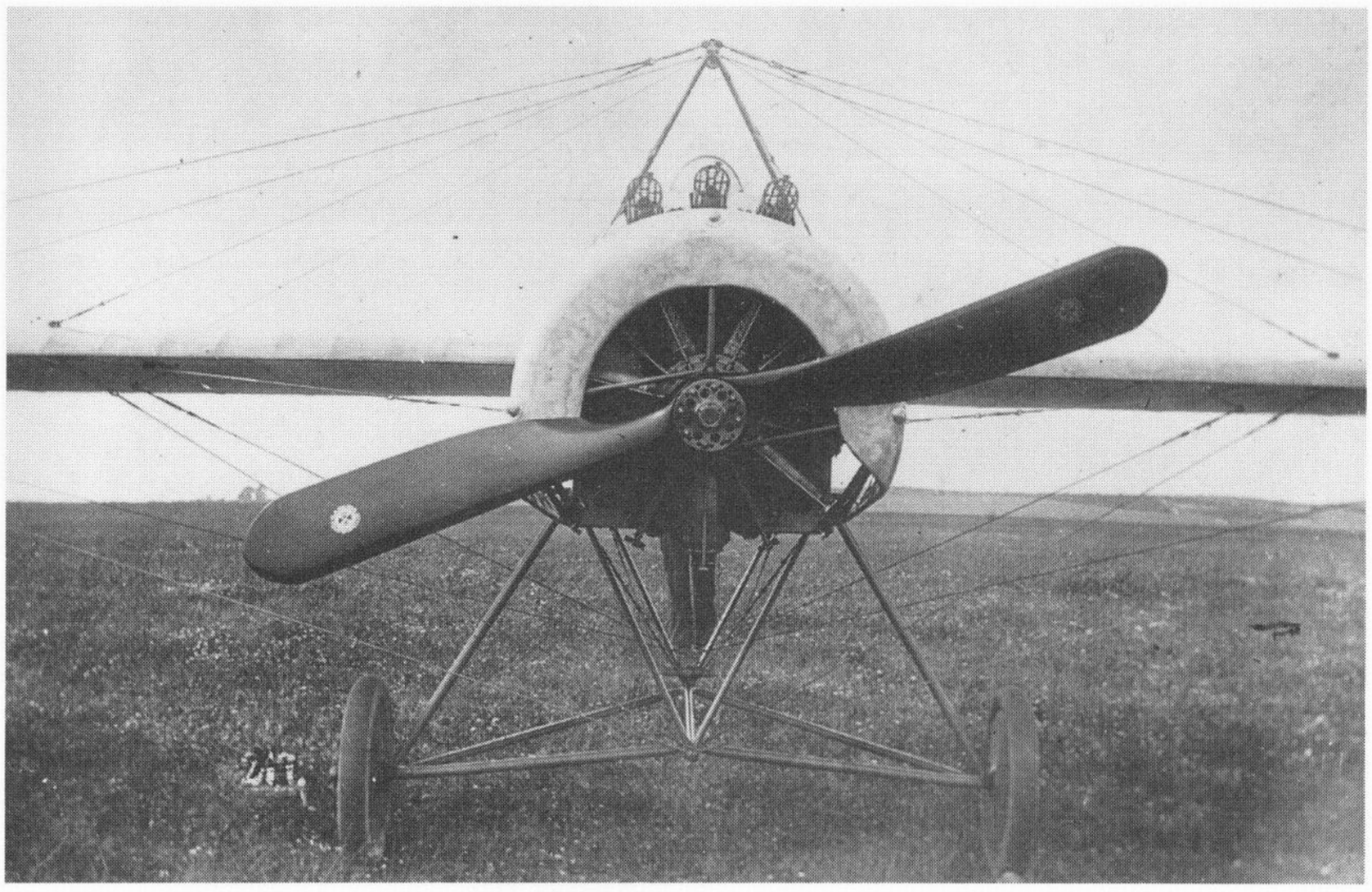
Blipping

'Blipping' is a term used for the practice of fine-controlling the speed of a rotary-engined aircraft by switching off and then on again its engine, using its magneto switch. It was commonly used in the First World War but is now only heard or seen at flying displays where such aircraft are still seen, such as Old Rhinebeck in the USA and Old Warden in the UK. Switching off stopped the ignition sparks for the engine and resulted in a loss of power, a slowing of the engine's rotation and a reduction in the gyroscopic effect of the rotating engine. When under full power, aircraft using rotary engines could be turned rapidly in one direction but less readily in the other (where the gyroscopic effect was working against the turn). By cutting power and slowing engine rotation a turn in that direction became easier. There were disadvantages to the use of 'blipping'. First was the fact that the freely rotating engine would still be drawing fuel into its cylinders and, when switched on again, misfiring could result. Another was that the sudden return of power generated a great jump in the gyroscopic effect. This would not be a matter of great concern with a lighter engine such as the 80hp Oberursal, but the much greater weight of the 160hp Oberursal would magnify this effect. This is particularly noticeable when a rotary-engined aeroplane is being run up on the ground: blipping of the engine results in a dipping of the wings on one side.



Pilot's view over the three guns on a Fokker E.IV. Frank Cheeseman

***(Below)* Frontal view of the E.IV fitted with three machine-guns.** Cross and Cockade International

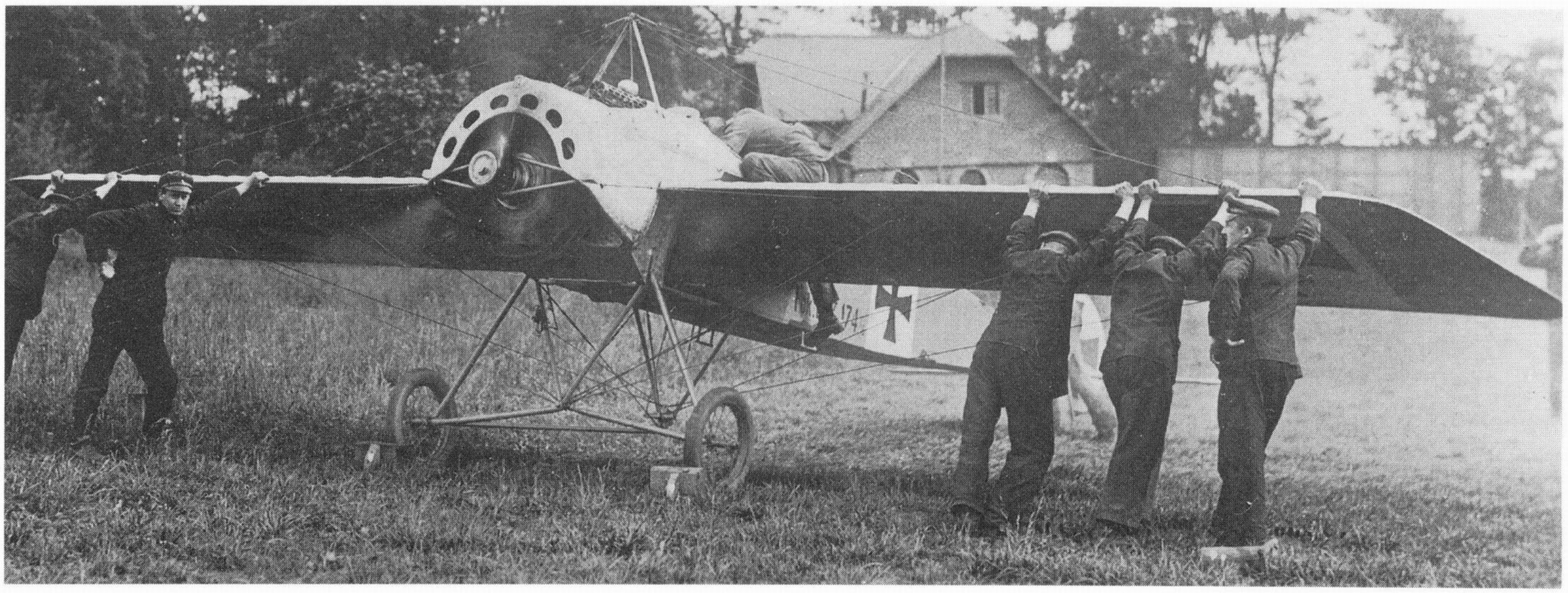


Ltn Max Immelmann also flew the E.IV (on one occasion Boelke's machine, much to Boelke's annoyance) but preferred to fly the E.III – in which he was eventually killed when his synchronizing mechanism malfunctioned and he shot off his own propeller.

The E-series in Operational Service

Initially, E-series aircraft were deployed in ones and twos to Feldflieger Abteilungen (FA) and Flieger Abteilung (Artillerie) (FAA) where they were flown by

Hptmn Oswald Boelke's E.IV, 174/17, fitted with the standard two machine-guns. Jack Bruce

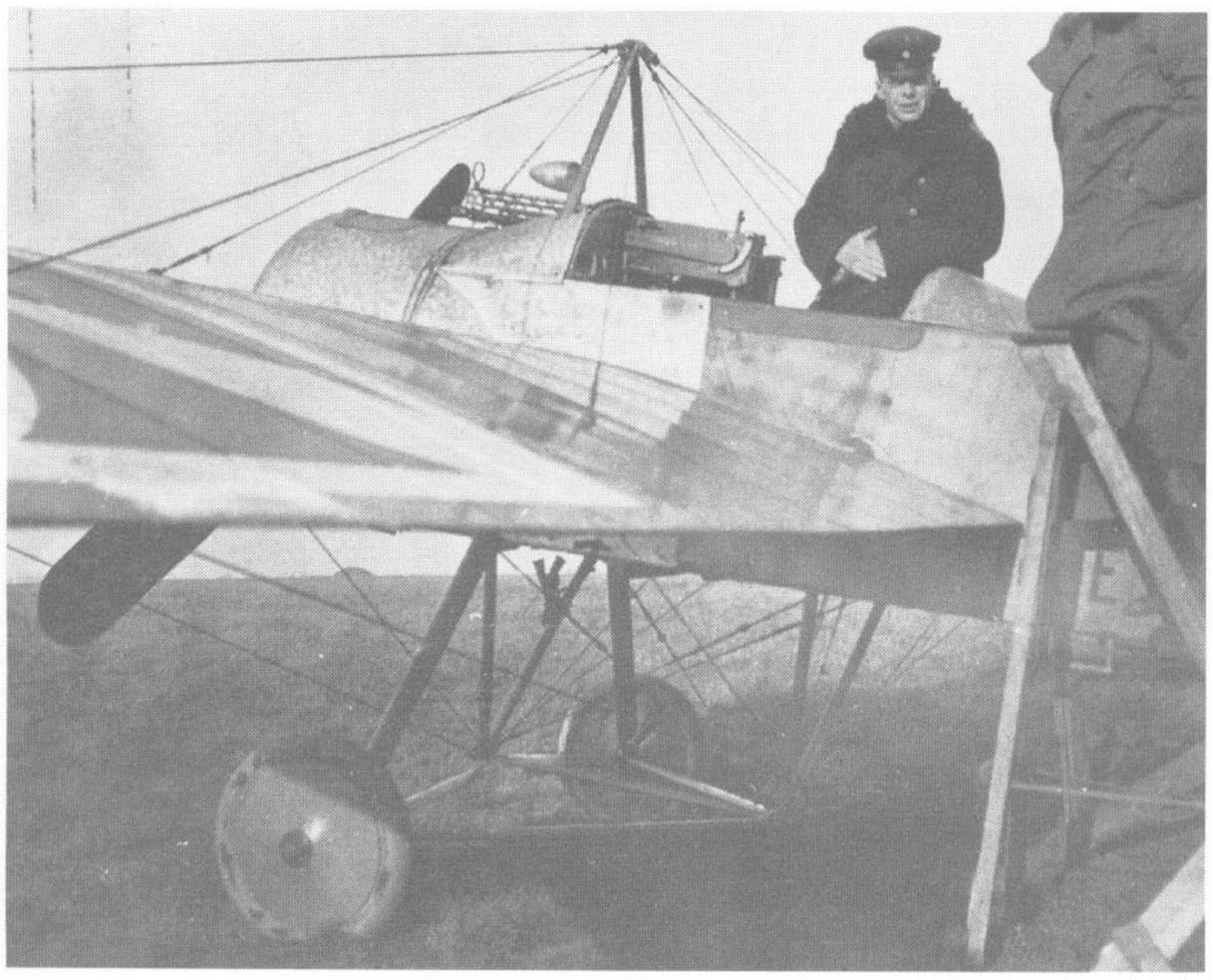


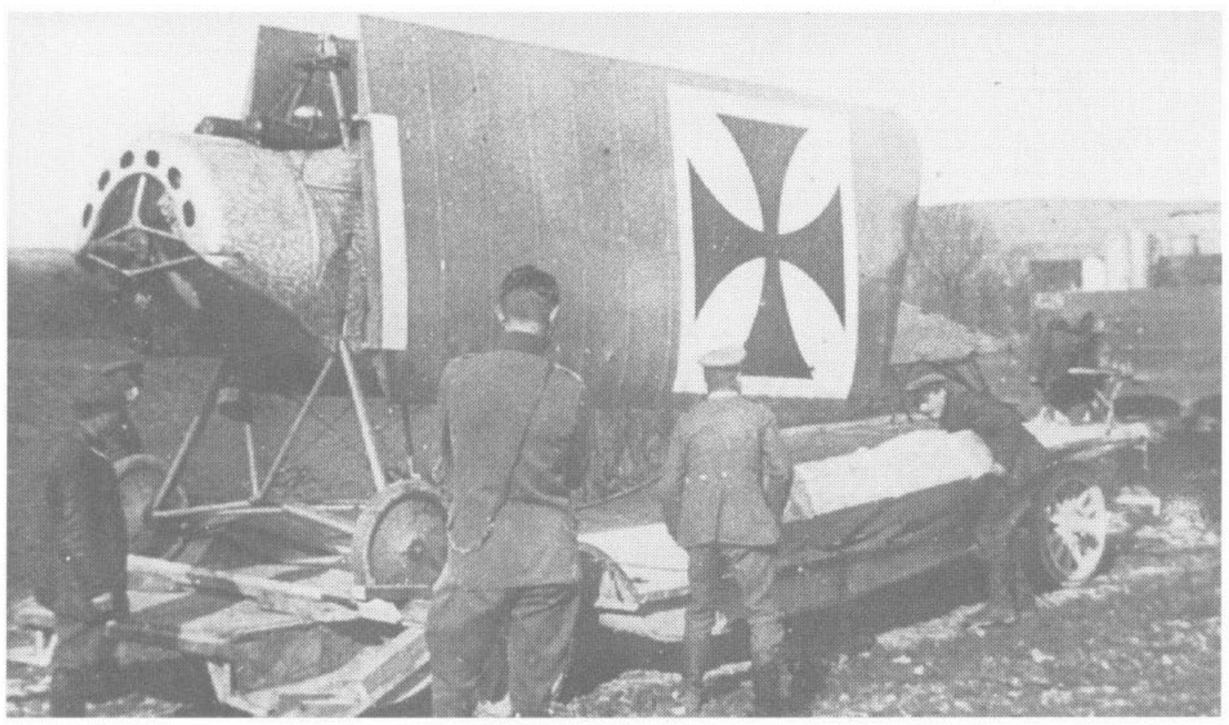
experienced pilots to protect the unit's two-seaters. As these pilots came to appreciate the potential of their single-seaters and use them aggressively they started to be grouped together for use as fighter aircraft in Kampfeinsitzer Kommandos (KEKs). By the time that the KEKs evolved into Jagdstaffeln (Jastas), which were dedicated fighter units, the E-series had mostly passed from front-line service

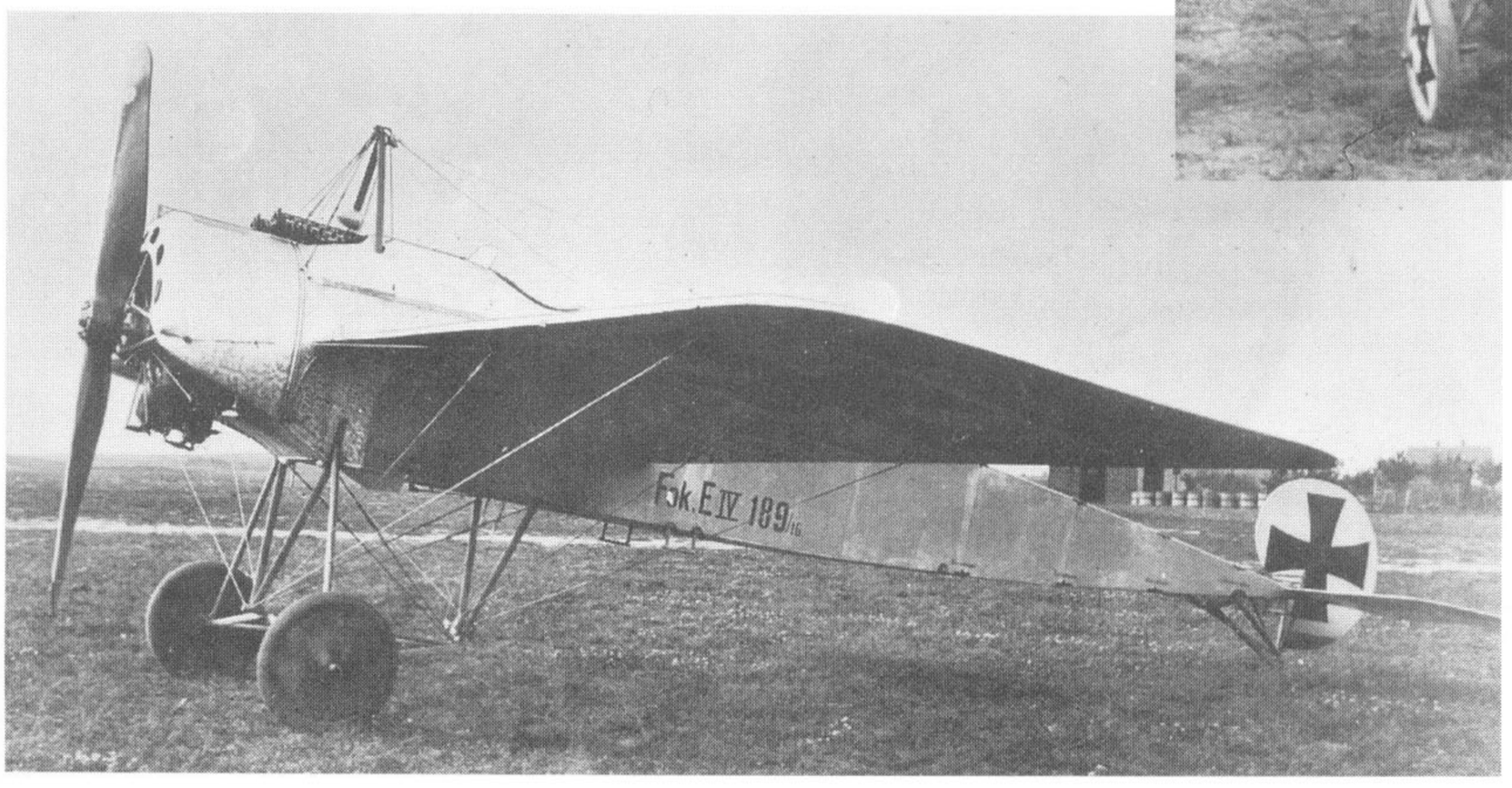
It is not an exaggeration to say that, in spite of their many faults, the Fokker E-series was probably the most significant aircraft of World War One. Initially copied from another manufacturer's original aircraft, it was neither a brilliant design nor a great aircraft. For all that, its deployment with the German Army and Navy caused the Allies to give serious thought to their own designs and to hasten into service improvements that may otherwise never have happened.

They were used by all of the great early fighter pilots, the men who were to influence the way in which fighters would be used from 1915 until the present day. The E-series gave a number of great pilots their first victories, Parschau, Boelke, Immelmann, Buddecke, Wintgens and Udet being just a few familiar names. It inspired Immelmann to 'invent' a classic manoeuvre which, as the 'Immelmann Turn' was still in use in World War Two. This was a diving attack from above and behind an enemy aircraft, followed by a half loop and a roll back from the inverted position from the top of the loop, giving a change of direction to bring Immelmann facing the attacked aircraft from in front of and above it.

Even more significant, the E-type gave Boelke the incentive to formulate a set of







(Above) **Oswald Boelke seated in his E.IV.** Cross and Cockade International

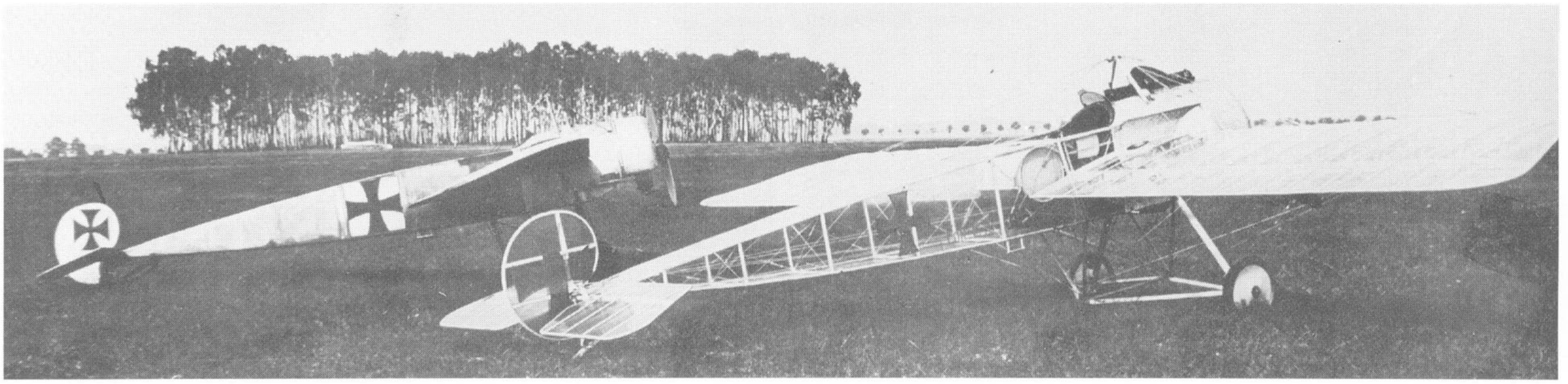
(Above right) **An E.IV stowed and on the move by transporter.** Cross and Cockade International

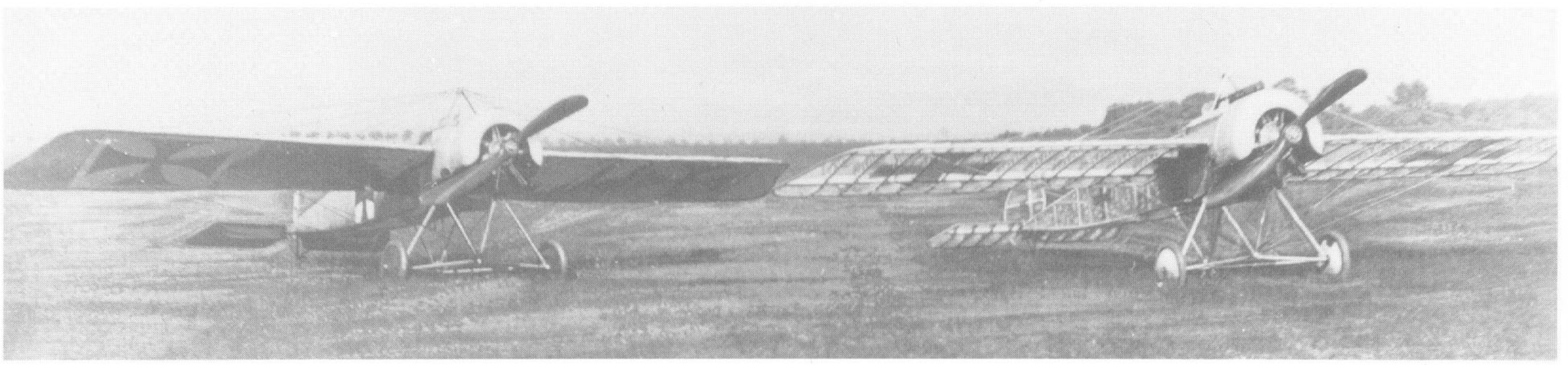
(Right) **Offstv Friedrich Altmeier in front of an E.IV of Flieger Abteilung 67.** Cross and Cockade International

(Below) **E.IV 189/16.** Jack Bruce

'rules' by which fighter pilots could fight and expect to survive. These are as valid today as they were then, and led Boelke to be known as 'the father of fighter pilots'.

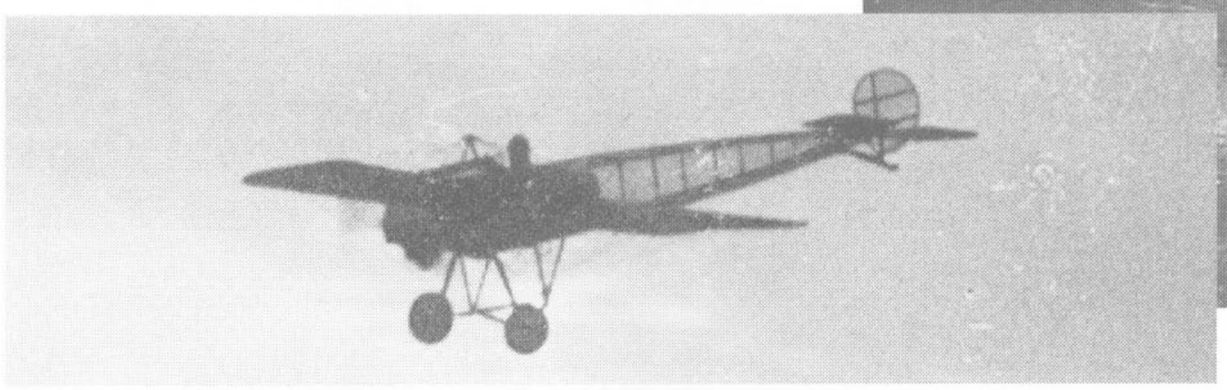
The other claim to fame, the only one that the E.IV enjoyed, was that it was the first aircraft to employ the two-gun configuration that was to become standard throughout the world until the advent of the multi-gun aircraft of the late 1930s.



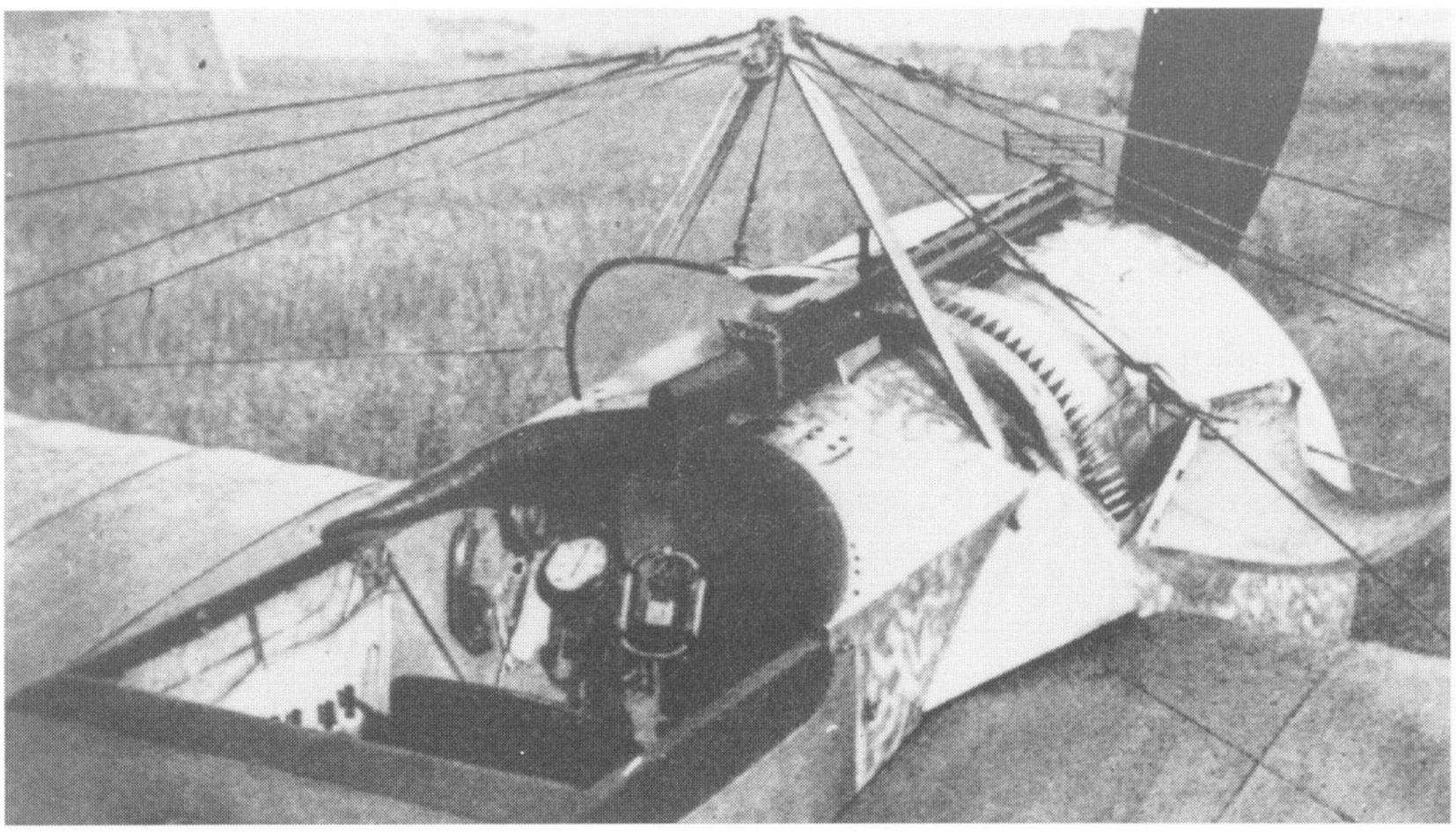


(Top & above) **Cellon-covered E.III, 396/16 alongside a standard E.III. It was hoped that this covering would render the machine invisible in the air. Not only was this not the case, but the Cellon was prone to wrinkling through moisture and total disruption if punctured.** Cross and Cockade International

(Right) **Further view of the Cellon-covered E.III, 396/16.** Cross and Cockade International



(Left) **Cellon-covered E.III, 396/16 in flight.** Cross and Cockade International



A Parabellum machine-gun installed on an early E.I. The upper cowling is hinged aside to allow access to the ammunition feed. Cross and Cockade International

The M.7

Urgency of Army orders for his monoplanes had caused Fokker to delay all work on the M.7 biplane, even though he had received orders for seven of the type from the Navy. When the pressure was relieved, he was able to turn his attention once more to the design.

M.7 was Fokker's first 'successful' biplane, his first biplane having been the ill-fated W.2 floatplane. Most of its fuselage

Max Immelman

Oblt Max Immelman was born in Dresden on 21 September 1890. He joined the Dresden Cadet School in 1905 and then served with the 2nd Railway Regiment from 1911, where he became an ensign. He had a period at the War Academy and re-joined his regiment when war was declared in 1914.

He learned to fly in November 1914 and was posted to Flieger Abteilung (FA) 62, where he originally flew the unit's LVG C.Is and then their Fokker monoplanes. He transferred to Kampfeinsitzerkommando (KEK) Douai when it was formed. His first victory was on 1 August 1915 and his score rose rapidly after that.

He was killed in combat with F.E.2bs of 25 Squadron RFC on 18 June 1916. The RFC gave credit to Capt G.R. McCubbin and Cpl J.H. Waller for his death. The Germans claim that he was killed when a faulty synchronization mechanism allowed him to shoot off his own propeller, causing the engine to vibrate and him to crash to his death.

At that time his confirmed score was fifteen and his awards included the Iron Cross 1st and 2nd Class, the Knight's Cross with Swords of the Royal House of Hohenzollern, the Saxon Commander's Cross to the Military St Henry Order 2nd Class, the Knight's Cross to this order, the Saxon Albert Order 2nd Class with Swords, the Saxon Friedrich-August Medal in Silver, the Bavarian Military Merit Order 4th Class with Swords, the Orden Pour le Mérite and a number of lesser awards.

Oberleutnant Max Immelmann.
Cross and Cockade International

Wilhelm Frankl

Ltn Wilhelm Frankl, the son of a Jewish salesman, was born on 20 December 1893 in Hamburg. He learned to fly before the war and was awarded his licence on 20 July 1913. His military flying started as an observer with Feld Flieger Abteilung (FFA) 40 in Flanders and he had risen to the rank of Vizefeldwebel by the end of 1915. He was awarded the Iron Cross 1st Class for shooting down a Voisin with carbine fire on 10 May 1915.

He was transferred to KEK Vaux where he flew Fokker monoplanes and promoted to Leutnant on 16 May 1916. On 1 September he was transferred to Jasta 4, being given command of it on 1 January 1917. He was killed in combat with 48 Squadron RFC when his Albatros D.III was seen to break up in the air on 8 April 1917. He was buried in Berlin Charlottenburg. By this time his score stood at nineteen (possibly twenty) and his other awards included the Iron Cross 2nd Class, the Hanseatic Cross, the Knight's Cross of the Royal House of Hohenzollern Order and the Orden Pour le Mérite. Because of his Jewish origins, he was ignored by the Nazis but, since World War Two, a newly formed German fighter unit has been named after him.

Leutnant Wilhelm Frankl.
Cross and Cockade International

Hans-Joachim Buddecke

Hptmn Hans-Joachim Buddecke was born in Berlin on 22 August 1890 and joined the Army as a cadet in 1904. He was commissioned Leutnant in 1910, but left the Army in 1913 and moved to the USA where he worked in his uncle's car factory. Buying a Nieuport, he learned to fly in America and was planning to start an aeroplane factory there when war was declared, and he returned to Germany and joined the Air Service.

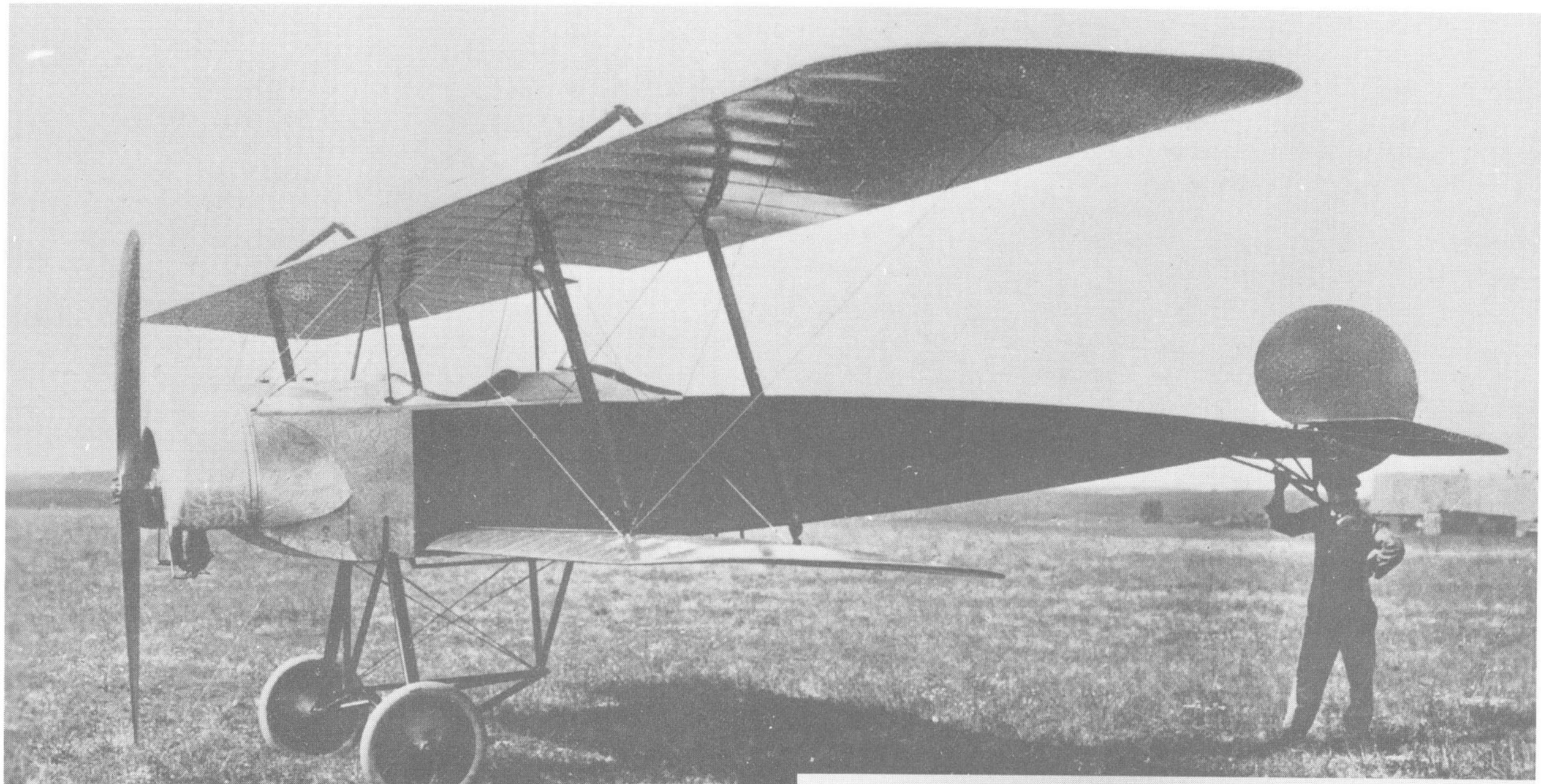
He served with Flieger Abteilung 23 flying Fokker monoplanes. He was sent to join FA6 in Gallipoli where he flew Halberstadt D.II and D.V, and Fokker monoplanes, and built up his score. He was brought back to France in late 1916 and commanded Jasta 4 until he was returned to Turkey in mid-December to fly with the Ottoman FA5. He returned again to France in early 1918 and flew with Jastas 30 and 18. Unused to the intensity of the fighting in France, he was killed by Sopwith Camels of 3 Naval Squadron on 10 March 1918; he was buried in Berlin on 22 March 1918. At the time of his death his score stood at thirteen victories and his awards included the Iron Cross 1st and 2nd Class, the Imtaiz Medal in Silver and Gold, the Saxon Military St Henry Order 4th Class and the Orden Pour le Mérite.

Hauptmann Hans-Joachim Buddecke.
Cross and Cockade International

structure, undercarriage and tail assembly were effectively copies of the welded tubular-steel structures used for the M.8, but there were differences, the most obvious of these being that the M.7 had two cockpits instead of the single large cockpit of the M.8. In the M.7 the pilot was placed at the rear and the observer in front, both cockpits being larger and more comfortable, neatly faired into the fuselage structure and fitted with windscreens. Provision was made for dual control. No armament was fitted. The

M.7 was powered by a seven-cylinder 80hp Oberursal U.0 engine, installed and cowled in the same manner as it was on the M.8.

Like W.2, M.7 was a sesquiplane but, unlike that machine, its short-span lower wing was made in two sections, each of which was attached to sockets welded to fuselage's lower longerons. The long-span upper wing was made in one piece and mounted above the fuselage on a pair of steel tubular inverted-V cabane struts, and connected to the lower wing by two pairs of interplane struts. Directly above these, inverted-V king posts carried the run of the warping control wires and were also used to anchor the wing's bracing cables. The rear edge of the centre-section of the upper wing was cut away to allow the observer



***(Above)* A Fokker M.7 fitted with an 80hp Oberursal engine.** Cross and Cockade International

***(Right)* Fokker M.7.** Cross and Cockade International

***(Below)* A Fokker M.7 of Marine Flieger Abteilung Kiel-Holtenau used as a trainer in early 1915.** Harry Woodman

access to his cockpit and to allow him to see upwards to the rear. Following Fokker's now established practice, both wings were constructed of wood, the lower wing being rigid and the upper fitted with flexible outer panels to facilitate wing warping.

The enforced delay of the M.7 meant that the prototype was not completed until January 1916. Fokker made the first flights in it and tested it for three days before saying that he was satisfied with it. It was also flown by de Waal and Weidner, both of whom found it easy to handle and

with better load capacity than the M.8; it could carry 230kg (500lb) including fuel for 1½ hours' flight. By contemporary standards, its performance was good. Fully loaded, it could climb to a height of 800m (2,600ft) in six minutes and to 2,000m (6,600ft) in twenty-two minutes.

Formal military acceptance trials were delayed until the first production aircraft was available but the prototype was subjected to a sand-loading test at Schwerin early in February, satisfying the Army's inspectors that it was safe. However, while making steep turns at about 60m (200ft) during an acceptance flight in one of the early production models, Alexander von Bismark experienced severe wing flutter, with the control column shaking in his hands. He tried to get the machine down safely but the flexing of the upper wing panels increased until they failed and the M.7 crashed. Both von Bismark and his passenger, Fw Opel, were seriously injured. (Von Bismark was an enthusiastic pre-war sporting pilot and friend of Fokker's who, because of defective eyesight, was unfit for military service, but came to work for Fokker as a factory pilot.)

Investigation suggested that the cause of this flutter was the height of the inverted-V pylons above the wings that, it was thought, meant that the angle of the bracing wires was too shallow to give adequate support. As a result, the height of the pylons was doubled for future production M.7 aircraft. Despite this, the problem persisted and another pilot, Scherff, experienced flutter-induced upper wing failure while gliding down after flight-testing an M.7 that was part of the Austro-Hungarian order for the type. In this case, one of the bracing wires snapped immediately before wing failure and Scherff was lucky to be able to steer the machine into shallow water at the edge of Lake Ostorf. Both Scherff and his passenger, a mechanic named Hoengen, survived the crash though both suffered ill health as a result, Hoengen dying a year later.

The M.7 was subjected to close scrutiny by engineers from Adlershof who blamed the wing attachment bolts and also gave Fokker a severe warning that he must drastically improve his production standards. As a result of these accidents and the investigation that followed, the structure of future M.7s was strengthened (resulting in a much heavier machine), which unfortunately reduced its performance.

The Navy's original order for seven M.7s had been increased to twenty-one by the time that they were ready for production. When completed they were designated the Fokker B and served with coastal defence units at Kiel and Wilhelmshaven. The Army ordered three of the Fokker Bs but, because of the problems experienced and although they had been paid for, they did not go into service with front-line units and may have been relegated to training use, possibly at Schwerin.

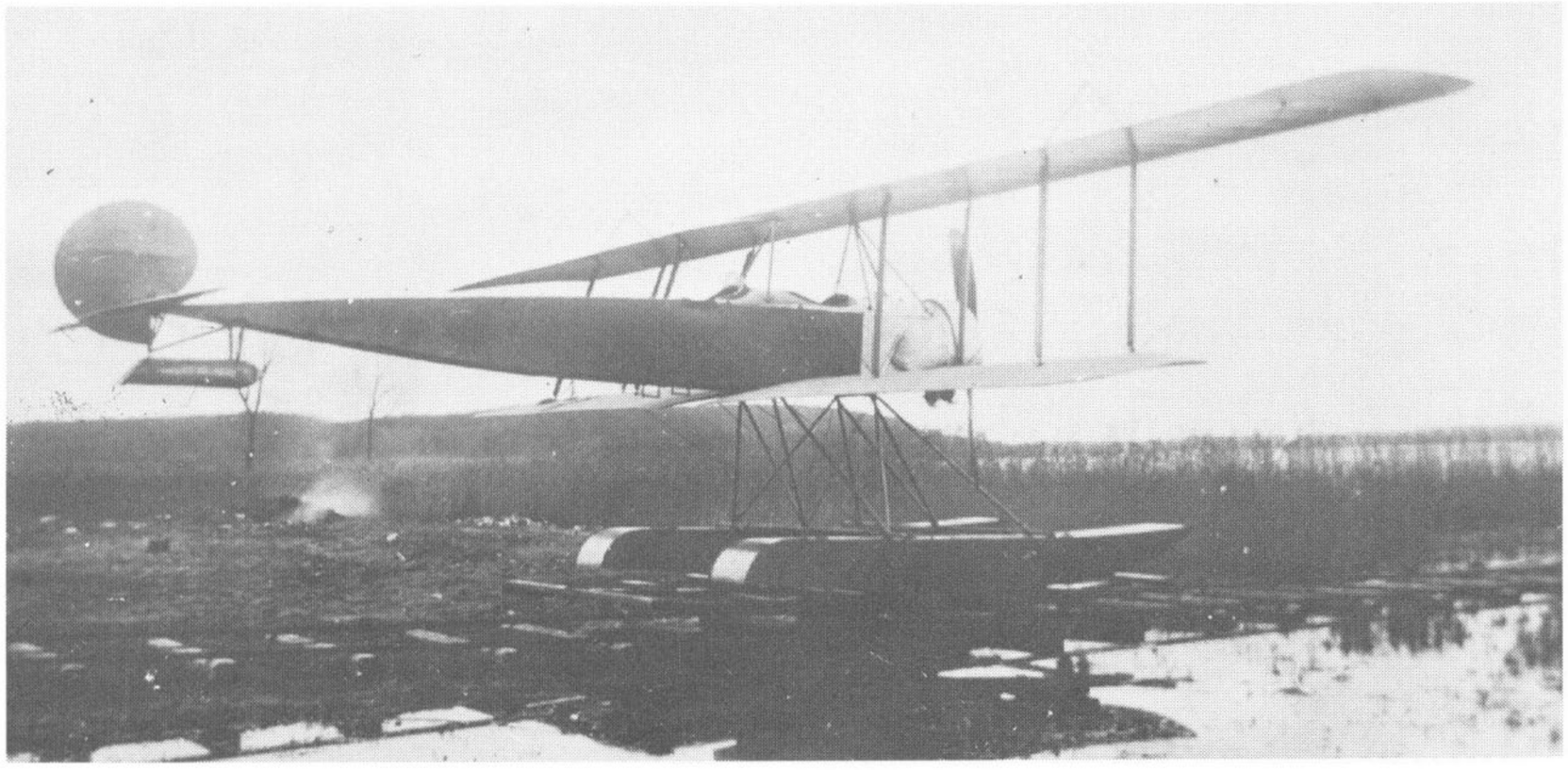
The Austro-Hungarian Army ordered a total of fifteen M.7s. The first twelve were initially designated as 'Fok.1 to Fok.12' but were later re-classified as B.I types with serials in the 03.01 to 03.12 range. They were bought to relieve a critical shortage of aircraft and at first served with front-line units, seeing service with Flik 6 on the Eastern Front, with Fliks 4, 8, 12 and 19 on the Isonzo Front, and with Fliks 16 and 17 in the Tyrol, until early in 1916. The B.Is' slow rate of climb limited their use in mountainous country and they were replaced by machines with better performances. They were then relegated to use as training machines and served in that capacity as late as August 1918.

Specification – Fokker M.7 (Austro-Hungarian – B.I)

Engine:	80hp Oberursal
Weights:	Empty 380kg (838lb); loaded 679kg (1,497lb)
Dimensions:	Upper span 11.70m (38ft 4½in); upper chord 1.50m (4ft 11in); lower span 7.20m (23ft 7½in); lower chord 1.50m (4ft 11in); wing area 26.0sq m (280sq ft); overall length 8.00m (26ft 3in); height 2.95m (9ft 8in)
Performance:	Maximum speed 130km/h (81mph) Rate of climb 1,000m (3,300ft) in 8 minutes, 2,000m (6,600ft) in 15 minutes 30 seconds

The W.3

With his eye firmly on possible naval contracts, and retaining his interest in water-based aeroplanes, Fokker next turned to the modification of the M.7 design as the basis for a new twin-float seaplane. He was able to do this with minimal expenditure; he still had the floats originally built for the W.2 and he had the Navy's permission to convert a rejected M.7 from their contract for the purpose. The main problem to be overcome was that with the added weight of the floats, the M.7's wing area would not provide sufficient lift for the machine to take off from water. The solution was to provide new wings. These were both of greatly increased span and retained the long overhang of the upper wing. Another pair of interplane struts was added and all struts were angled inwards to equalize the lengths of the internal bracing bays. The inverted-V king posts were retained to support the bracing wires and warping cables. A much strengthened undercarriage attached the floats to the fuselage and a third, cylindrical, float replaced the tail skid. Powered by



The W.3 experimental seaplane of 1915. Cross and Cockade International

the ubiquitous 80hp Oberursal U.0 engine, the new floatplane was designated W.3.

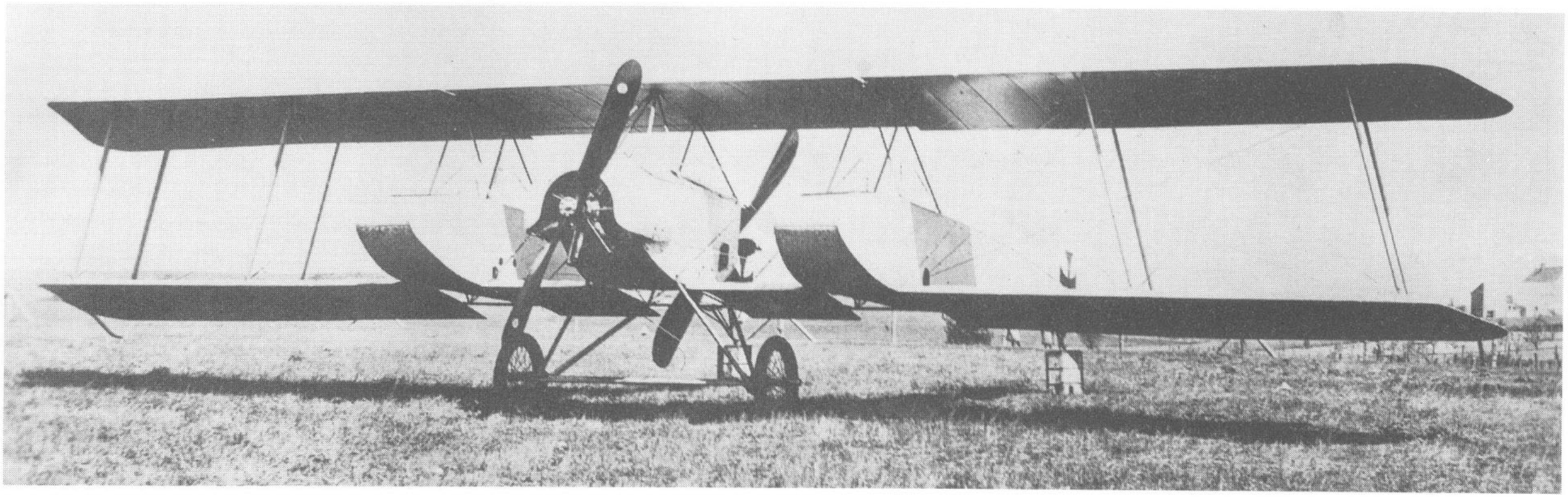
As ever, Fokker carried out the first trials with the new machine. Unfortunately, even with the greatly increased wing area and carrying no payload, it could not take off. After a short time, Fokker lost interest in the project and instead of carrying out further tests and instituting a development programme, he gave up, dismantled the new machine and rebuilt it as a standard M.7 that, on completion, was sent to the Marine-Landflieger Abteilung at Johannisthal where it ended its days in a training role.

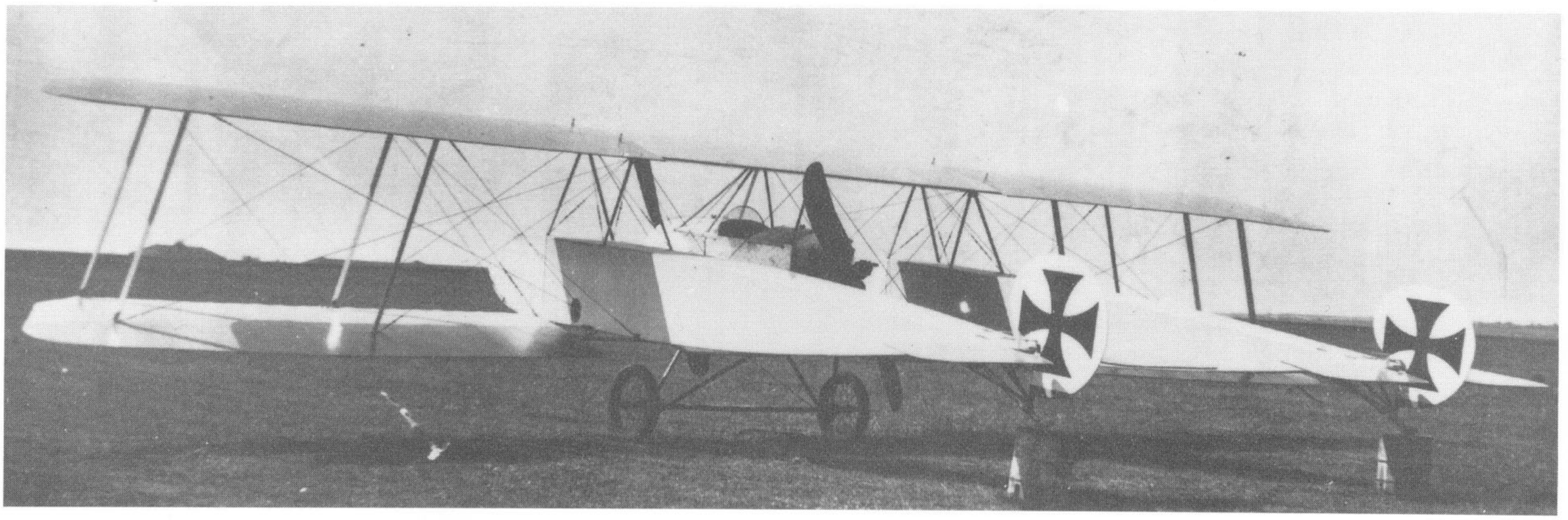
The M.9

Fokker's next venture was inspired by the Army's need for armed two-seaters capable of defending themselves against attack by the Allies' growing force of armed single-seat fighters. Understanding that attack was better than defence, he devised a somewhat bizarre twin-boom machine that carried a machine-gunner at the front of each boom; the pilot was seated in a nacelle mounted between the booms. The machine was fitted with two 80hp Oberursal U.0 engines, one cowled and mounted as a tractor at the front and the second, un-cowled, pushing, at the rear. The two booms were provided by engineless M.7 fuselages modified to have the gunners' cockpits in their noses. Each boom was fitted with its own rudder and tailplane, controlled via extended cable runs from the pilot's cockpit. The booms were joined to the fuselage by a strengthened wing section based on the M.7 upper wing structure. Outboard of the booms, the wings were again based on the M.7 upper wing; they were of equal span and of two bays. Interplane struts were sloped inwards to equalize the lengths of the wing panels. The upper wing was carried on inverted-V struts fitted to each of the booms and the central nacelle. No king posts were fitted above the upper wing and it appears that control was by means of warping the lower wing. Obvious though the requirement now appears, there was no strengthening connection between the rear ends of the booms.

M.9, the resulting aircraft, was a poorly engineered compromise. It was constructed in the cheapest possible manner by using existing components and without serious thought being given to how it would perform in the air – if it ever got there.

Flight testing was brief, a few days at the most. Despite his inherent faith in his own ability, Fokker took a number of precautions before he attempted to fly the M.9. He positioned staff equipped with fire extinguishers at intervals along the take-off path and had others standing by with cars and motor cycles poised to rescue him should it become necessary. M.9 did become airborne, after a lengthy run, but control in flight proved to be difficult. It was extremely tail-heavy and, not surprisingly, the mountings of the booms were not rigid enough to stop them from moving independently in an alarming manner when the wings were warped. Fokker made a second flight with two mechanics seated in the





***(Top)* A Fokker M.9 with two 80hp Oberursal engines.** Cross and Cockade International

***(Above)* Rear view of an M.9.** Cross and Cockade International

gunners' cockpits, hoping that this would overcome the centre of gravity problem

It is possible that, with some serious engineering work being done upon it, the M.9 could have been a success. Other German manufacturers had manufactured successful twin-boom aircraft, the AGO 'C' series being the most obvious. However, Fokker was not prepared to commit his time and resources to the development of M.9, so the prototype was dismantled and quietly forgotten.

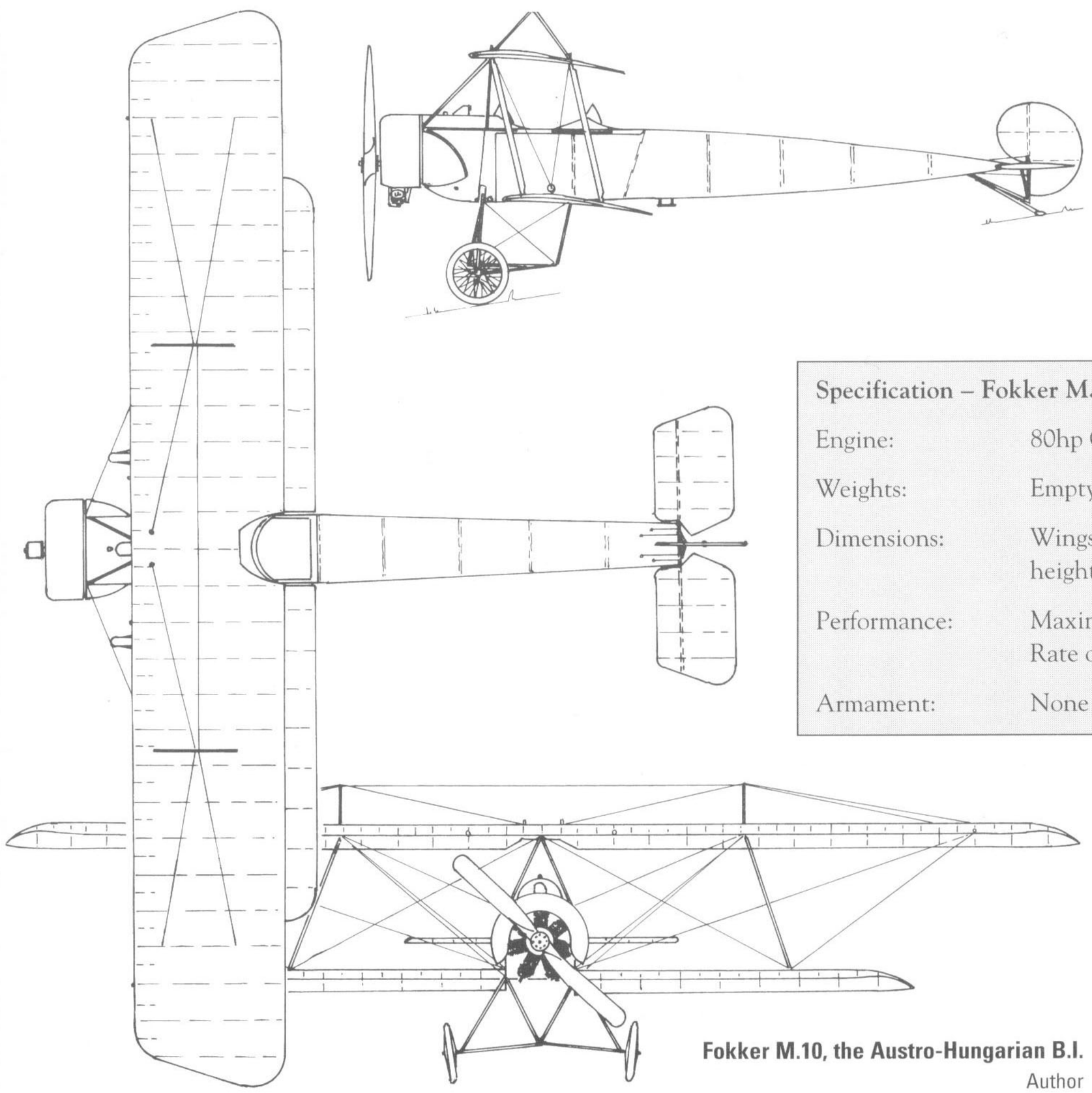
The M.10

Fokker's next project was a development of the M.7. It was designed to meet an Army requirement for an unarmed two-seat aircraft to be equipped with wireless telegraphy equipment and used for artillery liaison. The fuselage was essentially an M.7 fuselage but more space was needed in the forward (observer's) cockpit to allow for installation of the wireless and its ancillaries. This was achieved by moving the warping control levers to the rear. The wings were also of similar construction to those of M.7, but were of greater chord and improved in a number of minor ways. The lower wing was placed further back than that on M.7. The prototype of the new aircraft, now designated M.10, used the same undercarriage, tail assembly and cabane struts as M.7, but had higher inverted-V king posts. Originally it was also fitted with an 80hp Oberursal U.0, but with the additional weight of the wing improvements and wireless equipment, this gave insufficient power. The prototype was therefore modified to accept a 100hp Mercedes water-cooled engine with side-mounted radiators. This was not a success as the additional weight of the engine plus its cooling system absorbed the extra power it provided. The Mercedes was removed and replaced by the lighter 100hp Oberursal U.I rotary.

Two versions of the M.10 concept were built. The first, a single-bay machine designated M.10E – for *einsteilig* (single-bay) – closely followed the design of the prototype, but the mounting of its upper wing was strengthened by the addition of a further pair of steel struts. These were attached to the front end of the fuselage's upper longeron and to the wing at the same point as the front pair of the original cabane struts. This greatly improved the wing mounting which, on the M.7, had been a weak feature. Lateral control was poor, being achieved by the warping of only the outer panels of the upper wing. The additional weight, gained from the installation of the wireless and other military equipment, seriously affected the performance of the M.10E which was normally fitted with the 80hp Oberursal U.0, and so seriously underpowered. A number were built for the Army and saw active service in various theatres including the Eastern Front. The Austro-Hungarian Army bought a total of twenty-three of the type and these also saw active service. Both Armies eventually relegated their M.10Es to a training role

The second version was designed to overcome the problems of weight and low engine power. Fitted with new two-bay fully warping wings of equal span, it was designated M.10Z, the Z standing for *zweistielig* (two-bay). Power was normally provided by the 100hp U.I engine, though some machines used purely for training may have been fitted with the 80hp U.0.

The prototype M.10Z was accepted by the Army at Schwerin on 17 November 1915 and then sent on to Adlershof for further trials, where it arrived on 13 December. In German service it was designated as the Fokker B.II and small batches were bought for both the Army and Navy. The Austro-Hungarian Army also bought a small number. A small number of M.10Z machines saw service on the Eastern Front. M.10s were still in use in the training role until late 1917.



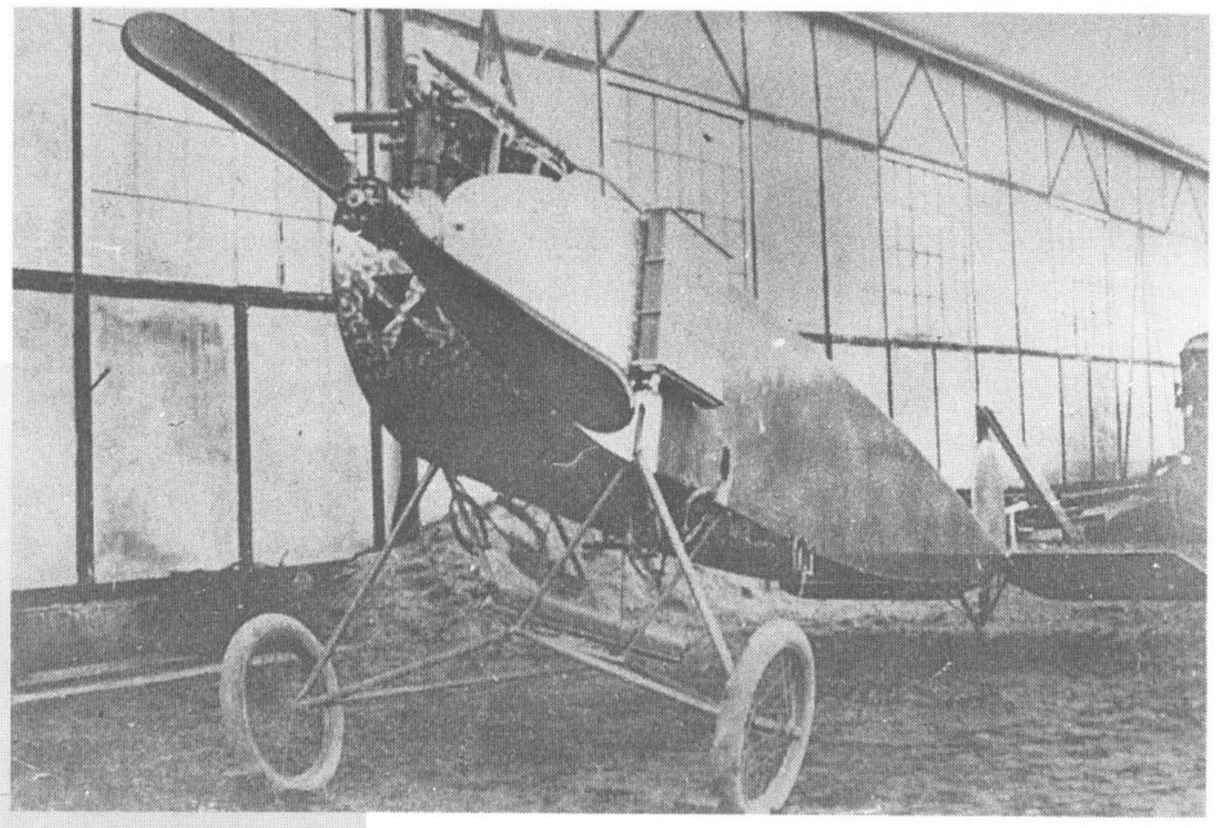
Fokker M.10, the Austro-Hungarian B.I.
Author

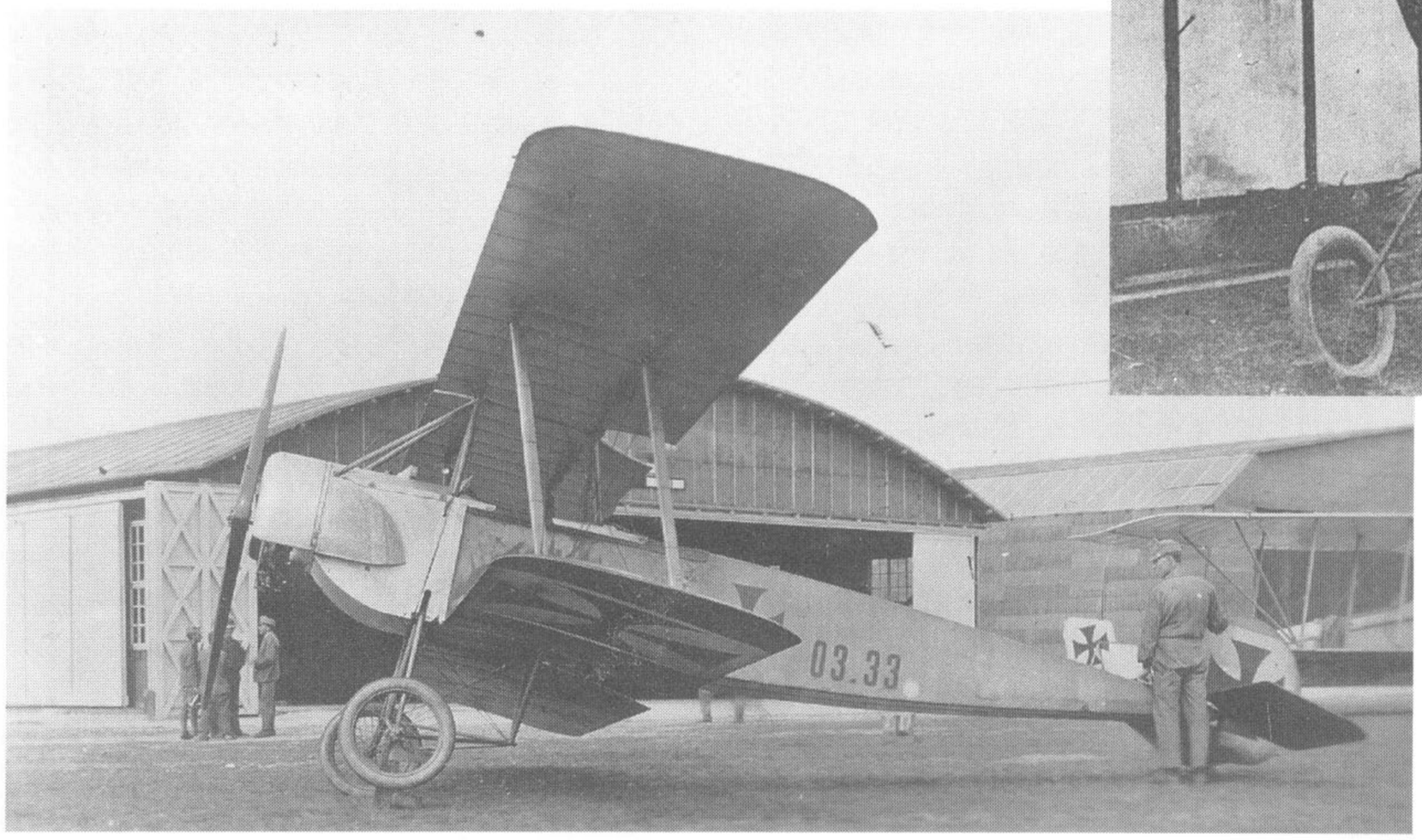
Specification – Fokker M.10 (Austro-Hungarian – B.I)	
Engine:	80hp Oberursal
Weights:	Empty 409kg (900lb); loaded 712kg (1,570lb)
Dimensions:	Wingspan 11.30m (37ft 1in); length 7.50m (24ft 7in); height 2.50m (8ft 2in)
Performance:	Maximum speed 130km/h (81mph) Rate of climb 2,000m (6,600ft) in 25 minutes
Armament:	None fitted

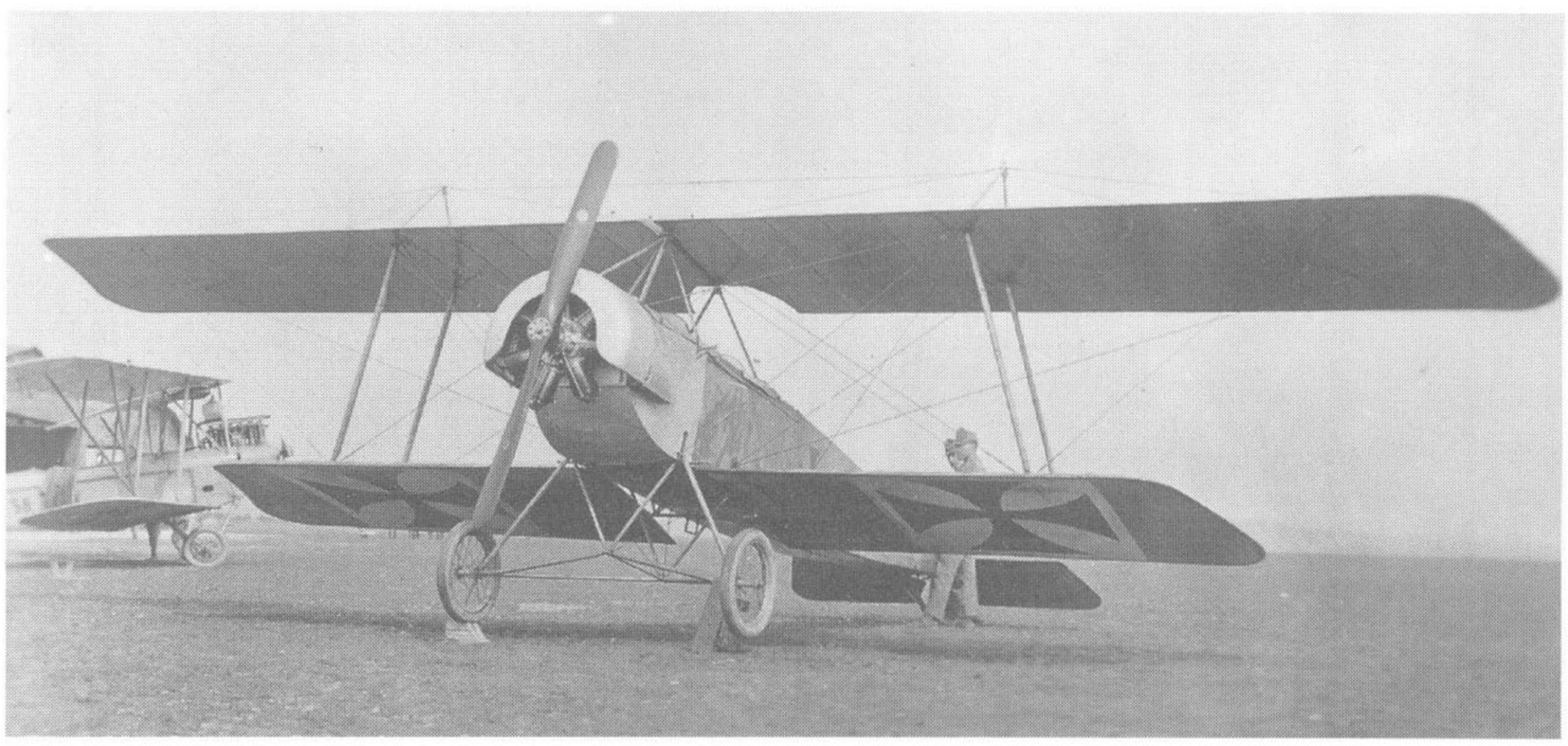
***(Right)* Basic fuselage of the original Fokker M.10 fitted with a 100hp Mercedes engine.** Cross and Cockade International

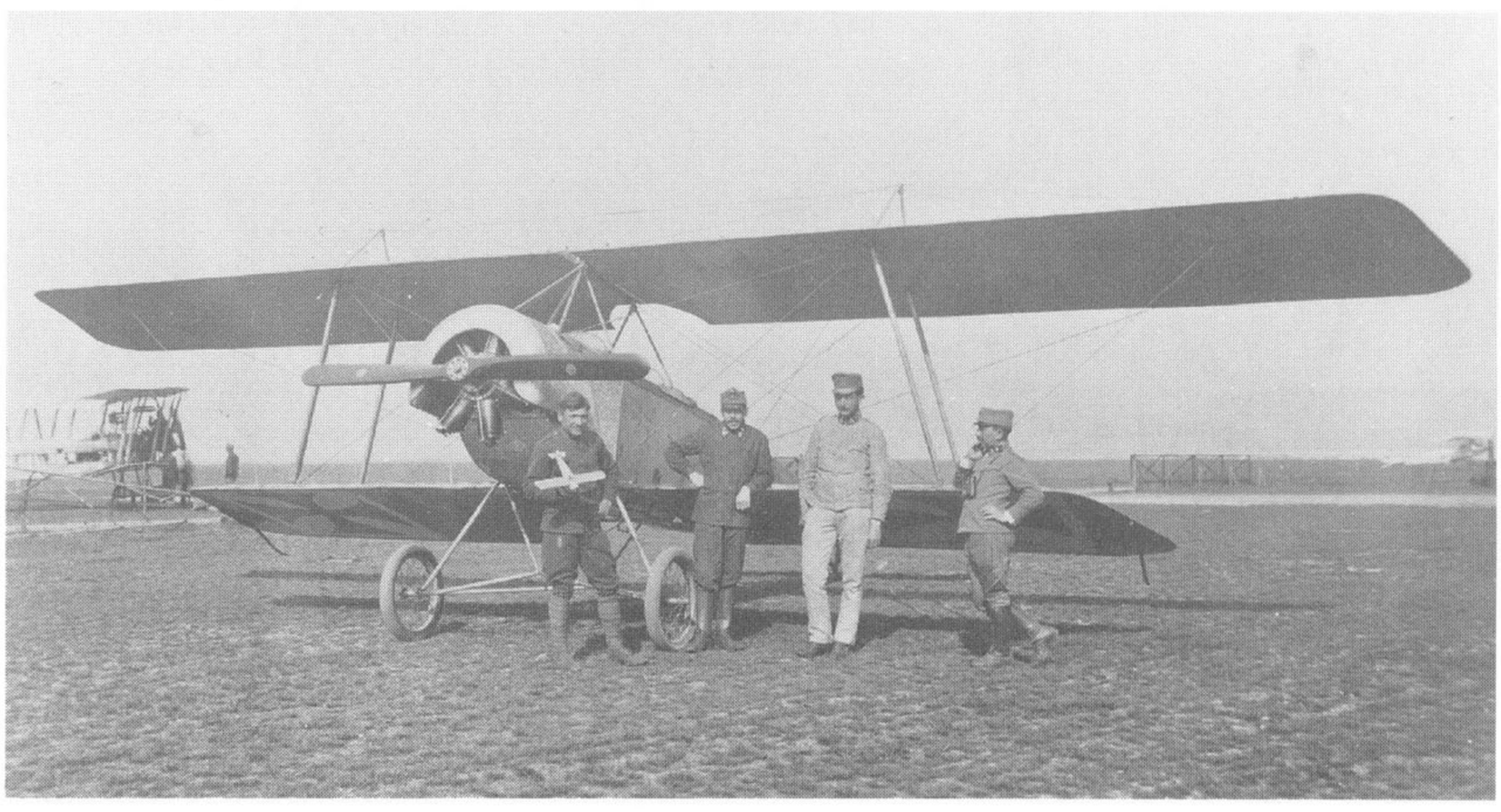
***(Top)* Austrian M.10E 03.33.** Cross and Cockade International

***(Middle & bottom)* Two views of an M.10E, probably also 03.33.** Cross and Cockade International







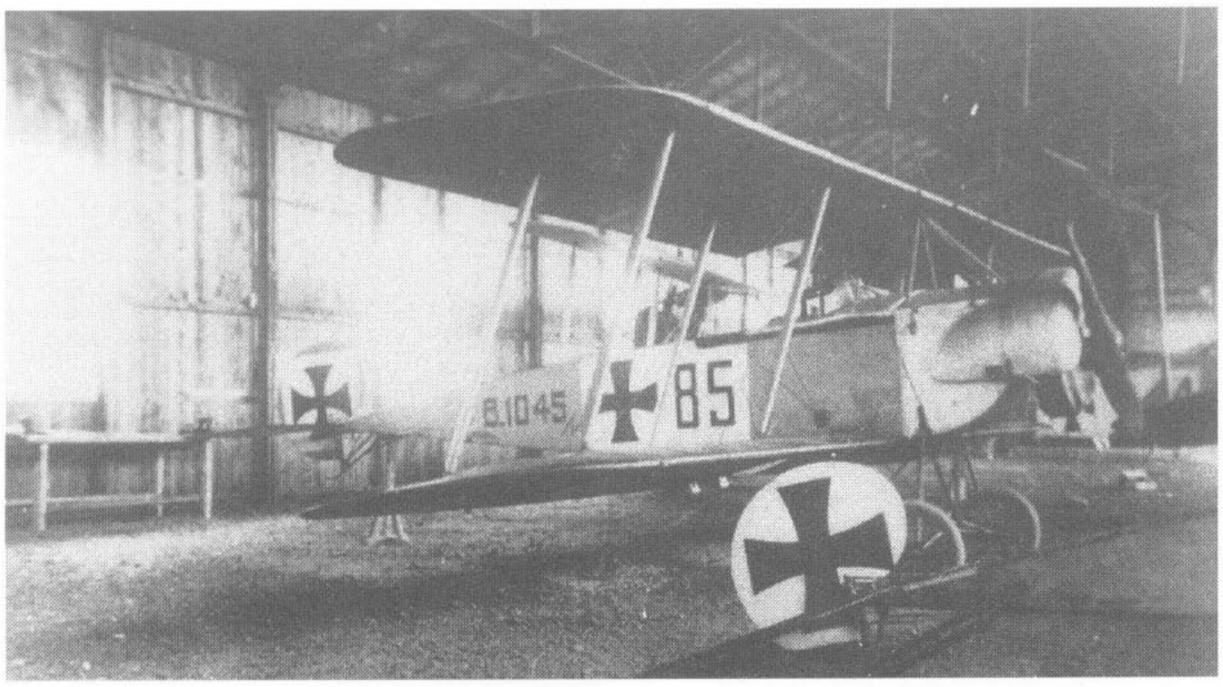


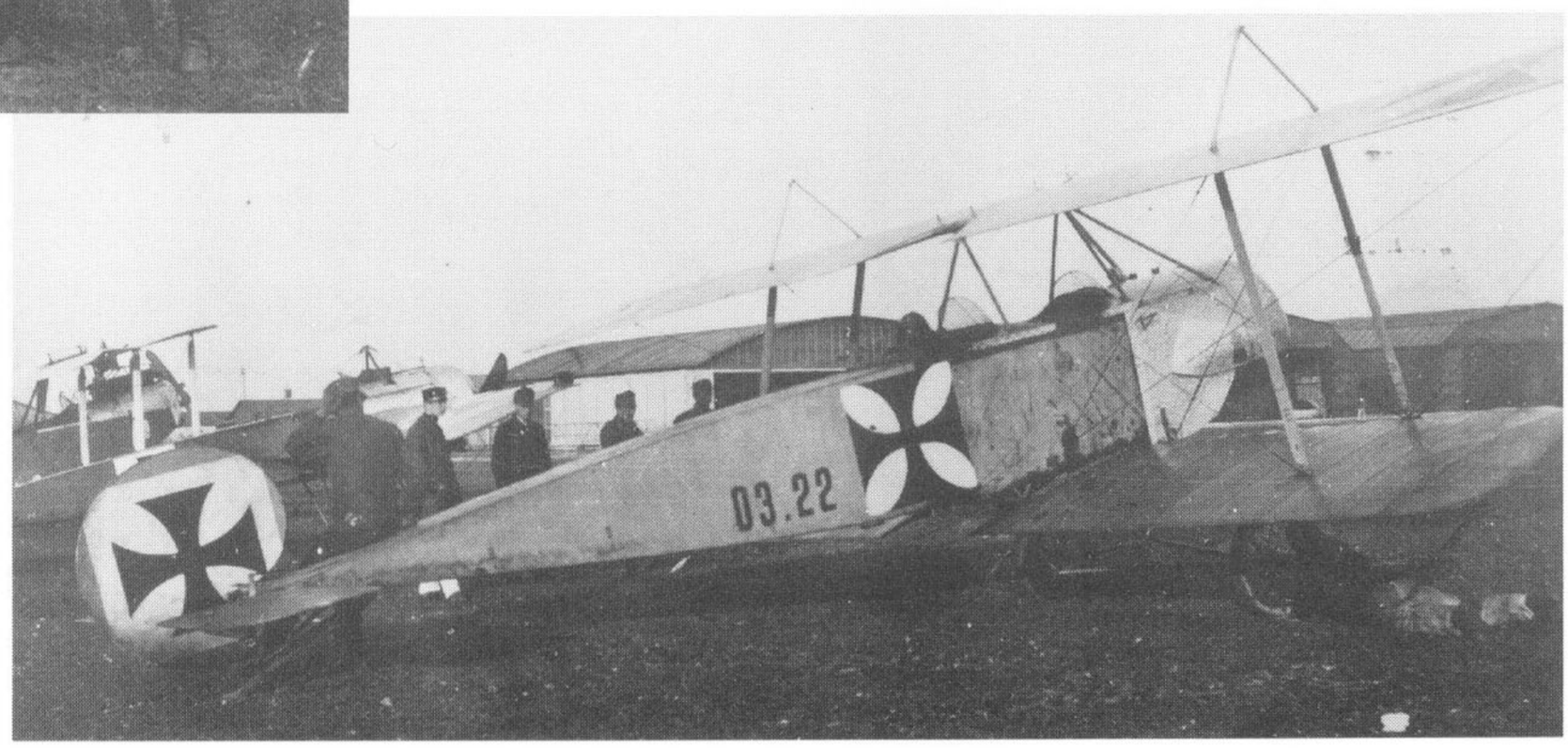
The Search for a New Fighter

By the spring of 1916 the days of the Fokker *Eindeckern* were numbered. The Allies had countered the 'Fokker Menace' by the introduction of their own new machines with forward-firing machine-guns. The performance of such as the French Nieuport 11 *Bébé*, the British Airco D.H.2 and the Royal Aircraft Factory F.E.2 and F.E.8 eclipsed that of the Fokker machines. The E-series would continue to provide useful service on the quieter fronts – Russia, the East and Italy – where the opposition was less demanding but, on the Western Front, they now became the hunted.

The German Air Service reacted promptly, issued a requirement for a new biplane fighter and asked all of its major suppliers to submit prototypes for consideration. In view of his earlier success with his monoplanes, it was expected that Fokker would be amongst the first to respond and come forward with a proposal, but this was not the case. Fokker's cultivation of Germany's fighting pilots had made him well aware of what they wanted to see in fighter aircraft. They had to possess a rapid rate of climb, good manoeuvrability, performance at altitude and sufficient firepower to ensure a quick, decisive victory. They also had to be capable of operation from small and rough landing fields, and be easy to maintain in service conditions. This 'specification' presented a major problem: none of Fokker's existing designs, the outdated monoplanes, the M.7 or the M.10 provided a suitable basis for a new design able to meet it. A major rethink was required.

The first consideration had to be the engine, as whatever was selected would directly affect the size and weight of the



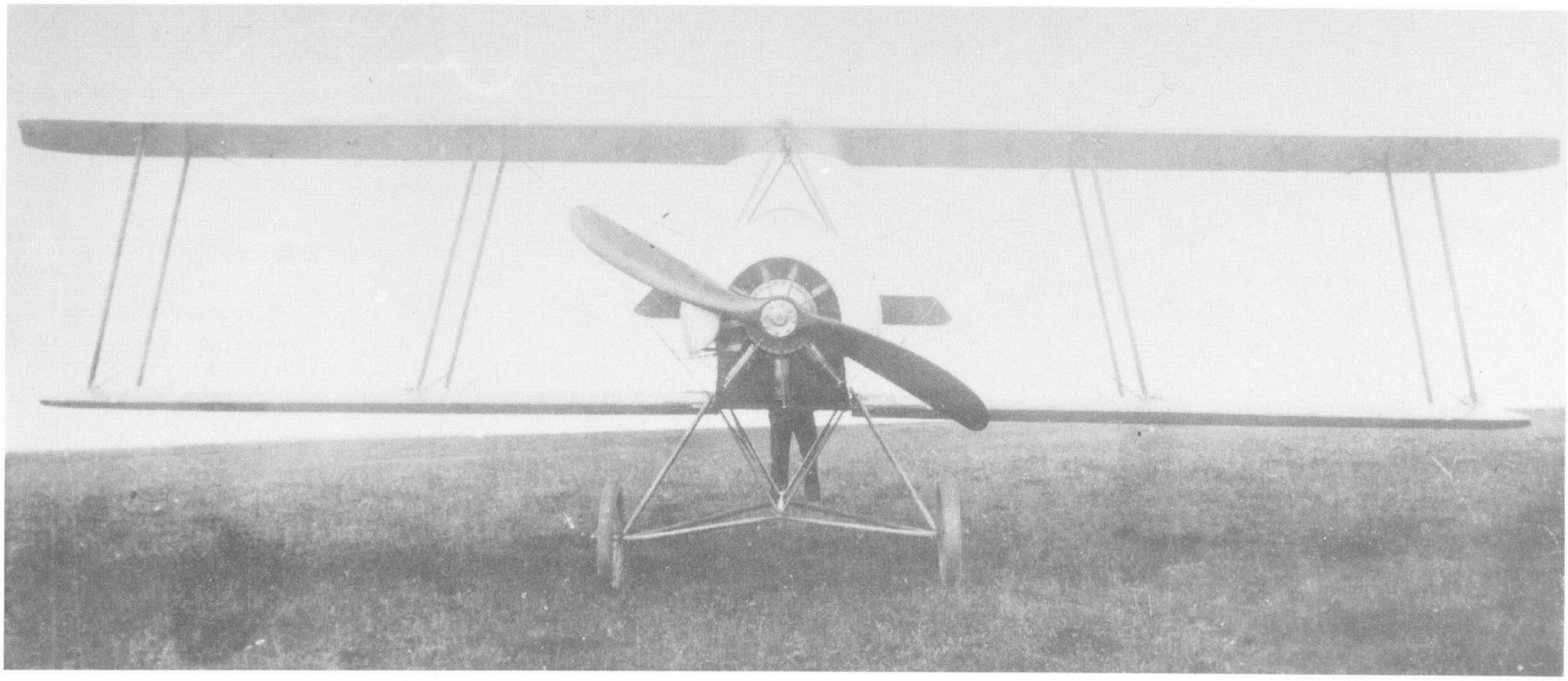


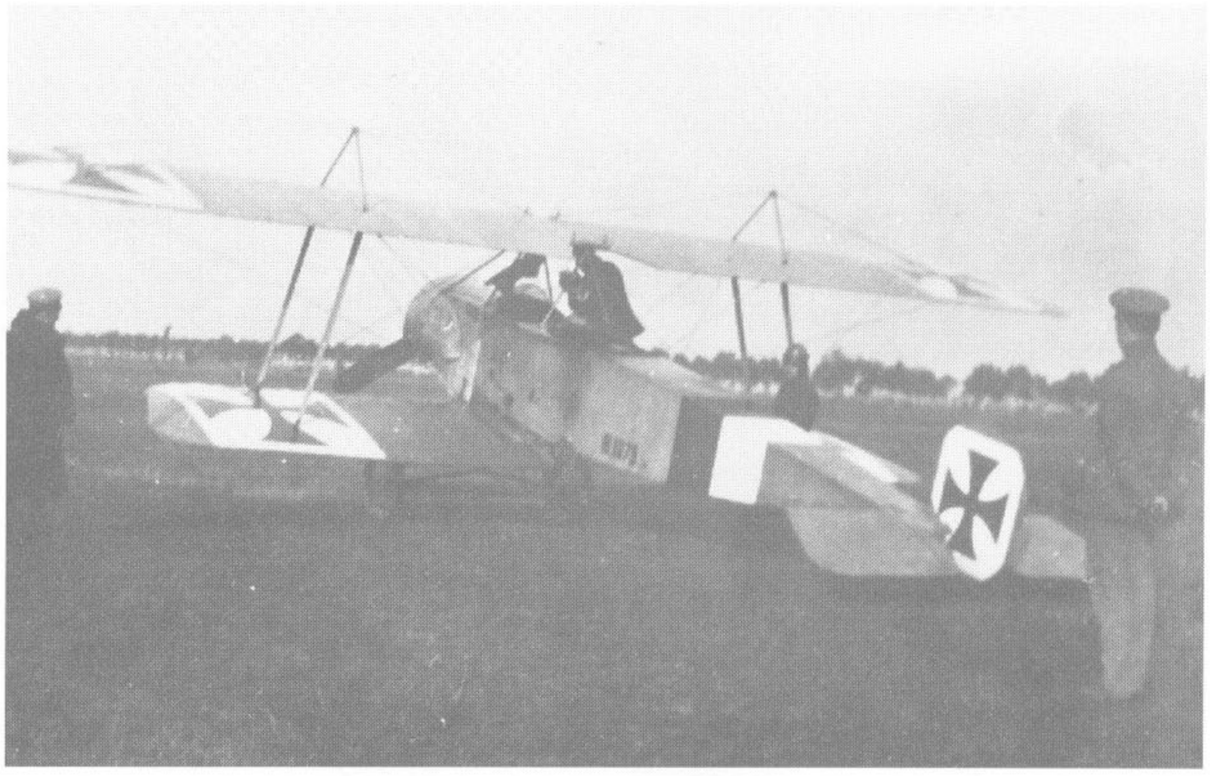
***(Top)* Fokker's workforce assembled in front of an M.10 – date unknown.** Cross and Cockade International

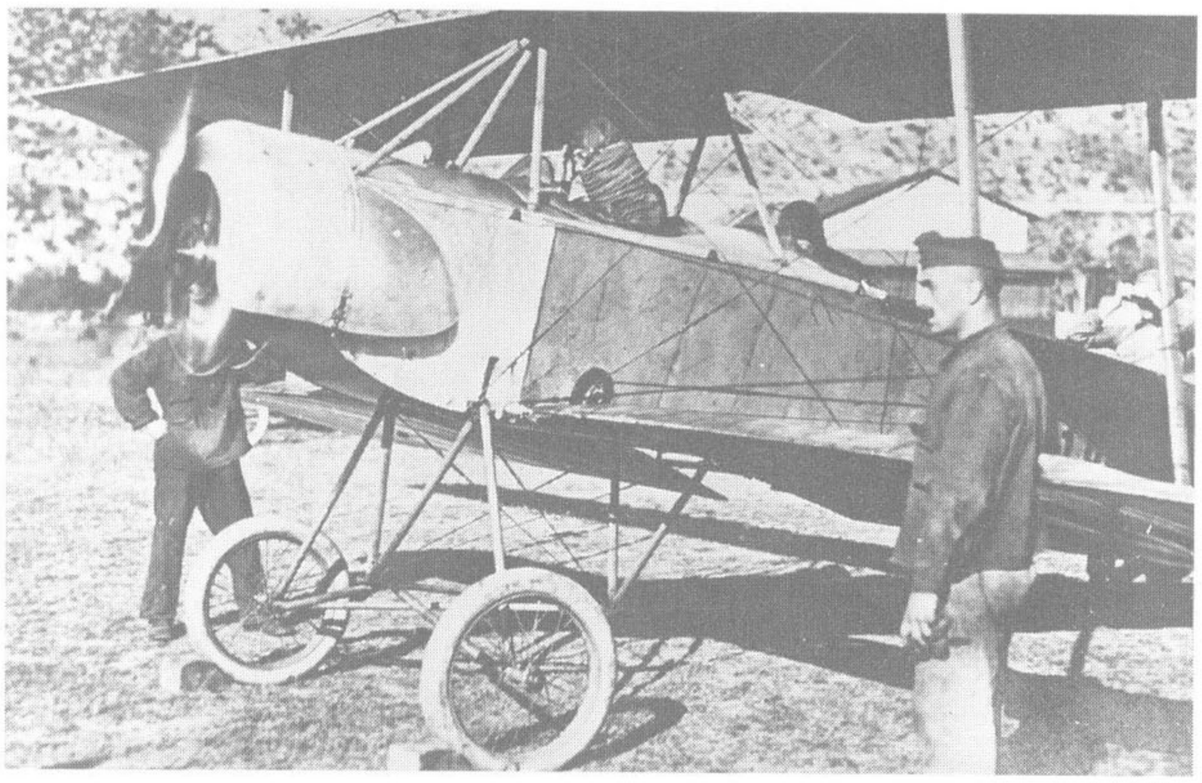
***(Above)* An M.10Z of Flieger Ersatz Abteilung 10.** Harry Woodman

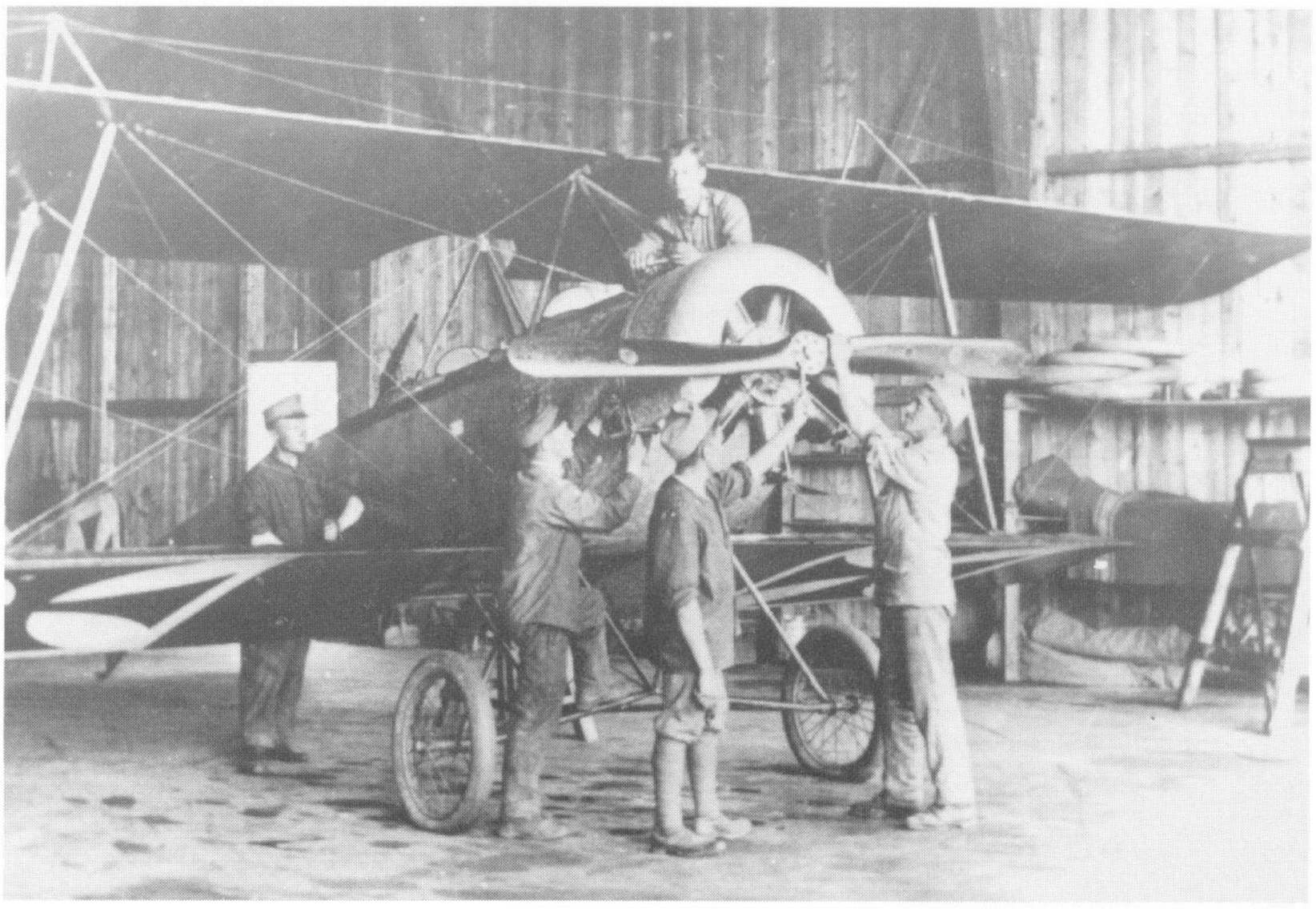
***(Above right)* Fokker M.10 B.1045/16 with the tail of an E.III in the foreground.** Cross and Cockade International

***(Right)* 03.22, an Austrian M.10.** Cross and Cockade International







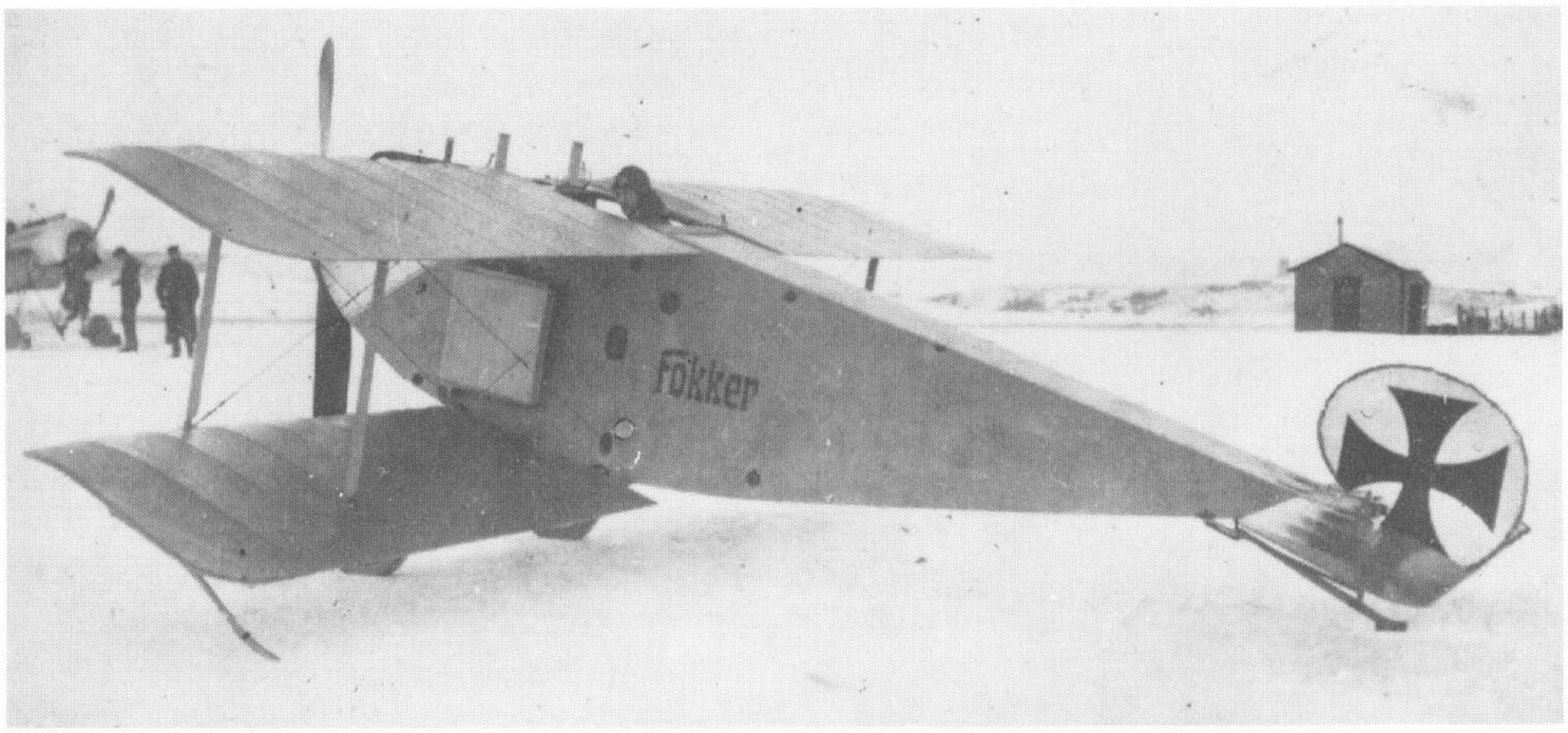


(Top) **A Fokker M.10.** Cross and Cockade International

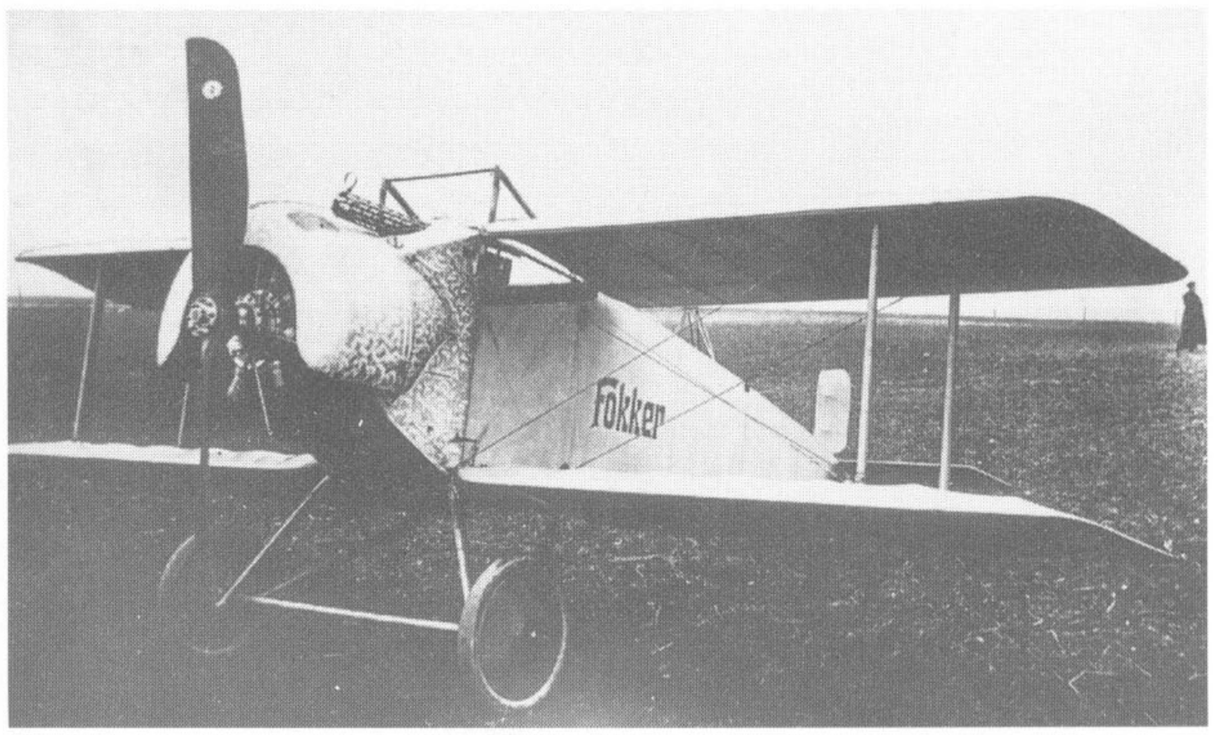
(Above left) **Fokker M.10 B.1079/16 of Flieger Abteilung 9b. The application of national and individual markings is interesting.** Cross and Cockade International

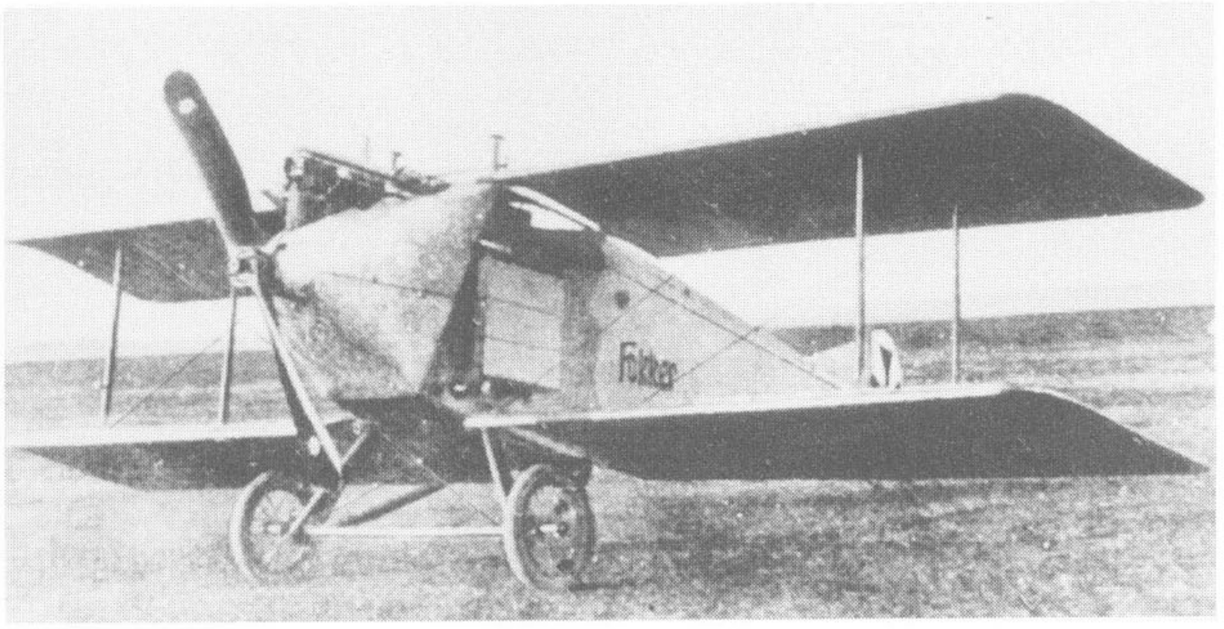
(Above) **An Austrian M.10 – the serial number in the '03' range is hidden by shadow.** Cross and Cockade International

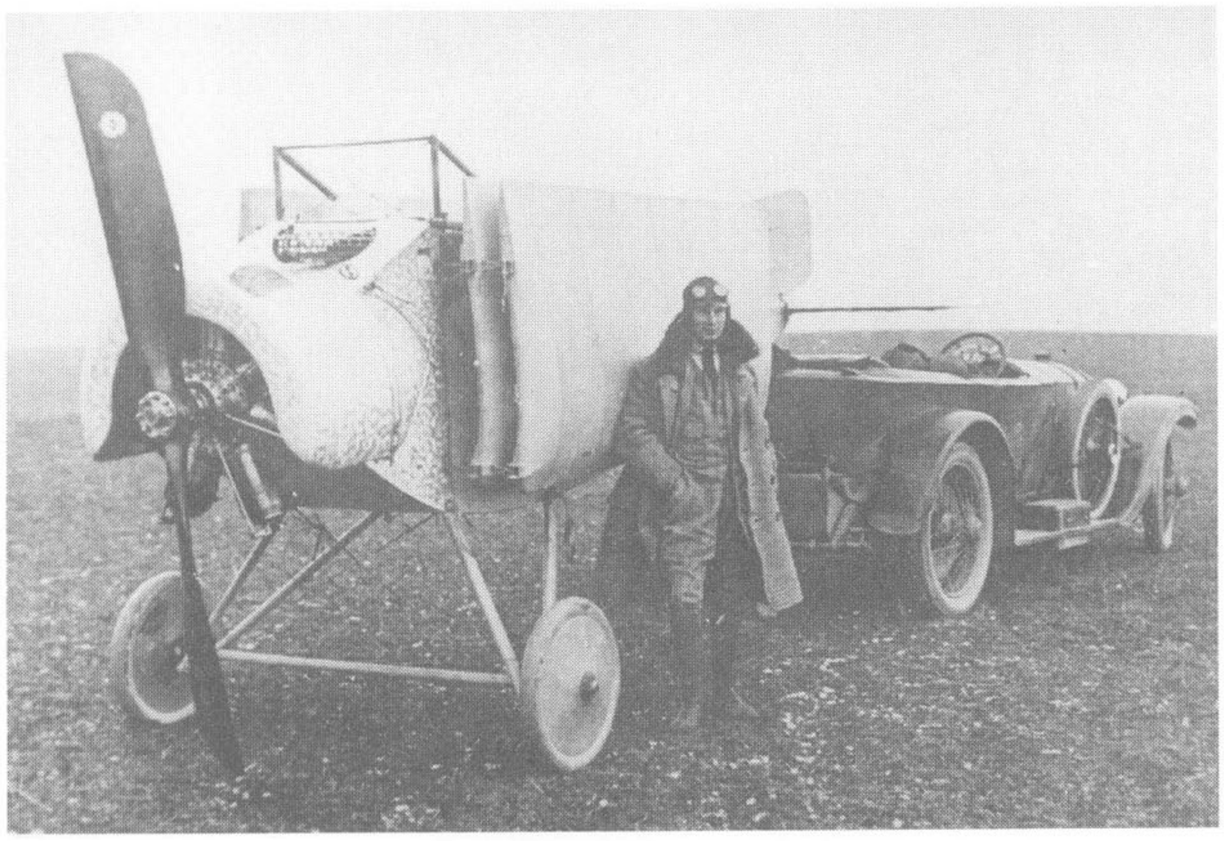
(Left) **Austrian M.10/B.I 03.37 of Flik 16 at Villach in the autumn of 1915.** Bernd Tötschinger

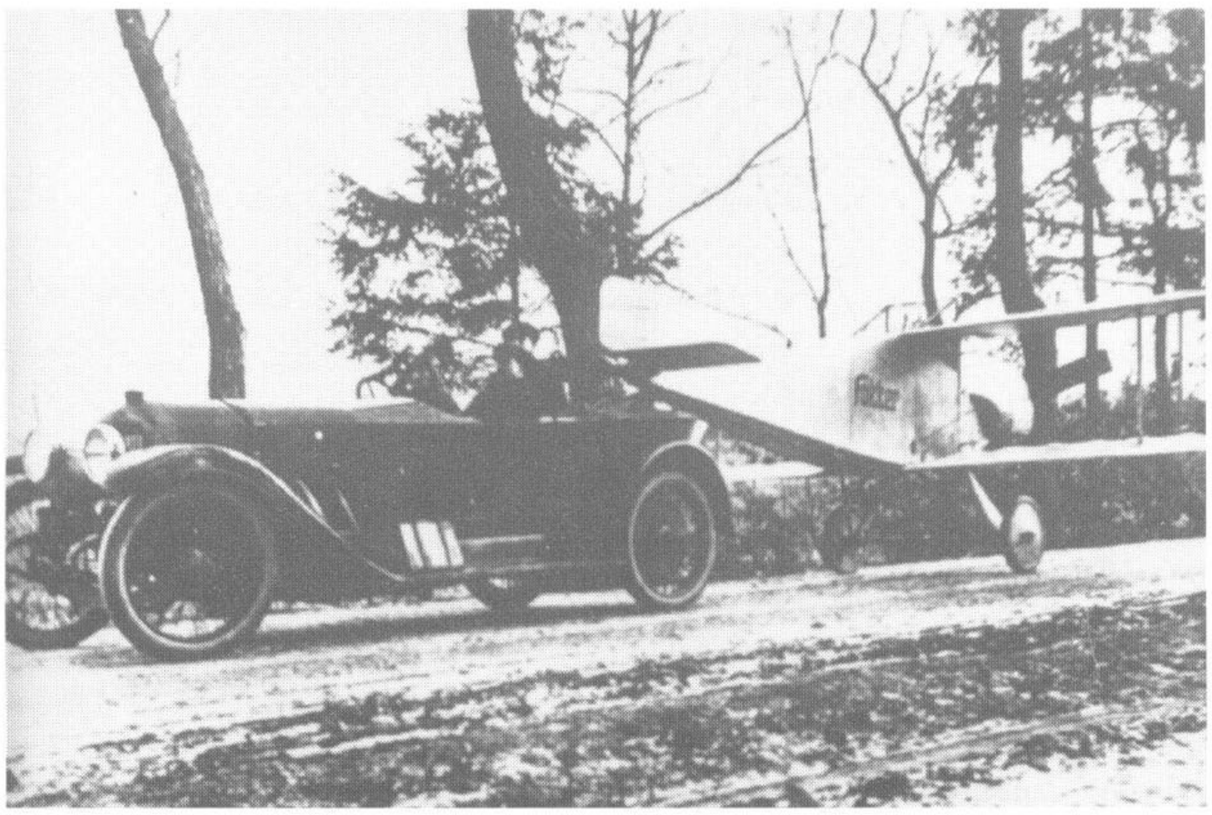


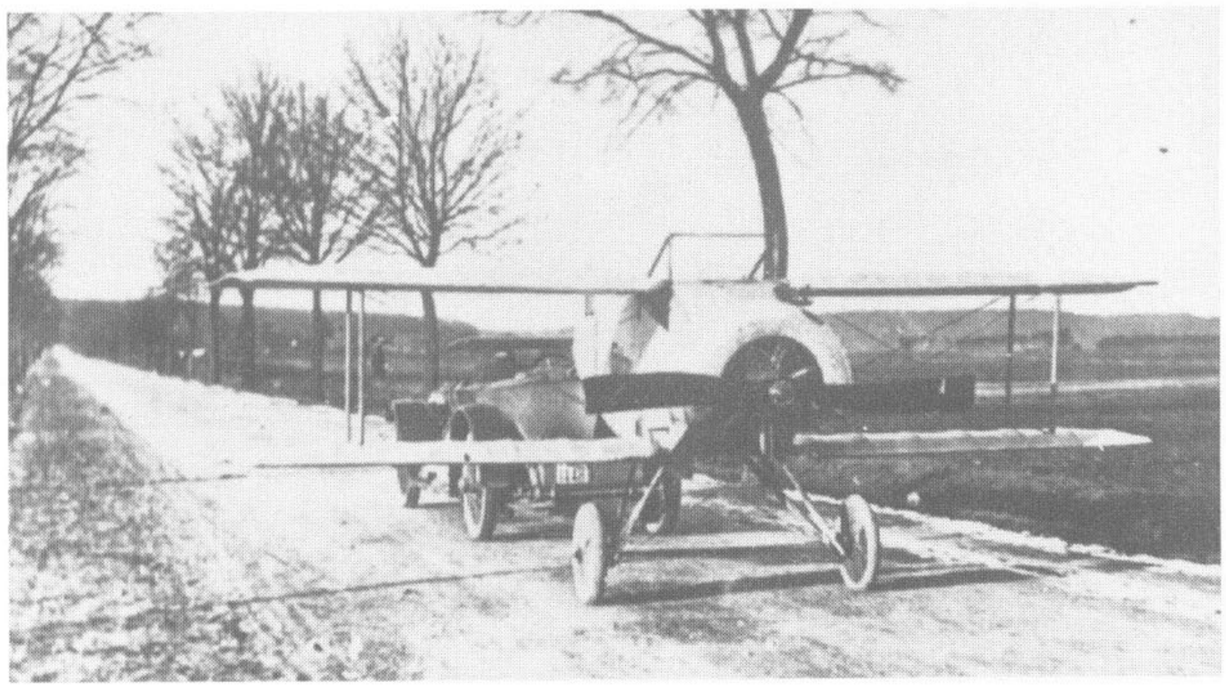
structure. It had to possess a good power-to-weight ratio, be reliable and, ideally, already be in quantity production. Fokker favoured the use of an air-cooled rotary engine as these tended to be lighter and less complicated than their water-cooled equivalents. However, his experience with the E.IV had made him wary of the 160hp Oberursal UR.III. It did provide greater power than the earlier Oberursal products and thus gave greater speed in a straight line, but its fourteen-cylinder, twin-row configuration created a greater gyroscopic effect. This would seriously compromise the manoeuvrability of a light machine,











***(Top)* The Fokker M.16E, nicknamed *Karausche* (carp), an experimental fighter that did not go into production. It is seen in the winter of 1915–16.** Harry Woodman

***(Above)* Fokker M.17E.** Cross and Cockade International

***(Above right)* Fokker M.18.** Cross and Cockade International

***(Right)* Fokker standing by an M.17E, demonstrating its transportability by road.** Harry Woodman

***(Below & below right)* Two views of an M.17 being towed by car in an undismantled condition.** Cross and Cockade International

making it impossible to turn quickly without blipping the engine – which would result in loss of height.

A water-cooled engine such as the 160hp Mercedes D.III would be reliable and provide suitable power, but the penalty was a cooling system that added substantially to its overall weight. This in turn would require a larger and stronger, and so heavier, airframe to support it. Further, his sources of information led him to understand that one of his competitors, Albatros, was absorbing all the water-cooled engines being produced and that he stood little chance of getting the numbers that he would need.

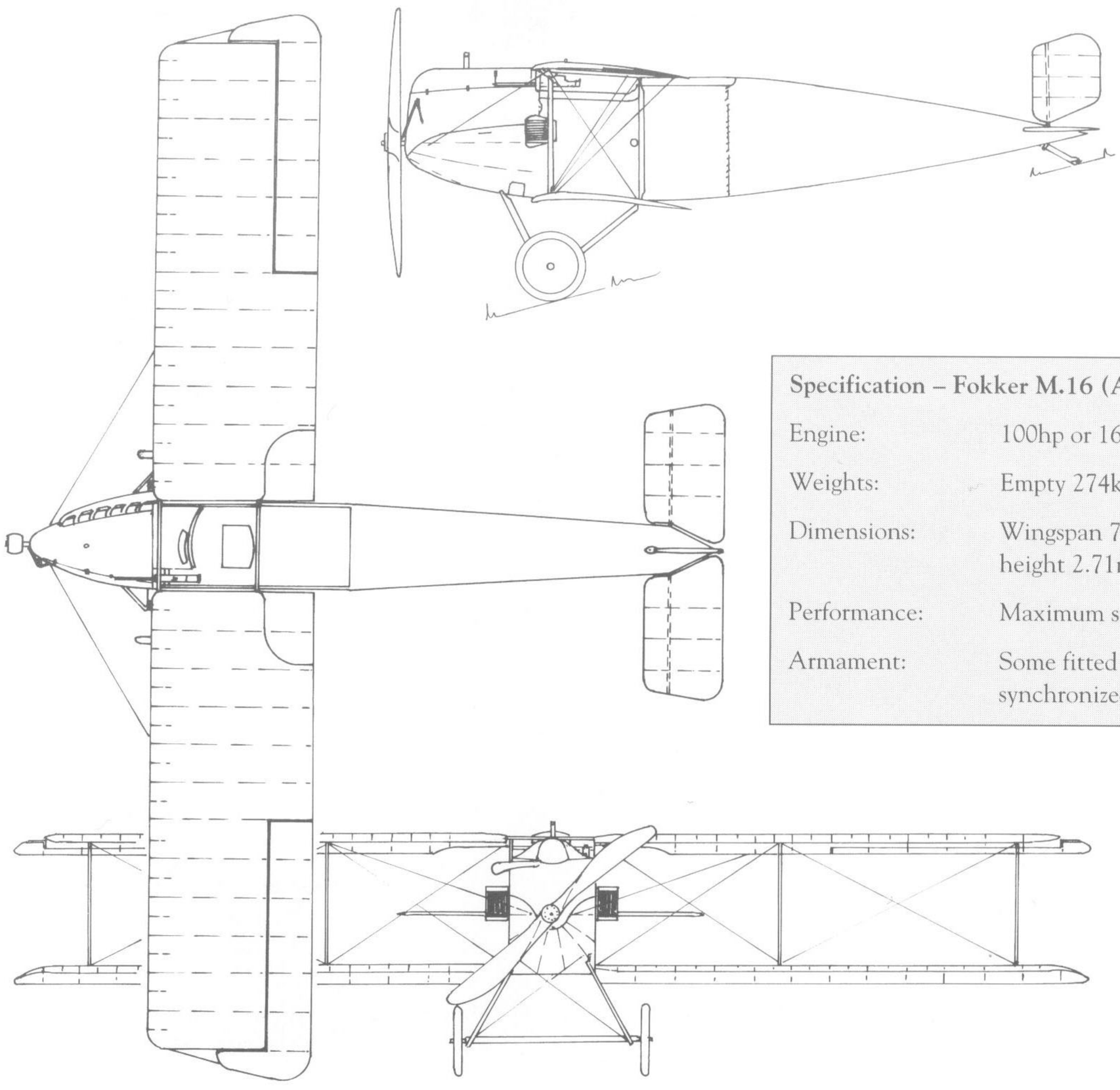
He was thus driven to select the 100hp Oberursal UR.I rotary. Other, more powerful, rotary engines were being developed by both Goebel and Siemens, but they were unlikely to be available in a reliable production form in time and anyway would cause the same problems that had been created by the UR.III.

Having made the choice of an engine, Fokker could now consider the airframe. His preference was for a small machine fitted with equal-span wings that, he felt, gave the best manoeuvrability. He considered that wing-warping gave more positive control than ailerons, and it was certainly cheaper to produce. (This view was not accepted by officials at Adlershof who were concerned that, in combat, a single bullet could cut a bracing wire and lead to the immediate collapse of the wing structure.) A small and light machine would also be easier to operate from restricted landing grounds at the front. One feature that he did retain from his M.5 design was its wing's aerofoil section that, having proved to be effective, would introduce no unknowns to be solved.

By now, Fokker had firmly established his preferred method of airframe construction. Wings were built up in the (then) conventional manner from wood. Fuselages, tail assemblies and undercarriages were welded assemblies of light, commercial-quality, seamless mild-steel tubing. Fokker's use of this practice was to continue throughout the war years.

Shrewd businessman that he was, Fokker chose to explore both water-cooled and air-cooled engines for his next prototypes. Thus M.16 and M.18 were both fitted with water-cooled engines while M.17 and M.19 were fitted with air-cooled rotary engines. It was also planned that each type should be available in either a single- or a two-seat version. The single-seat version would have single-bay wings and be identified by an 'E' (*einsteilig*) suffix. The two-seat version would be of longer span, with a two-bay configuration giving a greater wing area. This would be identified by a 'Z' (*zweistielig*) suffix. Paying attention to the stated official preference regarding control systems, all versions would be available with either wing warping or ailerons.

The first prototype of the series to be completed was M.16E. This was a single-bay biplane with a deep fuselage (slightly less deep than the wing chord). The top and bottom wing panels were of a similar shape and size and used the M.5 aerofoil section. The lower wings were fastened directly to the lower fuselage longerons. The rear spar of the upper wing was attached to the upper fuselage longeron, but the forward spar was attached to the fuselage via short steel cabane struts. The pilot's cockpit was located between the upper wing panels, and his seat was positioned so that his head and a small part of his shoulders protruded above the upper surface of the upper wing. This gave him excellent all-around vision at that level and above. His downward and forward views were poor, being limited by the wings beside him and the shaped metal engine cowling in front of him. M.17E was fitted with a water-cooled 100hp Mercedes



Fokker M.16. Author

Specification – Fokker M.16 (Austro-Hungarian – B.II)	
Engine:	100hp or 160hp Mercedes, or 185hp or 200hp Austro-Daimler
Weights:	Empty 274kg (604lb); loaded 481kg (1,060lb)
Dimensions:	Wingspan 7.20m (23ft 7in); length 6.20m (20ft 4in); height 2.71m (8ft 11in)
Performance:	Maximum speed 130km/h (81mph)
Armament:	Some fitted with one Bergmann LMG 15nA machine-gun synchronized to fire through the propeller arc

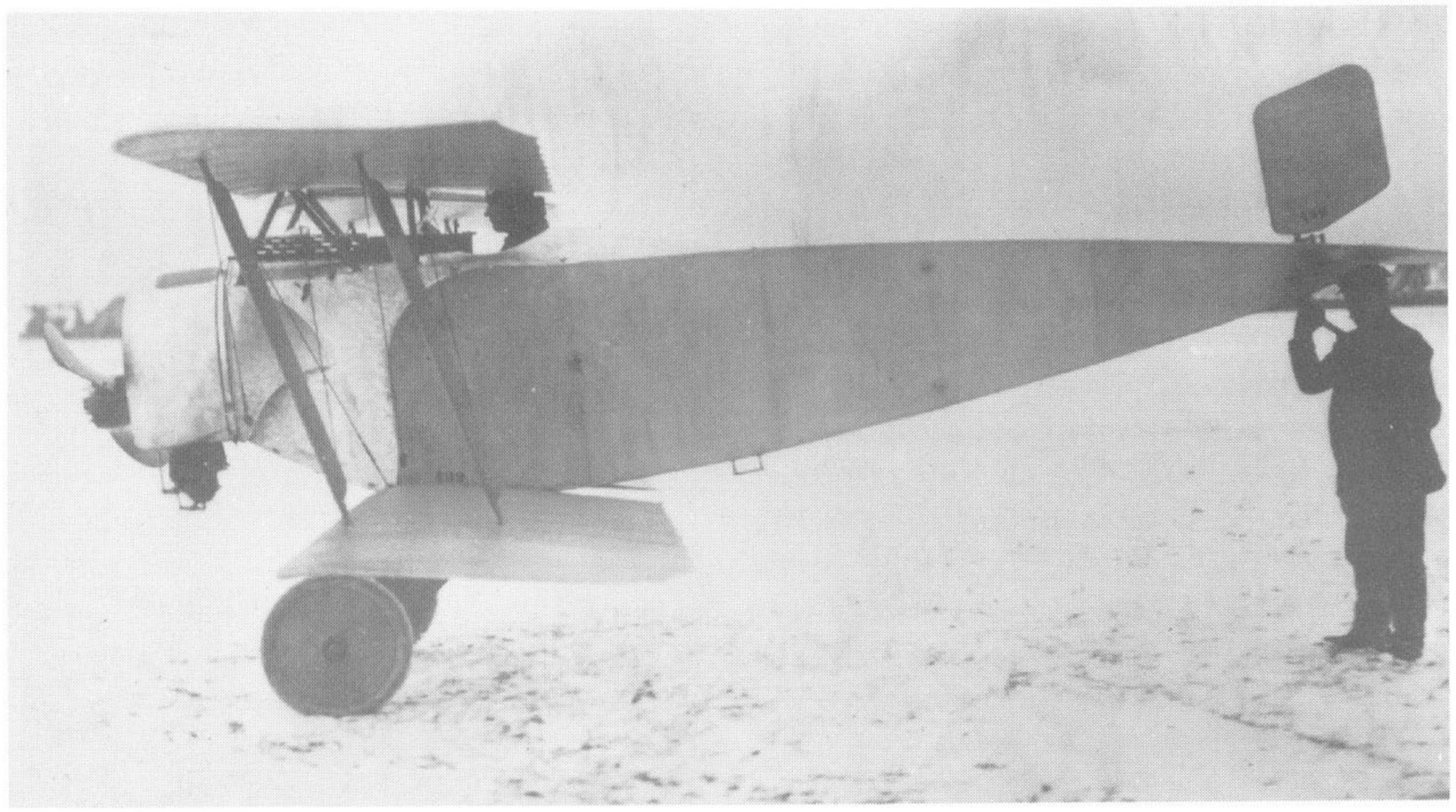
D.I engine with cooling radiator panels fitted to either side of the fuselage, slightly in front of the cockpit. The rear of the fuselage ended in a horizontal knife-edge similar to that of the M.5-series aircraft.

The tail assembly was also similar in shape and design to those of the M.5 series: a comma-shaped rudder and tailplanes carried on a single steel tubular spar. The undercarriage, a new departure, was a simple V-shape with the wheel axle carried on bungee cord springs. The wings and undercarriage were wire-braced, and lateral control was by means of warping wings. It was fitted with a single LMG 08/15 machine-gun.

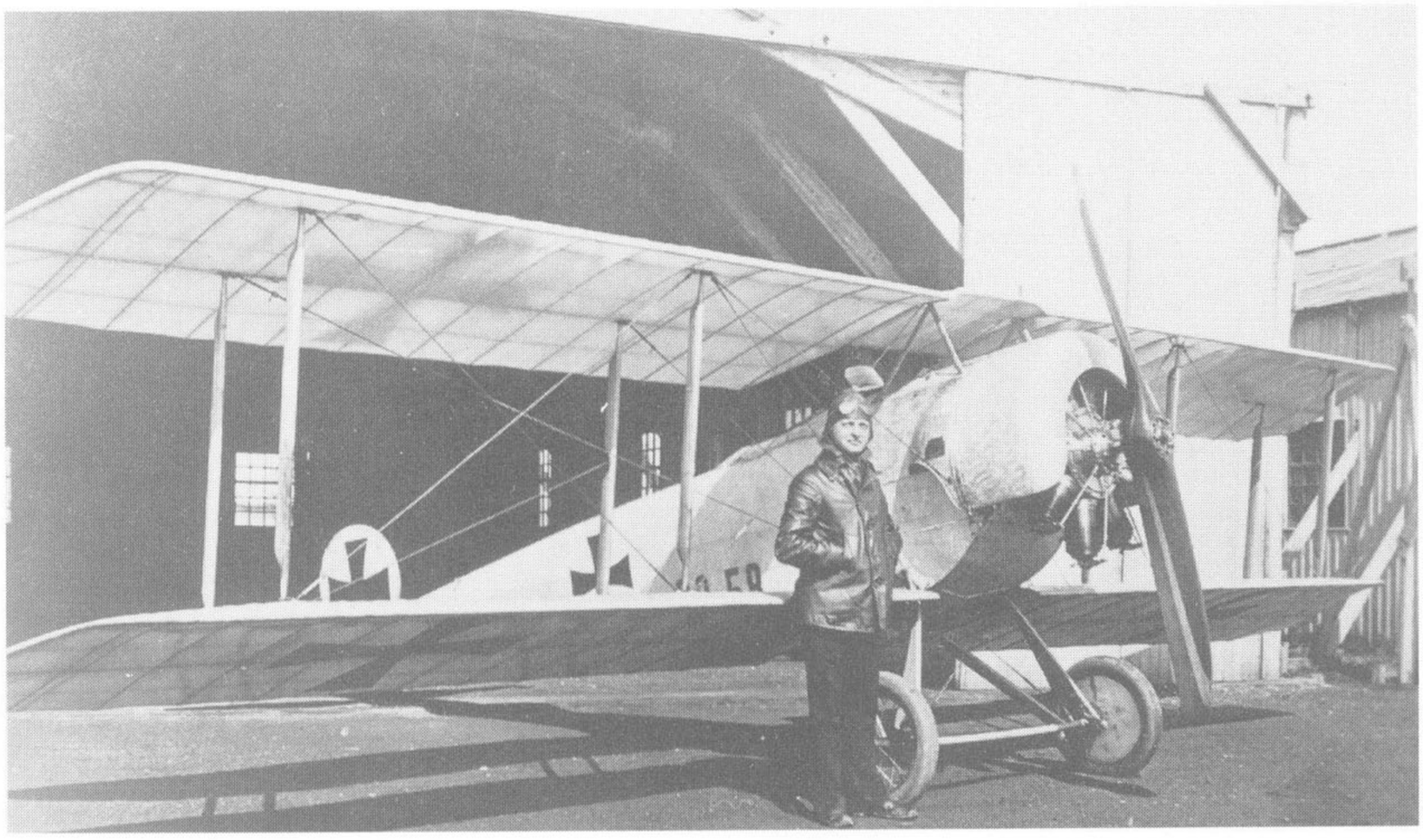
M.16E was completed towards the end of 1915 and made its first flights in the winter of 1915–16. It proved to be underpowered and, in spite of the fact that it was never fully equipped with its intended military load, proved to have a disappointing performance and was considered to be unfit for service use.

The next to be completed was the M.16Z, a two-seat, two-bay biplane originally fitted with a water-cooled 160hp Mercedes D.III engine. As with M.16E, the wings were directly attached to upper and lower fuselage longerons, and were again four equal-sized panels using the M.5 aerofoil section. Lateral control was initially by wing warping and the tailplane again similar to that of M.5. The rudder was of a balanced, near-rectangular shape and mounted forward of the rear end of the fuselage. The undercarriage was similar to that fitted to M.16E, a simple tubular construction with the single wheel axle sprung by means of bungee cords. The engine was totally enclosed by the metal cowling above and fabric-covered tubular steel structure below. This was intended to improve the airflow along the fuselage and assist the rudder, but it cannot have helped engine cooling and must have done nothing at all for ease of maintenance.

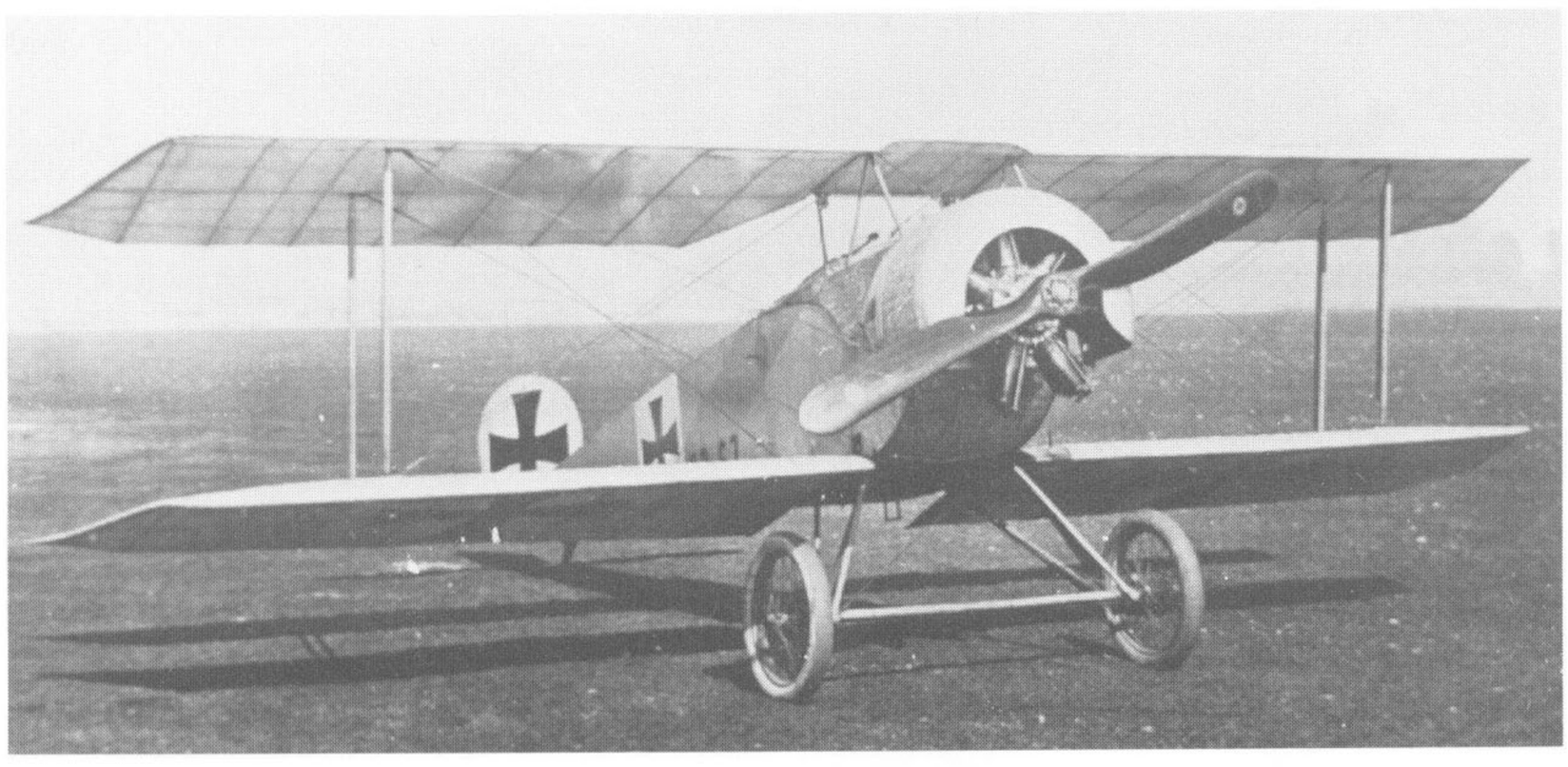
Fokker's intention was that M.16Z should be used as a two-seater fighter, but the 160hp Mercedes engine was not powerful enough to compensate for the additional weight of the observer/gunner plus his gun and ammunition. The performance was, again, disappointing and the German Army was not impressed. However, in parallel with his talks with the German Army, Fokker had discussed his new aircraft with the Austrian Army, and had succeeded in getting them interested enough to supply him with a 160hp Austro-Daimler water-cooled engine plus a firm order for one prototype and a



Fokker in the cockpit of the M.17K prototype, factory number 499. This was delivered to the Austrian LFT and became B.II 03.61. Cross and Cockade International



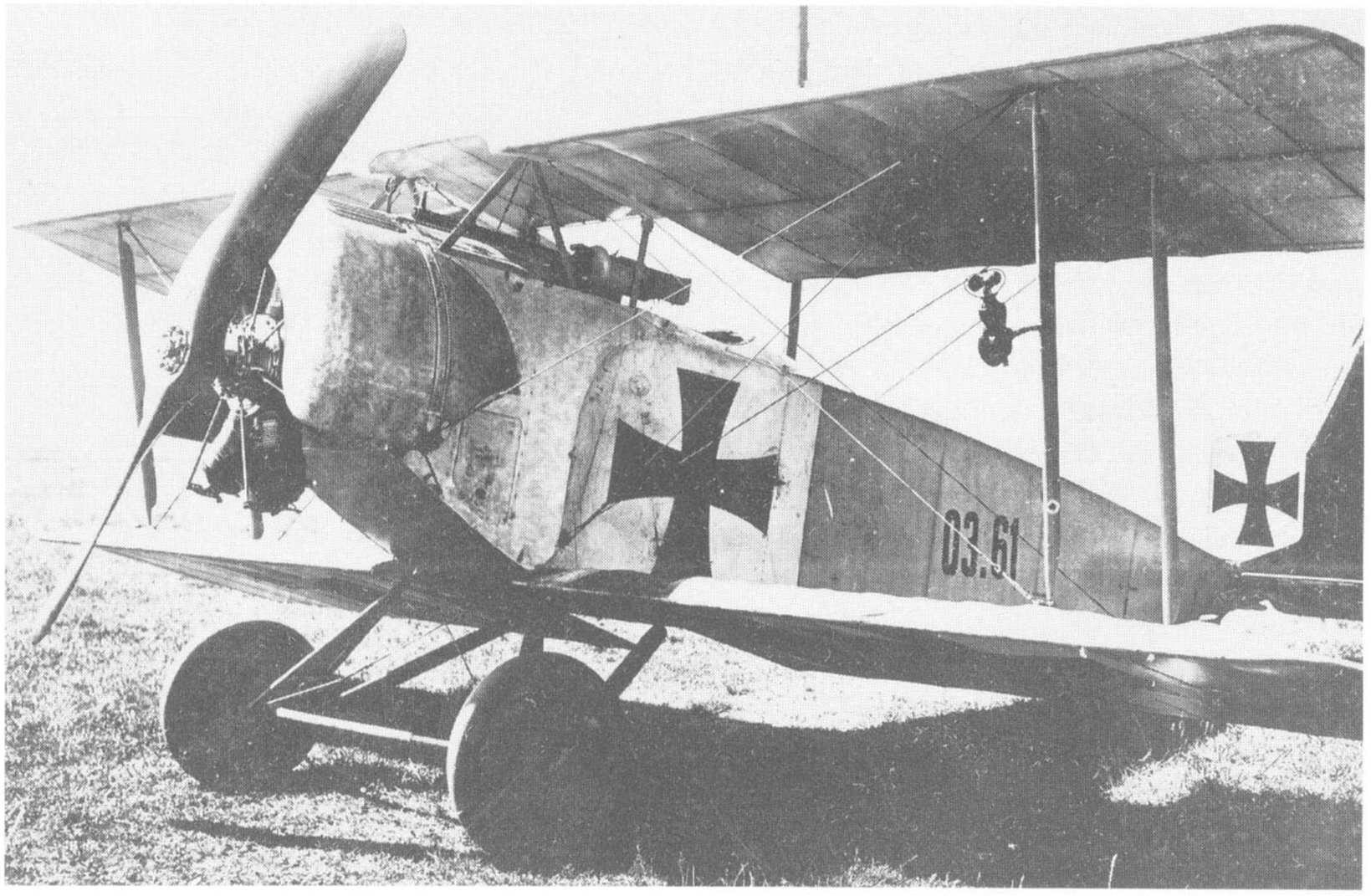
An Austrian Fokker B.II, probably 03.58, of Flik 7 at Parndorf. Cross and Cockade International

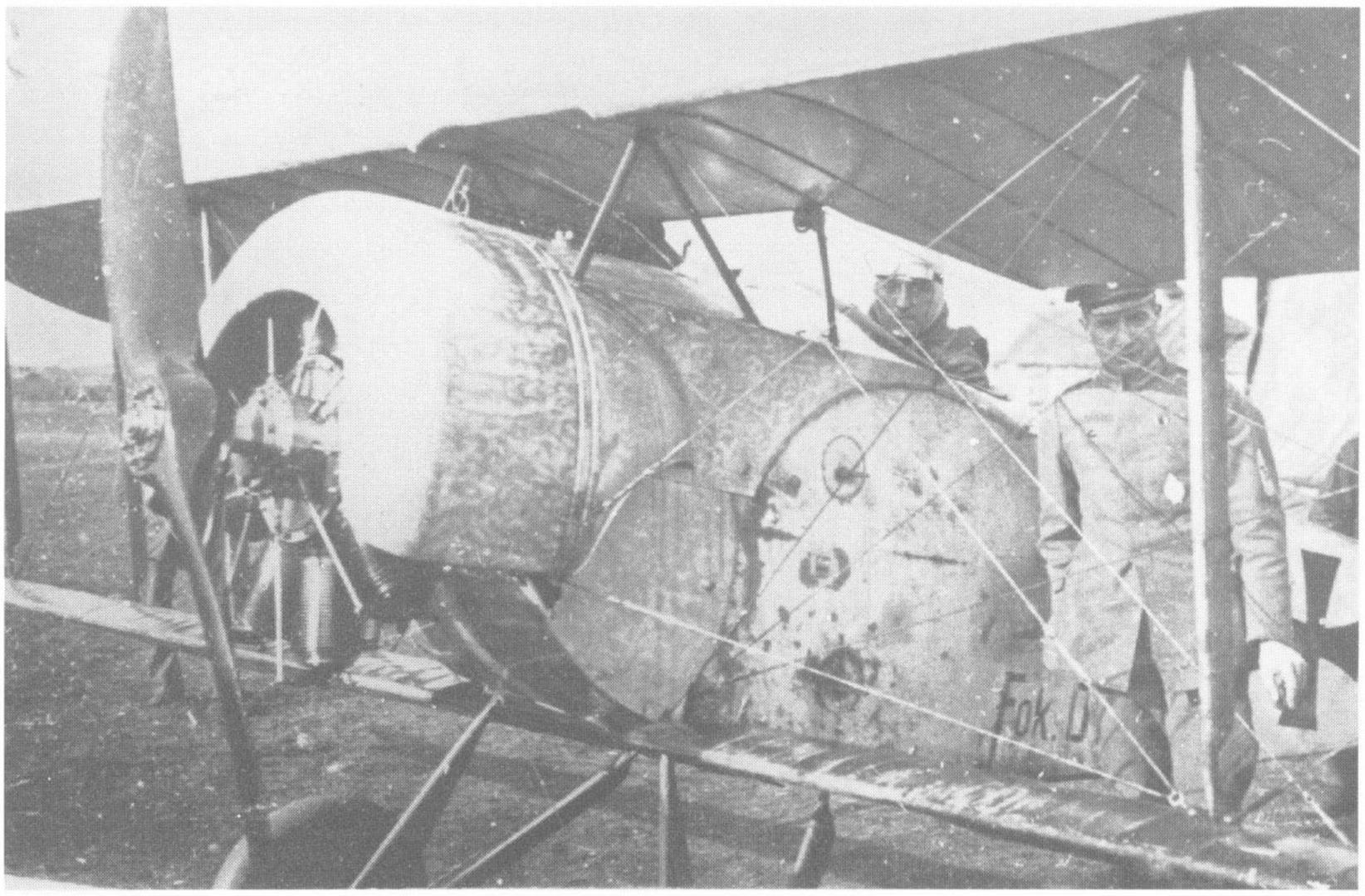


Austrian Fokker B.II, probably 03.67. Cross and Cockade International

provisional order for a further sixteen machines, should the demonstration be successful. With the Daimler engine installed, the wings fitted with balanced elevators (as the Austrians did not like wing-warping control), and equipped with a fixed, synchronized Schwarzlose M.16 machine-gun for the pilot and a further M.16 on a flexible mounting for the gunner, the M.16Z was delivered to the Austrian test centre at Aspern on 13 April 1916. At the same time, the Austrian Aviatik company was given an order to build a second prototype under licence. When this crashed during flight test, the Austrians cancelled Fokker's production order and the original prototype was assigned to Flek 6 at Wiener-Neustadt, where it remained until placed in storage and written off in April 1918.

The third prototype to be completed was M.17E, a rotary-engined version of the





***(Above)* Austrian B.II 03.61.** Cross and Cockade International

Austrian Fokker D.I (MAG) of the '04' serial range. Cross and Cockade International

design. It had single-bay wings and again all four panels were of similar dimensions and used the M.5 aerofoil section. Again the lower wings were attached to the fuselage lower longeron, and the upper wings were fixed to the fuselage via a pair of short cabane struts. The fuselage again filled the gap between the upper and lower wings and the pilot's eyes were level with the upper surface of the upper wing, giving him good all-round vision at that level. In a move to enhance his downward view, triangular panels were cut out of the top of each of the cockpit's sides. M.17E was powered by an 80hp Oberursal U.0 partly enclosed in a neat horseshoe cowling of the type fitted to the E.III monoplanes. A single LMG 08/15 machine-gun was mounted on the fuselage centreline in front of the cockpit. A crash pylon fitted to the fuselage over the pilot's head gave him protection in the event of a 'nose-over' on landing. The tailplane was similar to that of the M.16E, but the rudder was a near-rectangular balanced unit similar to that fitted to the M.16Z (but smaller). Despite the cut-away fuselage sides, the pilot's view remained poor. While his all-round view was excellent in level flight, his forward view was severely obstructed by the cowling when taking off or landing. Lateral control was by wing warping. The M.16E was a pleasant machine to fly but its performance was deemed inadequate by the military. In spite of that, Fokker liked it and kept it for his own use until, just before the end of the war, he sent it to safety in Amsterdam.

Perhaps because he enjoyed flying it, Fokker persisted with the concept and the design was extensively modified. The result was a single-bay biplane of very similar proportions to the earlier version. The main differences were that the fuselage was now similar to that of the M.5 but with a short top decking behind the cockpit. At the rear, the fuselage longerons came together in a point in both planes providing an insecure mounting for the tail assembly. The upper wing was of similar chord and span to the lower wing, but it was now built in one piece with a covered-in centre section. It was carried on short tubular-steel cabane struts (inverted-V at the front and a single vertical pair at the rear) above the fuselage, just above the pilot's sight-line. The rear edge of the centre section was cut away to give him access

to his cockpit and to allow him to raise his head to look forward over the wing. In a bid to further improve the forward view, the machine-gun was moved from the centre-line to the right-hand side of the fuselage. The undercarriage remained V-shaped, but was strengthened by doubling the tubes in the forward legs. The tail assembly remained the same as those fitted to the previous version. Although improved by the installation of a 100hp Oberursal UR.I, the performance remained poor and not at all suitable for front-line service as a fighter aircraft, and the German Army placed no orders for the type.

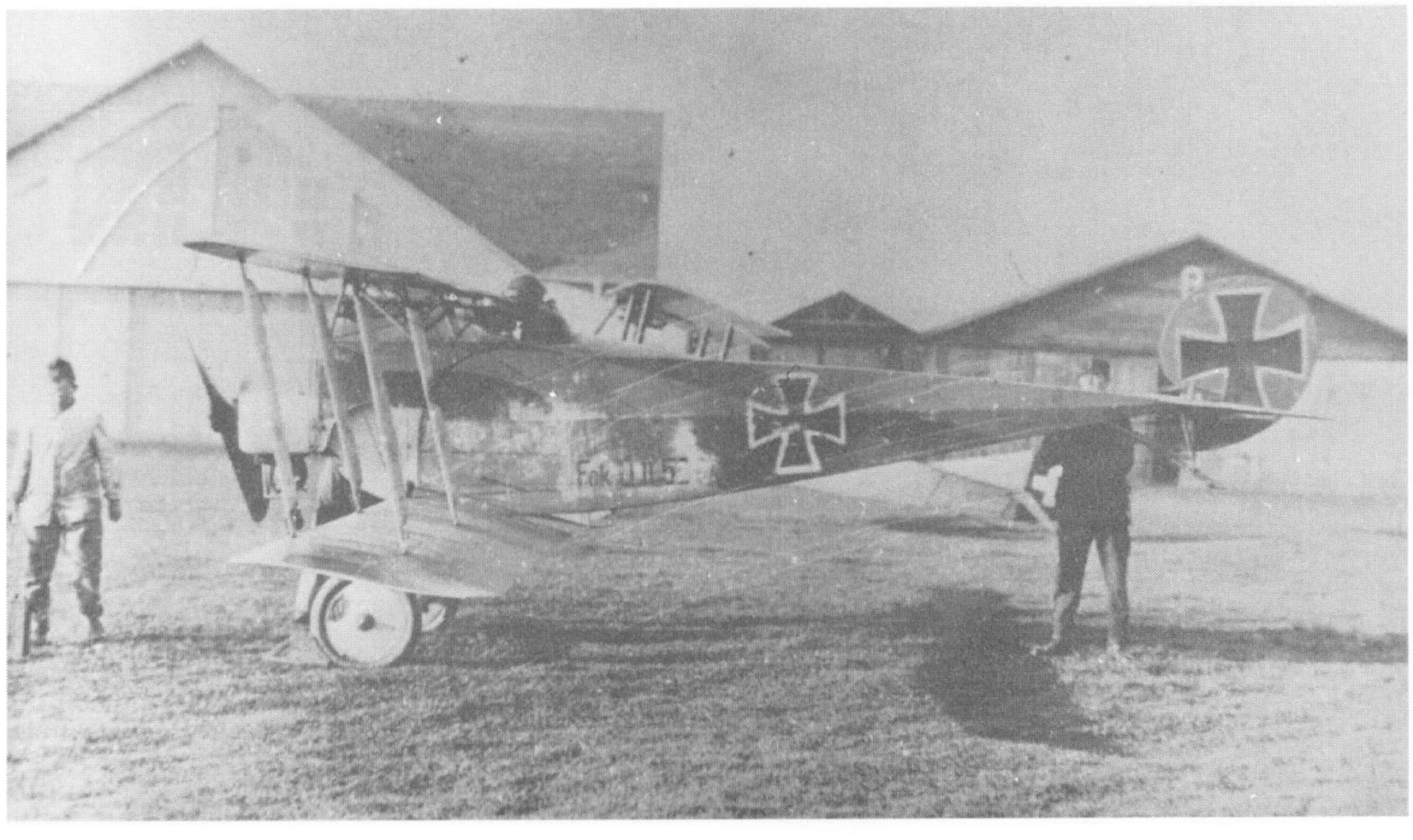
The modifications of the design that had resulted in the new M.17E and the subsequent build of the prototype (Factory Number 499) had been carried out with speed and it was available for testing by the beginning of spring 1916. Because it had an urgent requirement for a light manoeuvrable fighter aircraft the Austrian Army accepted the new model and, on 13 April 1916, 499 was sent from Schwerin to Wiener-Neustadt for evaluation. The Austrians bought a total of twenty-four M.17Es in place of the cancelled order for M.16s. In the event, only twenty-three were accepted for service; they were designated Fokker B.II and given the Austrian serial range 03.61 to 03.83. They differed from the original M.17E prototype in a number of ways. The rear end of their fuselages finished in a horizontal knife-edge (instead of the point) providing a more substantial mounting for the tail assembly. The tailplane remained the same as that of the prototype, but the near rectangular rudder was replaced by the comma-shaped type used on the E.IIIs. The fabric under the centre section of the wing was taken directly from the trailing edge to the leading edge and did not follow the rib contour. This gave more space between the under surface of the wing and the top of the fuselage, and improved the pilot's forward view.

It was originally intended that their Austrian armament would be installed at Aspern but, in the event, only the first machine of the order, 03.61 had guns fitted. These were a single 7.92mm Bergmann LMG 15nA machine-gun fitted in front of the pilot and synchronized to fire through the propeller arc, and a single 8mm Schwarzlose M16 machine-gun fitted on a mounting above the upper wing and firing over the propeller arc. Thus equipped, 03.61 was sent in June 1916 to Flik 11 on the Eastern Front for evaluation. On its subsequent return to Aspern it was used as a test bed for a number of machine-gun installation trials. The other twenty-two Fokker B.IIs of the order were shared between Fleks 4, 6 and 8, where they continued in use as unarmed single-seater trainers until 1918.

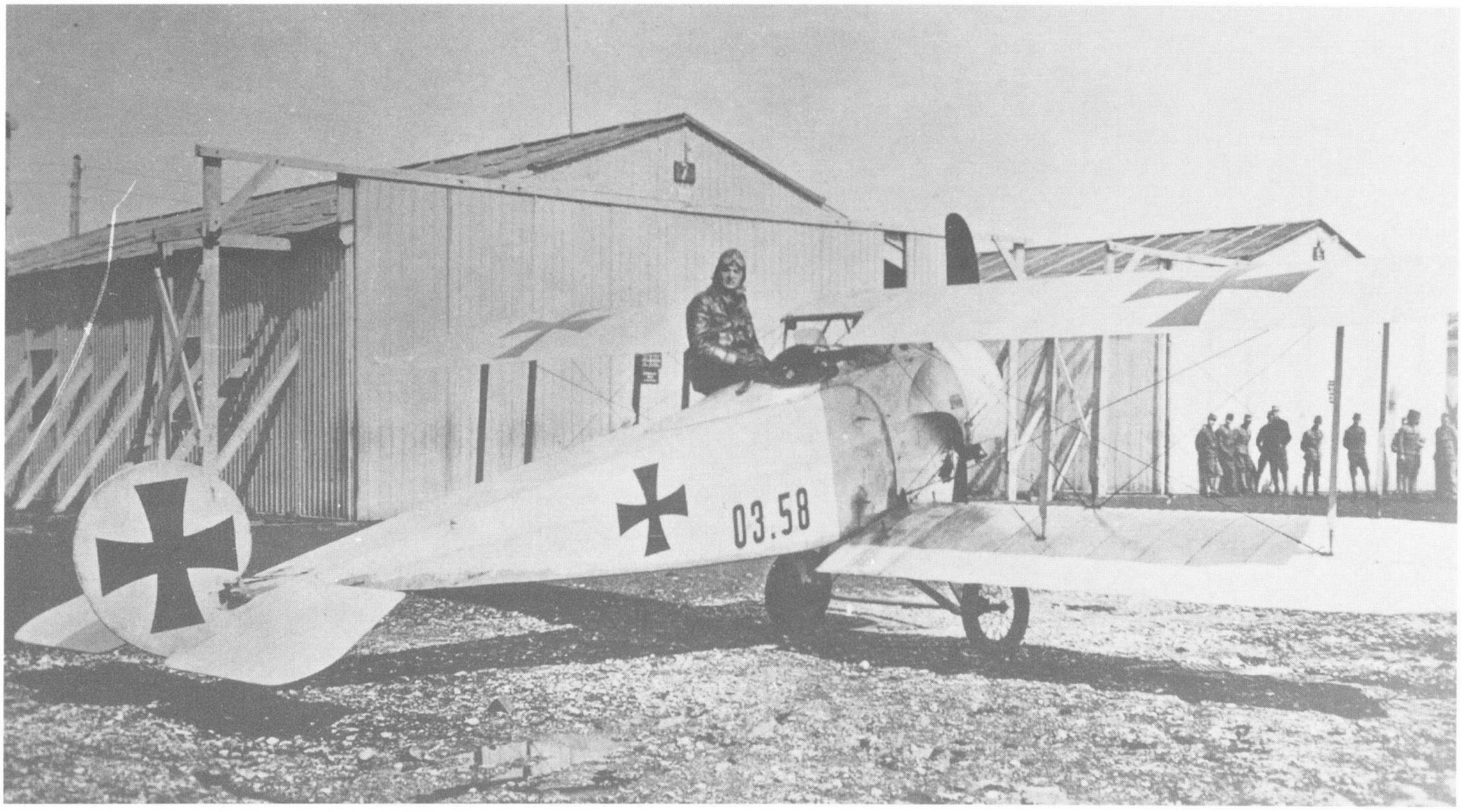
The D.II

M.17Z, the next in the series, had an identical fuselage to the earlier M.17E with the same pointed rear end giving an insubstantial mounting for its tail assembly. Its two-bay wings were of greater span and area than those of the earlier machine, this being to improve its climbing ability and performance at altitude. It was fitted with warping wings. It had the same tailplane as M.17E and the same small, near-rectangular balanced rudder mounted forward of the fuselage end. It was fitted with a captured 80hp Le Rhône rotary engine. Flight tests suggested that the fuselage was too short and that modifications were called for. The resulting new fuselage was 61cm (2ft) longer than the original and now finished in a more robust horizontal knife-edge. The small rectangular rudder was replaced by one of a comma shape fitted with a lower hinge point on the tripod tail skid mounting. The wings, mounted at pilot's eye level, were reduced in span by

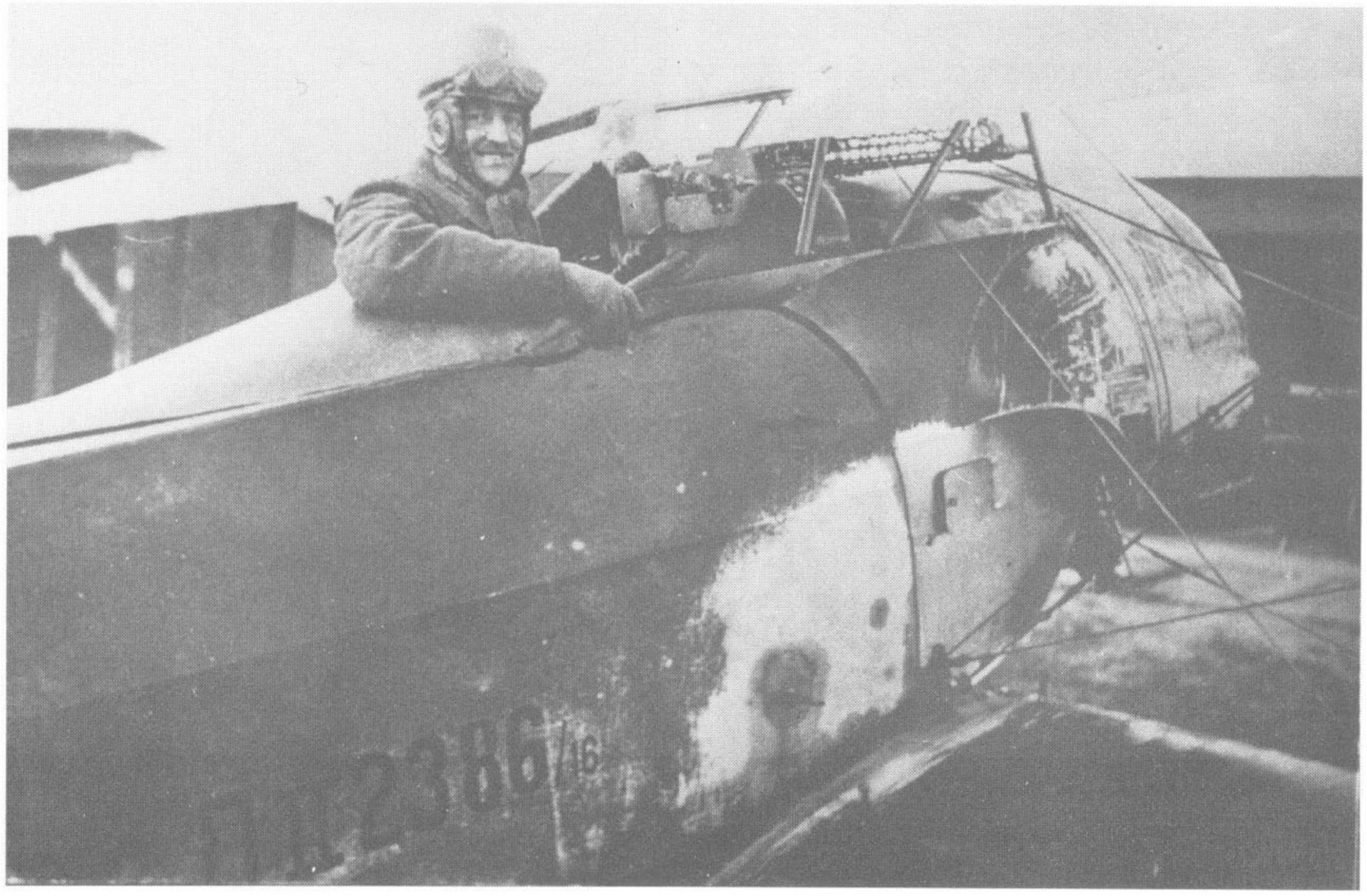
Fokker D.II, probably 528/16 of Jasta 16b which was interned in Switzerland.
Cross and Cockade International



528/16 of Jasta 16b. Cross and Cockade International



***(Above)* Austrian B.II 03.58 of Flek 7 at Parndorf.** Cross and Cockade International



D.II 2386/16 with Offstv Osten in the cockpit. Of interest is the washing-off of the fuselage dope by castor oil from the engine. Cross and Cockade International

30cm (1ft) and the size of the centre-section trailing edge cut-out was increased considerably. Wing warping control was retained. The 80hp Le Rhône engine was found to give insufficient power, so this was replaced by a 100hp Oberursal UR.I rotary. The undercarriage was a version of the simple V-struts used in the earlier models. Again, the front legs were provided by twin steel tubes.

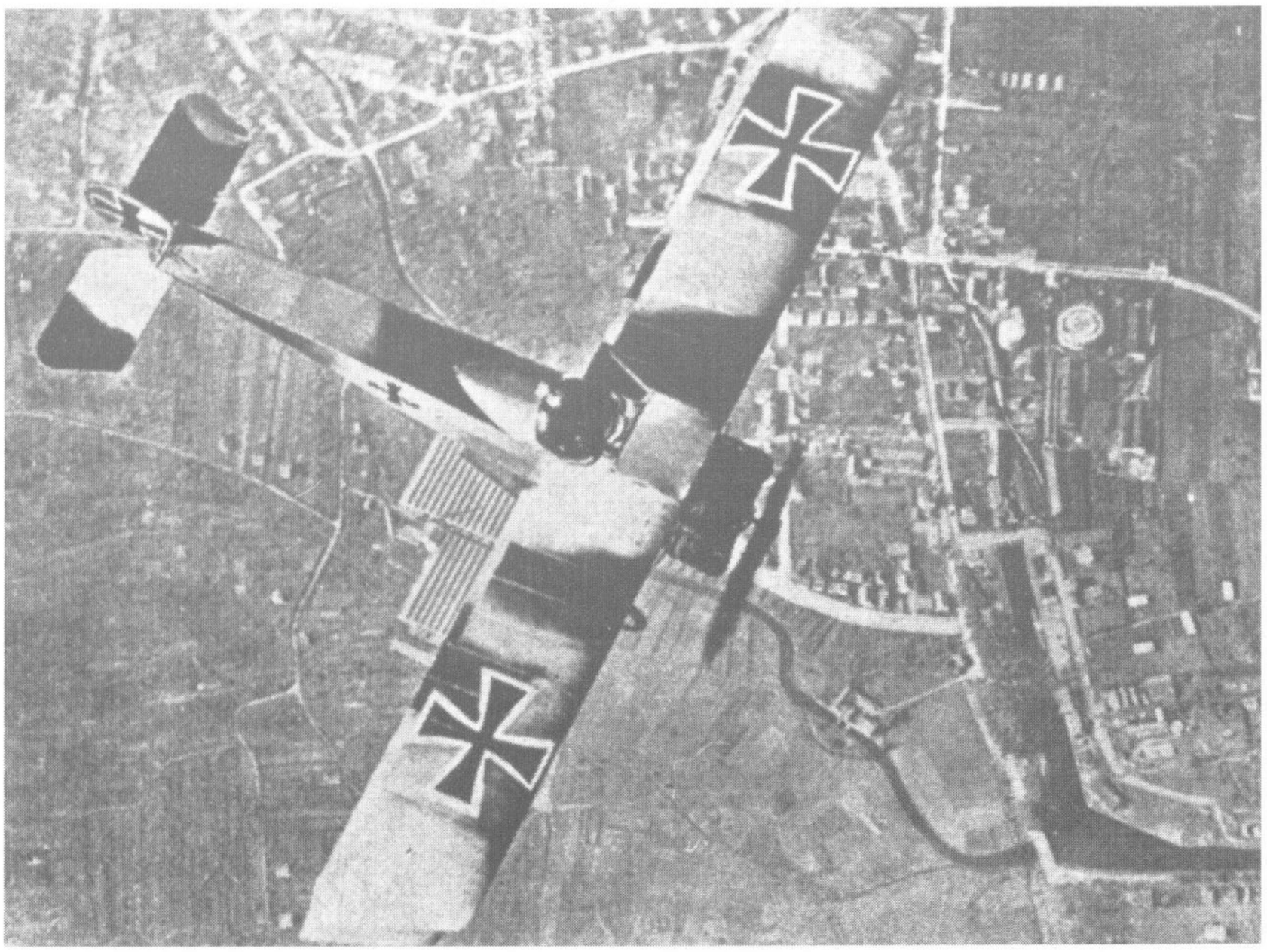
The prototype M.17Z was submitted for type-testing at Adlershof on 17 April 1916. The Test Committee found that its performance was an improvement on that of the Fokker E.II and indicated that, with some modification, it could provide a suitable replacement for that machine. The propeller ground clearance was found to be inadequate and the proof loading tests showed that some structural strengthening was required. Despite these criticisms, the M.17Z was recommended as suitable for operational use and the type designated as the Fokker D.II. The German Army ordered 132 of the type. These were to be fitted with the 100hp Oberursal UR.I and with single 7.92mm LMG 08/15 machine-guns (originally these were of the earlier LMG 08 type). The Army accepted that early deliveries would be fitted with wing-warping controls but insisted that the later production run should have ailerons.

For a number of reasons, production of the D.II was slow to start. The modifications called for from the type-tests and the change from warping wings to ailerons was a part of this but, possibly, more significant delay was caused by the fact that facilities at Schwerin were inadequate for the quantity of orders Fokker had in hand. The result of this was that, although they were

issued to a number of front-line units, by the time that they became available they had been outclassed not only by Allied aircraft coming into service but also by the products of rival German manufacturers. No longer viable for use on the Western Front, they were quickly withdrawn. A few served in quieter places such as Turkey and Macedonia but the majority of them found employment as training aircraft on the home establishment. At their peak of availability there were sixty-eight in service but, by September 1917, only ten of the type remained in use.

The D.I

M.18E, the second of the prototypes fitted with a water-cooled engine, resembled its predecessor, M.16, in many ways. It, too, was a single-bay biplane with warping wing control and a deep fuselage filling the gap between upper and lower wings. The wings themselves were again four panels of similar shape and dimensions, the bottom panels being attached to the lower fuselage longerons and the upper panels to the top fuselage longerons. As in the earlier model, the pilot's forward view was restricted by the location of the upper wings and the engine, but the sides of the fuselage were cut away to help in this. A single forward-firing synchronized LMG 08 was fitted to the left side of the fuselage top in front of the pilot. The installation of the 100hp Mercedes D.I engine was similar to that of M.16, but its engine cowling was of better design and shape. Engine cooling was by means of large, flat radiator panels fitted one on either side of the forward fuselage. The rear end of the fuselage tapered to a point providing an inadequate mounting for the tail surfaces. The tailplane was similar to that of M.16, but the vertical surfaces differed considerably in that M.18E had a vertical fin in front of its rudder. Work on M.18E had progressed rapidly and it was available for flight test before M.17Z. Like Fokker's other single-bay biplanes, its climbing performance was disappointing and no further development of the type was carried out.

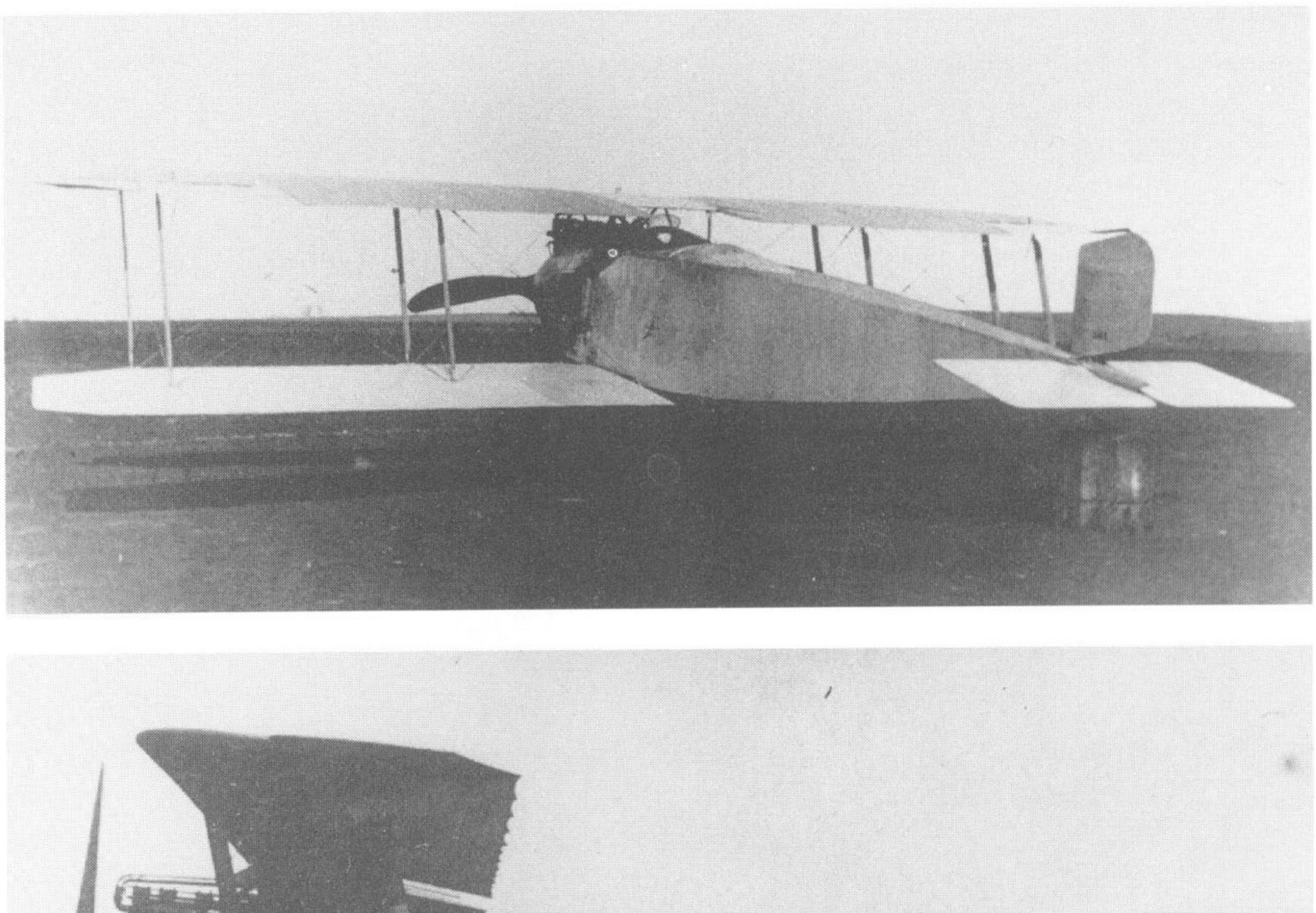


Specification – Fokker M.18 (Austro-Hungarian – B.III)

Engine:	100hp Mercedes D.I
Weights:	Empty 442kg (975lb); loaded 700kg (1,540lb)
Dimensions:	Wingspan 9.05m (29ft 8in); length 5.70m (18ft 8in); height 2.69m (8ft 10in)
Performance:	Maximum speed 150km/h (93mph) Rate of climb 1,000m (3,300ft) in 6.2 minutes, 4,000m (13,000ft) in 39.57 minutes
Armament:	One Schwarzlose machine-gun mounted on the upper wing and firing over the propeller arc

***(Top)* A D.II carrying the individual marking 'R' on its upper wing surface and fuselage side.** Cross and Cockade International

***(Centre right)* Bird's eye view of a D.II above an unidentified town.** Cross and Cockade International



***(Top & above)* The prototype Fokker M.18, factory number 301, fitted with ailerons.**
Cross and Cockade International

Fokker standing by the M.18 prototype. Cross and Cockade International

Fokker already had solutions for the problems – a new, shallower fuselage and two-bay wings of equal span. The upper wing was built in one piece and fitted with balanced ailerons. It had a large cut-out to give the pilot access to the cockpit and to allow him to raise his head to look forward over it. It was carried above the fuselage on short tubular-steel cabane struts, the forward ones being an inverted V, and the rear pair being single vertical struts. Control by wing-warping was abandoned and balanced elevators were fitted to the upper wings only. The rear of the fuselage ended in a point, again giving an inadequate mounting for the tail assembly. Originally, the tail assembly was similar to that of M.17, a small near-rectangular rudder and a 'balanced' all-moving tailplane. The large, flat panel radiators were replaced by small but bulky radiator blocks on either side of the fuselage.

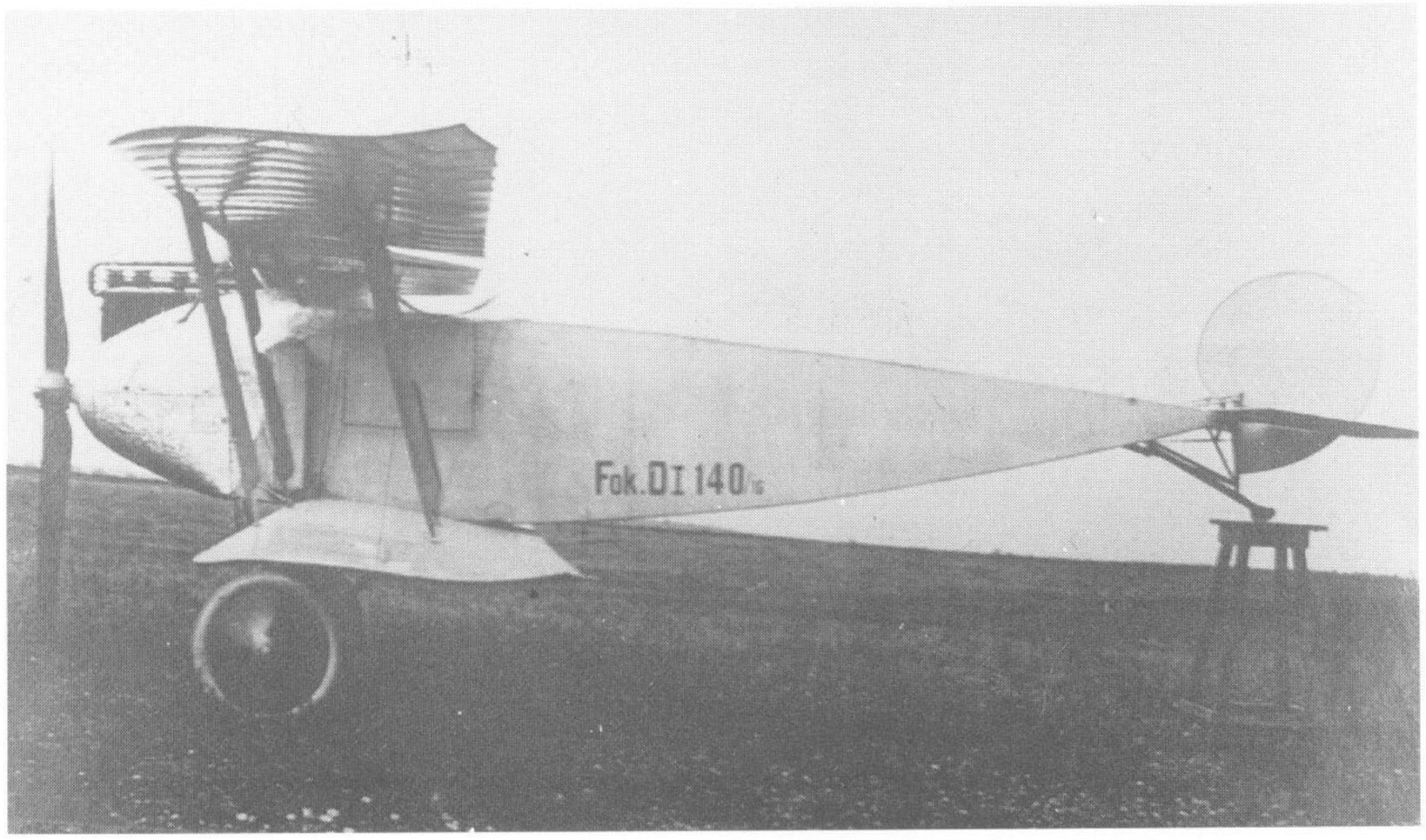
The two-bay wings gave a better rate of climb and development of the prototype continued. To improve lateral control, the aileron-fitted upper wing was replaced by a warping wing of similar dimensions. The rear fuselage was changed to that on M.17, with the flat knife-edge ending that provided a good support for the tail assembly. The tailplanes remained the same but the rudder was changed to the now-familiar comma shape supported at the end of the fuselage and down on the tubular-steel tail skid mounting. The single machine-gun was moved to the right-hand side of the fuselage and the size of the engine's cooling radiators was increased slightly.

The improved version of M.18, now designated Fokker D.I, was submitted for official type-testing at Adlershof on 15 April 1916. In his book *Flying Dutchman*, Fokker claims that 'In official tests, the D.I proved to be the fastest and most efficient fighter available.' Official records offer a different picture. The report by two very well-qualified officials, Professor Dr Ing. Bendemann and Dipl-Ing. Madelung, included a statement to the effect that while, from a distance, the Fokker D.I looked good, closer examination revealed flaws in both the design and workmanship. It was recommended that Fokker took advantage of advances in technical details demonstrated in the Albatros D.I design and the point was made that, contrary to security regulations, Fokker had taken a number of photographs of that machine and therefore had had ample opportunity to study it.

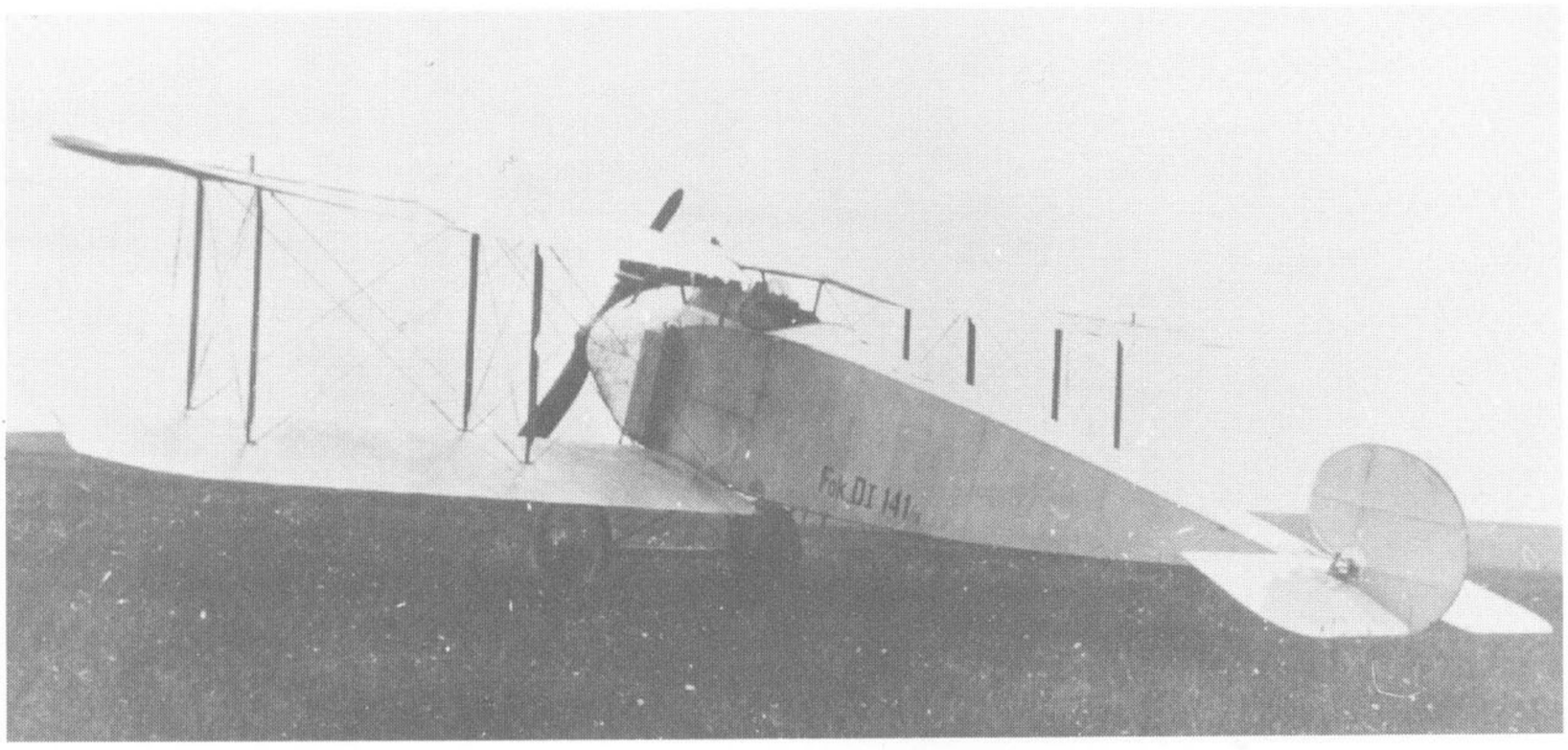
Fokker received an order for only three of his D.I aircraft, that were to be fitted with 120hp Mercedes D.II engines and used for flight trials. Further orders for the type were withheld until he could prove that he had taken notice of the various criticisms made of the design weaknesses and that the standard of his workmanship had improved considerably.

Following this, the D.I underwent a series of detailed structural tests each resulting in requests for modifications and improvements, including strengthening of the forward cabane struts, stronger bolts for the lower spar attachment and strengthening of the control stick and rudder assembly. These requirements met, the D.I was passed as suitable for combat service on 6 June 1916. Fokker's initial order for three of the type was amended to an order for eighty – the largest order given to any German manufacturer at that date. The D.Is were all to be fitted with a 120hp Mercedes D.II engine and aileron control in place of wing warping. A later modification resulted from flight trials that proved that the comma-shaped rudder gave insufficient directional control. To improve this, a vertical tail fin was added in front of the rudder. Production build-up was reasonably fast and ten D.Is were in operational service at the front by August 1916. By the end of October, the number in use had risen to seventy-four and an order for a further ten aircraft was placed during that month.

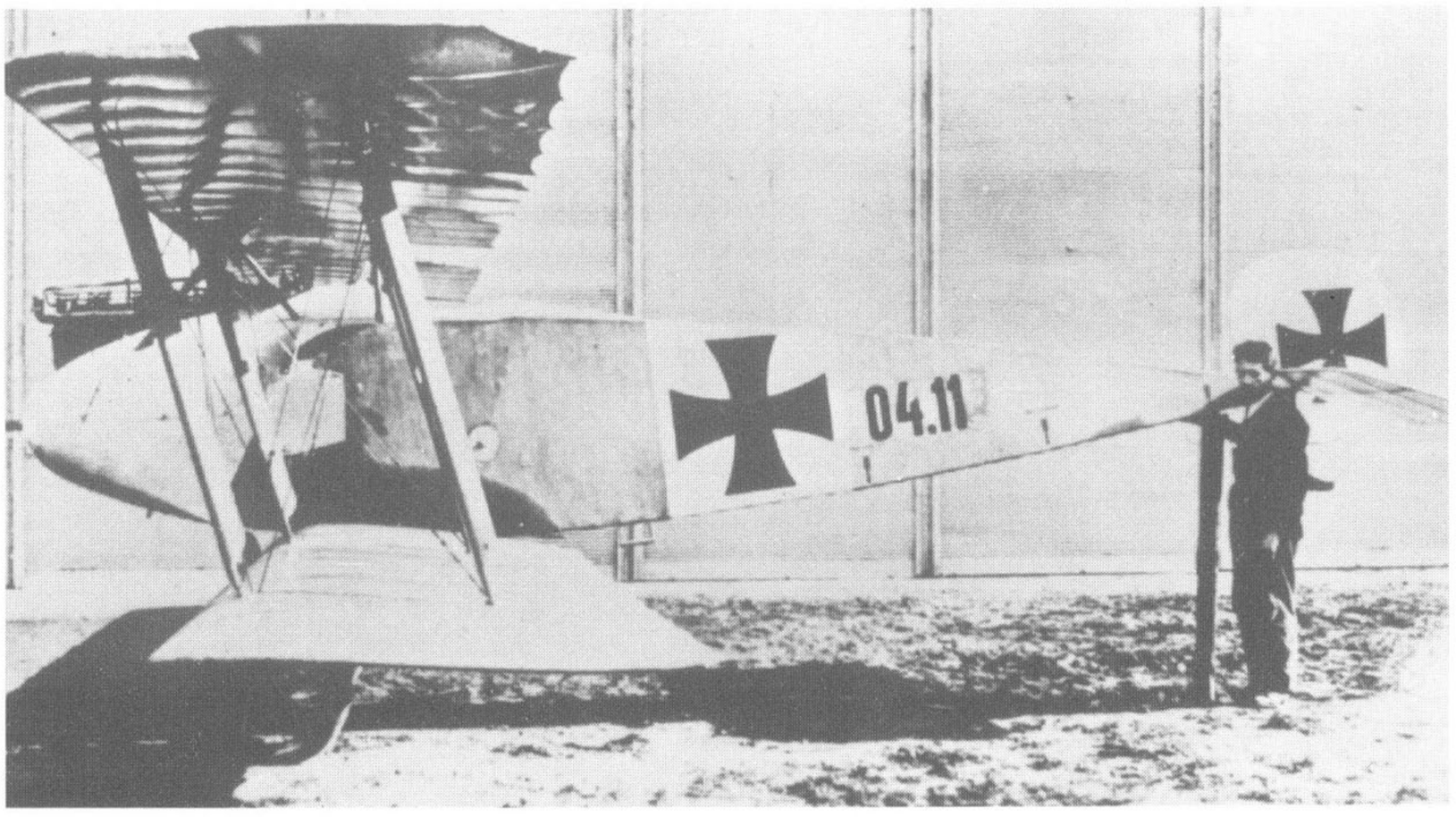
Few records of the operational use of the D.I are available, although a D.I flown by



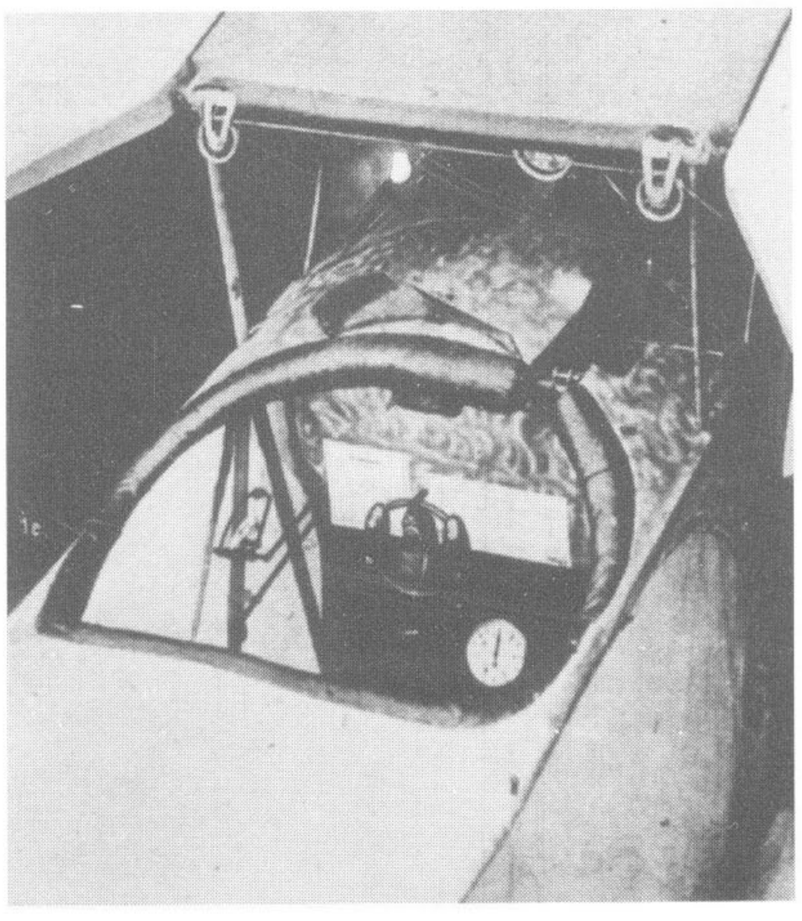
The first Fokker D.I, 140/16. Cross and Cockade International



D.I 141/16. Cross and Cockade International



An M.18 in Austrian service. This was initially given the serial number 03.92 and then, as a Fokker B.III, it was numbered 04.11. Its factory number was 501. Cross and Cockade International

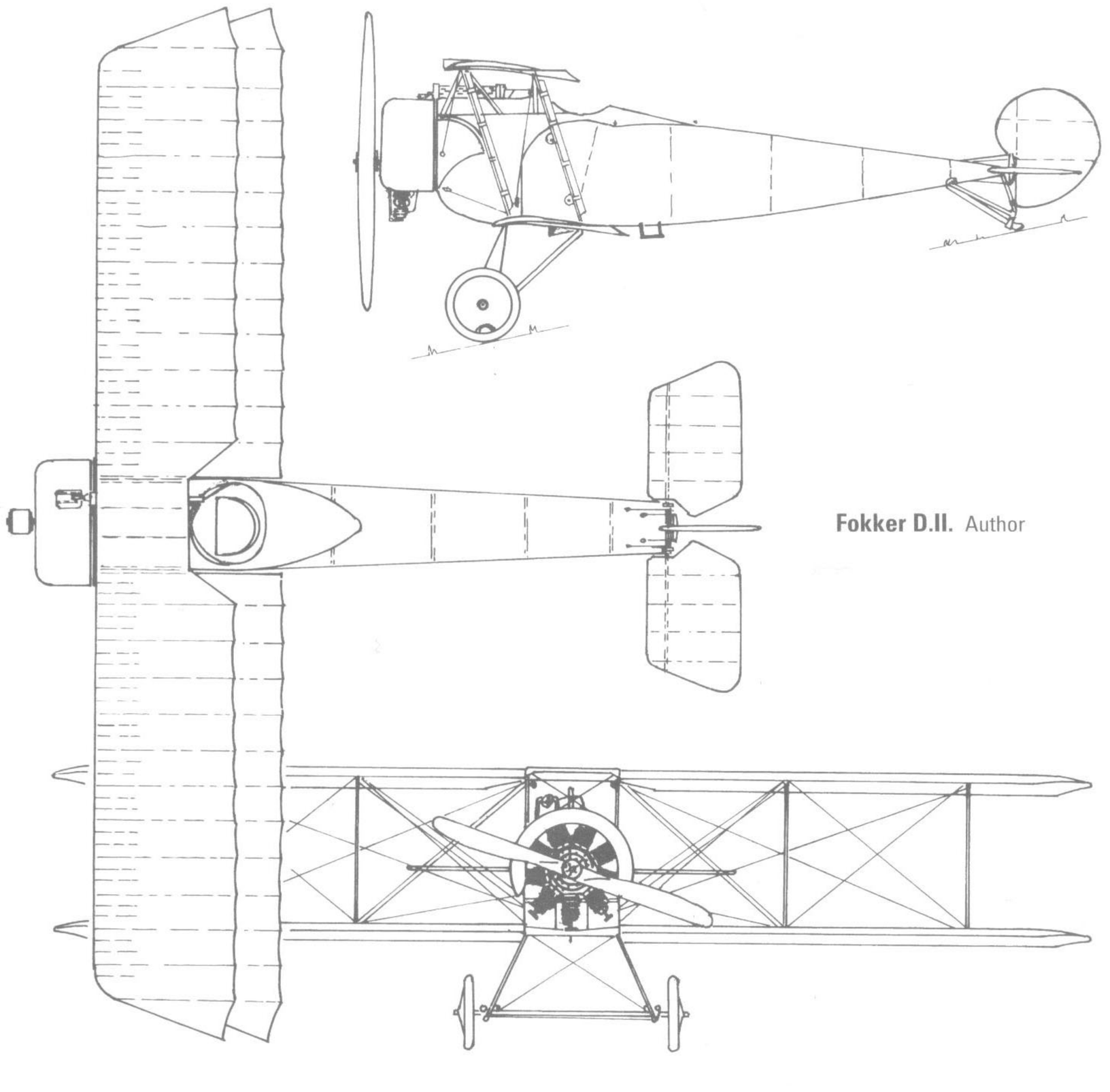


Cockpit of an unidentified Fokker biplane.
Cross and Cockade International

Fokker D.I, possibly 208/16. Cross and Cockade International

Specification – Fokker D.I

Engine:	120hp Mercedes D.II
Weights:	Empty 463kg (1,020lb); loaded 671kg (1,480lb)
Dimensions:	Wingspan 9.05m (29ft 8in); 1.25m; length 6.30m (20ft 8in); height 2.47m (8ft 1in)
Performance:	Maximum speed 150km/h (93mph) Rate of climb 1,000m (3,300ft) in 4 minutes; 4,000m (13,000ft) in 23 minutes
Armament:	One LMG 08/15 machine-gun synchronized to fire through the propeller arc



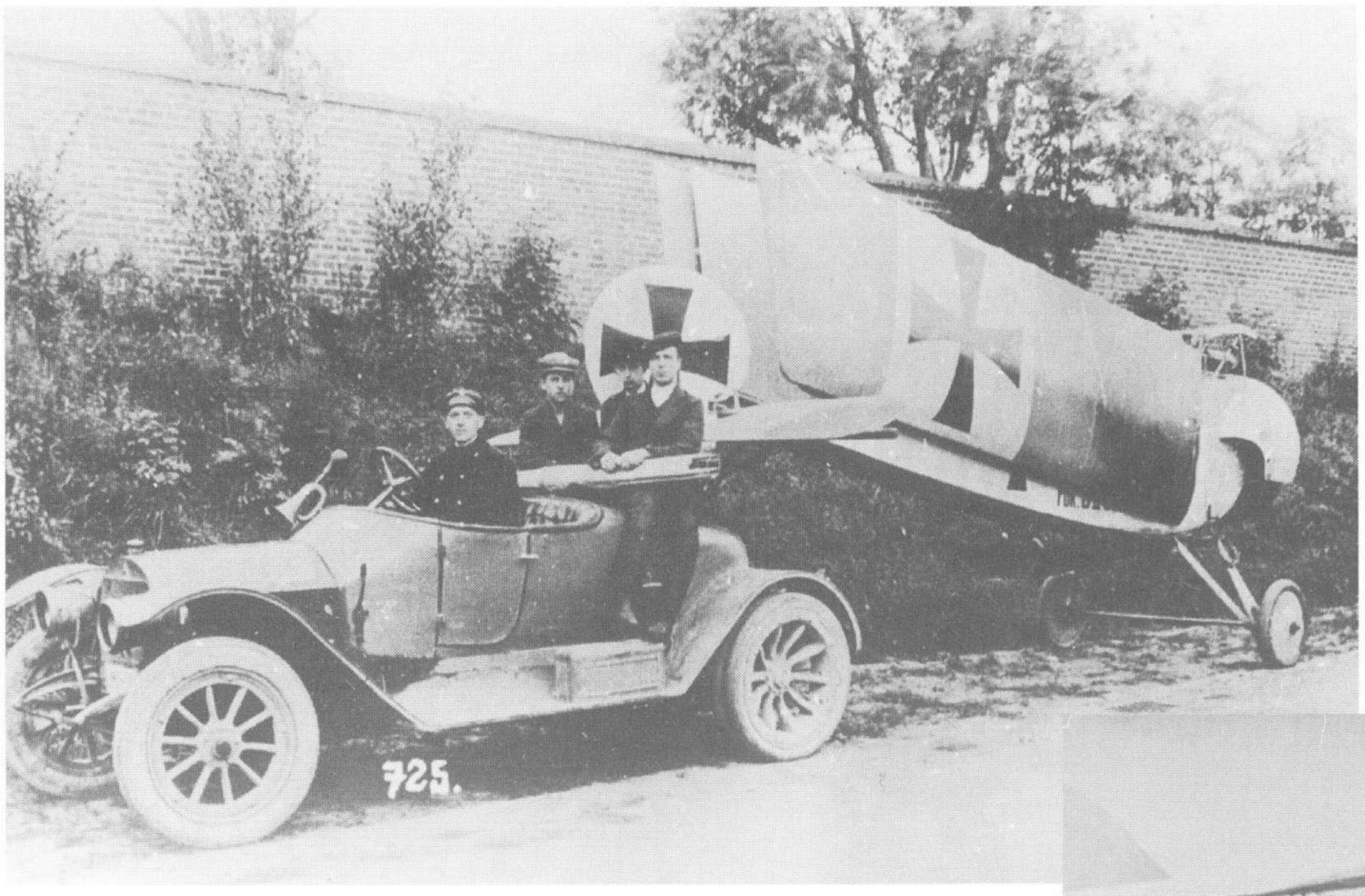
Fokker D.II. Author

Vfw Hans Miesegades of Jasta 3 lost its wings during a test flight in August 1916 and, on an operational flight (but with no enemy aircraft nearby) on 4 December 1916, the wings of Fokker D.I 175/16 failed and the pilot, Vfw Karl Ehrnthaller, was killed in the crash that followed.

Taking these two crashes into account and adding to them the failures of the wings of two Fokker monoplanes and three other incidents with the type, Kogenluft (*Kommandierender General der Luftstreitkrafte*) acted quickly. He commanded that, primarily because of increasingly deficient factory workmanship, Fokker aircraft were not permitted to be flown at the front. The balance of the aircraft ordered would be used to equip flying schools. Those D.Is remaining at the front were quickly side-lined to training activities or put into store. Even had the quality problems not arisen when they did, it is doubtful whether the D.I would have remained in service on the Western Front for very much longer. It was already outclassed by new Allied aircraft as well as new faster, heavier and better-armed aircraft from other German manufacturers.

In addition to the Army's orders for the type, the German Navy bought six, but no information on their service use is available.

With his flair for salesmanship, Fokker had, uninvited, sent the prototype D.I

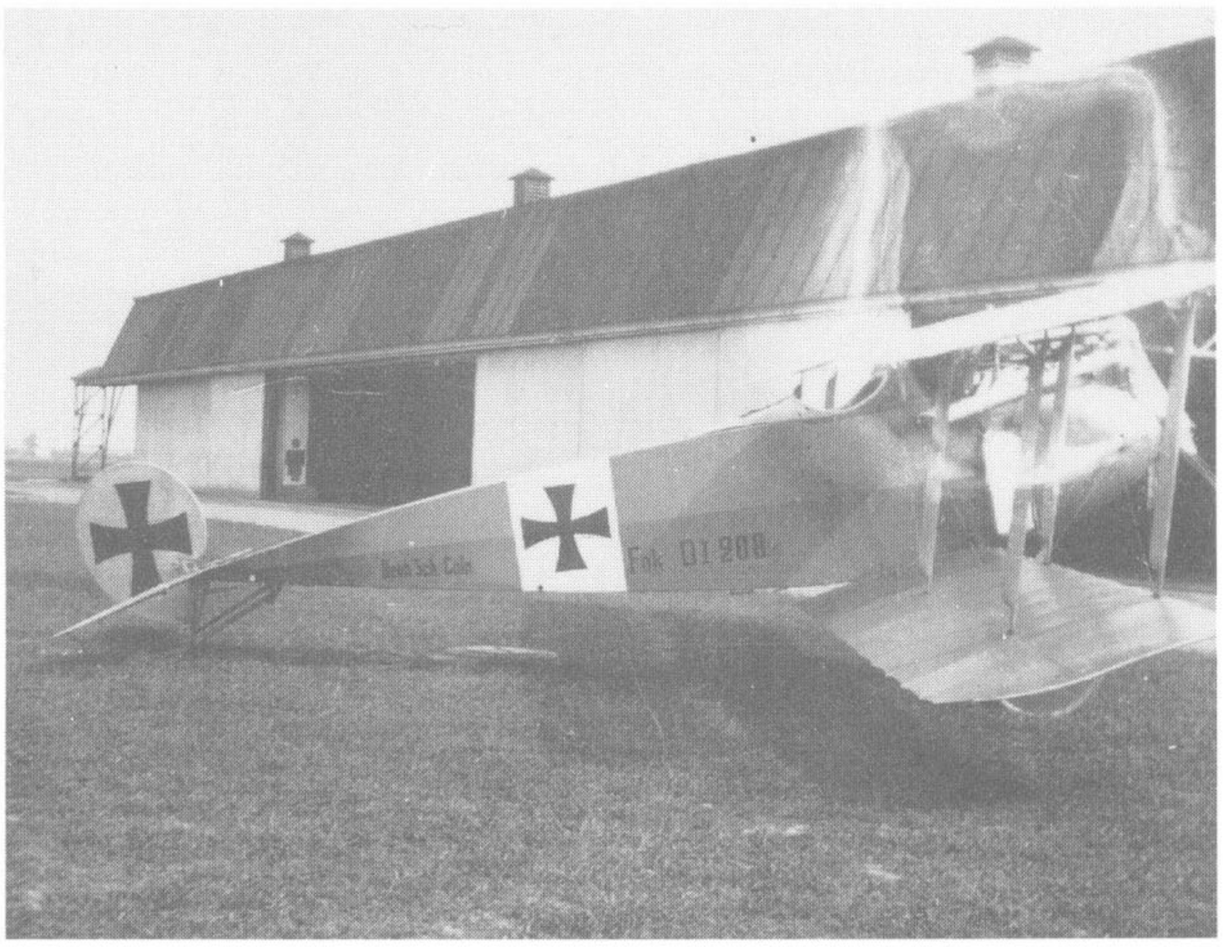


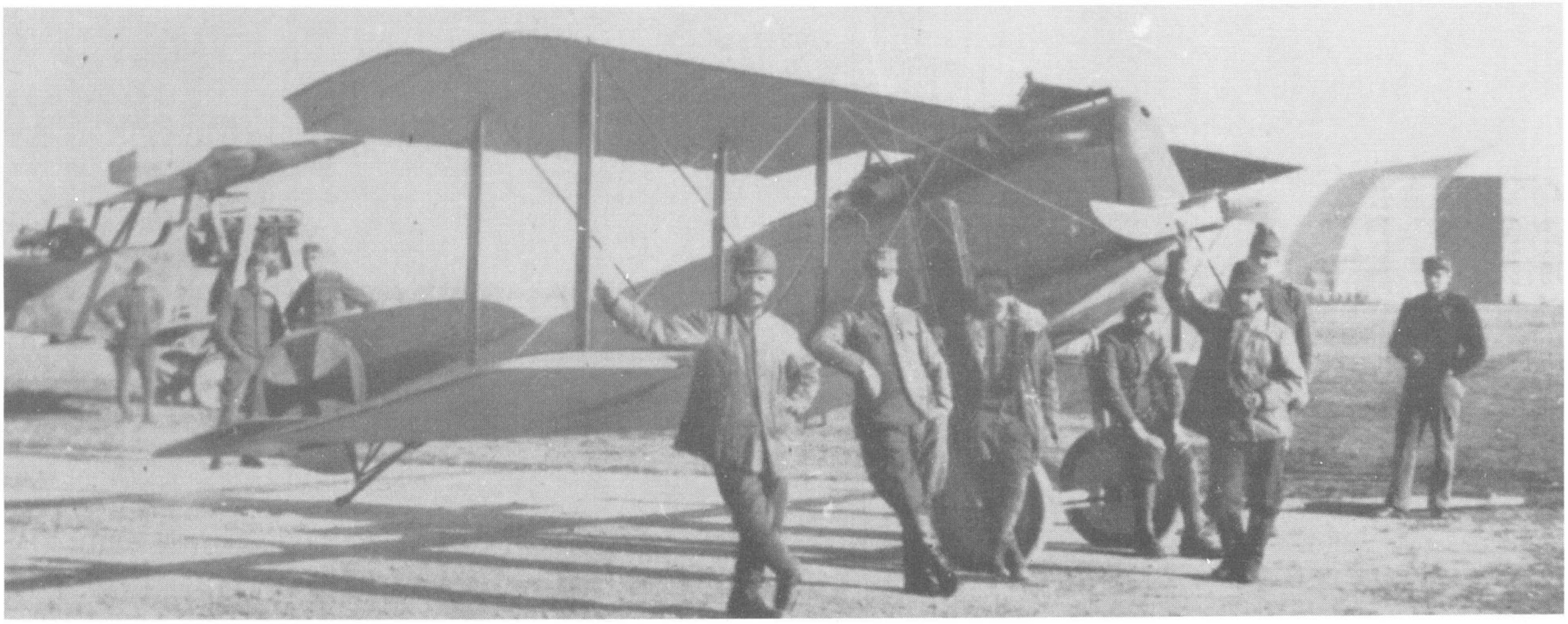
Fokker D.II dismantled and packed for travelling. Cross and Cockade International

(Below left) **Fokker D.I 208/16 of the Bech Schule Coln.** Cross and Cockade International

(Below right) **Hptmn Raoul Stojsavljevic of Flik 16 with Fokker B.III 04.15 armed with one LMG 08/15 mounted above the upper wing and angled (at 15 degrees) to fire above the propeller arc.** Greg Van Wyngarden

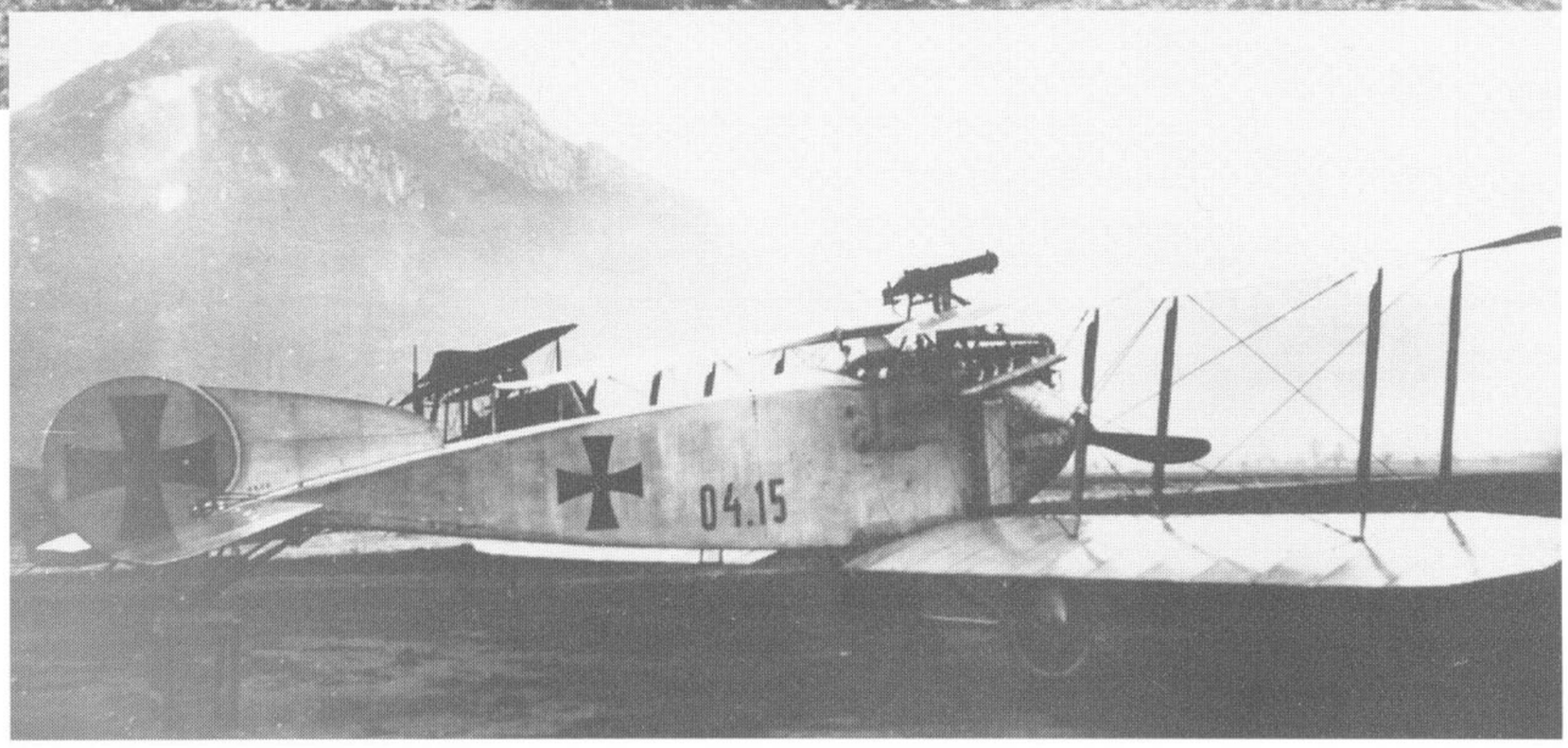
(Bottom) **Based on the Fokker M.21/D.IV, this was built under licence by MAG.** Cross and Cockade International





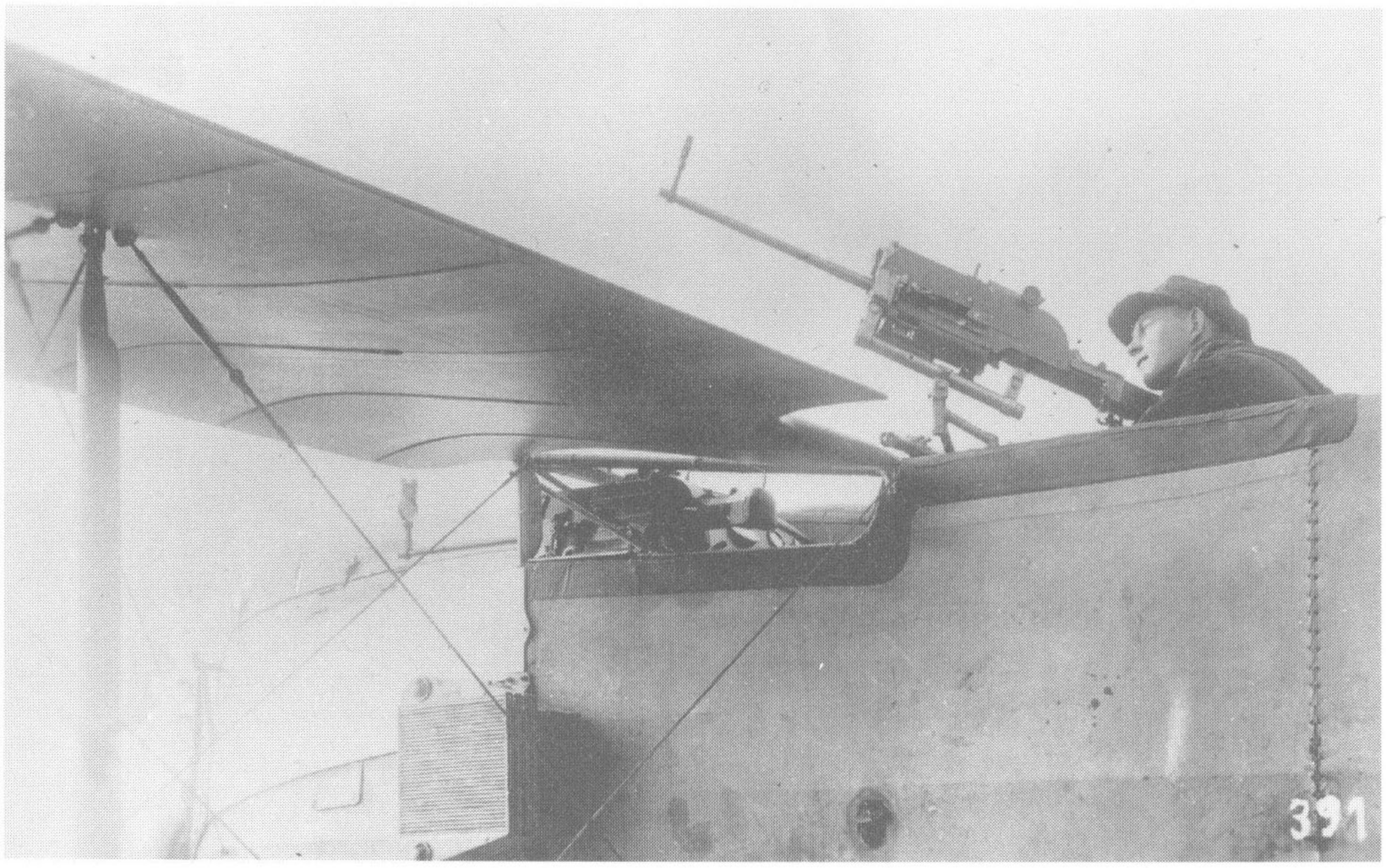
Austrian B.III 04.22 of the Fliegeroffizierschule at Wiener-Neustadt. Greg Van Wyngarden

***(Right)* B.III 04.15 with a dramatic background.** Cross and Cockade International



***(Below)* Fokker B.III 04.12 'Mädi' armed with a single Schwarzlose machine-gun mounted above the upper wing and angled at 15 degrees to fire over the propeller arc.** Cross and Cockade International

with its 120hp Mercedes D.II engine to the Austro-Hungarian Army's test centre at Aspern, a stroke of genius. At that time they had a need for a fighter trainer and placed an order for a total of eighteen machines, all to be fitted with warping wings and 100hp Mercedes D.I engines. The first seven production machines were delivered in August 1916 and went into Austrian service as the Fokker B.III. A further nine machines were delivered in September 1916. They were deployed with Fliks 4, 12, 19 and 28 on the Isonzo Front, with Flik 16 on the Karnten Front and with Fliks 17, 21 and 24 in the South Tyrol. They were mainly used as trainers to prepare pilots for the more powerful Brandenburg D.I that was about to enter service. A further eight B.III aircraft were built by the Austrian MAG company to a specification issued by Flars (*Fliegerarsenal*)



The prototype M.16 was fitted with two Schwarzlose machine-guns. One, synchronized, was fixed and fired through the propeller arc; the other was on a flexible mounting beside the pilot. Use of this is demonstrated here by Fokker mechanic Carl Henze. This aircraft was delivered to the Austrians at Aspern and numbered 03.91. Cross and Cockade International

engineers at Aspern. The first machine was delivered on 21 November 1916 and the remaining seven aircraft in March–May 1917. They were all sent to Flek 6 in Wiener-Neustadt as unarmed trainers. Five were still in use in July 1917.

The D.III

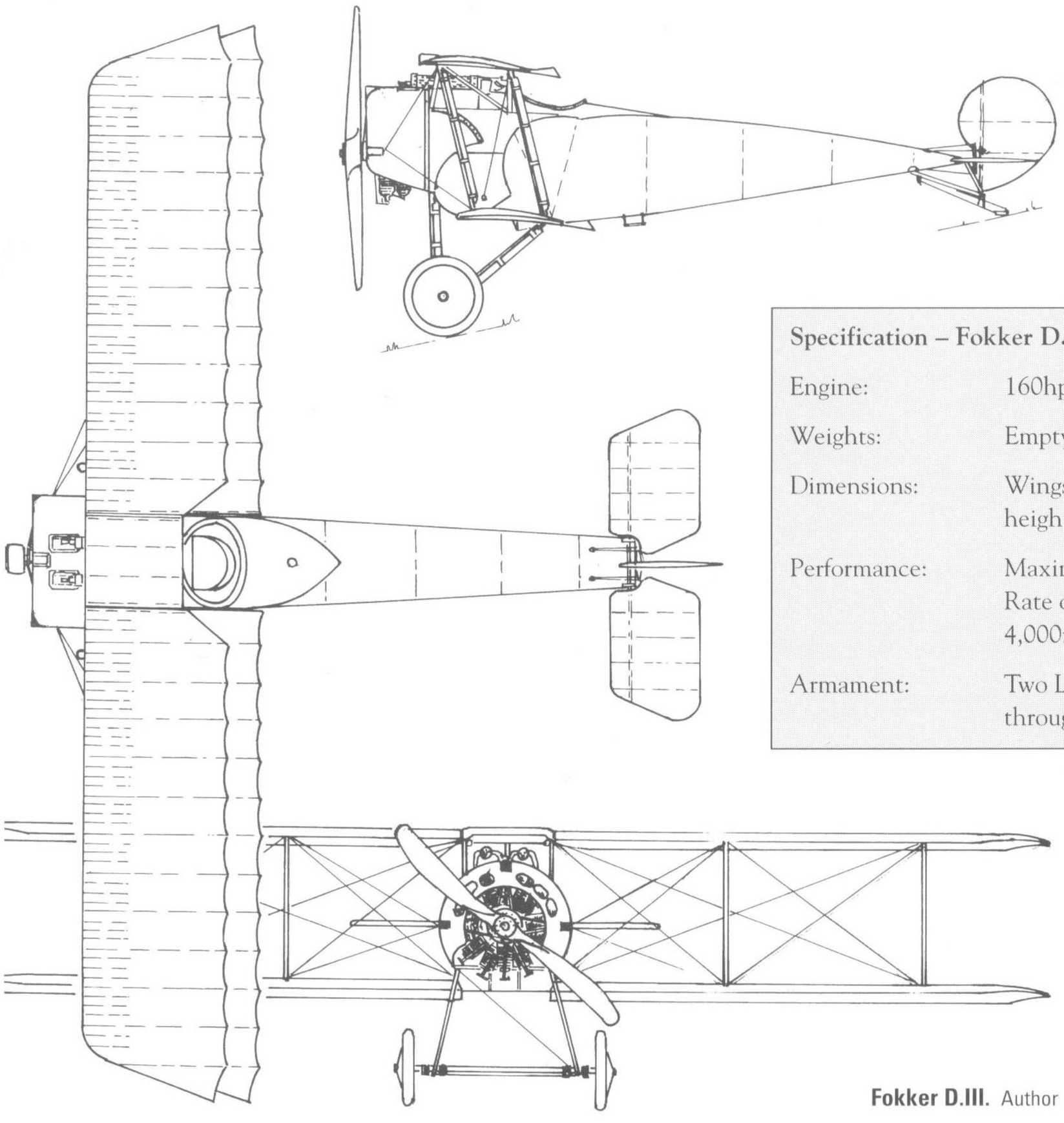
Following closely on the completion of M.17, Fokker's next prototype was designated M.19 although, in reality, it was an improved version of the earlier machine. A two-bay biplane, its wing structure, spar sections, bay lengths and bracing were all basically those of the M.17/D.II. Its cabane struts incorporated an additional inverted V fastened to the engine mounting frame, similar to that used on the M.10. (These additional struts were deleted from production machines.) Its fuselage was also similar to that of D.II, although improvements had been made in some areas. Its tail assembly was the same, with the comma-shaped rudder and no vertical fin. The undercarriage was identical. Because the M.19 used components already approved for the D.I and D.II aircraft, it was understood that its acceptance would be a formality, and the type was designated as the Fokker D.III.

Where the D.III did differ from the earlier biplanes was in its engine installation and armament. Both of these were as those used on the E.IV monoplane, the 160hp Oberursal UR.III fourteen-cylinder, twin-row rotary engine and a pair of forward-firing synchronized LMG 08 machine-guns mounted in front of the pilot.

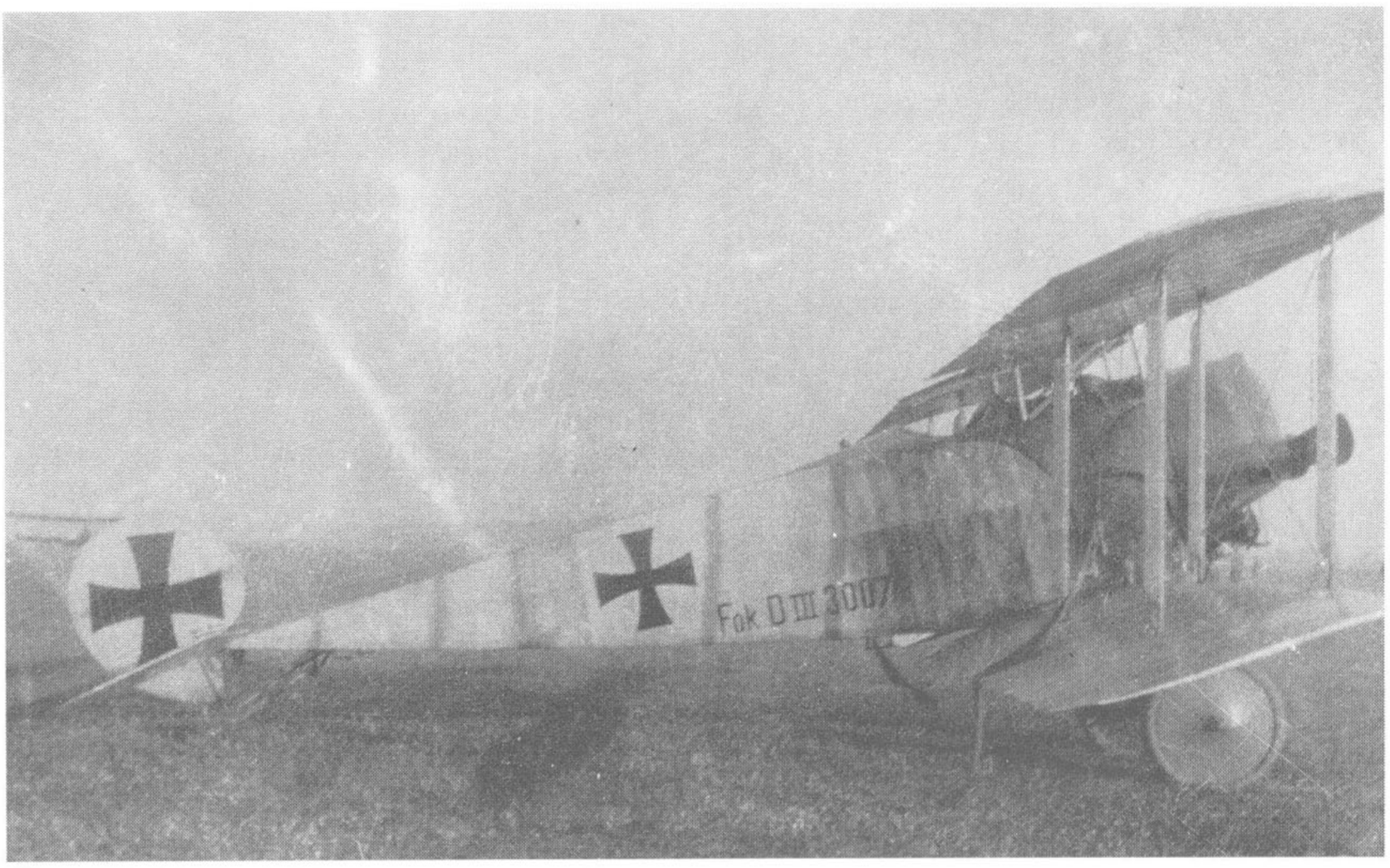
As with E.IV, a single rear mounting bearing was inadequate to support the bulky rotating mass, so additional bearings

Specification – Fokker D.III

Engine:	160hp Oberursal UR.III
Weights:	Empty 452kg (997lb); loaded 710kg (1,570lb)
Dimensions:	Wingspan 9.05m (29ft 8in); length 6.30m (20ft 8in); height 2.25m (7ft 5in)
Performance:	Maximum speed 160km/h (100mph) Rate of climb 1,000m (3,300ft) in 3 minutes; 4,000m (13,000ft) in 20 minutes
Armament:	Two LMG 08/15 machine-guns synchronized to fire through the propeller arc

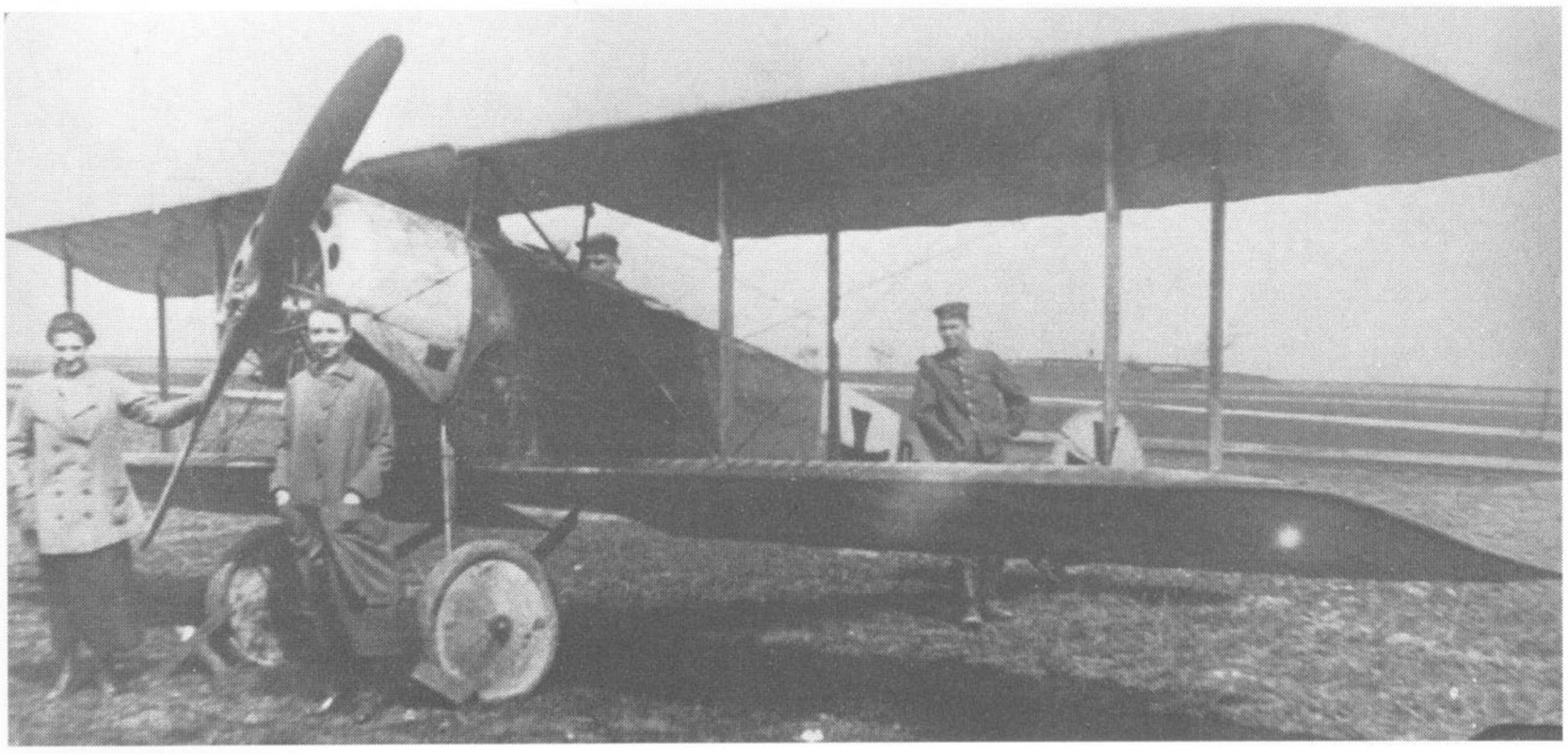


Fokker D.III. Author



Fokker D.III 3007/16. Cross and Cockade International

Oswald Boelke with a Fokker D.III, possibly 352/16. Cross and Cockade International



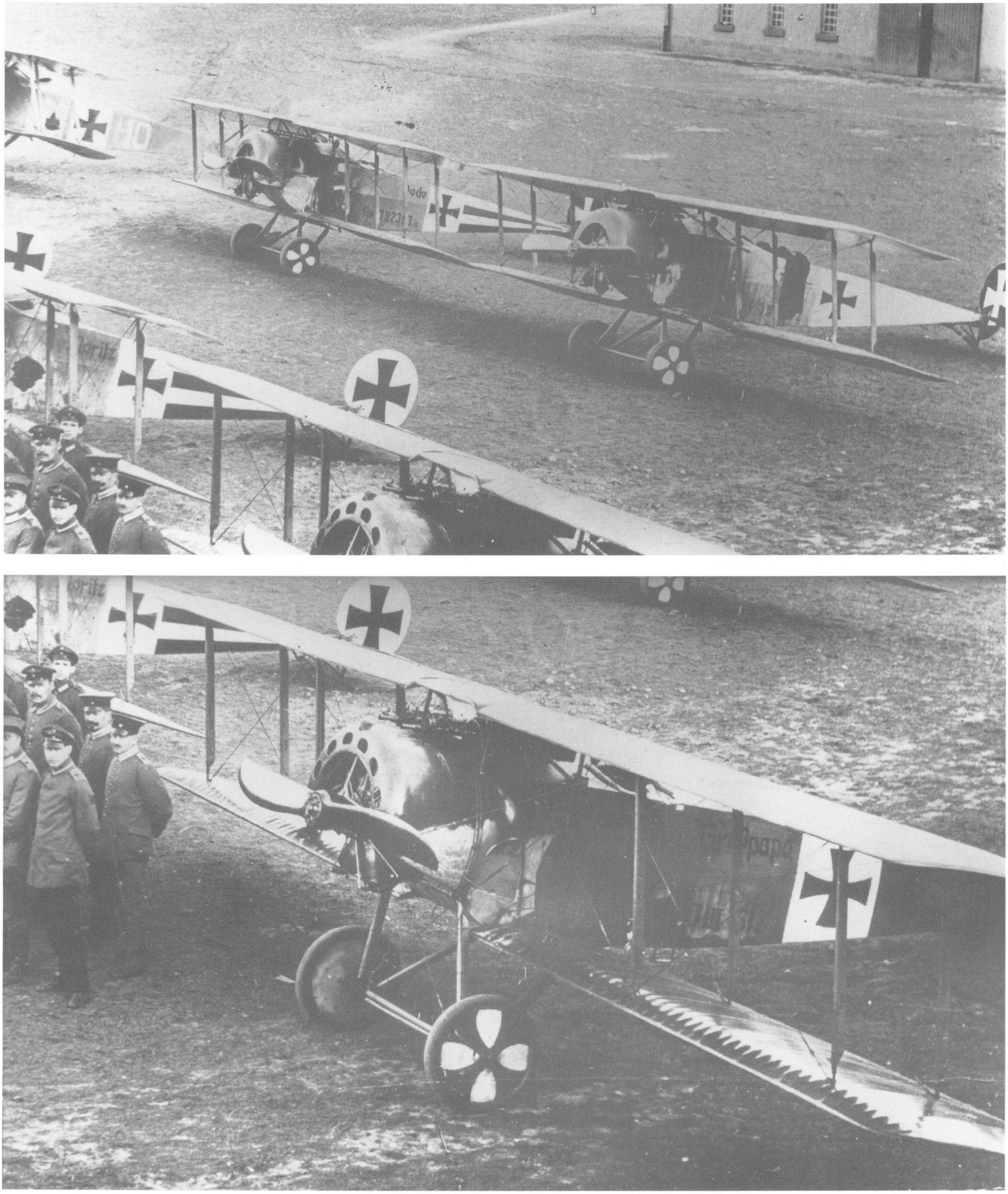
Fokker D.III. Cross and Cockade International

carried on a steel support 'spider' were fitted in front of the engine. The engine cowling with six cooling vents in its front face was also that used on the E.IV. Because of its more powerful engine, its performance was a great improvement on that of either the D.I or D.II and that, coupled with its increased firepower, made it an apparently formidable machine; although it is worth noting that neither the reliability of the UR.III nor its requirement for meticulous maintenance between flights had improved since its use in the E.IV.

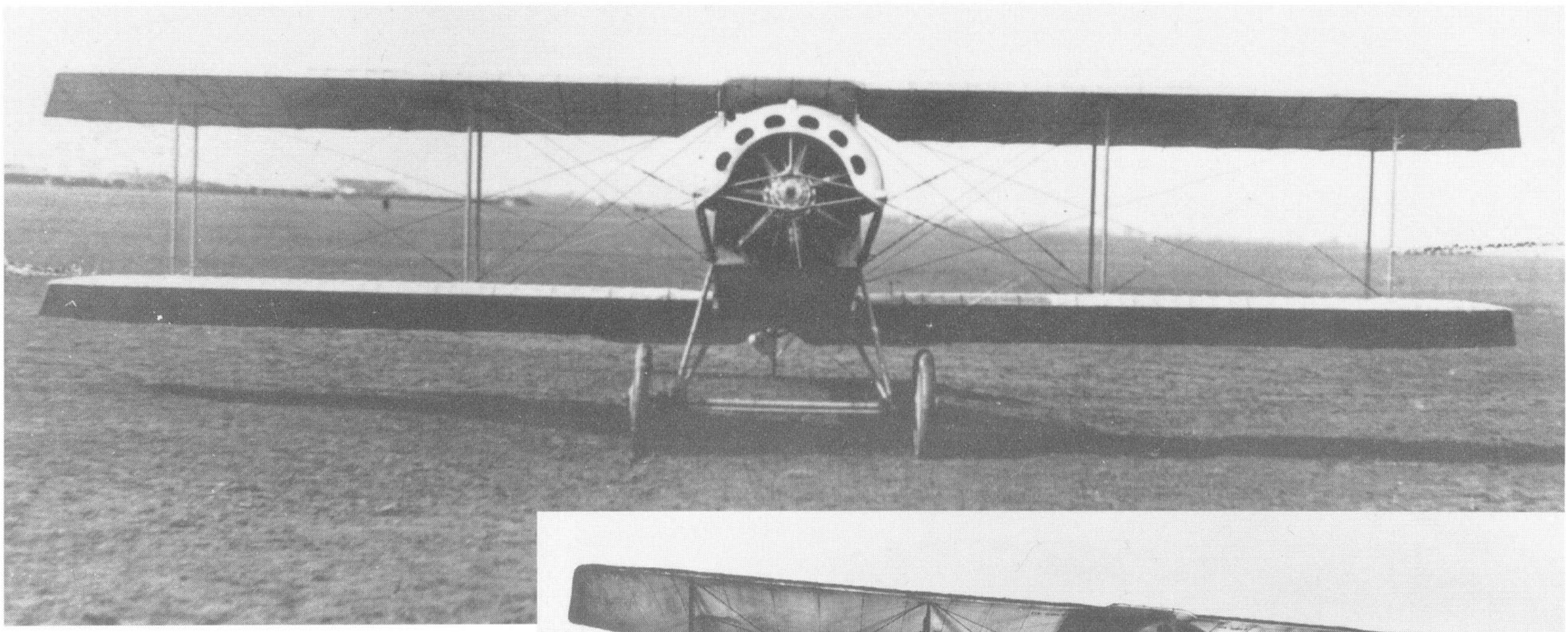
The prototype (now designated D.350/16) was accepted on 26 June 1916 and sent to Adlershof for technical and flight evaluation on 20 July. Idflieg placed an initial order for thirty of the type in June 1916 and followed that with an order for a further twenty later that month. An order for a further sixty was placed in August, and one for a final batch of one hundred in November 1916. The prototype and all of the earlier batches were equipped with warping wings, but it is possible that the final batch was equipped with aileron control.

The first seven production aircraft had been accepted by 1 September 1916 and one of these, D.352/16, was sent to Jasta 2 where it was flown by Oswald Boelke. At first Boelke was enthusiastic and, flying it, added six victories to his score. But he soon came to realize that its performance was no better than that of the Allied types in use (Sopwith 1½ Strutters and Nieuport Scouts). When the new Albatros D.I arrived at the front he changed to that type which, if not as manoeuvrable as the Fokker, was faster, particularly in a dive.

In early October 1916, acceptance testing of Fokker's next prototype (M.21) at Adlershof revealed that all was not well with the quality control system at Fokker's factory, and led Idflieg to demand that a random sample production D.III be provided for test. The aircraft chosen was D.369/16, which was submitted to the full series of load tests and critical examinations between 13–24 November. While the wings passed satisfactorily, both the rudder and elevator failed and control cables were found to stretch excessively, making control difficult. The fuselage mounting and fuel tank were found to be acceptable but questions were raised regarding the quality of both workmanship and materials used. Fokker was directed to pay a great deal more attention to both



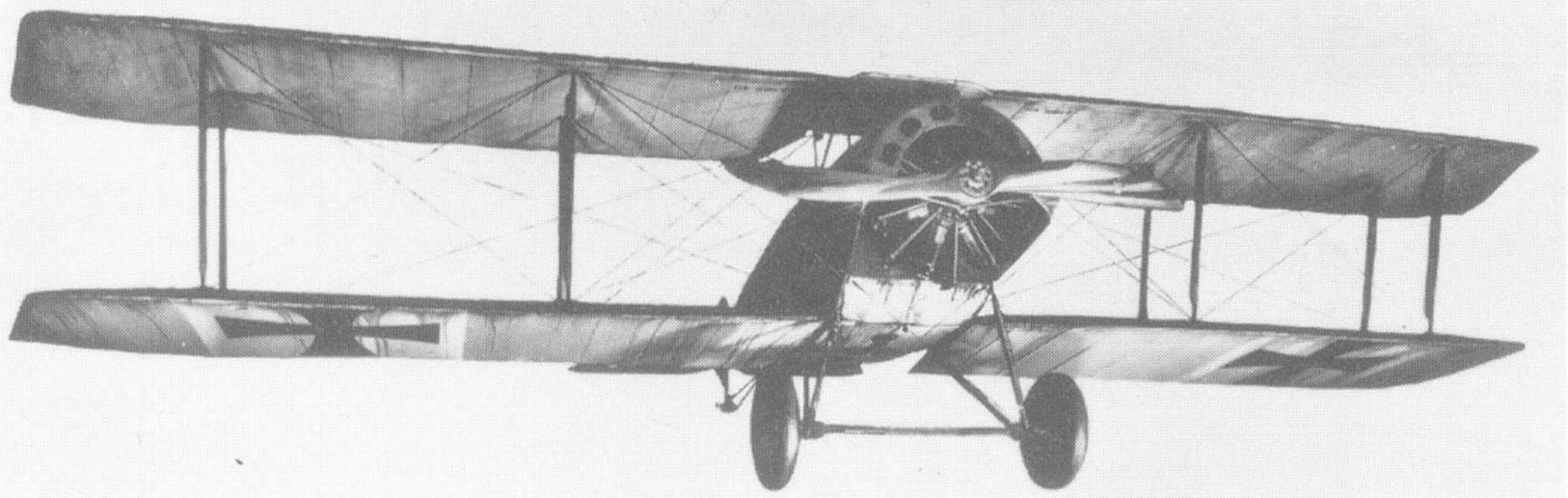
An assembly of interestingly marked Fokker D.III aircraft. That nearest the camera is named 'Grosspapa'. Others are 'Dodo' and 'HO'. Unfortunately no serials are readable. Cross and Cockade International



(Top) **Austrian Fokker D.I (MAG) serial number 04.41.** Cross and Cockade International

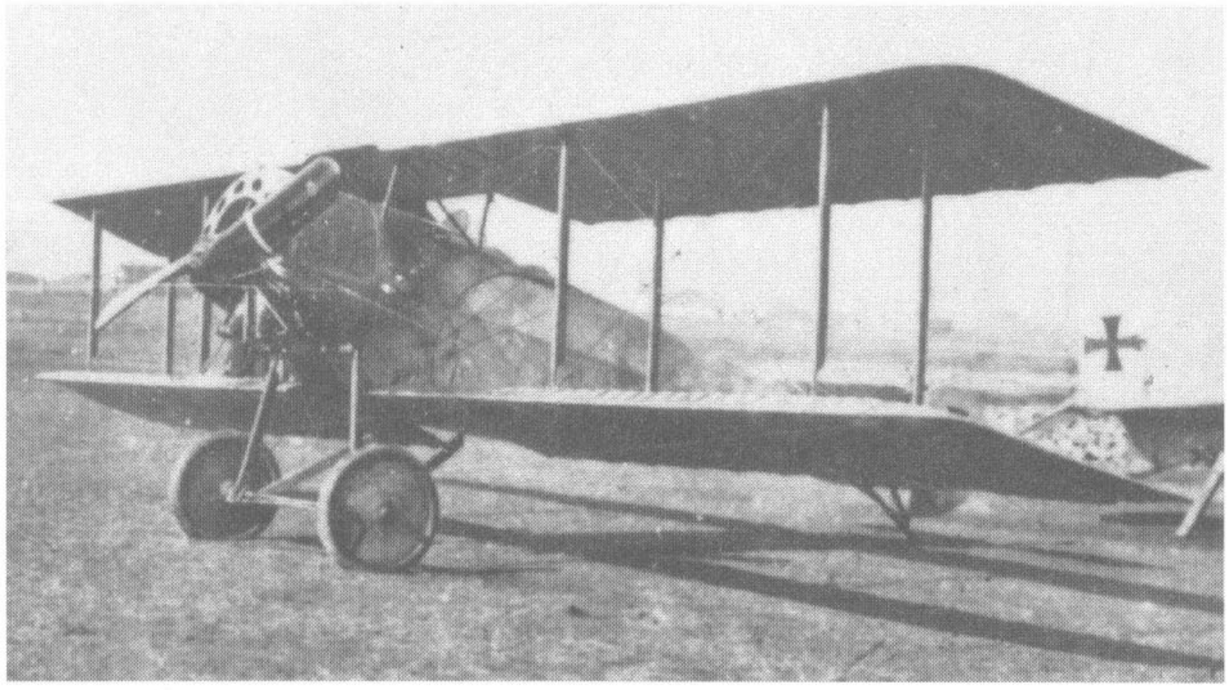
(Right) **A Fokker D.III of Jasta 2.** Cross and Cockade International

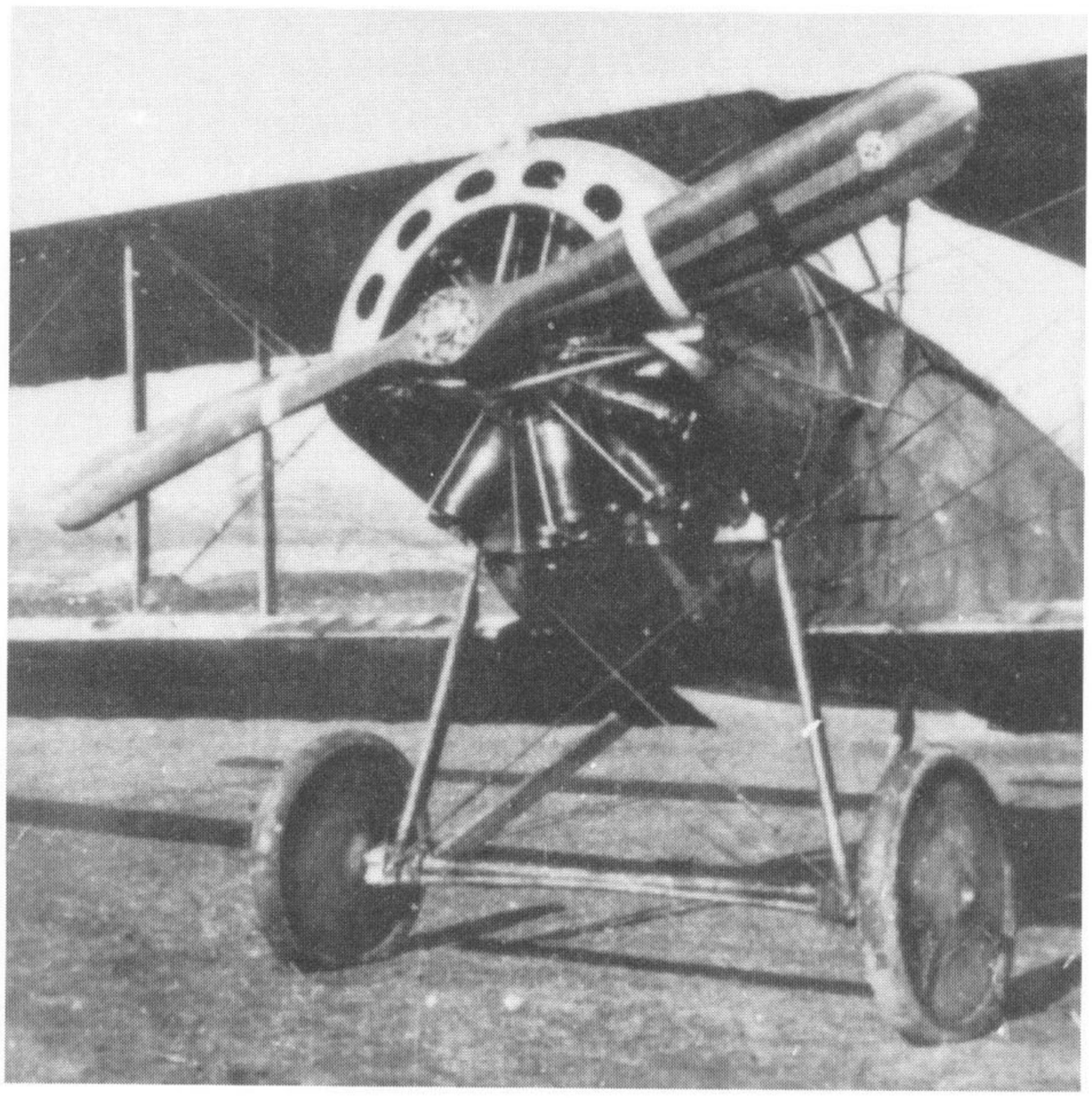
(Below) **Flik 30 pilots with a Fokker D.I (MAG).** Cross and Cockade International



(Above right) **An Austrian Fokker D.I (MAG) of Flik 30.** Cross and Cockade International

(Right) **Flik 30 D.I (MAG).** Cross and Cockade International





Close-up of the nose of a Flik 30 D.I (MAG). Cross and Cockade International

Fokker and Quality Control

Throughout the war years, the reputation of Fokker's products was overshadowed by quality problems of one sort or another. These mainly came from a combination of his parsimonious nature, his virtually non-existent formal engineering training and his lack of understanding of the basic essentials needed for successful production engineering.

An examination of the records of virtually all of Fokker's wartime aircraft reveals that each went through a period when defects in either its manufacture or the materials used for its construction were revealed and later rectified at his expense. The E-series monoplanes suffered from this, as did the later D-series biplanes and then, tragically, the Dr.I triplane. The D.VI and D.VII seemed to escape without such problems, but the same weaknesses of control came to light again in the E.V/D.VIII at the end of the war.

Fokker's rejection of the need for stress calculations for structural components was undoubtedly responsible for some of these problems but the main cause was his apparent insistence on using the cheapest materials available, regardless of their fitness for the task for which they were being bought. To this was added his disregard for the need for adequate quality control of both components procured and the standard of workmanship in his production workshops.

The recurring sequence of design, acceptance, manufacture, fault and rectification ate deeply into his profits and also stopped him from being awarded profitable production contracts and follow-on orders. It undermined his credibility as a reliable aviation contractor and engendered distrust of his products by the German procurement departments. At one time, the use of his aircraft for combat was banned and he came close to being prosecuted on the grounds that he was both defrauding the German government and endangering the lives of German pilots.

aspects. With this proviso, the D.III remained in production but, on 6 December 1916, Kogenluft's embargo on the use of Fokker-built aircraft for combat purposes came into force. All of the D.IIIs in service and those still coming off the production line were either relegated to training duties or sent to home defence units – the Kampfeinsitzer Staffeln (Kestas) and one Naval Defence flight – where they continued to serve well into 1917. Even then, they continued to be of use and, as late as spring of 1918, a few of the type were issued to front-line squadrons to provide them with experience of rotary engines (by then a rarity at the front) prior to their re-equipment with the new Fokker Dr.I triplanes. A total of 210 D.IIIs were produced for the German Army. None were ordered by the Austro-Hungarian Army or saw service in that theatre.

Problems

Fokker's next proposed prototype, M.20, was a wire-braced experimental monoplane. It is doubtful that it progressed beyond the drawing board, although Fokker did provide copies of drawings of it to consultant Villehad Forssman for consideration.

***(Top)* A young Ernst Udet behind the padded butt of the LMG08/15 fitted to his Fokker D.III.** Cross and Cockade International

***(Above)* Ernst Udet's Fokker D.III, 364/16. The rear-facing 'observer' was cut out of tin plate.** Cross and Cockade International

The Army's choice of the superior Albatros designs in preference to his 'D-series' was a major setback for Fokker. At first, his reaction was to blame the Army and its pilots for their desertion of him. Close behind that came blame for the Flugmeisterei engineers for their adherence to the results of theoretical calculation. Finally came the understanding that, if he was to stay in business as a major contractor supplying his own creations, he needed aircraft capable of competing with Albatros' best.

In Germany, the allocation of engines to airframe manufacturers was made by Idflieg on the logical basis that priority was given to those who were building the types most needed by the Army at any particular time. Thus, with no successful prototypes to offer, Fokker's needs came low on the list and the majority of 160hp water-cooled engines coming off the Mercedes production line were directed to the Albatros and Pfalz companies. In order to keep his workforce intact, Fokker was given an order for the manufacture of 400 AEG C.IV biplanes. It was felt that this machine with its welded tubular-steel fuselage and (largely) wooden wings lent itself to the skills of the workforce at Schwerin. Also, Fokker was told to study the quality of AEG construction and the means by which it was attained, in the hope that this would improve his production methods. This contract, though lucrative, did nothing to boost the sales of Fokker's own designs, or his ego, and was undertaken most reluctantly.

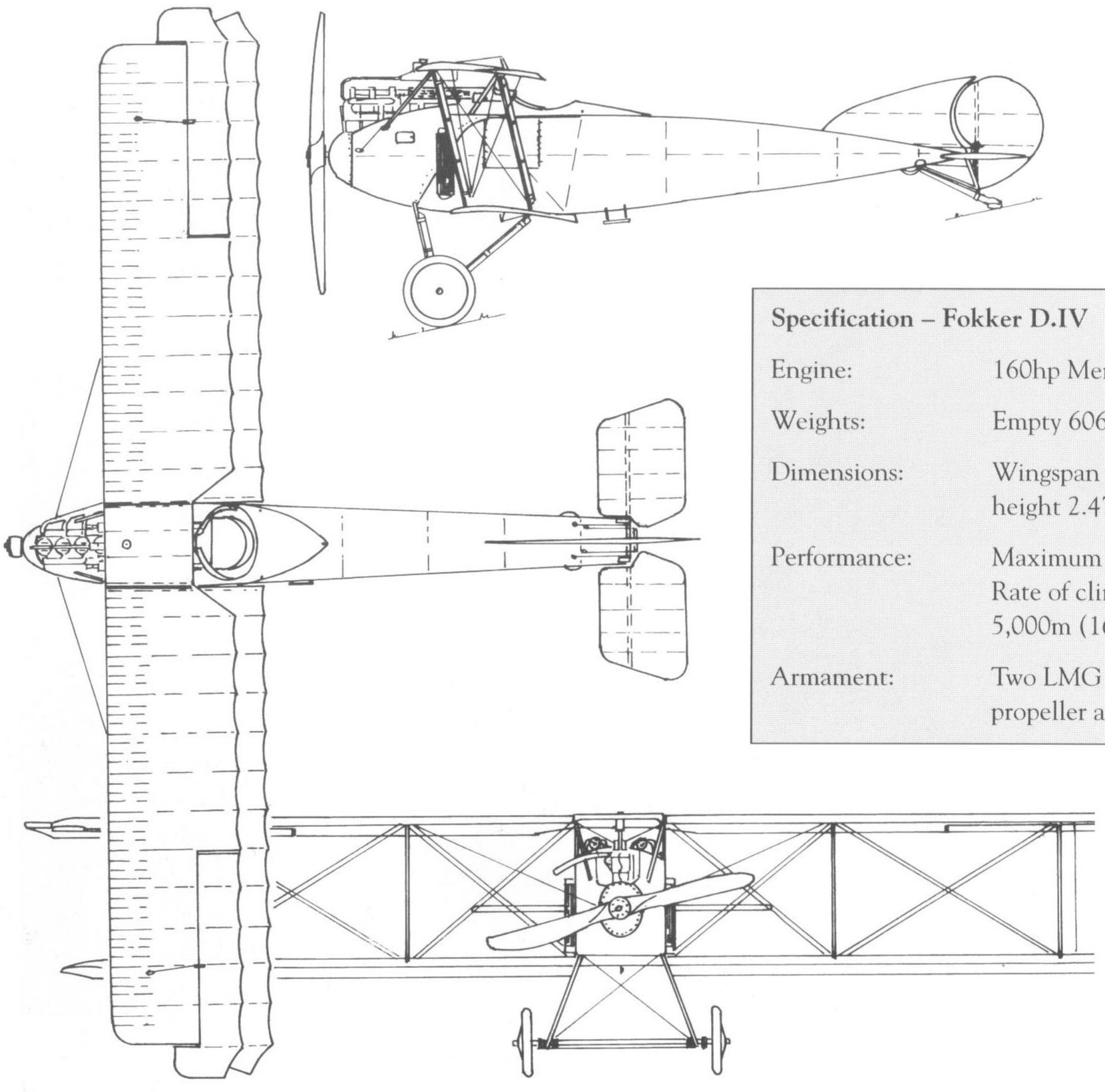
Some time earlier, Fokker had tried to improve the D.I by installation of a water-cooled 160hp Mercedes D.III engine. The resulting two-bay biplane with warping wings followed closely D.I's structure but had a small triangular tail fin fitted to compensate for the additional side area of the larger engine. In spite of the considerable increase in available power, Fokker had done nothing to strengthen the airframe that remained structurally identical to that of the D.I. It was not a success and was abandoned when it ran into what were seen as insoluble structural problems.

The D.IV

The success of the Albatros designs caused Fokker to think again and to reconsider use of a more powerful engine. The result was M.21, again a two-bay biplane based closely on the D.I structure and fitted with the 160hp Mercedes engine, side-mounted radiators, twin synchronized LMG 08 machine-guns, ailerons and a finless comma-shaped rudder.

Initially, design of the M.21 was somewhat 'fluid' and several prototypes were built with slightly differing configurations. The first to be completed featured an engine cowling that came to a rounded 'point' behind the propeller and was fitted with a comma-shaped rudder and no tail fin. A later version had a deeper, faired nose and a large spinner fitted to its propeller. This version also had no tail fin and the comma-shaped rudder. The production prototype reverted to a spinner-less propeller and a rounded, cowled nose with the finless comma-shaped rudder. Engine exhaust systems varied from vertical to horizontal pipes before the long horizontal pipe of the production machines was finalized. Some later production types were fitted with 'triangular' tail fins, the shapes of which varied slightly.

The first of the prototypes was completed during September 1916 and sent to Adlershof where its structure was tested between 2 and 7 October 1916 with Fokker (reluctantly) present. The results were not good and the first failure occurred when the turnbuckle bolt of the main bracing wire tore out before reaching the maximum specified loading. With these replaced, the tests continued until more failures occurred. At this point, critical examination revealed



Fokker D.IV. Author

Specification – Fokker D.IV

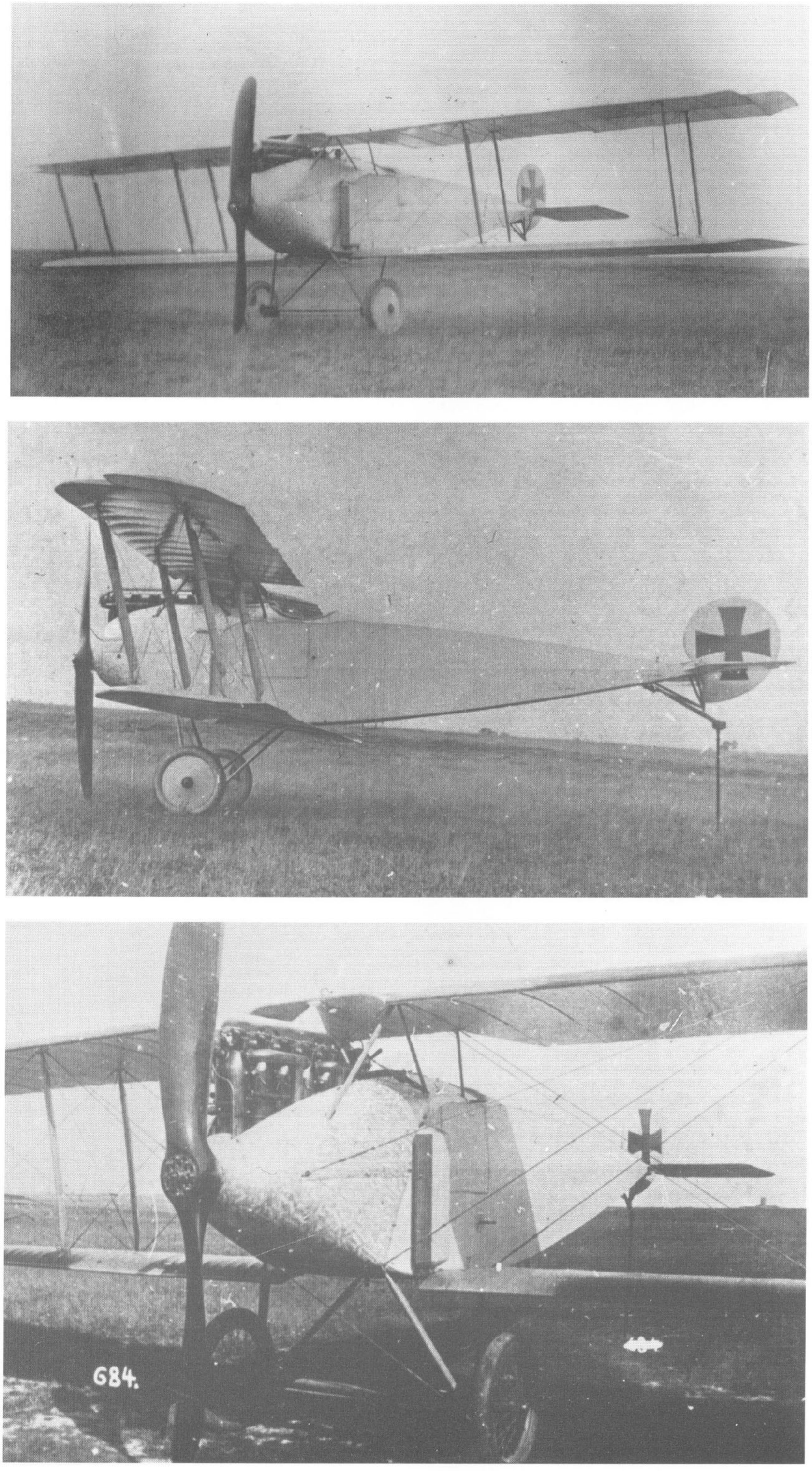
Engine:	160hp Mercedes D.III
Weights:	Empty 606kg (1,340lb); loaded 841kg (1,850lb)
Dimensions:	Wingspan 9.70m (31ft 10in); length 6.30m (20ft 8in); height 2.47m (8ft 1in)
Performance:	Maximum speed 160km/h (100mph) Rate of climb 1,000m (3,300ft) in 3 minutes, 5,000m (16,000ft) in 30 minutes
Armament:	Two LMG 08/15 machine-guns synchronized to fire through propeller arc

that the bolts, turnbuckles and bracing wires were all well below an acceptable standard. All of these were then replaced using components drawn from the Adlershof workshops stores; the tests were allowed to continue and the specified load factor was reached without deformation of the wing.

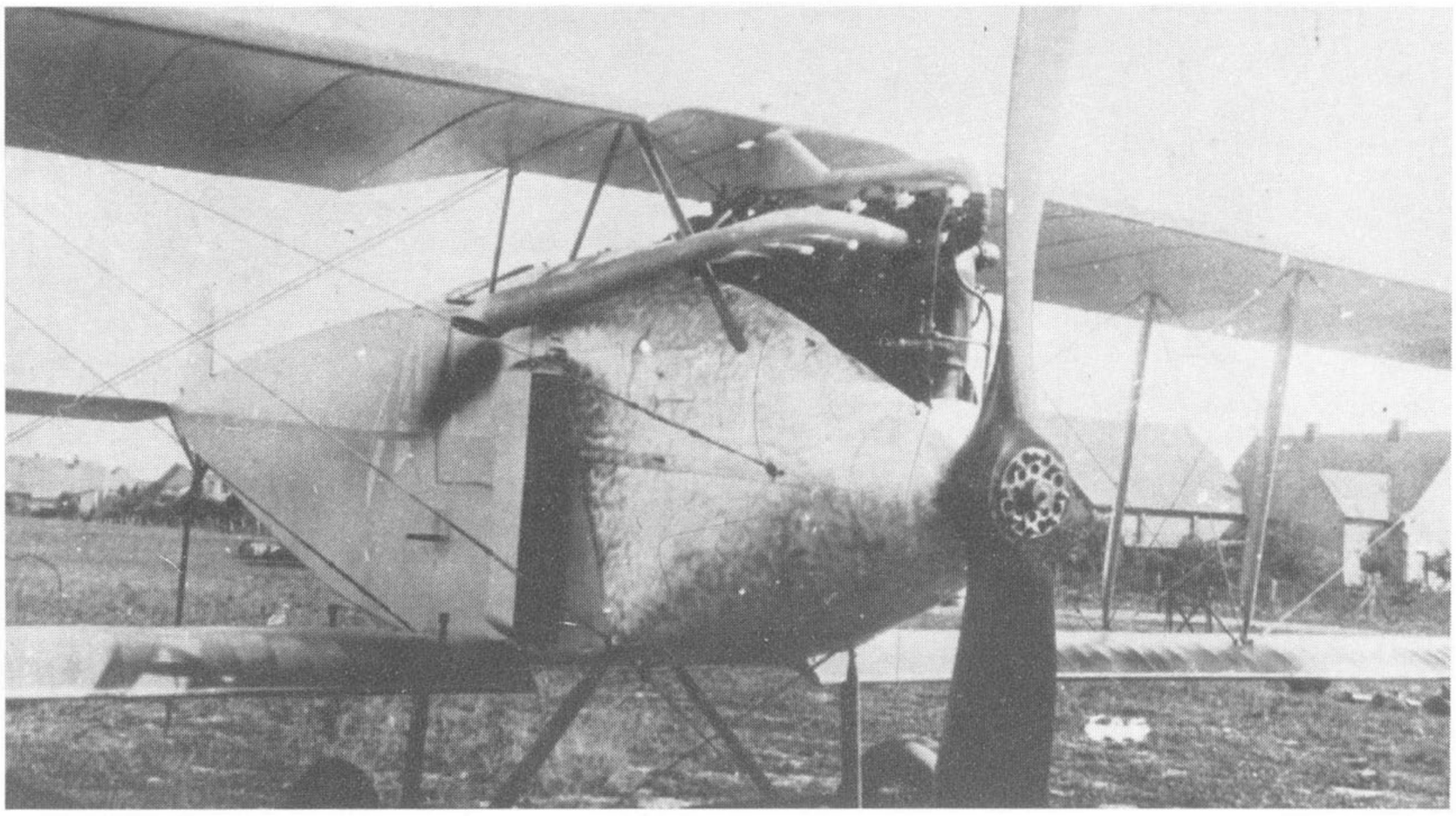
Fokker was directed to replace the half-wing damaged by the earlier failure and the tests continued on 13 October. During these the upper wing rear spar cracked and Fokker was told that this needed to be replaced by a stronger unit. A strengthened wing finally passed to load tests on 26 October. The tests continued with the wing passing that for inverted flight. After having passed all of the specified tests, the wing was tested to destruction on 4 November 1916 and finally achieved a result well above the specified level. The engineer responsible for the tests reported that he considered the M.21, now designated Fokker D.IV, acceptable for service, but added the proviso that it was absolutely necessary for the strengthening changes to be made and that it was essential that quality control at Fokker's factory be strictly observed during manufacture.

Despite this grudging acceptance, Fokker's problems were not over. Testing of an E-series monoplane fuselage after a series of crashes of the type at the front revealed that its structure was inadequate to withstand forces resulting from application of its rudder and elevator. The similarity of construction of the rear fuselages to that of Fokker's biplane fighters caused the strength of the latter to be questioned. When the D.IV fuselage at Adlershof was loaded to simulate rudder and elevator forces the right lower longeron was found to deform at 68 per cent of the specified load. Fokker had these longerons replaced by stronger tubing and, on 25 October, the fuselage was found acceptable. Fokker was directed that all completed fuselages had to be modified in the same way.

Fokker's problems continued when the controls were subjected to testing and it was found that the welding of tubing and ribs to the rudder and elevator posts failed under load and the ribs came adrift. Also, the fin retaining bolt broke, causing failure of the structure. This was not all. The elevator arm collapsed before the control column was loaded to the specified level and the rudder foot control became badly bent. Fokker was required to strengthen these components using stronger tubing and thicker-gauge steel sheet as appropriate.

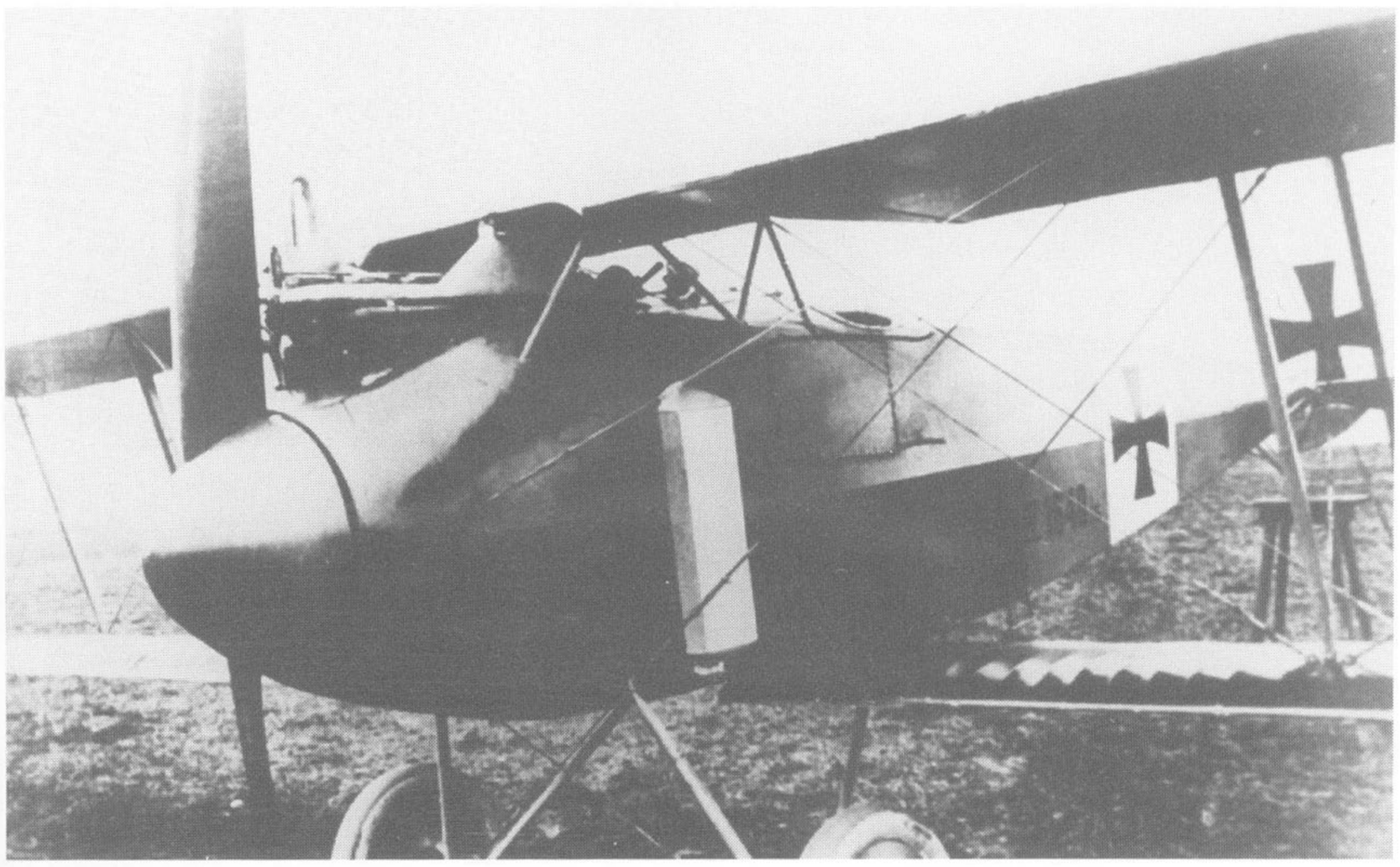


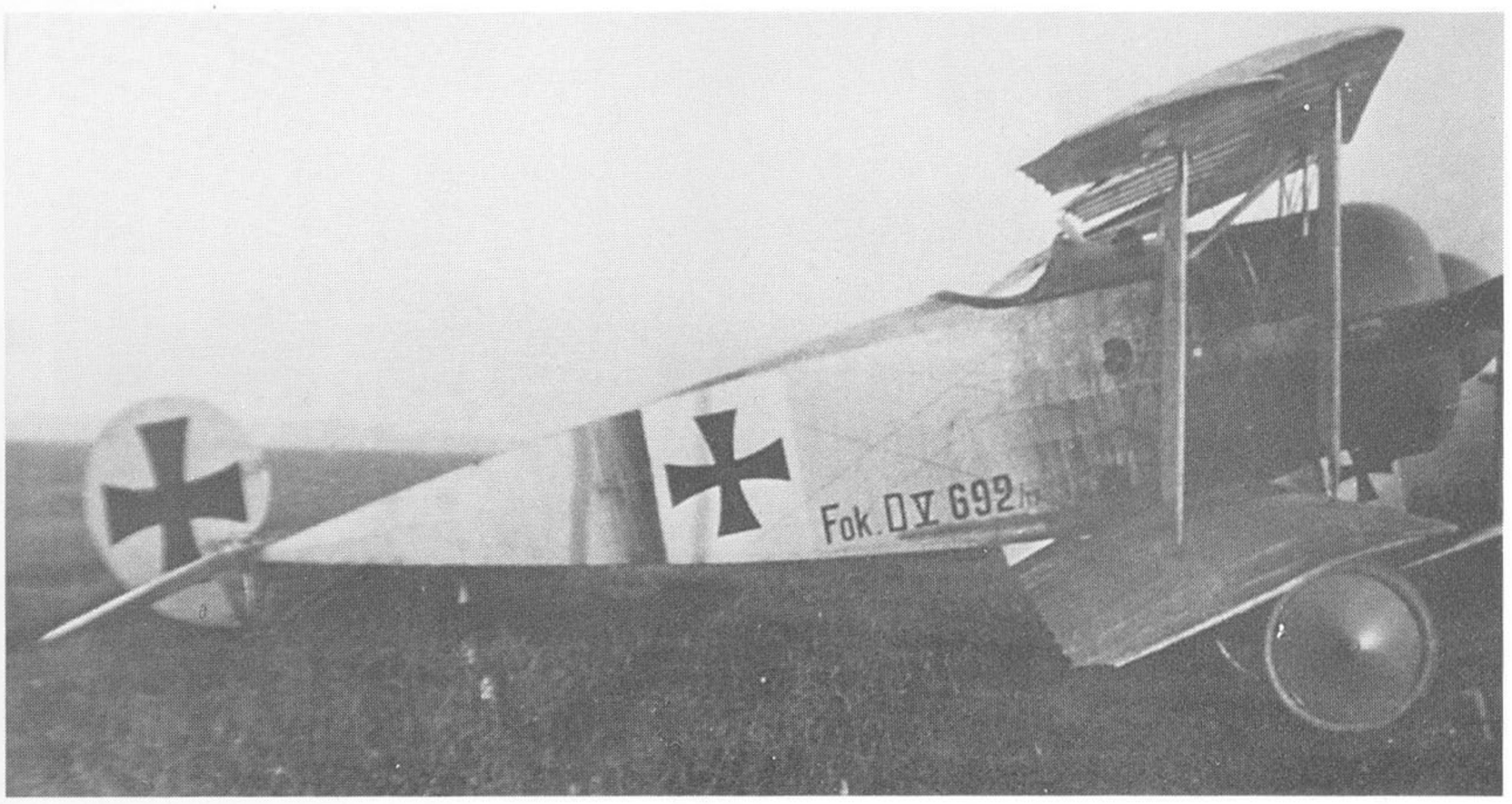
Three views of the Fokker D.IV prototype. Cross and Cockade International



Further view of the D.IV prototype. Cross and Cockade International

(Below) **Fokker D.IV 1640/16 with an improved engine installation and a large spinner.** Cross and Cockade International





Fokker D.V 692/16 training aircraft with no armament. Cross and Cockade International

By the time that all of these faults were corrected all Fokker aircraft had been banned from front-line use and the D.IV was never able to prove itself in action. Production of the D.IV continued through to March 1917, with most of the type being used for training purposes away from the front. The air service inventory still had thirty-three of the type on charge in December 1917. Four were bought for the Swedish Army and intended for the defence of Stockholm. All were fitted with 150hp Benz Bz.III engines, but only one was assembled, fitted with a single machine-gun and flown. The rest remained in storage.

The M.21

Fokker's next prototype was the M.21, which seems to have made its first appearance as a single-bay biplane in June or July 1916. Its design was clearly based upon that of the D.II, having the slab-sided fuselage and the tail assembly of that machine. It was powered by a 100hp Oberursal UR.I rotary partly enclosed in the familiar horseshoe-shaped cowling. A short plywood fairing was fitted to the top of the fuselage behind the pilot. It differed in that its upper wing was mounted further forward than that of the D.II, it was swept back by 6 degrees and it was fitted with large, balanced ailerons. It was mounted above the fuselage on short tubular-steel cabane struts with vertical struts at the front and rear, and a further strut on each side angled from the bottom of the front strut to the top of the rear strut. Its centre section retained the now familiar 'hollowed out' under surface designed to improve the pilot's forward vision. The lower wing remained the same as that of the D.II. Little is known of the life of this machine, which may have been scrapped or (possibly) used as the basis for the next version.

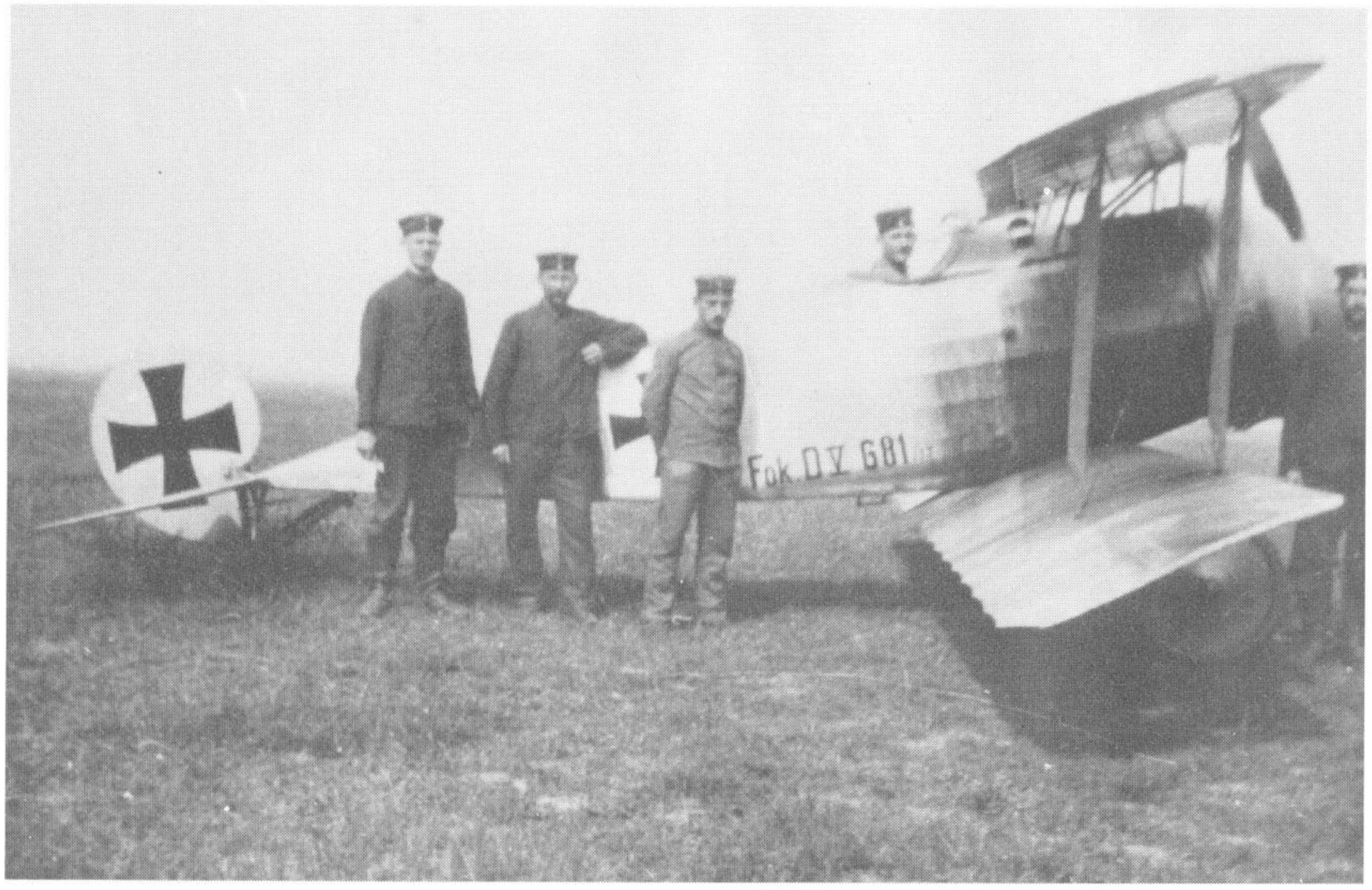
The D.V

The next identifiable prototype, the M.22, made its appearance in early August 1916. It retained the upper and lower wing shapes and the cabane strut arrangement, but had its engine (again the UR.I) completely enclosed in a circular cowling. The sides of its fuselage were faired from this cowling back to a point behind the pilot by rounded formers and a number of stringers. The top of the fuselage behind the pilot was

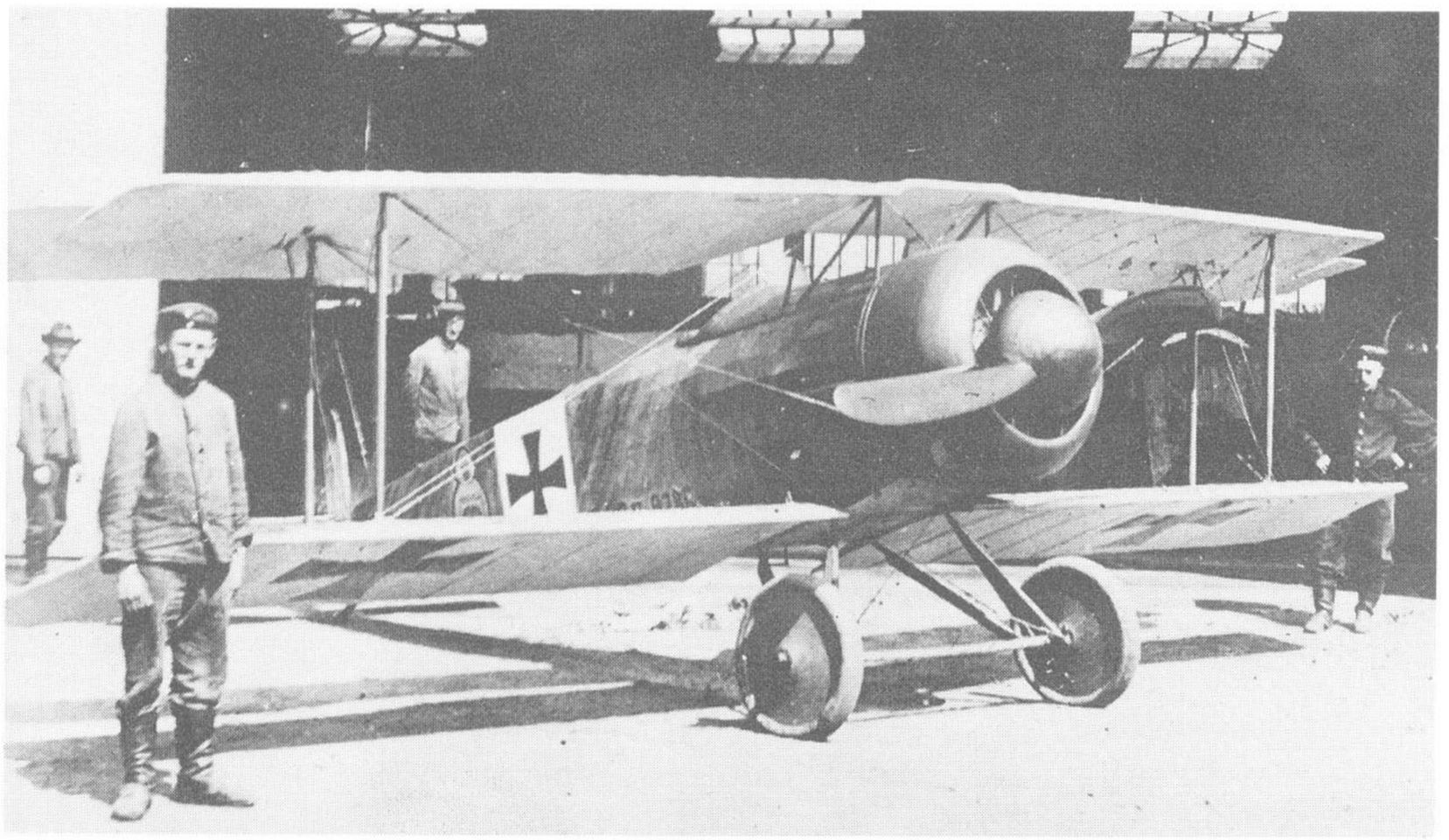
similarly faired back to its horizontal knife-shaped rear end. The propeller was fitted with a large rounded spinner that left a small annular gap for the flow of cooling air through the cowling front. These modifications gave a great improvement to the drag coefficient but reduced the flow of cooling air to the engine, with the result that it tended to overheat when the aircraft was climbing in hot conditions. The front 'leg' of the V-shaped undercarriage was made up of a pair of steel tubes that were faired together. The rear leg was a single steel tube. Springing of the wheel axle was by means of wrapped bungee cords.

Structurally, the wings were similar to Fokker's earlier biplanes, having three riblets between each pair of ribs and wire trailing edges. Their spars, machined from planks of pine, were originally much lighter than those of earlier models but, for production, had to be strengthened. The rudder, elevator and ailerons were welded tubular-steel structures. A single LMG 08 was fitted with its ammunition box close to the pilot's knees. Immediately in front of this was an 85ltr gravity fuel tank shaped to fit the fuselage.

By October 1916, Fokker had convinced Idflieg of the worth of this design and had received an order for 200 of the type, now designated Fokker D.V, to be used for training single-seater pilots well away from the lines. Despite this order, Idflieg was deeply conscious of the quality problems experienced with Fokker's earlier machines and imposed a strict testing and acceptance programme. D.2710/16, a sample taken at random from the production line (to avoid 'special' preparation), was sent to Adlershof for testing between 12 October and 1 November 1916. The



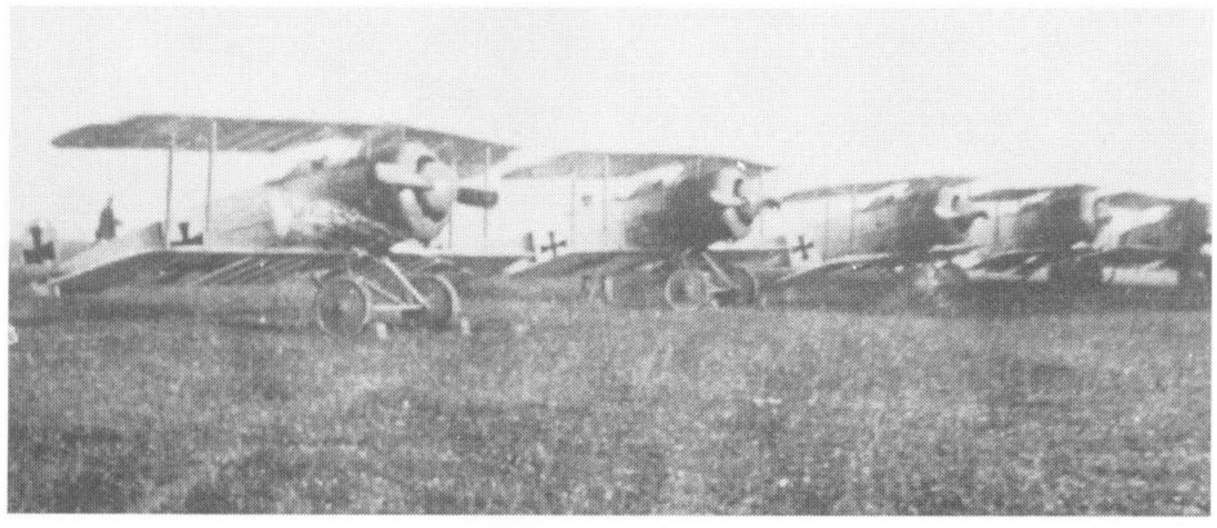
Fokker D.V 681/16. Cross and Cockade International



(Above) **Fokker D.V 2786/16.** Cross and Cockade International

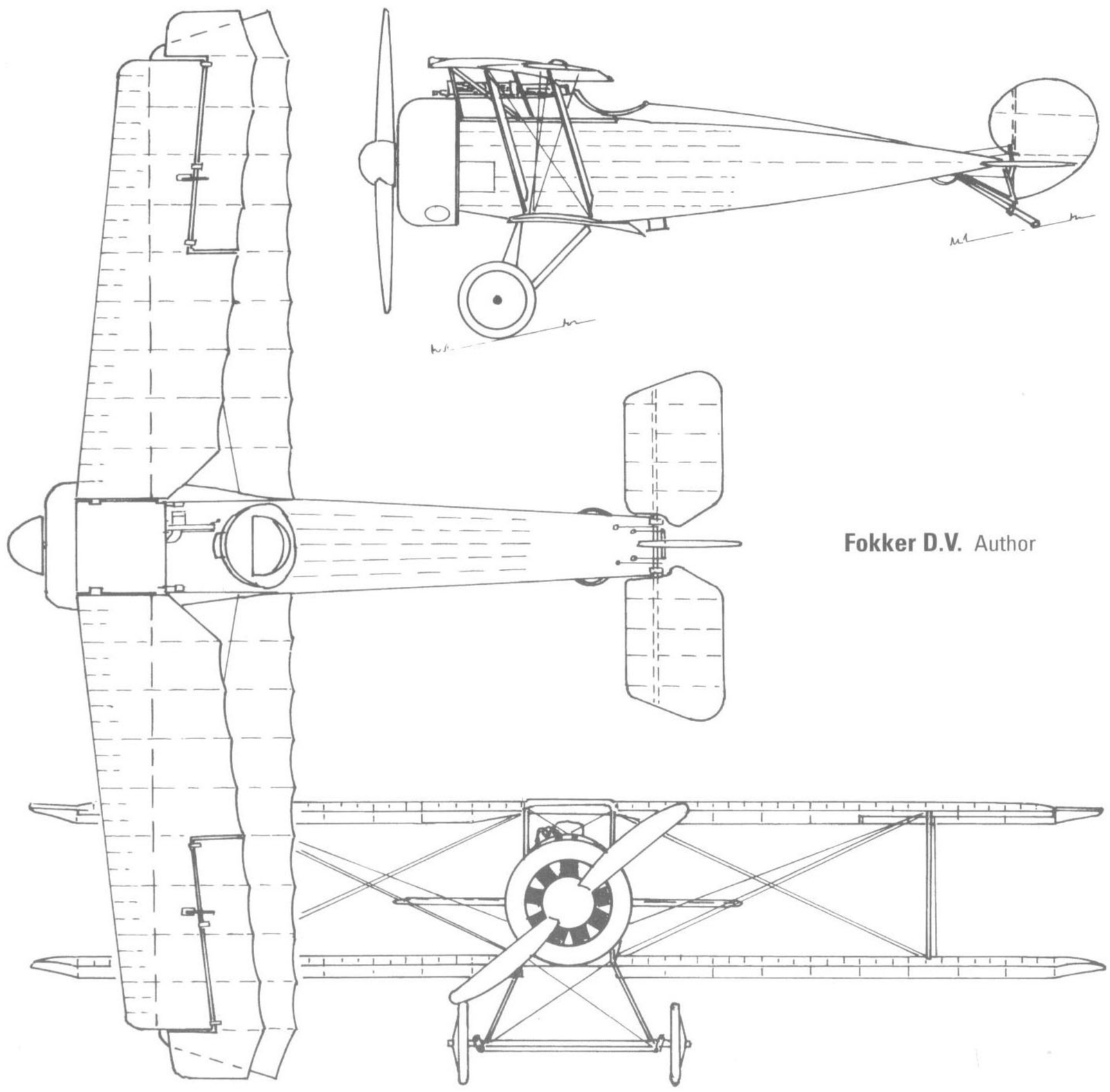
(Left) **Ltn Hempel in D.V 2697/16.** Cross and Cockade International

(Below) **A line-up of D.Vs, probably at a *Jastaschule*.**
Cross and Cockade International



Specification – Fokker D.V

Engine:	100hp Oberursal UR.I
Weights:	Empty 363kg (800lb); loaded 566kg (1,250lb)
Dimensions:	Span 8.75m (28ft 8in); length 6.05m (19ft 10in); height 2.30m (7ft 6in)
Performance:	Maximum speed 170km/h (106mph); rate of climb 1,000m (3,300ft) in 3 minutes, 4,000m (13,000ft) in 24 minutes
Armament:	One LMG 08/15 machine-gun synchronized to fire through the propeller arc (most aircraft of the type were used for training and thus unarmed)

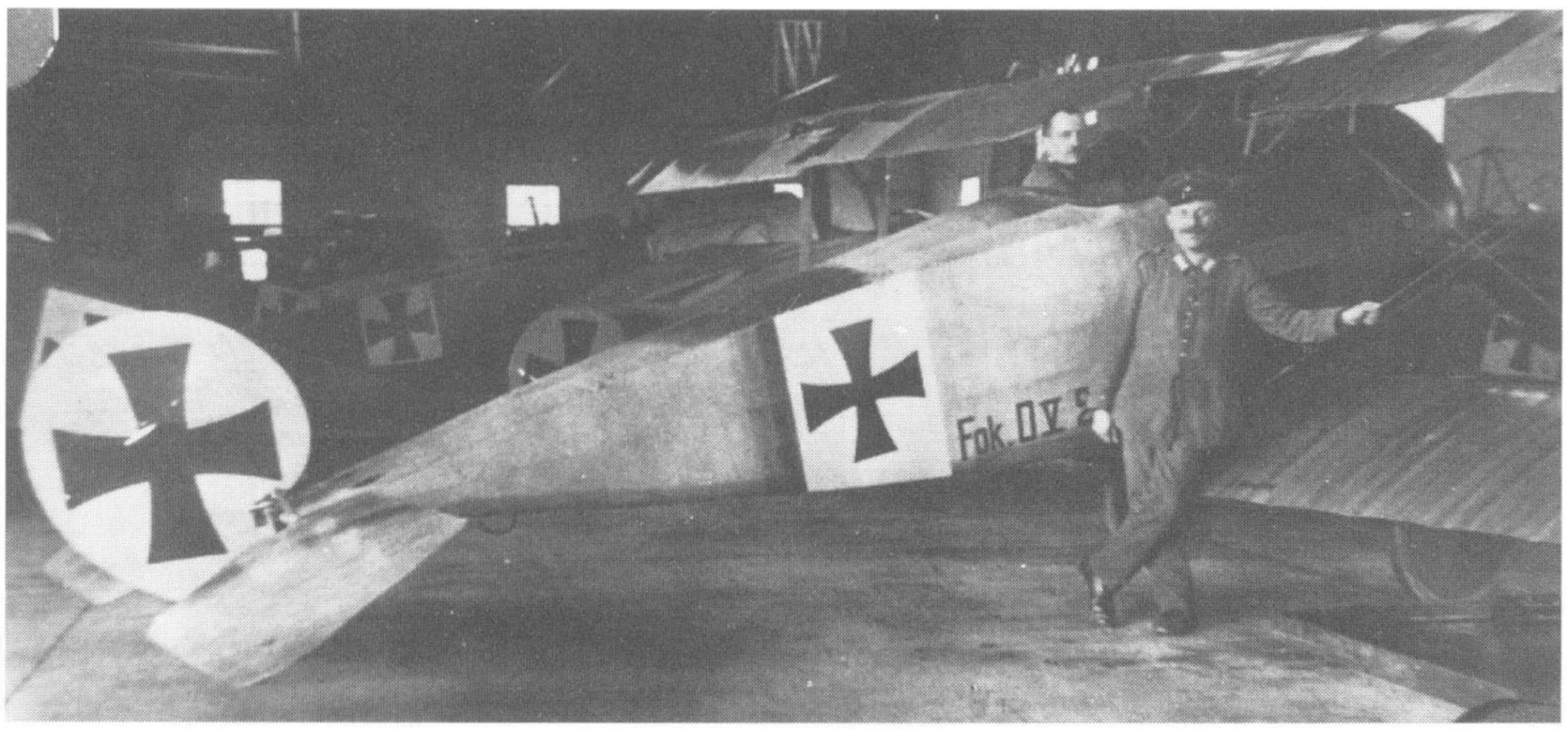


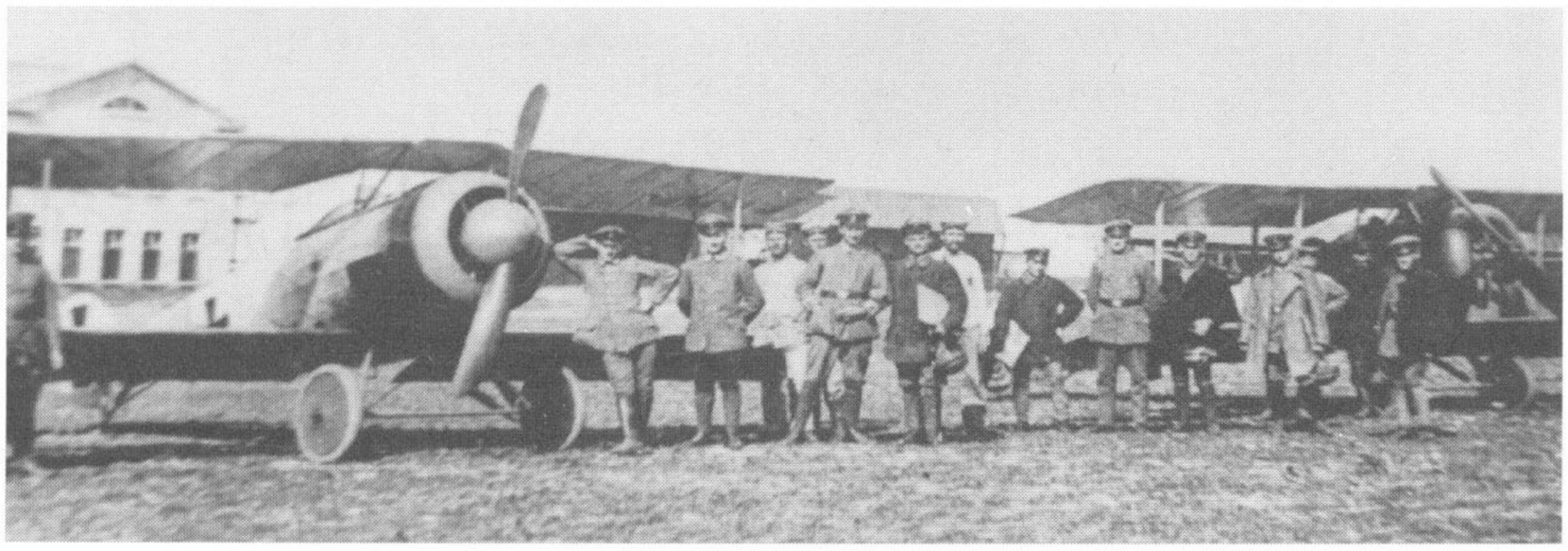
Fokker D.V. Author

Fokker D.V of the 2700/16 series. This is a training aircraft and was probably used at either an Armee Flug Park or with a Jasta to familiarize pilots with rotary engines prior to their equipment with Dr.I triplanes. Greg Van Wyngarden

(Right) **Fokker D.V at (probably) a naval training unit.** Cross and Cockade International

(Below right) **Unarmed Fokker D.V training aircraft with instructors and pupils.** Greg Van Wyngarden



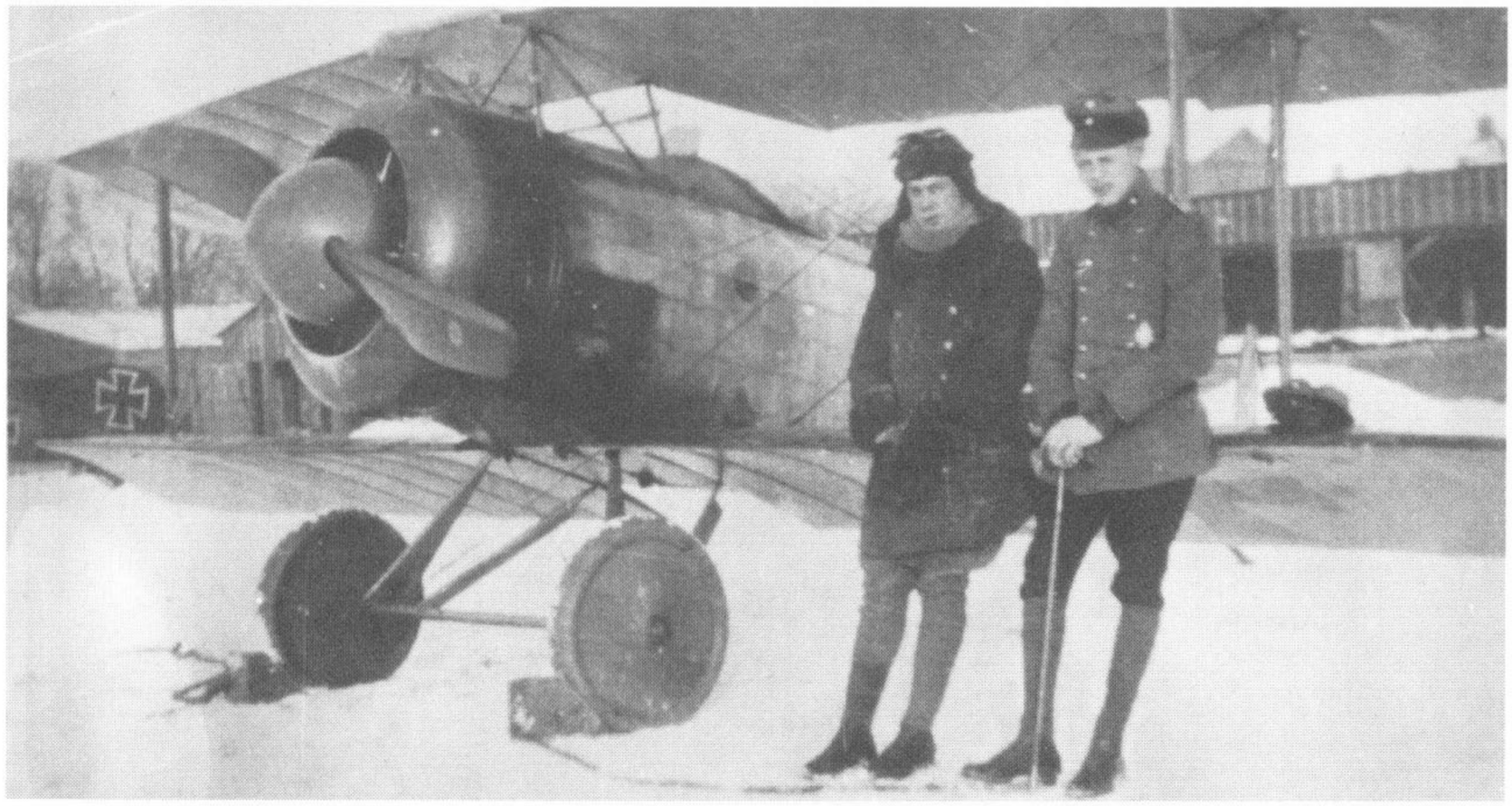


tests revealed weaknesses and Fokker was required to supply two new wings fitted with the strengthened spars and a strengthened rudder. With these modifications, the D.V was deemed to have met the specification. In addition to the strengthened spars and rudder, production aircraft had a revised cabane strut layout. Front and rear struts remained as before, but the angled strut now went from the base of the rear strut to the top of the front strut.

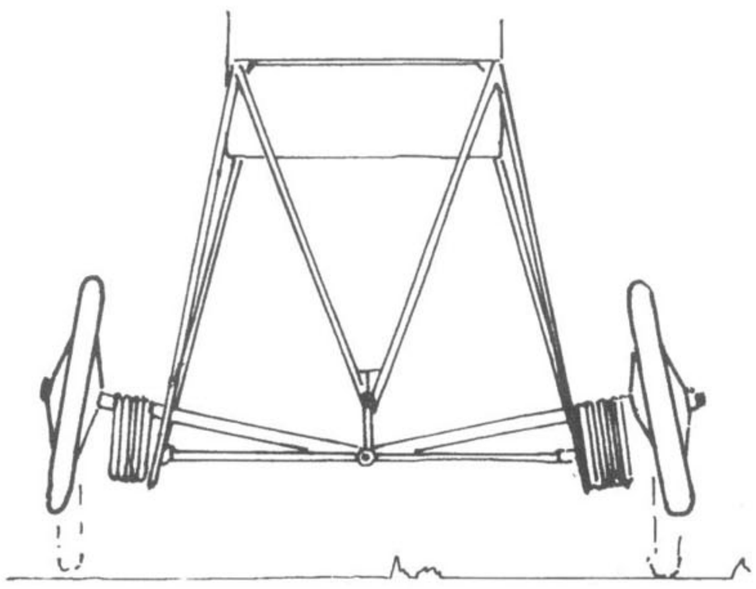
A second batch of fifty D.Vs was ordered in February 1917 and this was followed by a third (and last) batch of fifty more in April 1917. Acceptance of production aircraft commenced in December 1916 and the final machine was accepted in July 1917.

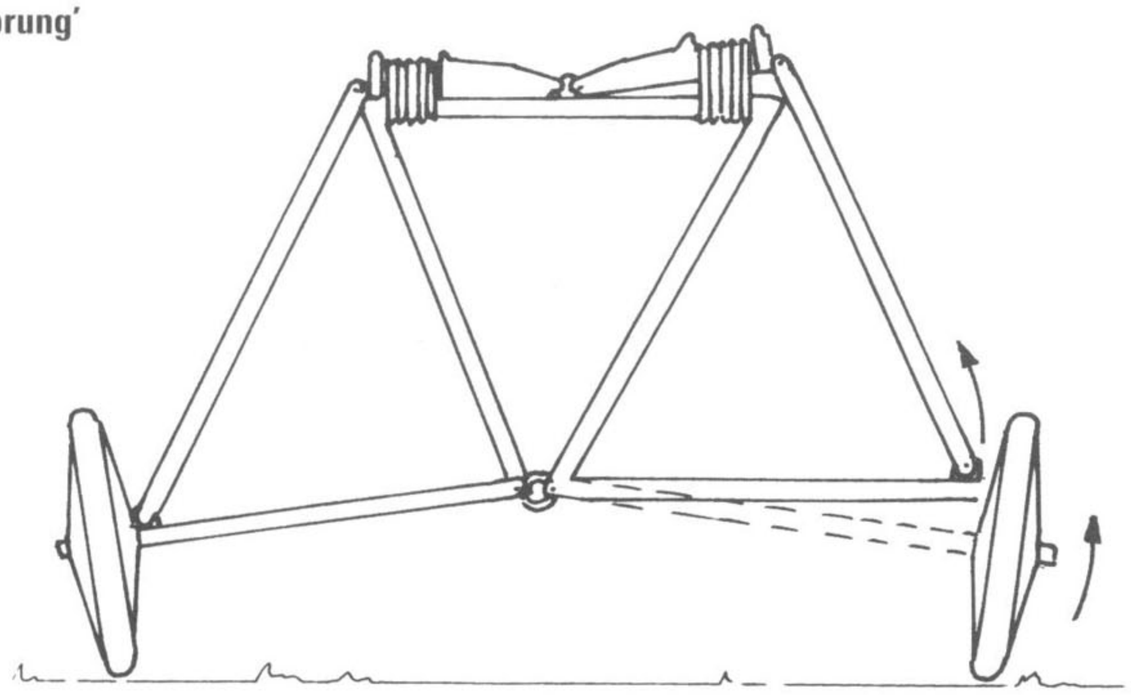
The D.V was seriously underpowered, but was satisfactory as a training aircraft and served mainly in that role, though a few were attached to both Army Home Defence Flights and Naval Port Defence Units (where they were also used for training purposes). Later, the D.V was one of the rotary-engined aircraft supplied to front-line units to re-accustom them to rotary engines in readiness for their re-equipment with Fokker triplanes or the new generation of rotary-engined Pfalz and Siemens-Schuckert biplanes.

(Right) **Ltn Paul Baumer and Hans-Joachim von Hippel with a Fokker D.V on the Jasta 5 airfield at Boistancourt, probably immediately prior to the re-equipment with Fokker Dr.I triplanes.** Cross and Cockade International



Morane undercarriage with 'sprung' axle *(left)*. Fokker undercarriage with 'sprung' legs *(right)*.





NOTES ON THE FOKKER MONOPLANE BROUGHT DOWN NEAR RENESCURE, 8 APRIL 1916.

Type. M.14. No. of machine 509.

Apparent date of delivery from the makers. March 1916.

General design of aeroplane. Similar to a Morane monoplane (not parasol). It had no fixed tailplane. Single seater.

Total span 33 feet.

Total length 25 feet.

Cord of main plane 6 feet.

Petrol capacity, back tank 98 litres = 21.5 gallons.
front tank 22 litres = 4.8 gallons.
Total - 26.3 gallons.

Oil capacity, 6 gallons.

Each wing has two lift cables.

The lateral control is by warp not ailerons.

There are single cables to the rudder and elevator.

The wings are arranged so as to fold back easily and certain turnbuckles are marked to show which are to be undone when folding the wings.

The shock absorbers for the undercarriage are housed inside the fuselage and the wheels are splayed slightly outwards.

Engine. 9 cylinders, 100 h.p. Gnome. with inlet and exhaust valve i.e. not monosoupape. It is practically the same as those turned out by the French Gnome Company in 1913 with a few modifications to the exhaust valve.

It is beautifully finished

It is fitted with a multiple contact breaker, enabling any one cylinder to be switched off independently of the others.

Propeller. 250 diameter by 220 pitch. Not deflector.

The gun is a Parabellum and fitted so as to fire through the propeller directly parallel with the line of flight of the machine.

A special interrupter worked from the engine is fitted so that the gun only fires when the bullets will clear the propeller.

It is fitted with a rectangular foresight which has two beads 43 m/m on either side of the centre.

The distance from the foresight to the backsight is 920 m/m. The rectangular foresight is presumably to allow for a hostile machine crossing the front, and if this inference is correct the Germans apparently estimate the speed of our machines as 82 miles an hour.

The gun is fired by a thumb push on the control lever of the machine.

The speed of the machine is practically the same as that of a 80 h.p. Morane Scout with deflector propeller but the climb is not nearly as fast.

The pilot who flew it to-day reported that the lateral control is not good and the fore and aft control distinctly bad.

The machine pulls up in a very short distance after landing.

(Sd.) R Brooke-Popham.

Brigadier-General.
D.A. & Q.M.G.
Royal Flying Corps.

In the Field.
9 April 1916.

EXTRACTS from REPORT on FOKKER E.III
with 100 H.P. German Gnome Engine.

GENERAL DESCRIPTION.

AEROPLANE.

Type.	Fokker E.III.

ENGINE.

Horse Power.	100 h.p.
Usual Description.	9 Cyl. Gnome (not monosoupape)

AIRSCREW.

Diameter	8 ft. 3½ ins.
Number of blades.	Two.

TYPE OF CONTROL.

Wheel or stick	Stick.

SPAN.

Of Wings	32' 11"
Of Tail (no tailplane, only balanced elevator.)	9' 6½"

OVERALL LENGTH.

Of Aeroplane.	24 ft.

Further Particulars.

1. Balanced elevator and rudder - no fixed tail planes.
2. "Warp" control of Wing.
3. All wing connections fitted with quick detachable joints for rapid dismantling.
4. A clamp is fitted on the control stick by which it can be locked in any position of fore and aft control.
5. "Track" of undercarriage wheels is 6' 8½".
6. All steel fuselage - brazed joints - no sockets.
7. Double flap doors in the floor between the pilot's knees and shutters on either side under wings - all of which can be worked by pilot for getting a better view.

CONSUMPTION TRIALS.

CONSUMPTION PER HOUR.

Petrol	9½ galls.
Oil	2½ galls.

ENGINE REVOLUTIONS.

On the ground	1180
In the air when flying level at 8,000 ft.	1140/1150.

AIRSPEED (indicated) 71 - 72 m.p.h.

TIME taken to climb to 8,000' 17 mins.

SPEED TRIAL.

Any dead weight carried above that of instruments and special attachments. 30 lbs. and gun.

Average speed (corrected for wind) 86.4 m.p.h.

SPEED TRIAL AT HEIGHT.

Any dead weight carried above that of instruments and special attachments. 30 lbs. and gun.

Height.	Temperature.	Revolutions.	Speed m.p.h.
(Ground	15° Cent.	1210	86.4) (as above)
1,000 ft.	10 "	1205	87½
3,000 "	6 "	1180	86
5,000 "	5 "	1140	84
7,000 "	4 "	1140	82½
9,000 "	3 "	1130	80
11,000 "	0 "	1120	77½

CLIMBING TRIAL.

Any dead weight carried above that of instruments and special attachments. 30 lbs. and gun.

Height.	Time Mins.	Secs.	Average rate of climb. Feet per min.	Engine revs.	Airspeed by Indicator	Temp.
1,000 feet	1	0	1000	1170	60	17°c.
2,000 "	2	45	570			
3,000 "	4	25	600	1160	57	15°c.
4,000 "	6	20	520			
5,000 "	8	30	460	1156	55	10°c.
6,000 "	11	10	370			
7,000 "	14	0	350	1100	54	5°c.
8,000 "	17	30	290			
9,000 "	23	0	180	1080	53	0°c.
10,000 "	28	0	200			
11,000 "	35	0	140	1060	53	1°c.
12,000 "	48	0	80			
12,200 "	51	0				

TACTICAL FEATURES.

Armouring.

Protection from fire from ground.

(a) For Pilot.	Nil.
(b) For tanks.	Nil.
(c) For passenger.	Nil.

Facilities for reconnaissance. Very poor.

Facilities for bomb dropping. Nil.

Further Remarks.

This machine can be dived very steeply and showing an air speed of 115 m.p.h. comes out of the dive with complete ease.

Notes on erecting a Fokker.

In order to erect a Fokker of 80, 100 or 160 H.P., three mechanics are necessary. They proceed as follows:-

1. The two planes are removed from the fuselage while one man loosens both the diagonal cables and remove the distance tube. Another loosens the clamps for the planes on the rear edge. Two men are now able to draw out the planes towards the rear and lift them from the fuselage. Both planes are then laid flat on a clean piece of ground near the machine.

2. The upper cables are then pulled out straight, and the turnbuckles, which are painted blue, on the top cabane are loosened a few turns. At the same time, the blue painted turnbuckles are loosened on the cabane cable, so that the cabane can be slightly inclined to the rear.

3. Now place one plane on the fuselage. Put the balance wires over the pulleys, and lock the planes into the fuselage by fastening the bolts and pressing forward the safety springs. Proceed in the same manner with the second plane.

4. The lift cables will now be loosened from the lower cabane, and those which are painted red are placed on the right, and those which are painted green on the left. *The turnbuckles are then secured to the lower ball sockets* [WRITTEN IN MANUSCRIPT ON ORIGINAL REPORT].

5. In order to tighten the cables, the two blue turnbuckles, to which each pair of cables is fastened, are tightened equally until the front cables are sufficiently taut. The turnbuckles of the cabane cables are then tightened up equally until the cabane is over the centre of the fuselage, and in line with the sockets of the main spars. The turnbuckles are now locked with safety wires, and the machine is ready to fly. Should there be any pressure on the control lever, it should be tied over in the opposite direction to which it naturally inclines. Leaded turnbuckles should never be unfastened.

If a machine is to be trued up, for instance after being repaired, or after a long period of use, the machine must be put in a flying position and all the turnbuckles loosened. The control lever is accurately centred with the strap that is in the fuselage. When this is done, the lower rocker should be absolutely horizontal. When trueing up a machine, one should begin with the front spars. The leading edges of the planes must be exactly in the same straight line. When this is done, the rear spar is adjusted. Looking now from the tail of the machine, the trailing edges of the planes should be exactly parallel with the leading edges.

If a machine is properly trued up, when the control lever is left alone, it should remain in a central position. If there is any pressure, the lever, as has already been said, can be tied down on the opposite side to which it inclines.

General Remarks.

1. Cables should not be too tight, and, on the other hand, not too loose.

2. The lever when at rest stands in the middle of the fuselage.

3. Turnbuckles are painted red to the right and green to the left (in direction of machines).

4. Only those turnbuckles which are painted blue should be loosened. Those which are leaded should not be loosened.

5. Revolutions of the engines:-

a). for 80 H.P.	1200-1220	- flying level.
b). for 100 H.P.	1220-1240	- flying level.
c). for 160 H.P.	1200-1280	- flying level.*

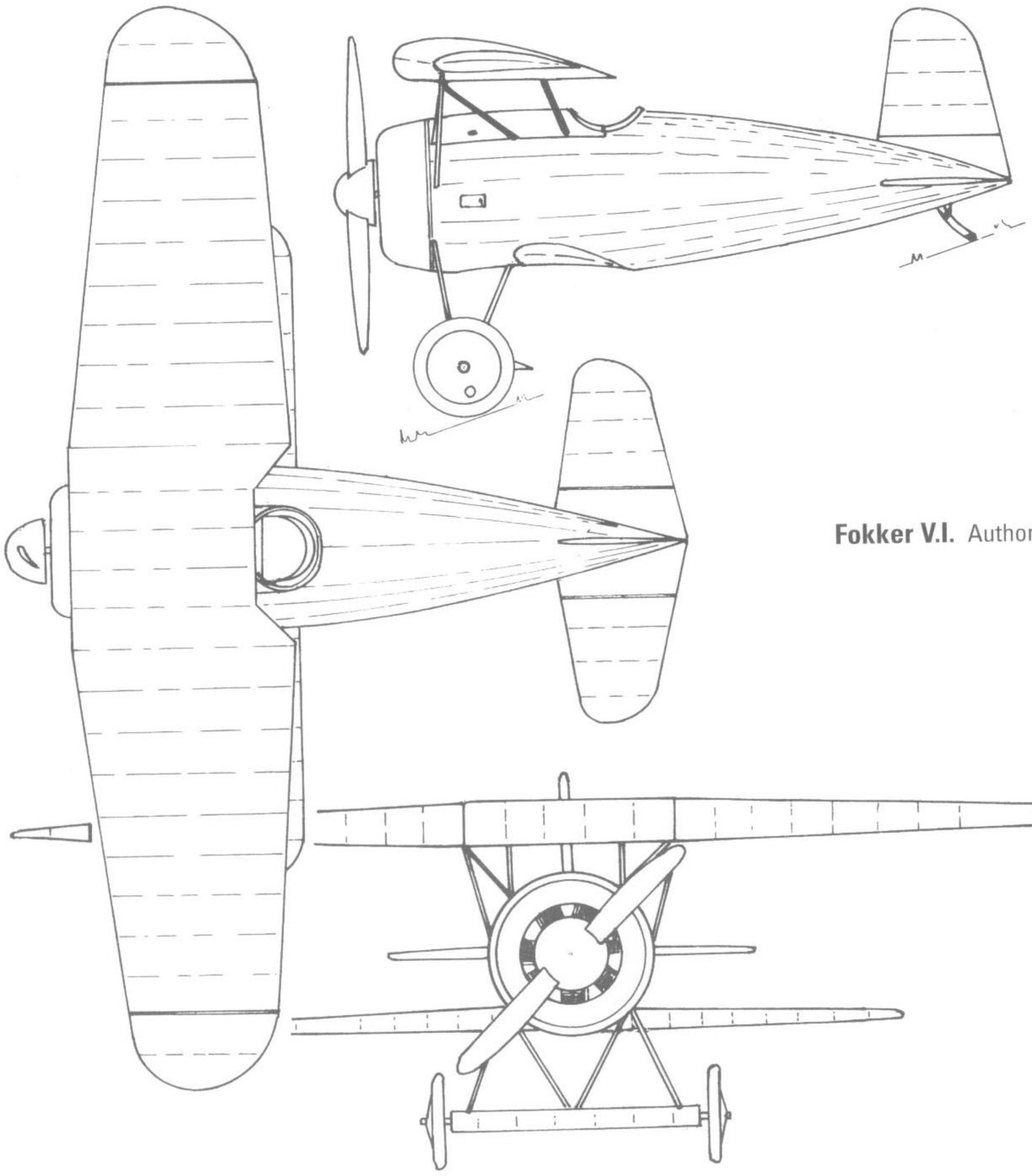
** Note that on the original report, the second value for engine revolutions '1280' is in fact smudged and could possibly be either the 1280 quoted or 1260.*

CHAPTER FOUR

Triplanes

New Designs

The replacement of Moser by Reinhold Platz (*see* 'Fokker's Subordinates', page 16) more or less coincided with Fokker's acceptance that his basic design, the copied Morane structure that had evolved into the D.V, had reached the limit of its potential for further development. To remain in business a new concept was required and a fresh approach had to be considered. With this came a new designation for prototype aircraft – 'V' – which signified *Versuchmaschine* (experimental aircraft). V designations were to continue beyond the end of the war.



Fokker V.I. Author

The V.1

The first of the new series was V.1. This was a futuristic-looking cantilever-winged biplane with thick wings and a stubby, streamlined fuselage. It had no struts or bracing wires apart from those of the cabane and the undercarriage. Its basic airframe followed Fokker's established practice. Its fuselage frame, tail assembly and undercarriage were of welded tubular-steel construction and its wings were built entirely out of wood. It was powered by a 100hp Oberursal UR.I engine which was completely enclosed in a circular aluminium cowling. However, here the similarity ended.

The fuselage, although based upon a steel frame, was streamlined by wooden formers and stringers so that the circular shape of the cowling was blended back to the rear end of the fuselage. This was then conventionally covered in fabric.

The wings were of wooden construction as before, but were of extremely deep section based on two spars, both of which were deep. These spars were no longer machined from solid wood, but were of a box section fabricated from relatively thin wooden top and bottom strips joined by plywood sides. The resulting spars were both strong and light. The wing ribs were built up from thin plywood. Narrow wooden strips provided the trailing edges and the completed structures were entirely covered in thin birch veneer.

The upper wing was of greater span and chord than the lower. Built in one piece, its two spars were parallel with the front spar being the deeper of the two. Only this

Specification – Fokker V.1

Engine:	100hp Oberursal
Weights:	Not known
Dimensions:	Wingspan 8.06m (26ft 5in); length 5.00m (16ft 5in); height 2.90m (9ft 6in)
Performance:	Maximum speed 180km/h (112mph) Rate of climb 1,000m (3,300ft) in 2.5 minutes, 5,000m (16,000ft) in 30 minutes
Armament:	None fitted

Junkers-Fokker Werke AG

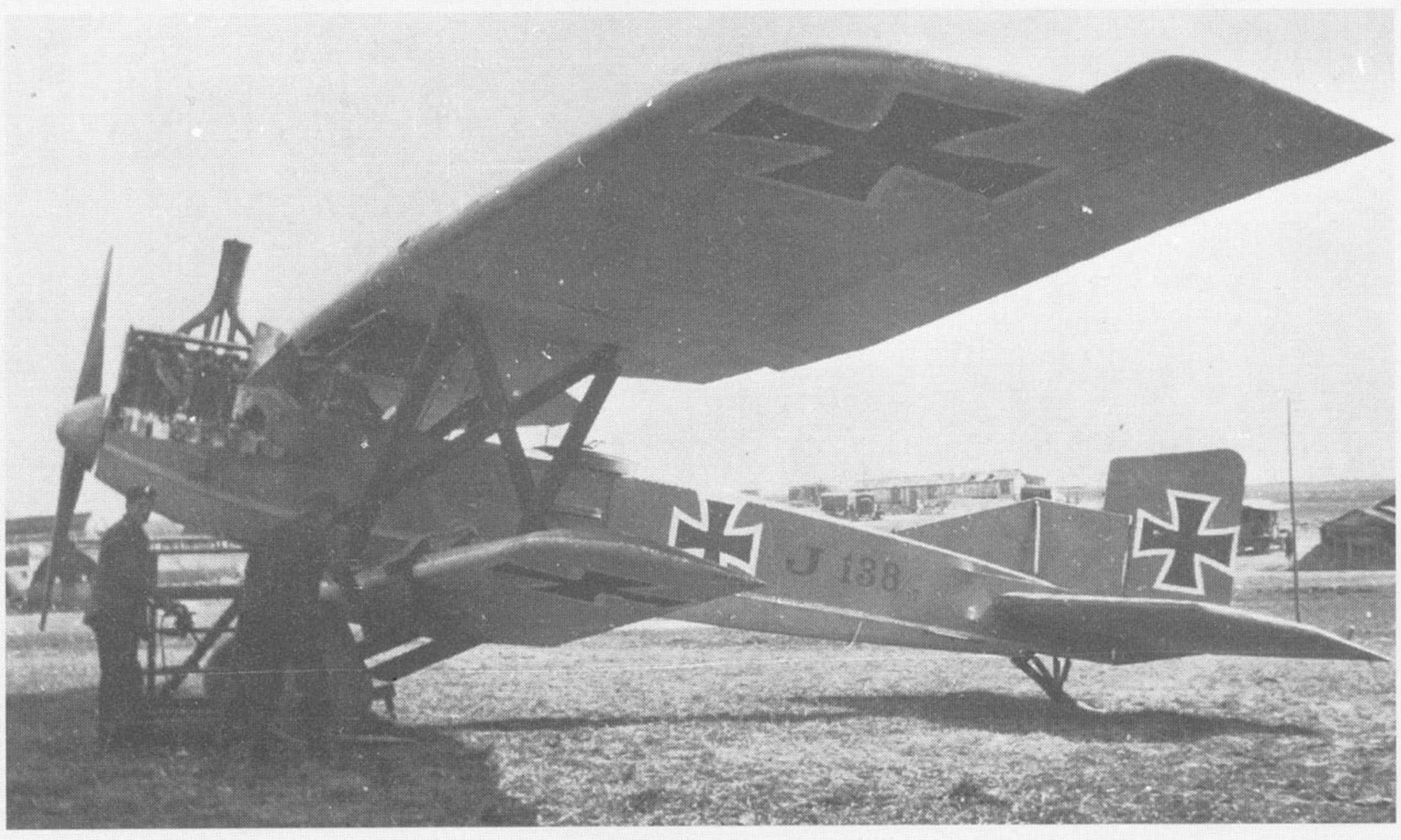
Professor Hugo Junkers was a man of many parts. Born in 1859, he had studied at the Technische Hochschule in Berlin. His creative energy and drive led him to found a manufacturing company to exploit his patented designs in gas-fired water heating, thermodynamic instrumentation and ventilating systems in 1895. He was also responsible for the design of an opposed-piston gas engine for use in the blast furnace industry. Later, he progressed to the design of a light opposed-piston engine suitable for aircraft and fast boats.

Appointed as Professor of Thermodynamics at the Technische Hochschule in Aachen in 1897, he lived in Frankenburg and established his own private research laboratory there. Possessor of an astoundingly creative mind and with a capacity for painstaking research, he became interested in aviation in 1907 through a friend who had built several biplanes and was then working on a canard monoplane. This machine featured a single-surfaced aluminium wing and metal front plane, elevators, rudder and radiator, manufacture of these being undertaken by Junkers' factory during 1912.

This involvement led Junkers to resign his professorship at Aachen that year and to concentrate his mind and the resources of his company (Junkers & Co.) on aviation matters. He became convinced that the solution to parasitic drag was the contain all structural members within the basic airframe, and he conceived the 'thick' wing with a deep aerofoil section, internal bracing structure and a load-bearing 'skin' to achieve this. Being of a scientific nature he built wind tunnels to prove his theories; the first of these was built at Aachen and, after he left that establishment, another at Frankenburg. In 1914, he started a programme of research into the relationships between aerofoil shape, camber and thickness that was to continue until after the war.

By February 1915, his results (including the fabrication of a representative section of wing) convinced him that he was in a position to build an aircraft incorporating his theories, and he approached Idflieg for funding. Although he gained no immediate support, he continued with his work (funded by the profits from his company's products) and, in July 1915, was rewarded with a contract to build a single aircraft. With his staff, he visited the *Prufanstalt und Werf der Fliegertruppe* (Test Establishment and Workshops of the Aviation Troops) on 17 August 1915 to discuss the practicalities of aircraft design and, from this, started building experimental components leading to the construction of his first monoplane.

His first aircraft, designated the Junkers J.1, was a 'clean', all-metal, cantilever-winged monoplane. It was powered by a 120hp Mercedes D.II water-cooled engine and had its radiator beneath its fuselage. Use of duralumin had been considered for construction but, at that time, this material tended to powder or delaminate and could not be reliably welded. Thus, J.1 was fabricated using thin ferro-magnetic steel sheet, which was commercially available and could be welded without difficulty.



***(Above)* The original all-steel Junkers J.1 monoplane of 1915.** Cross and Cockade International

Production Junkers J.I J138.17 used for ground-attack duties. Cross and Cockade International

J.1 was subjected to an Idflieg load testing programme in late November and then suspended from the workshop roof for engine thrust tests – there was nothing slip-shod in Junkers' approach to design and manufacture – in December 1915. Passing these, it was taxied and 'hopped' on 12 December 1915. Damaged by a gust of wind that caused its wing-tip to touch the ground, it was repaired and made its first actual flight on 18 January 1916. A second flight followed the same day and a third (with speed trials) on 19 January. J.1 proved to be fairly fast and to have an excellent rate of climb.

As a result of the success of this, Idflieg placed an order for six all-metal monoplanes, each to be armed

with a single machine-gun and to be powered by a 120hp Mercedes D.II engine. Preliminary work, basic design and a wind tunnel programme started immediately and resulted in the Junkers J.II, which proved to be a sleek-looking monoplane with many advanced features. Although, because of its steel construction, it was relatively heavy, it met all of the requirements that Idflieg had stipulated when awarding the contract. Unfortunately, events had moved on since then and, because its performance was not now considered adequate, no further funding was provided by Idflieg.

Junkers understood that, continuing with the use of steel sheet, he was not likely to be able to reduce the weight of his design so he returned to the consideration of duralumin, which had been used extensively in the construction of airships. By now, the homogeneity of this material had become more reliable and, although welding it still presented problems, Junkers felt he could achieve satisfactory results by other means of fabrication. He abandoned the smooth skin of his earlier designs and instead used the metal in a corrugated form that would improve its stiffness.

In summer 1916, Idflieg issued a requirement for an armoured aircraft intended for ground attack and, resulting from this, in December 1916, Junkers received funding for the construction of three armoured biplane prototypes with the promise of a large production contract should these prove successful. Junkers & Co. eventually built five machines of this design and they went into military service designated Junkers J.I.

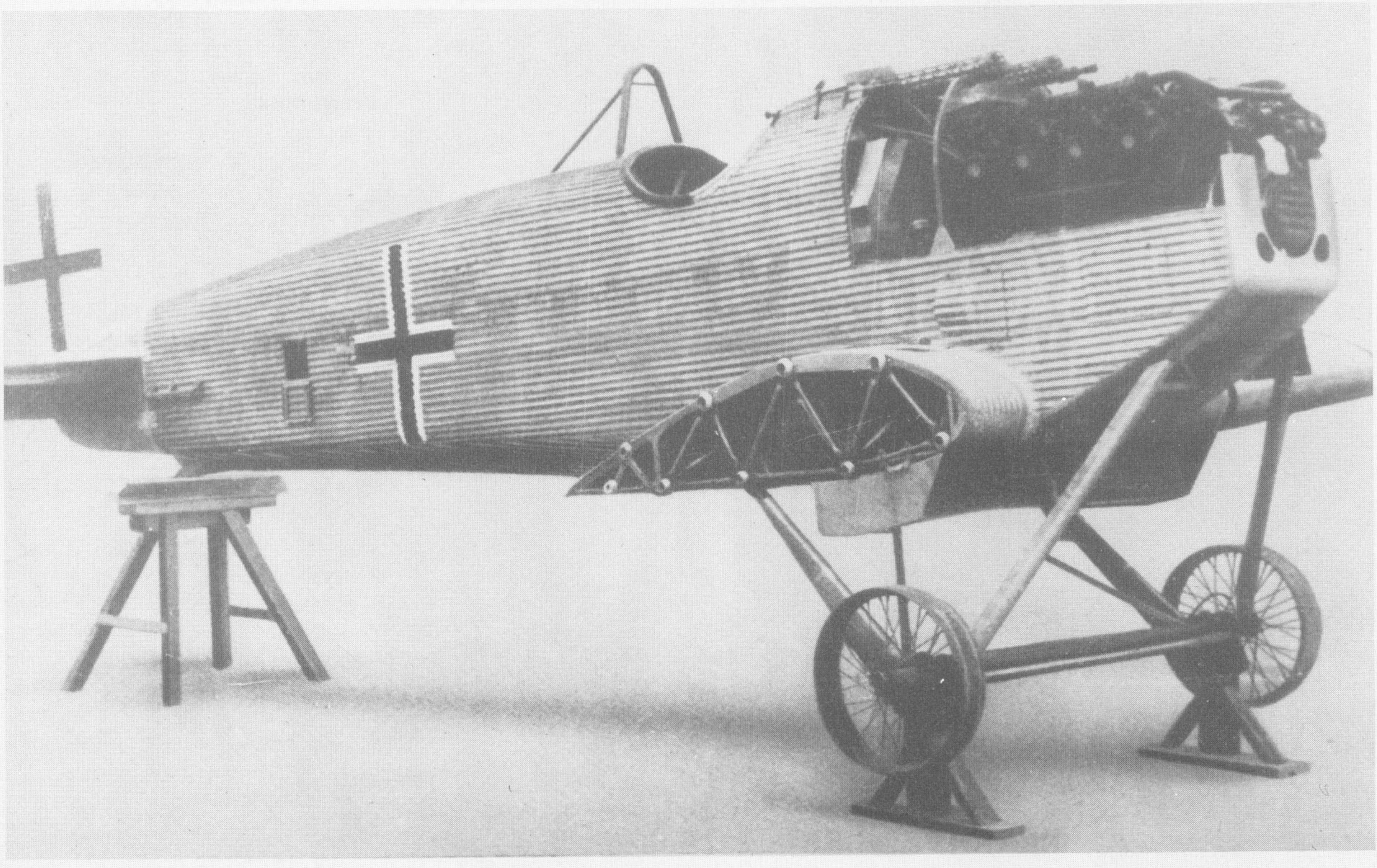
At this point, Idflieg recognized that Junkers, while capable of designing and building innovative prototype aircraft, lacked production expertise and knowledge of flying. They therefore proposed that he should join forces with Anthony Fokker, a pilot of great skill with an unrivalled appreciation of the effect of design on flight characteristics and a staff with good quantity production experience. Neither Junkers nor Fokker was enthusiastic about this proposal, but eventually each was made to realize the advantages to be gained and agreed to the formation of the Junkers-Fokker Werke AG. This was formed on 26 October 1917 with a total capital of 2.6 million Marks, each 'partner' contributing half.

Forced upon them, it was never a happy partnership. Both men went into it with the sole purpose of getting what they could out of it without contributing anything. Their personalities were those of opposites. Fokker, the brilliant pilot and salesman, was scornful of 'theory' and made decisions by instinct; Junkers was a brilliant theoretician who carefully weighed up all possibilities and consequences before making any move. Neither man was prepared to listen to or understand the other, and both were guarded in what they passed on to each other. The duration of the liaison was brief and Fokker eventually sought to sell his shares in summer 1918. He later claimed that he 'lost his investment' in the process – which is quite likely as Junkers was far shrewder with finance than Fokker ever was.

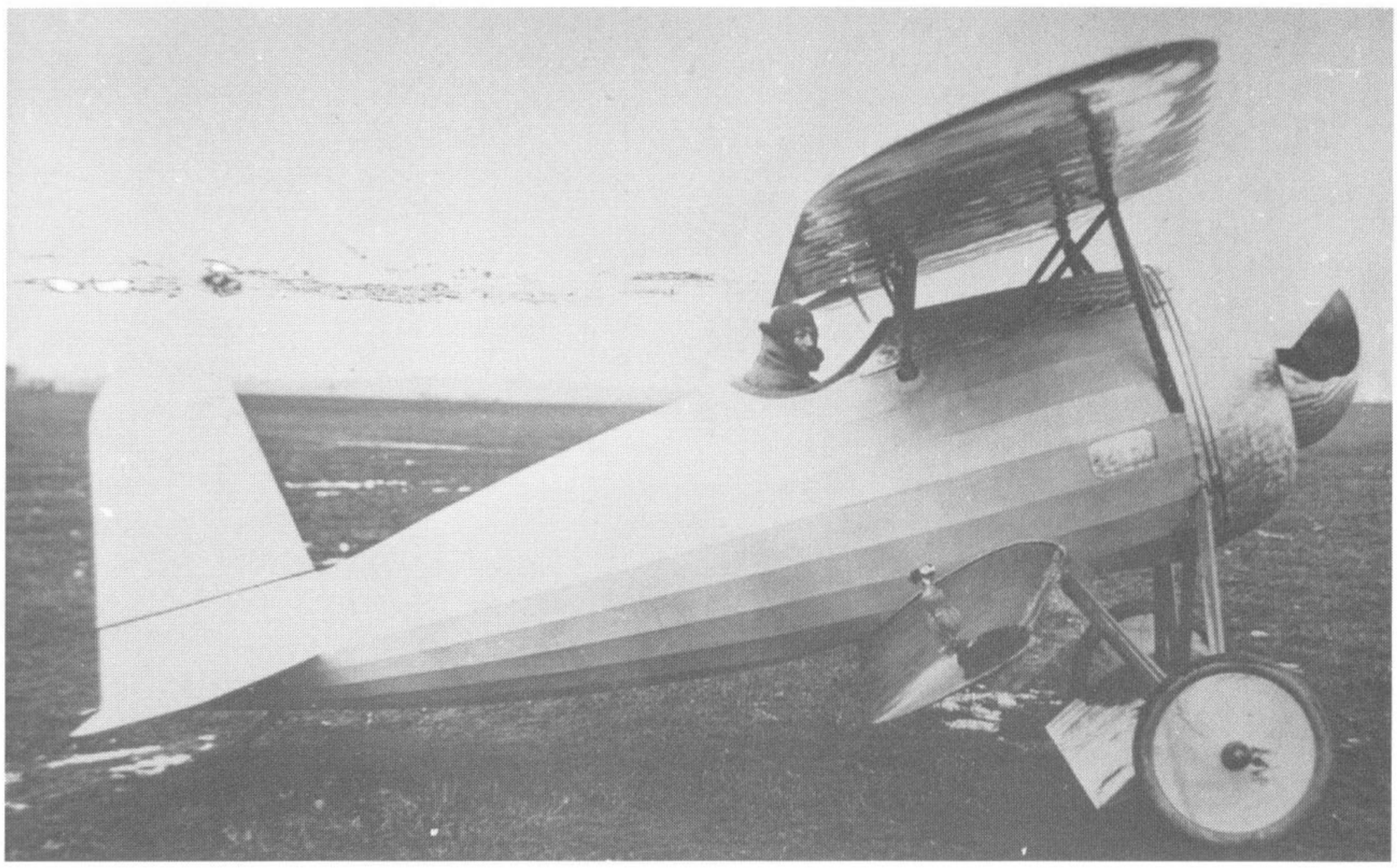
For all that, it was an interesting experience for each of them and both men undoubtedly gained something from the association. Junkers briefly enjoyed the benefit of Fokker's experience when flying his machines and the use of Fokker as a demonstration pilot at the 1918 Fighter Competitions (*see* pages 114–15). What Fokker gained was an insight into the design and advantages of 'thick' cantilever wings and the monoplane configuration. Both were to stand him in good stead in later years, though his wing designs continued to employ wood rather than elaborate metal shapes.

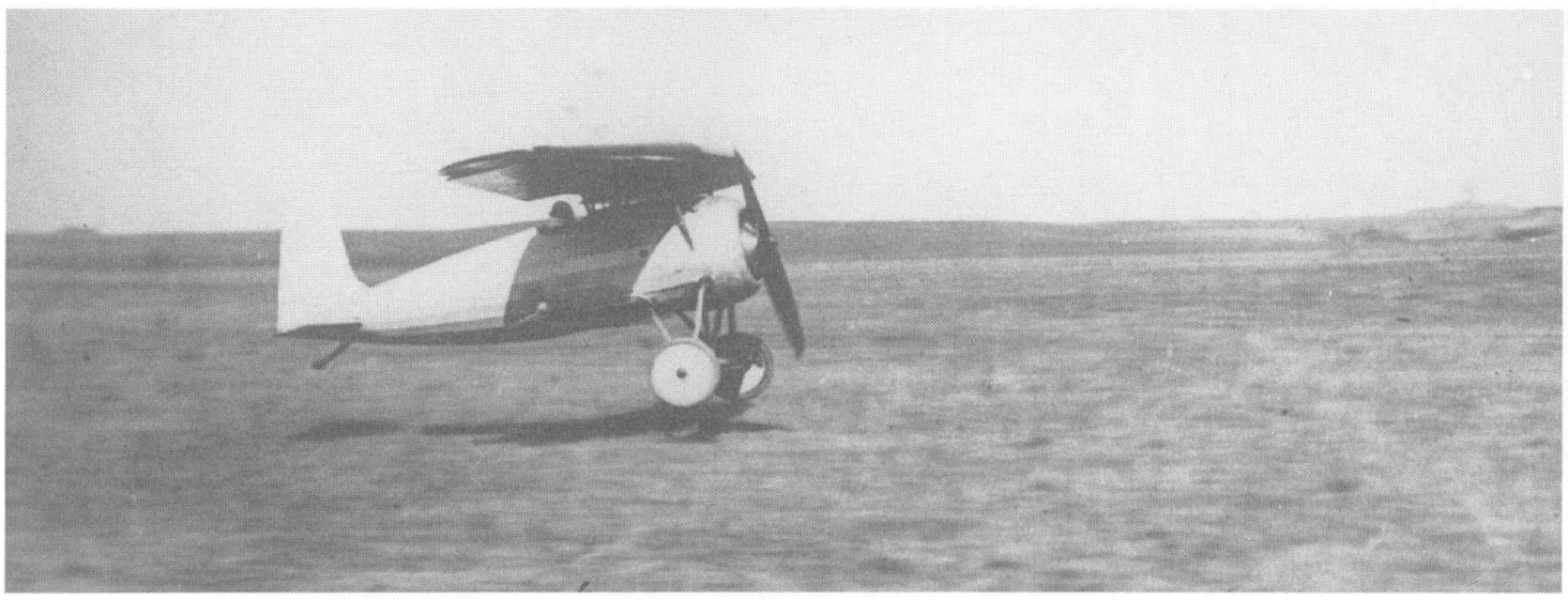
Junkers extended his range of designs with the Junkers J.9, a low cantilever-winged single-seat monoplane that went into service as the Junkers D.I in October 1918, though it is doubtful whether any was actually used in combat before the war ended on 11 November. The D.I and the later two-seat Junkers CL.I were both used by *Freikorps* pilots against the Bolsheviks in the Baltic area during post-war civil unrest in Germany.

Junkers gained full control of the Junkers-Fokker Werke AG after the war. It was renamed Junkers Flugzeugwerke AG in April 1918 and continued in business, becoming known for the corrugated-aluminium Ju 52 transport, the Ju 87 dive bomber and the versatile Ju 88 – different versions of which were used as fighters and bombers – of World War Two.



Fuselage of the Junkers J.9 (D.I) showing the use of corrugated duralumin sheet and the depth of the wing section. Cross and Cockade International





***(Top)* The Fokker V.1 in its original form, with Fokker in the cockpit. The high gloss finish on the wings can be seen in this photograph. The curious shaped object on the near lower wing is a Morell anemometer.** Peter Grosz

***(Above)* The V.1 being flown by Fokker without a spinner in January 1917.** Harry Woodman

Fokker in front of V.1, this time fitted with a Garuda propeller. Greg Van Wyngarden

wing was fitted with ailerons but, unlike earlier Fokkers (and virtually all other manufacturer's designs) these were not let into the trailing edge of the wing, but were formed by the wing-tips that were pivoted on a steel tube fixed to the rear face of the front spar, thus providing aerodynamically balanced ailerons. Their actuating system of control horns, pulleys and cable runs were contained within the depth of the wing. (A similar system had been used by Blériot in his Libellule design some nine years earlier.)

The smaller lower wing was also built in one piece. Its construction was similar to that of the upper wing, but it had no ailerons and its two spars converged and joined at the tips on each side.

The new 'thick' aerofoil of these wings gave greater lift than the thin sections previously employed and the rounded leading edges gave greatly improved stall characteristics. It was easy to achieve a smooth finish on their plywood covering and this, plus their lack of struts, reduced drag considerably.

The lower wing was seated in a 'slot' provided for it beneath the fuselage, and was clamped to the lower fuselage longerons. The upper wing was mounted close to the fuselage on a steel cabane structure formed from a pair of tripods at the front and a further pair of struts at the rear. Because some doubt existed as to the correct angle of incidence for this exceptionally thick sectioned wing, its mounting allowed it to be adjusted in flight by raising and lowering the main spar. This was achieved by a system of levers and a pilot-operated crank in the cockpit. Variations of the tripod cabane struts introduced on V.1 were to become standard on all future Fokker wartime biplanes and parasol-winged monoplanes.

The rudder and elevators of the tail assembly were similar to those of the ailerons in the upper wing and were formed tips, pivoted to form aerodynamically balanced surfaces. Controls for these were again run within their structures.

The undercarriage consisted of a V structure on each side strengthened by a further V in the front bay, the apex of which was welded to the undercarriage spreader bar. Another new feature was the fairing of the spreader bar by the addition of a small sub-wing of similar aerofoil section to the main wings. This was claimed to provide enough lift to compensate for the weight of the entire undercarriage.

Fokker was to continue to use this sub-wing for all of his wartime designs.

The pilot was seated low down in a cockpit, positioned under the trailing edge of the upper wing, which was cut away at that point to allow him some upwards vision and access to his seat. His view forward under the wing and over the fuselage and engine cowling was restricted and would not have been improved by the fitting of a pair of machine-guns in front of him.

V.1 was powered by a 100hp Oberursal UR.I rotary engine and originally fitted with a large rounded spinner over its propeller that allowed only a small annular gap for engine-cooling air. After its first flight it was subsequently flown with other shapes and also without a spinner.

Despite its new features and the use of material new to the factory, V.1 was built in five weeks and made its first flight at the end of 1916. Fokker is said to have been pleased with its performance, though it must have suffered from cooling problems as the large spinner was exchanged for other, smaller, spinners before being discarded altogether.

To remain in business, Fokker had required a new concept and V.1 was certainly that. Even in an era when aircraft design developed at an unprecedented pace this was a major step forward. So much so that it is difficult now to understand just how it came about and who, or what, inspired it. Of Fokker's team, Platz was a sound and immensely practical welding technician. What knowledge he had of aeronautical design and engineering was self-taught and achieved largely by trial and error. Fokker himself was a brilliant experimental pilot with a keen mind. He had the ability to sense both weaknesses and strengths in each new aircraft he flew, offer practical solutions to problems and to suggest probable areas of improvement. However, both men lacked the theoretical knowledge needed to conceive and design the innovative features incorporated in V.1. Having said that, it was Fokker's company and his money that was involved. During this period he had been subjected to the influences of two men who were qualified engineers, Professor Hugo Junkers and Villehard Forssman. Fokker had always been quick to pick up and use other people's ideas, and it is thus probable that the inspiration came from Fokker and was based upon what he had learned from these people.

In Forssman's case, it would mainly be the use of plywood and in Junkers's case

Villehard Forssman

Fokker's interest in the use of plywood for aircraft construction resulted from his association with Villehard Forssman, a Swedish engineer with a consulting practice in Johannisthal. Forssman, whose services had been used by Fokker with regard to a number of patent problems, had good connections with Bruning und Sohn AG, the owners of four of the largest plywood veneer manufacturing factories in Germany. Fokker had consulted with Forssman regarding the M.20 prototype, providing him with copies of the drawings with a view to the use of plywood in its construction. When that was shelved they also discussed Fokker's next project, the M.22, Fokker again providing manufacturing drawings. Forssman agreed to build a set of plywood-covered wings for it, and had completed them and sent them to Adlershof for flight and other testing by 24 November 1916. Sadly, no details of the wings have been found to date, nor do we have access to any relevant test results. It is therefore not possible to comment on just how good these wings were or what advantages they offered. However, despite not having used them for his D.V, Fokker must have been impressed, as plywood construction was to figure significantly in his future aircraft.

Fokker as a Pilot

By 1917, Anthony Fokker was an exceptional pilot. Like most of his generation, he was virtually self-taught, starting with powered hops across a flying field and progressing to a brief first flight. Fokker's first hops were at the end of 1910; his first tentative flight was in early May 1911 and by 16 May that year he had passed the test for a flying licence. He was granted German Flying Licence Number 88 on 7 June 1911. He rapidly gained experience flying Goedecker's and his own aeroplanes and, before long, instructing others in the art of flying. By the time that he moved to Johannisthal in December 1911 he was a seasoned exhibition pilot. While he was able to give a dazzling demonstration of aerobatics with virtually anything that was flyable, most of his flights were made in his own machines. His frosty reception from other more experienced pilots at Johannisthal soon gave way to recognition of his ability and he was reported in *Berliner Zeitung und Mittag* – which misspelt his name as 'Focke' – in glowing terms using expressions like 'amazingly sure' and 'simply splendid'. With the move to a more robust aircraft, his M.5, Fokker taught himself to 'loop the loop'. This manoeuvre, common though it is today, was then considered at least daring and at worst foolhardy. That he was not the first pilot to perform this manoeuvre in Germany – there may have been as many as twelve before him – does not detract from the fact that he taught himself to do it, even though he feared the outcome.

But, daring pilot though he was, Fokker's abilities went far beyond the mastery of exhibition flying. He was also an outstanding test pilot and, although not an engineer, was intuitively able to diagnose faults in a new machine and to suggest the best way for their correction. These abilities stood him in good stead throughout his life. In the earlier years of his career, he test-flew nearly all of his products, bringing his keen mind to any problems they presented. He became a great showman and never missed an opportunity to promote his company's products – usually by means of spectacular demonstration flights. To these abilities could be added a natural shrewdness and a nimble mind that was quick to grasp any opportunity that presented itself, however small. He learned to cultivate the military flying fraternity. As a pilot of acknowledged great ability, he was listened to when he joined in their conversations and discussions of flying. From these he gained an insight into their equipment requirements and was able to be at least a step ahead of competing German manufacturers.

Anthony Fokker sits on the cockpit coaming of Fokker D.II 547/16. Cross and Cockade International

the advantages of a thick aerofoil section. Platz's contribution would have been to turn the ideas passed to him by Fokker into a practical workable solution.

Although streamlined and futuristic in appearance, V.1 was not successful. Its ply-covered wings were heavier than a similar fabric-covered structure and the 100hp engine was not powerful enough to allow it to climb rapidly. At one time it was fitted with a pair of LMG 08/15 machine-guns but these were removed – probably in an attempt to reduce weight but also possibly because they obstructed the pilot's already limited forward view.

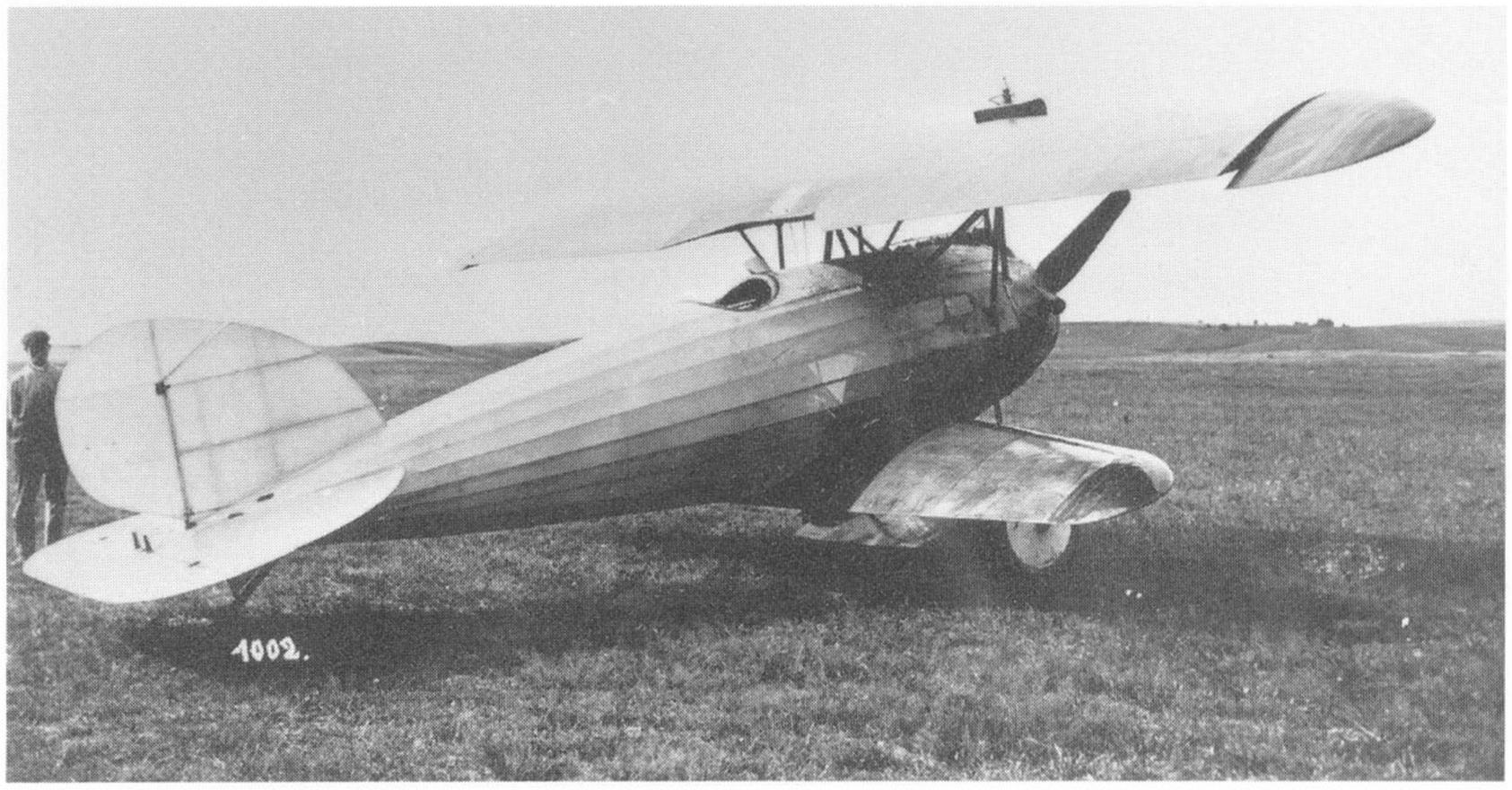
V.2 and V.3

In typical Fokker manner, next came a version of the same design with a water-cooled engined. This was the V.2 and, powered by a 160hp Mercedes D.III engine, it was expected to have a superior rate of climb to that of the earlier machine. Although it had an increased wing area, intended to compensate for the additional weight of the heavier engine and its cooling system, the construction and shape closely followed that of the earlier machine. It had the same pivoted, balanced ailerons and rudder as the V.1 but was fitted with a conventional tailplane and elevator. As with V.1, it was possible for the pilot to adjust the angle of incidence of the upper wing in flight. However, V.2 was no more successful than V.1. The increase in horsepower provided by the Mercedes engine was offset by its vastly increased weight, and it failed to produce the expected improvement in the rate of climb, which remained unsatisfactory.

The third of these advanced designs was V.3, which was also powered by the 160hp Mercedes D.III. This was mounted lower in the fuselage than that of V.2, improving the aerodynamics of the fuselage and probably also the forward view of the pilot. The V.3's shape and structure remained similar to those of V.2, but the upper wing was raised further above the fuselage and it was made larger, giving it increased area.

The pivoting wing-tips with their 'buried' control system were retained but V.3's tail assembly reverted to a conventional format and shape similar to that used on the Albatros D-series fighters, with external control horns and cable runs. Engine cooling was initially by means of a radiator panel mounted in front of the upper wing centre section and facing forward. This was later changed to a pair of narrow 'ear'-type radiators mounted one on either side of the fuselage nose.

Although of advanced design and appearance, none of these prototypes offered much improvement in performance. Fokker claimed that they were rejected by visiting officials because, with their cantilever wings and thick aerofoil sections, they were considered too unconventional. No record exists of any official visits to Schwerin to inspect these machines but it is probable that, following his customary practice, Fokker showed and demonstrated them to service pilots visiting the factory. If this was the case, then they could well have advised Fokker of the unsuitability of his prototypes for front-line use. Whatever actually happened, none of the machines was submitted to Adlershof for type-testing and no official German record of their existence exists.

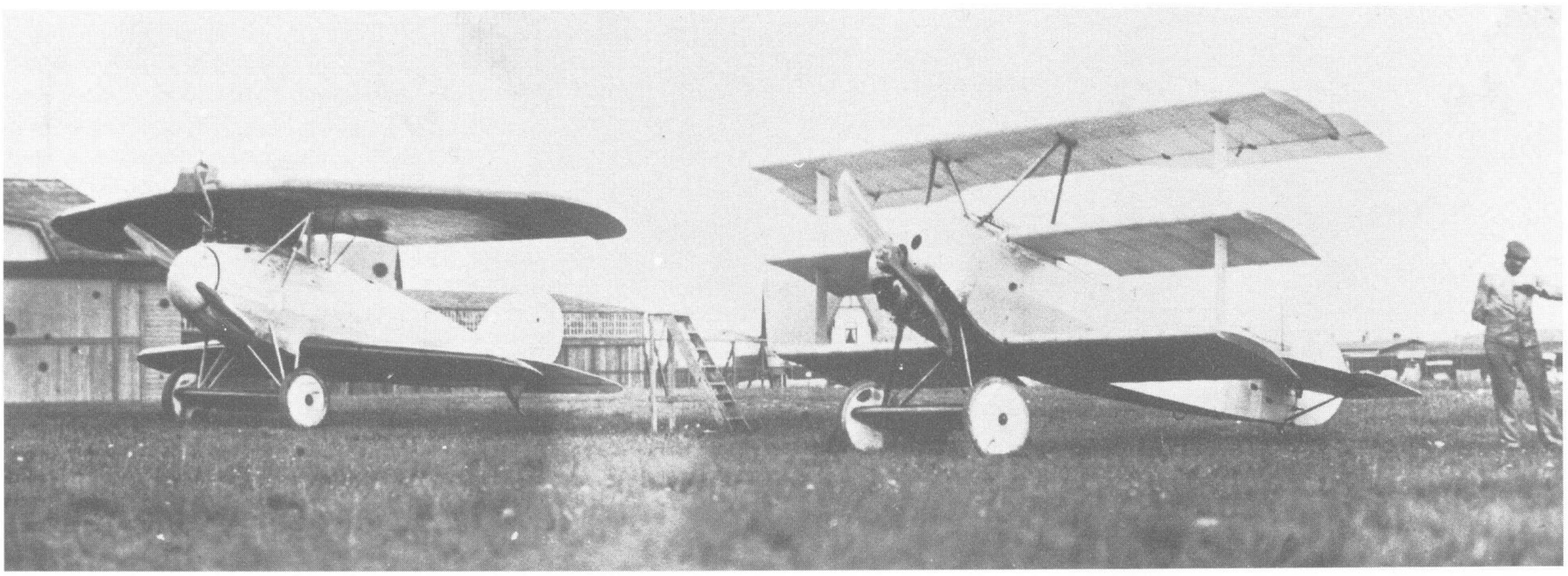


V.3 retaining the wing-tip ailerons but now fitted with conventional tailplane, fin and rudder. The upper wing has been raised and its area enlarged. Harry Woodman

The First Triplanes

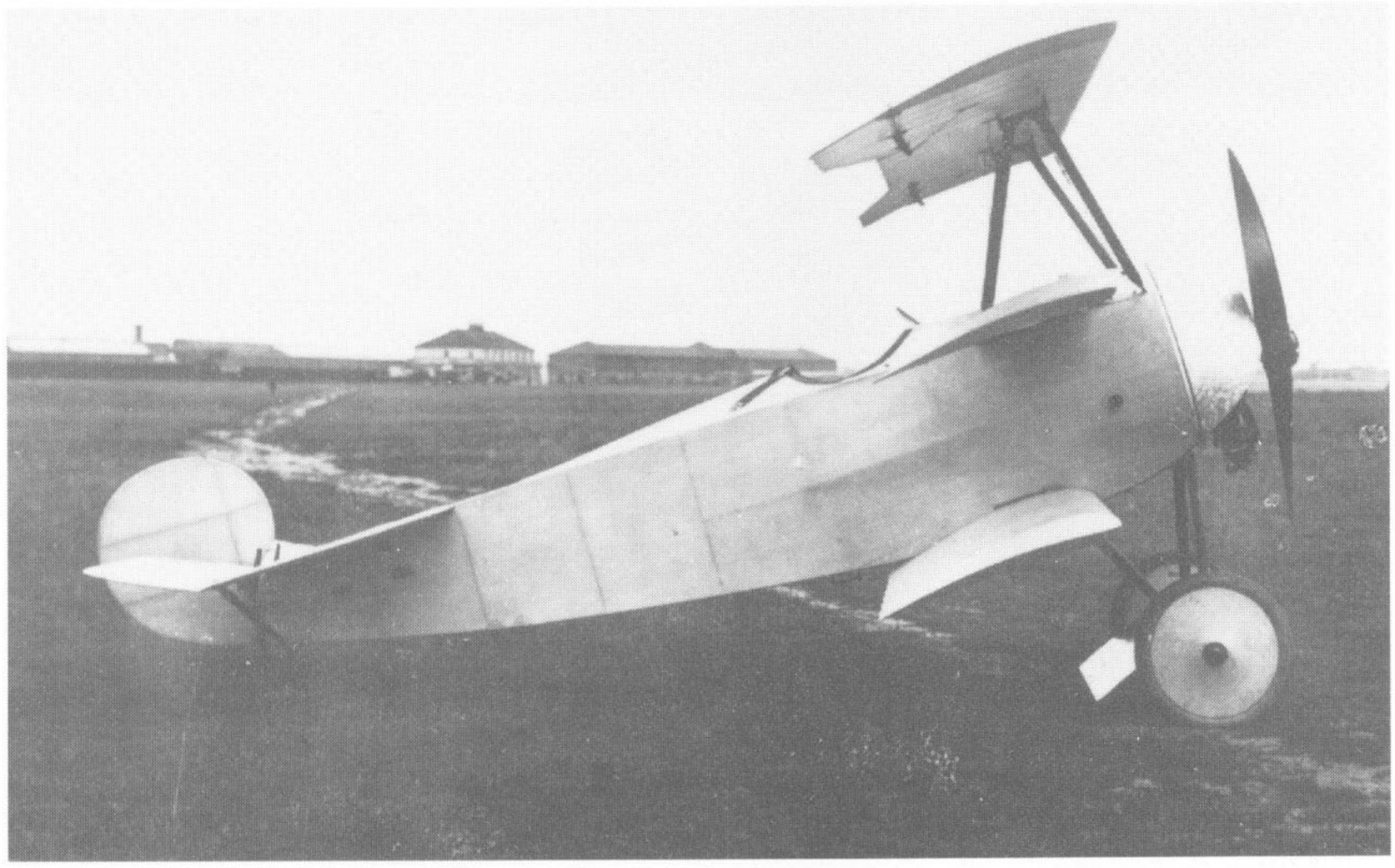
Never one to be dispirited for long, Fokker persevered. His next prototype was V.4, which was planned as a rotary-engined biplane to be sent to the Austro-Hungarian MAG company as a demonstrator. It was ordered as such on 12 June 1917 but it is possible that it got no further than the drawing board in this configuration, as no records of it, photographs or documents, seem to have survived. This being the case, we can only guess as to whether it was intended to follow the streamlined shape of its predecessors and to incorporate some of their technical innovations, or whether it was intended from the start to be a light, conventional machine. Whatever was intended, V.4 lasted only a short time in this configuration

In February 1916, British naval squadrons on the Western Front were re-equipped with the new Sopwith Triplane. This new fighter aircraft was a light machine owing much to the earlier Sopwith Pup: the fuselage and tail assembly were of similar shape and construction and like the Pup it was armed with a single Vickers gun, synchronized to fire forward through the propeller arc. It was powered by a 110hp Le Rhône. It served at the front for a very short time before both it and the Pup, which equipped RFC squadrons, were replaced by the heavier and faster Sopwith Camel. In that time, the Triplane's performance made a great impression on the German pilots, who envied its manoeuvrability and incredible rate of climb, which were both vastly better than those of their heavy Albatros D.IIIs. During a visit to Jasta 11, von Richthofen told Fokker of his recent combat with a Triplane, how he had narrowly escaped defeat and stressed that Fokker should build such a machine. Fokker was taken to a forward observation post to see British Triplanes in action and, later, was allowed to examine a captured example before it was sent on to Adlershof for appraisal. From what he had seen and



(Above) **V.3 (left) and V.4 converted to form the triplane prototype.** Thijs Postma

V.4 showing its clean, uncluttered lines. Peter Grosz



heard, Fokker appreciated that it could only be a matter of time before the pilots' enthusiasm reached higher authorities.

On his return to Schwerin, Fokker instructed Platz to abandon V.4 as a biplane and to complete it as a triplane. Although he had closely examined the captured example, he had taken no notes and passed on virtually nothing in the way of technical detail. From the way in which it had originated, V.4 was a compromise so, while work upon it was underway, Fokker launched work on V.5 which, designed from the start as a triplane, may be said to be the true Fokker triplane prototype.

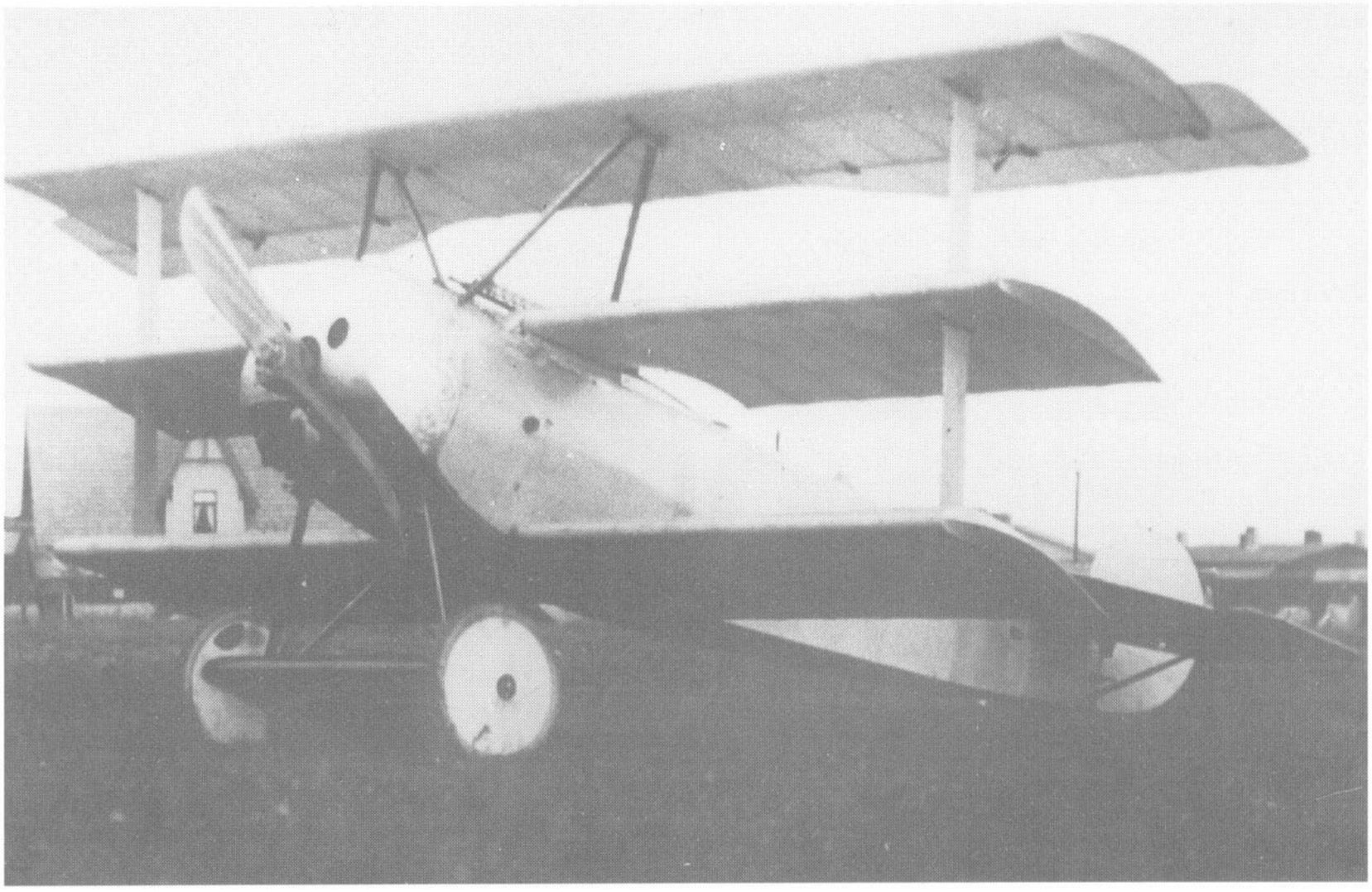
In this way Fokker managed to steal a march on his competitors and, by the time that news of the pilots' enthusiasm for a triplane did reach higher authorities, causing Idflieg to issue a requirement for triplane prototypes to German manufacturers, work on Fokker's triplane was well in hand.

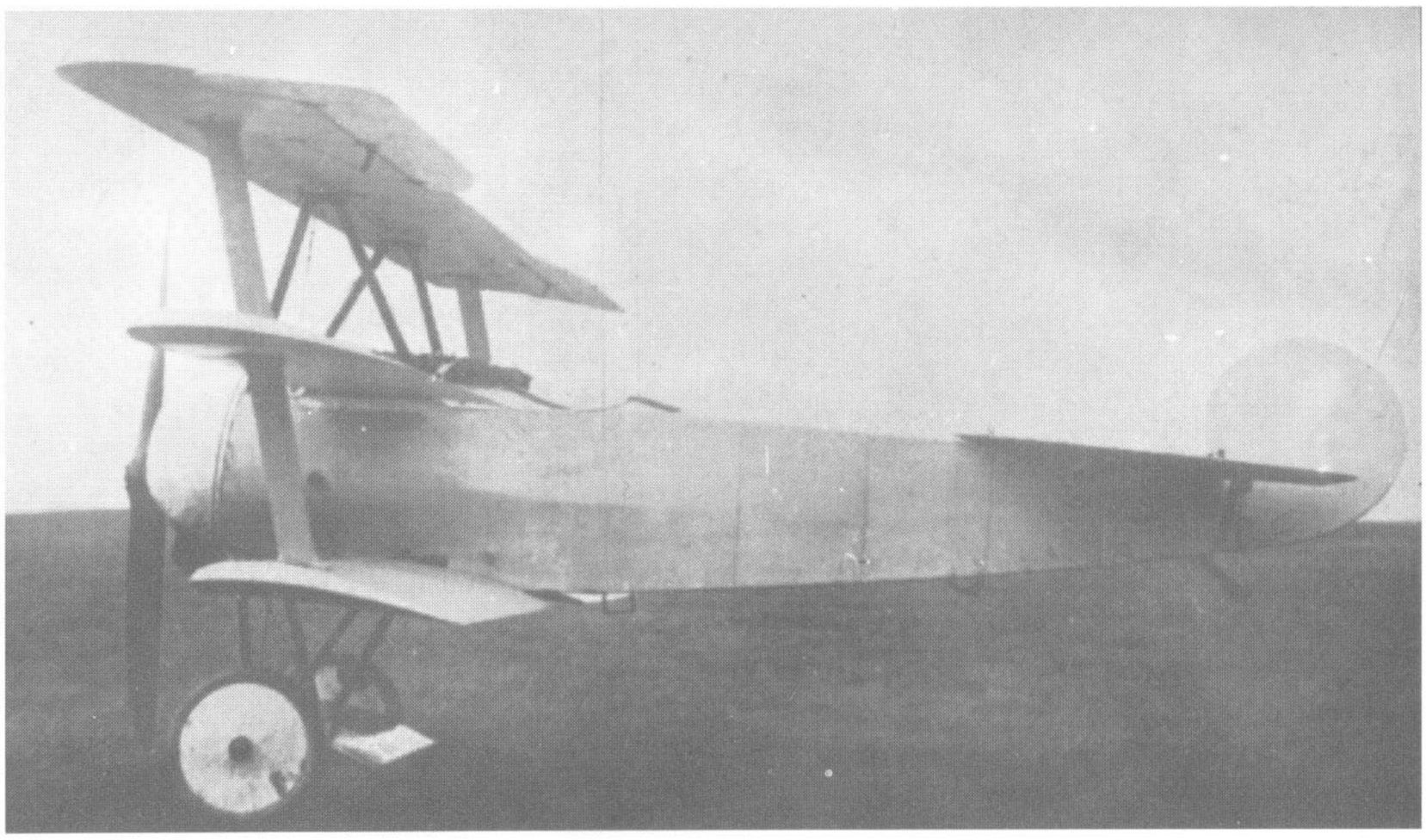
When completed the V.4 was a neat, simple, machine. It abandoned the streamlining of the earlier V-series machines, having a fabric-covered, rectangular-sectioned, tubular-steel welded fuselage. It was powered by a 110hp Oberursal UR.II rotary engine closely cowled in a variation of the now-familiar Fokker aluminium horseshoe shape. The only concession to streamlining was in the use of three thin triangular plywood panels, two of which were fastened to the circular engine support frame on either side of the fuselage and ran back to just behind the pilot's cockpit. They held the fabric covering away from the frame and blended the circular shape of the cowling to the fuselage's flat sides. The third plywood panel fitted to the top of the fuselage behind the cockpit and ran down the remaining length of the fuselage, again blending that from round to flat.

Each of the wings was built in one piece and all were of fabric-covered, light wooden cantilever construction, and of the same narrow parallel chord using essentially the

Specification – Fokker Dr.I

Engine:	110hp Oberursal UR.II
Weights:	Empty 406kg (895lb); loaded 586kg (1,290lb)
Dimensions:	Wingspan 7.19m (23ft 7in); length 5.77m (18ft 11in); height 2.95m (9ft 8in)
Performance:	Maximum speed 185km/h (115mph) at sea level, 165km/h (103mph) at 4,000m (13,000ft) Rate of climb 1,000m (3,300ft) in 2.9 minutes, 5,000m (16,000ft) in 23.83 minutes
Armament:	Two LMG 08/15 synchronized to fire through the propeller arc





Two views of the modified V.4, fitted with interplane 'struts'.
Harry Woodman *(top)* and Cross and Cockade International *(bottom)*

same deep-sectioned wing ribs. All had slightly rounded wing-tips formed by use of wing ribs fitted on their sides to the normal end ribs.

Their main spars, while appearing to be a single items, were in fact each built up from two box spars, of similar construction to those used on V.1, positioned close together and joined by plywood panels top and bottom. The resulting spars were light and extremely strong, and had excellent torsional characteristics. The leading edges of the wings were formed in curved plywood and the trailing edges by wires.

The lower wing was fitted into a 'slot' in the under-surface of the fuselage and was clamped up to the bottom longeron. The middle wing, of the same span as the lower wing, sat on the upper longeron, to which it was clamped. It was faired into the cowling shape with detachable aluminium panels, the cockpit ends of which were padded. The upper wing was of greater span than the lower pair and had long, unbalanced ailerons hinged from its trailing edge. It was mounted high above the fuselage on a pair of tubular-steel inverted-V struts, the front bay only of which was wire-braced. The upper ends of the struts were welded to a block upon which the wing spar sat and to which it was clamped. There were no interplane struts or bracing wires.

The tailplane was roughly triangular in planform and fitted with unbalanced elevators. The rudder was a variation of Fokker's 'comma' shape. Both tailplane and rudder were of welded steel-tube construction. Ailerons, elevators and rudder were fitted with conventional control horns and external cables. No weapons were fitted.

The undercarriage comprised a pair of V-struts with the axle contained in a fabricated casing inside a deep aerofoil-sectioned

Triplanes

Triplanes were not 'new' in 1917. The configuration had been suggested by Sir George Cayley as an improvement on the large monoplane wing of William Henson's proposed 'Aerial Steam Carriage' of 1843 and, in 1868, Henson's associate, John Stringfellow, built a three-winged version of the 'Aerial' that was powered by a small steam engine. The first recognized man-carrying powered flight was made by the Wright 'Flyer', a biplane and, while biplanes dominated the early pioneer years, neither monoplanes nor triplanes were uncommon.

Scientific investigation of the triplane configuration compared to biplanes and monoplanes was carried out at the Massachusetts Institute of Technology in the USA and a report of the findings (Entitled 'Aerodynamical Properties of the Triplane' and written by J.C. Hunsaker and T.H. Huff) appeared in *Flight* magazine on 23 November 1916. Research was also carried out in the Göttingen wind tunnels in Germany, and this report was in wide circulation by March 1917. The object of the Massachusetts investigation was to establish whether a triplane configuration could offer better weight-lifting capabilities than a monoplane with an equivalent wing area. It was recognized that because of their reduced span and chord, a triplane's wings could be of lighter construction than those of the equivalent monoplane, but would have similar strength.

The scientific investigations proved that, as with a biplane, the upper wing provided most of the lift while the lower wing contributed little. The contribution of the middle wing was proved to be negligible. It should be noted that the American experiments were carried out with wings of relatively thin aerofoil section (RAF6 and Curtiss section), suitable for high-speed flight but not providing good lift characteristics. A further problem for a conventionally constructed triplane would be increased 'drag' caused by the additional wing and the struts and rigging required to brace the structure. Fokker's thick cantilevered wing provided greater lift than the thin sections and eliminated the need for additional rigging wires. Thus, although the thick section itself gave increased drag, this was compensated for by the lack of rigging wires.

sub-wing. The upper ends of the struts fitted into sockets welded to the fuselage-bottom longeron. The axle was sprung by means of bungee cord wrapped around it at either end. Only the front bay of the undercarriage was wire-braced.

Fokker flew V.4 and found that its performance was satisfactory; it climbed to 1,000m (3,000ft) in 2.5 minutes and to 5,000m (16,000ft) in 28 minutes. He decided that its handling qualities could be improved, and had balanced ailerons and elevators fitted. In addition to Fokker, V.4 was flown by a number of service pilots visiting Schwerin. One of these was Ltn Werner Voss, who was obviously impressed by the experience and reported back favourably to von Richthofen. However, in spite of these favourable omens it was decided that V.4 should not be submitted to Adlershof for evaluation and type testing.

Pre-production Fokker F.I 102/17 seen here with Jasta 11 and flown originally by Manfred von Richthofen. Cross and Cockade International

The V.5

Fokker's instruction to start work on V.5 was given on 7 July 1917. As has been said, it was designed from the start as a triplane and, while its construction closely followed that of the V.4, there were significant differences. These included new wings of greater span but of the same narrow chord. The spans of these wings now descended from a long upper wing to a shorter middle wing, and then to a still shorter lower wing. Viewed from the front, their proportions now looked right

Again, only the upper wing was fitted with ailerons, constructed from welded steel tubing, but these were now balanced with characteristic overhangs at their tips. Thin and wide interplane struts were fitted to improve torsional stiffness. The width of these allowed them to be held by clamps fitted on either side of each wing spar.

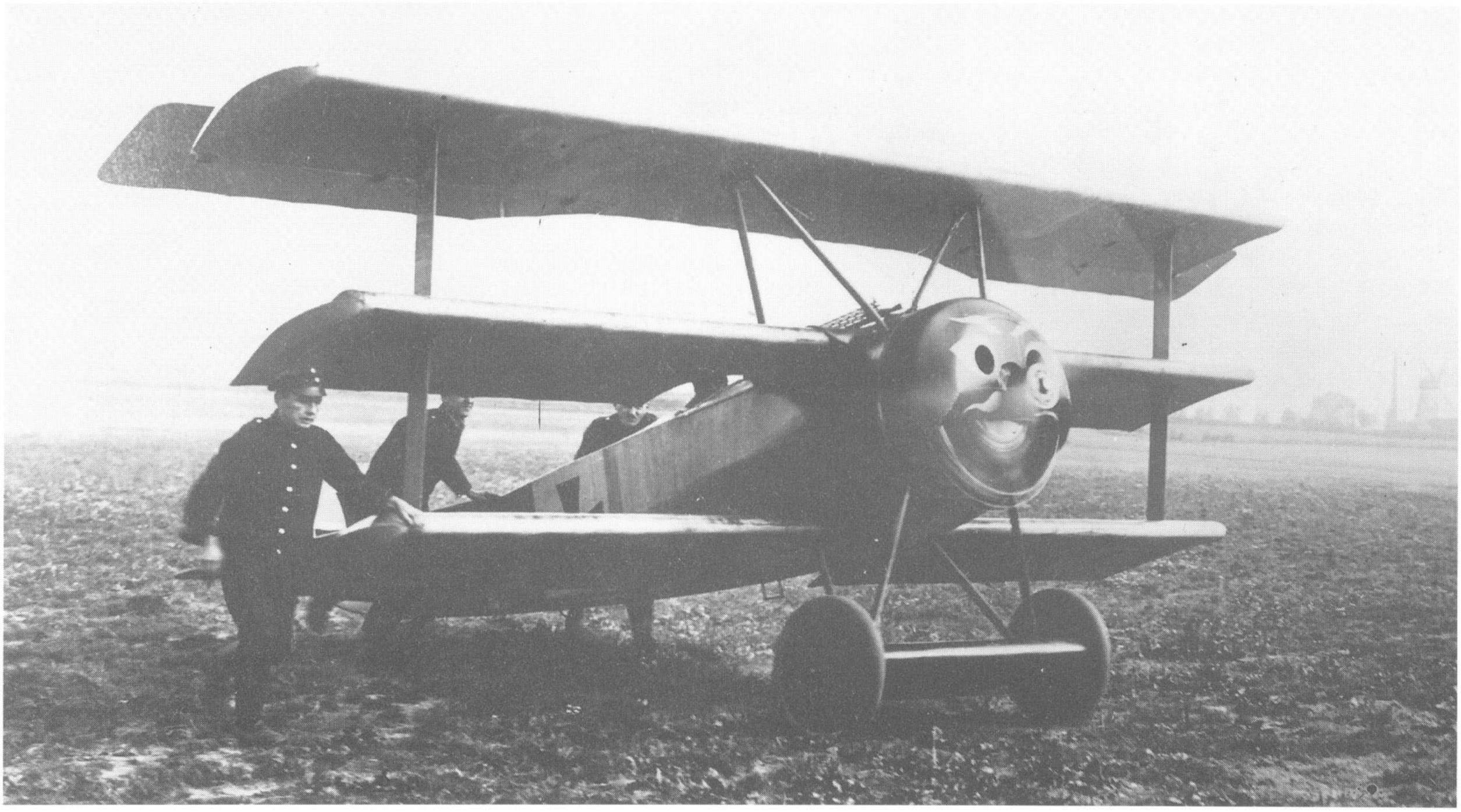
The tailplane shape underwent a series of changes. Initially it was a rather 'boxy' triangular shape with near-rectangular balanced areas on its elevators, but then it gained a slightly curved leading edge before it eventually became a plain triangular shape with round-ended balanced areas on its elevators. This shape was to be continued through all of Fokker's wartime products.

The V.5 was powered by the same 110hp Oberursal UR.III engine as the V.4, and equipped with a pair of LMG 08 machine-guns. Thanks to its increased wing area, it enjoyed a faster rate of climb than V.4 and could reach 1,000m in 1.5 minutes and 5,000m in 18 minutes. Fokker himself demonstrated V.5 to the military acceptance commission, who could not fail to be impressed by its performance in his hands.

On 9 July 1917, Idflieg placed orders for the design and construction of six experimental triplane fighters. These orders were shared equally between the Siemens-Schuckert Werke and the Pfalz Flugzeug-Werke. Surprisingly, Fokker was not included in these though, with one triplane flying and a second being constructed, he alone could demonstrate a triplane fighter to Idflieg, quote performance figures and invite front-line and other pilots to sample its performance. It is probable that the authorities' failure to place an order at this stage was linked to their still-valid prohibition on the use of Fokker-built machines for combat purposes.

On 11 July, emboldened by the successful flights of his first triplane, Fokker ordered the construction of two more machines based on the V.5 design. Visually, all three V.5 machines were similar. On 14 July 1917, Idflieg recognized Fokker's triplane work and placed orders with him for a batch of twenty V.5s. The small size of this order followed Idflieg policy of not placing large orders for new aircraft types until a random sample had passed type testing.

Eleven days later, the Flugzeugmeisterei invited all German aircraft manufacturers to Adlershof to inspect a captured Sopwith Triplane and, at the same time, Idflieg advised that they were prepared to place contracts to support practical triplane fighter projects. The German aircraft industry became obsessed with triplanes and many committed valuable resources to the development of triplane fighters, bombers, reconnaissance and maritime aircraft. But Fokker had gained a substantial lead. His first V.5, now allocated the Military Number F.I 101/17 (Factory Number 1697) was submitted for test to destruction at Adlershof between 7–11 August 1917. Although some rib buckling was observed, the test was deemed completely satisfactory and the design was accepted without reservation. The next two V.5 machines, (Factory Numbers 1729 and 1730) were accepted as 'pre-production' models and, allocated Military Numbers F.I 102/17 and 103/17, were delivered to the aircraft park for evaluation by front-line pilots. All three V.5 machines were similar in construction, though the second and third were fitted out with the full military load including weapons and ammunition.



Pre-production Fokker F.I 103/17 with Jasta 10, being taxied by Werner Voss. Cross and Cockade International

On 28 August 1917, F.I 102/17 was handed over to Jasta 11 and F.I 103/17 to Jasta 10. Ltn Werner Voss made his first flight in F.I 103/17 on 29 August 1917 and Rittmeister Manfred von Richthofen his in F.I 102/17 on 1 September 1917. The lives of these two machines were short.

Von Richthofen gained his first victory in F.I 102/17 on 1 September 1917 when he shot down a 6 Squadron RFC R.E.8 at 07.30hr over Zonnebeke Woods, his sixtieth victory overall. On this occasion the R.E.8's observer was standing up and made no attempt to fire at the approaching triplane, probably in the mistaken belief that it was a Sopwith. Von Richthofen's second triplane victory came on 3 September when he brought down a 46 Squadron Sopwith Pup south of Bousbecque at 07.35hr. While he was on leave in Germany, F.I 102/17 was flown by Oblt Kurt Wolff who was shot down and killed in it by Flt Sub-Lt McGregor of 10 (Naval) Squadron on 15 September.

F.I 103/17 was to have a slightly longer life. Voss gained his first victory in it, a Sopwith Camel of 45 Squadron, on 3 September 1917. Twenty days and a further nine victories later, he gained his last. This was a D.H.4 of 57 Squadron which he brought down south of Roulers at 09.30hr on 23

Werner Voss

Ltn Werner Voss was born on 13 April 1897 in Krefeld. He had enlisted in the local militia and was called to serve with the 11th Westphalian Hussar Regiment on the Eastern Front when war was declared in 1914. Promoted first to Gefreiter and then Unteroffizier, he requested to transfer to the Aviation Service and was accepted on 1 August 1915. He was trained at Feld Ersatz Abteilung (FEA) 7 and then at Krefeld before returning to FEA7 as an instructor. He was promoted to Vizefeldwebel and transferred to Kampfgeschwader 4, Staffel 20, on 10 March 1916. Initially, he flew as an observer, but he obtained his pilot's badge on 28 May 1916 and was commissioned on 9 September. Having shot down two enemy aircraft, he was transferred to Jasta 2 on 21 November 1916. His score rose rapidly and he was transferred to Jasta 5 and then to Jasta 29 as acting commander. He then moved to Jasta 14, again as acting commander before being sent to command Jasta 10 on 30 July 1917.

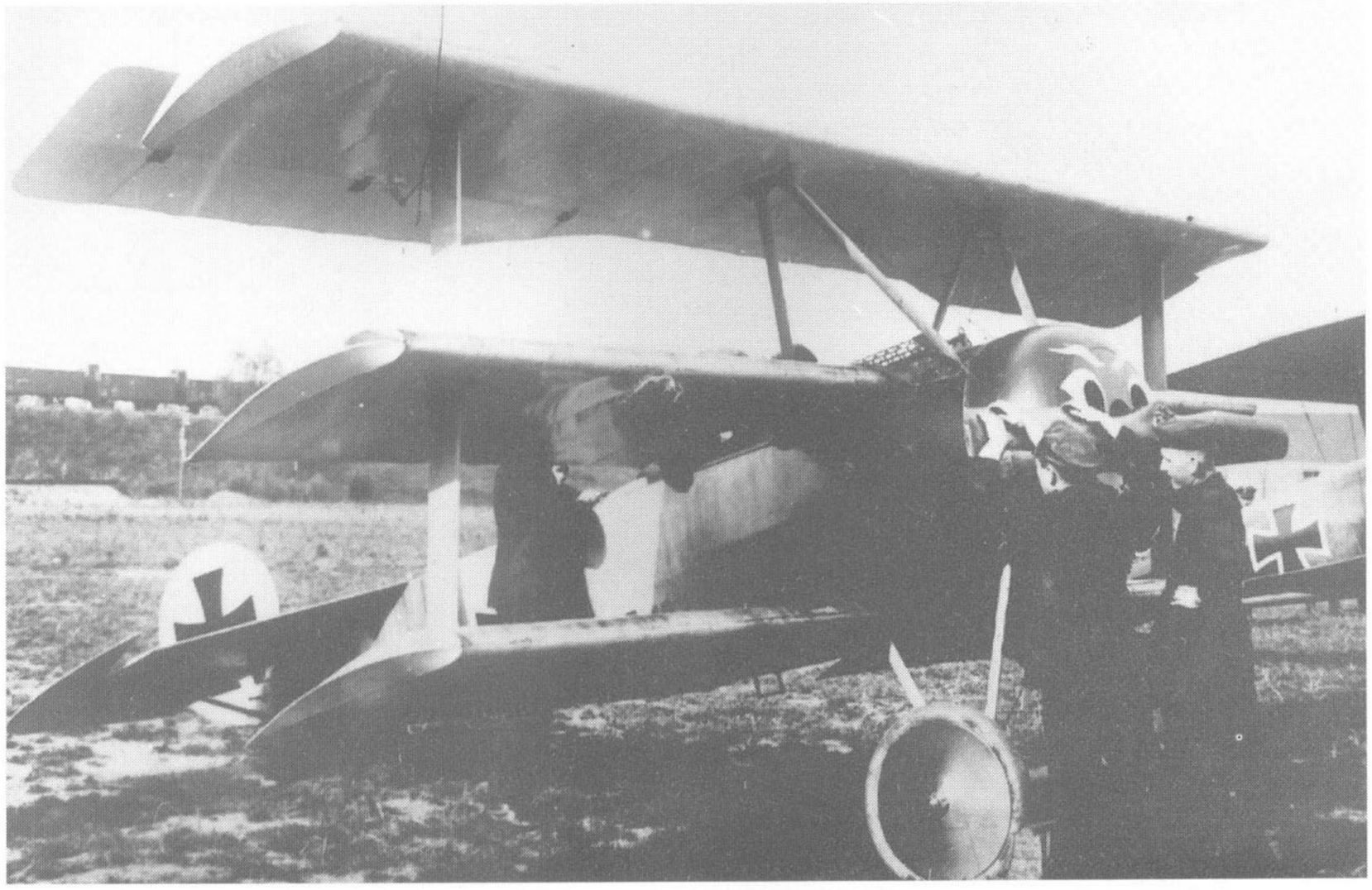
Flying Fokker F.I 103/17, he was killed in combat with pilots of 56 and 60 Squadron on 23 September 1917 (*see* pages 93, 95, 97 and 98).

By this time, Voss's score stood at forty-eight victories and his numerous awards included the Iron Cross 1st and 2nd Class, the Knight's Cross with Swords of the Royal House of Hohenzollern and the Orden Pour le Mérite. Voss was buried by the British at Plum Farm, to the north of Frezenberg.

Leutnant der Reserve Werner Voss.
Cross and Cockade International

September. He spent much of the rest of the day with his brothers, Otto and Stelly Max Voss, both of whom were Leutnants and then, at 18.00hr he took off again on a patrol with Ltn Bellen and Vfw Rudenberg as wingmen, followed by a second flight from Jasta 10 comprised of Oblt Wiegand flying an Albatros D.V and Ltns Bender and Kuhn in Pfalz D.IIIs. They flew towards Zonnebeke with Voss's flight in the lead and Wiegand's flight above and behind him. There were thin wispy clouds at all levels and the main thick bank was at 2,740m (9,000ft). It was a busy time in the air and there was no shortage of targets.

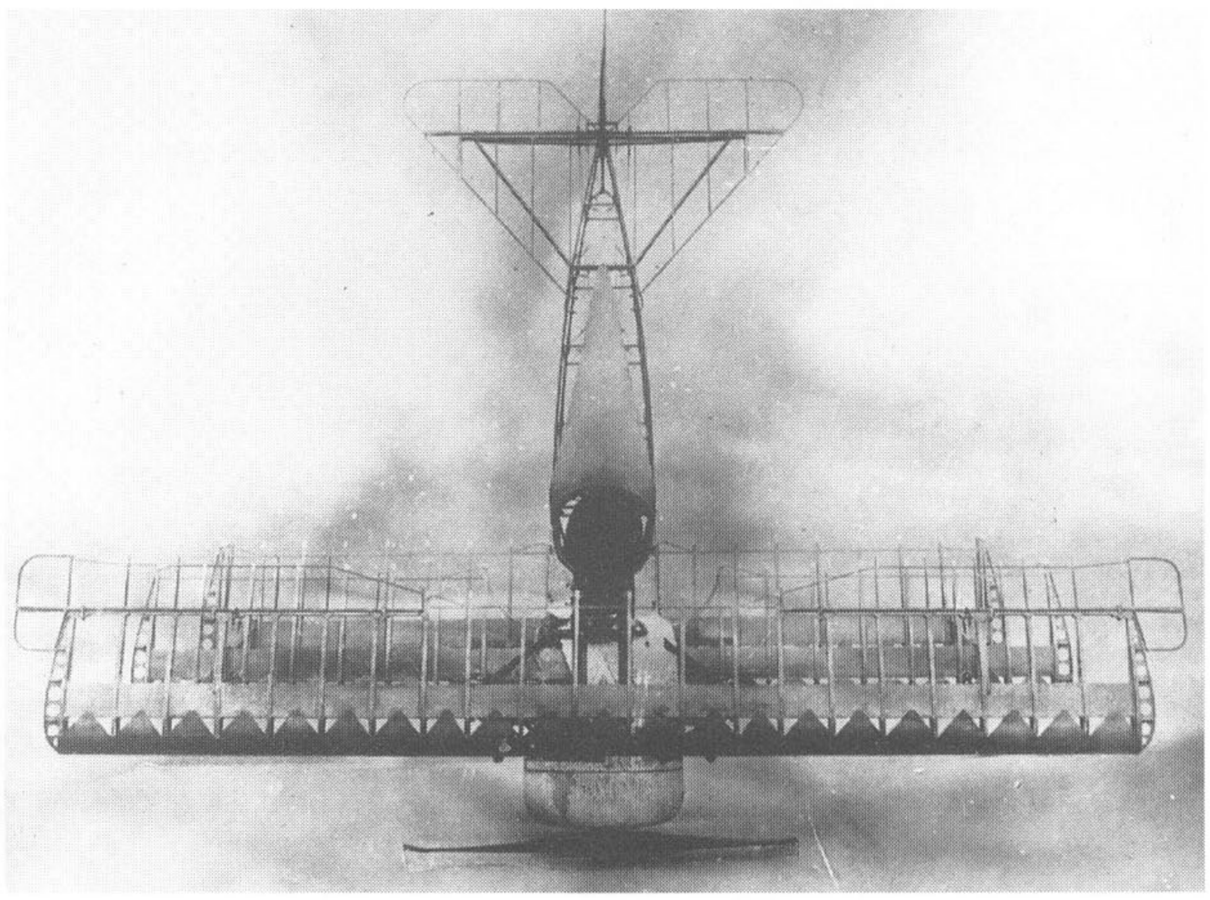
At about 18.25hr Voss came across two flights of S.E.5as from 60 Squadron RFC, led by Capt Keith Caldwell, that were returning from a patrol. Separated from the rest were two machines flown by Capt Chidlaw-Roberts and Lt Hammersley. Voss attacked Hammersley and hit him hard, damaging his engine and sending him down into an inverted spinning escape. Chidlaw-Roberts came to Hamersley's aid and fired both his guns at Voss at close range. Voss immediately spun around and fired at Chidlaw-Roberts, damaging his aircraft and forcing him out of the fight. He, in turn, was rescued by 'B' Flight from 56 Squadron who had seen his predicament and joined the battle. Capt J.T.B. McCudden, who was leading the flight, attacked from Voss's right and Lt A, Rhys-Davids from Voss's left. Voss saw them coming and adroitly spun his machine around to face them. Other 56 Squadron machines joined in and in no

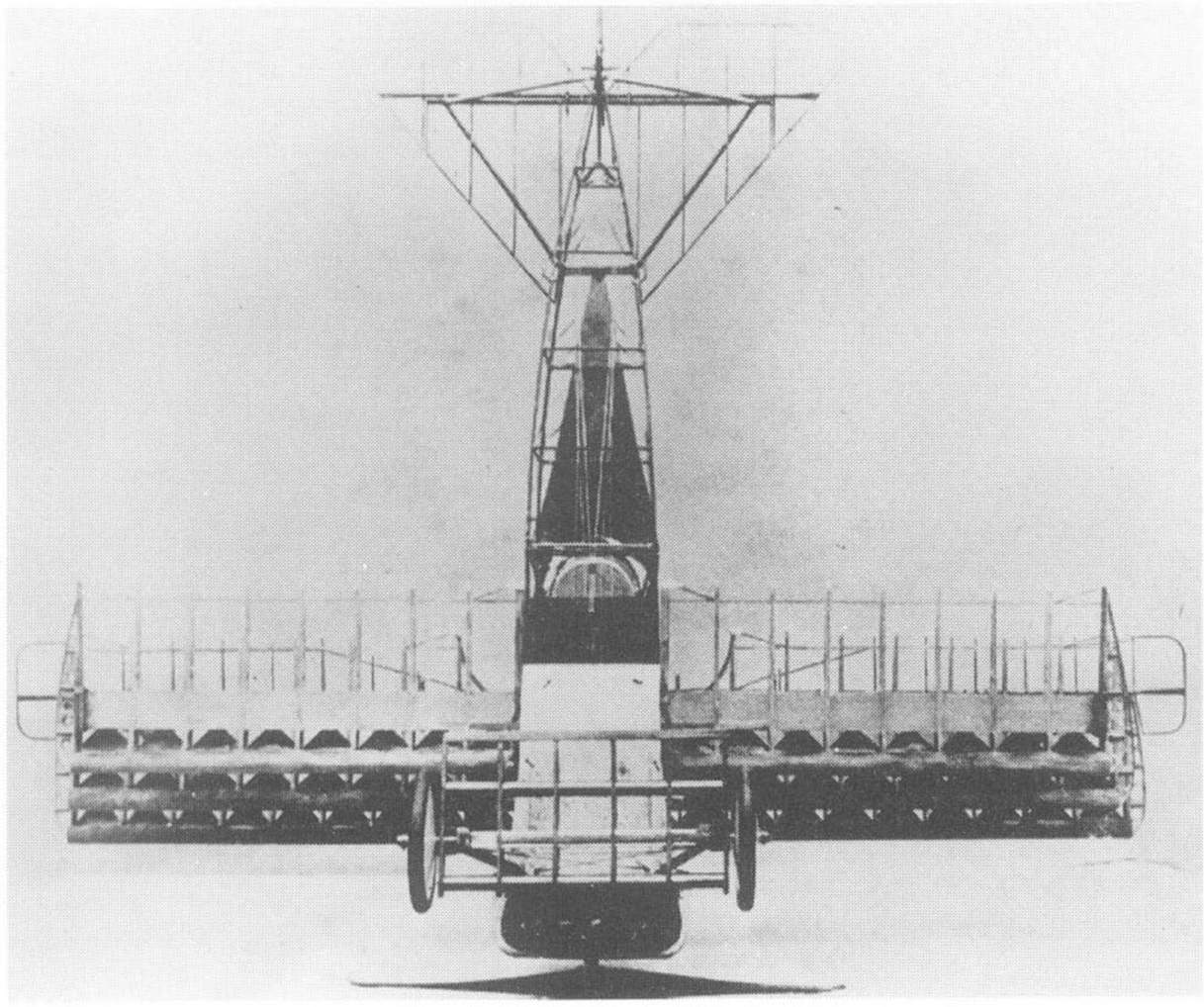


***(Above)* Voss's Fokker F.I, 103/17, being prepared for take-off.** Cross and Cockade International

Anthony Fokker standing with Werner Voss watching something in flight. Frank Cheeseman

time Voss was in the middle of the formation and being attacked from all sides. Somewhere during this action, the Albatros and Pfalzs dropped out of the fight and Voss continued on his own, using his personal skill plus the triplane's manoeuvrability and rate of climb to maximum effect. All of the 56 Squadron aircraft engaged





***(Above)* Plan view of a beautifully detailed model of an early production Fokker Dr.I triplane. *(Right)* Underside view of the same model.** Peter Grosz

The wreckage of Werner Voss's triplane, F.I 103/17, lay in the open under enemy fire for a month before Lt G. Barfoot-Saunt, the RFC Intelligence Officer responsible for this, could get to it to examine it and to salvage anything he considered to be of interest.

In accordance with its established practice, the RFC allocated the wreckage of F.I 103/17 the number G.72 in their listing of 'Captured German Aircraft', although it was a total wreck. Examination of it by Lt Barfoot-Saunt had to wait until 27 October 1917, by which time access to it was relatively safe. Bearing in mind that, when it crashed, it was seen to disintegrate and that it had been exposed to the weather and to German fire for a month, no attempt was made to salvage the complete remains. The following reports are to be found in the files at the Public Record Office in Kew, London:

1. FROM PRO FILE AIR 1, BOX 1061

Incident report made to Lieut Barfoot-Saunt, Wing Intelligence, Area HQ, RFC
Subject: – Fokker Triplane which was shot down by a flight of SEs. Total wreck. Number 103/17. Date – September 1917.

Details
Little of this machine is intact to allow a fully detailed description at this time but the following points are worthy of note. The machine is one of the new Triplane 'Scouts' which have been reported active in the Sector during the past four weeks. The fuselage is of alloy tubing covered with fabric, whilst the wings are of wood, fabric covered. The Le Rhone engine is covered with a cowling, or rather partly covered as the cowl is not a full one possibly to assist cooling as are the two holes in front/top of the same. The machine features a new attempt by the enemy at camouflage. The entire upper and side surfaces are doped in various shades of green, blue and grey which takes the form of streaks applied at various angles – vertical on the fuselage and slanted on the tail. The upper and second wing have not been salvaged but the streaks on the bottom wing are just off the vertical, slanting slightly to the left. Lower surfaces are greyish blue. Upper surface dope is of poor quality but the fabric is good.

Area Intelligence Officer

2. FROM PRO FILE AIR 1/1061/204/5/1579 Allocated RFC Number G.72

REPORT ON FOKKER TRIPLANE

Brought down by Lieut Rhys-Davis [sic] of No 56 Squadron on 23 September 1917, near ST JULIEN.

GENERAL. This machine was for a long period in the open before being salvaged and is therefore in very bad condition. It is camouflaged green on the upper surface and sky blue on the lower.
Pilots seat is adjusted by releasing two wing nuts which are fastened to two tubes in rear, thus allowing the seat to be raised or lowered.
Makers No 1730
Fabric is good but dope is of very poor quality.

CONSTRUCTION. The fuselage is of 2 mm steel tubing braced with 18 gauge piano wire, all the steel work being welded together as in the AEG. (G.67)
The system of fixing the wires to the struts has not been found before; a piece of tubing is welded across the angles made by the struts and longerons and the wire is then bent round these, the ends being made fast to a turnbuckle in the centre of the span. (See PLATE No 1).
The fuselage is covered with fabric, the top having a plywood fairing which is also covered by fabric: the piece on the bottom is laced.
Main Planes. Only the lowest one was salved.
It consists of wooden ribs and one large main spar (box type) built up of 7 members 11/32" x 9/16" (average) which taper towards the wing tip. These are covered with three ply on the sides, top and bottom, the last two being reinforced at the fuselage end by a piece of spruce 2' x 5/16" fixed on the outside. [It seems unlikely that Barfoot-Saunt would give dimensions in sixths of an inch and it is more likely that this should have read 5/16", a more conventional engineering dimension – author.]
Span of this plane (approx.). 14' 10"
Cord ... ... 1' 11"
Dimensions of Span ... 10cm x 25 cm

Tail Plane is fixed across the fuselage, which is cut away like the Sopwith machine so that the tail plane when in position is flush with the fuselage. It is constructed of steel tubing.
The fabric is fixed on to strips of fabric sewn round the ribs and the upper and lower surfaces sewn to the strips.

Cord (average) ... ... 3' 9"
Span ... ... 6' 9"

The Elevators are on each side of the fuselage, connected by a single axis tube, and balanced and constructed of steel tubing. The fabric is fixed in the same way as the tail plane.
The two balanced pieces are triangular and are 1' 2" x 7½"

Cord (average) ... ... 16½"
Span ... ... 8"

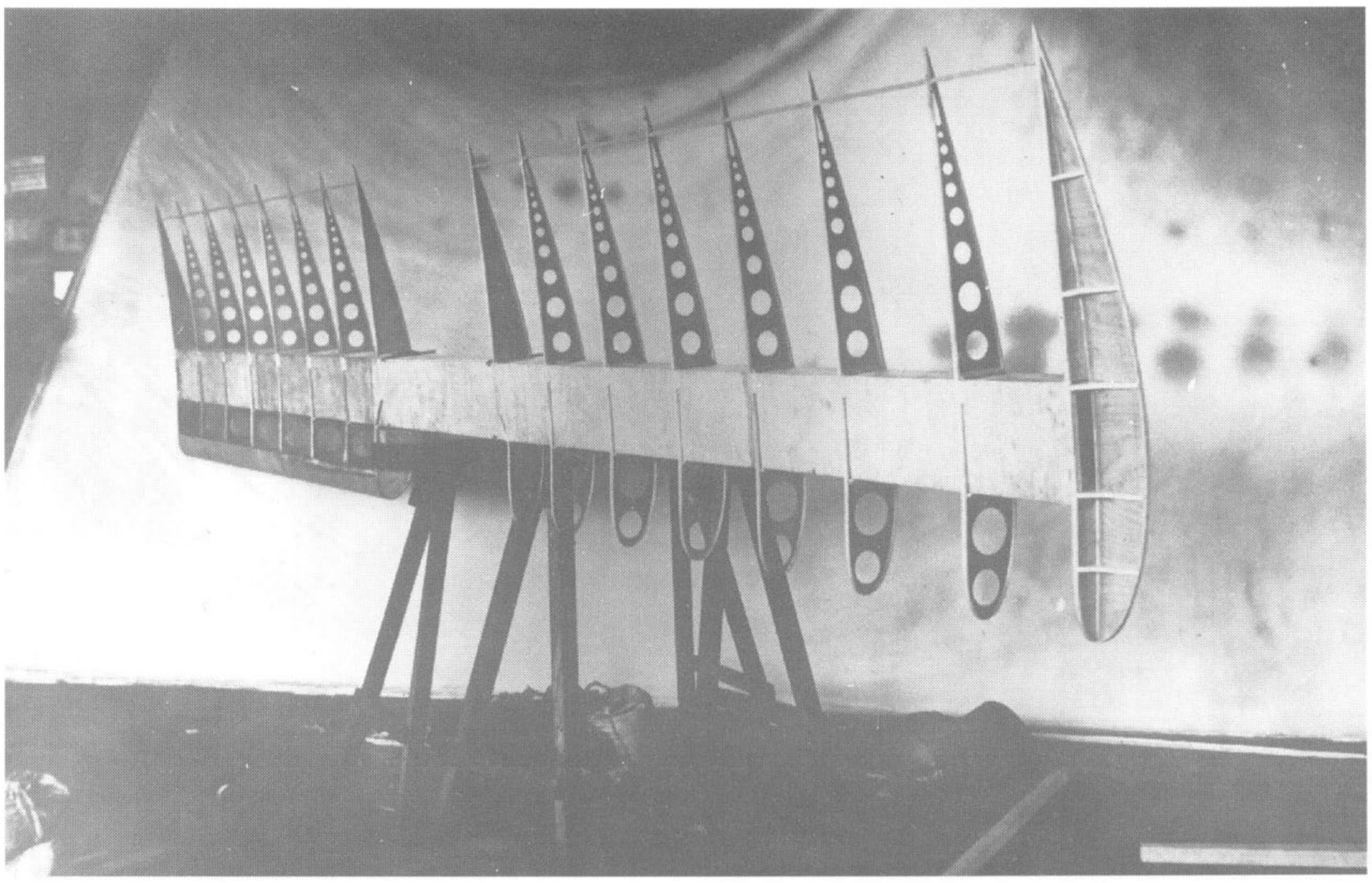
The controls pass down the fuselage and emerge under the tail plane, the one to the top of the King post going up through the tail plane itself. These controls are not duplicated.
The tail skid. The post is ash and the shoe is steel in the shape of a knife edge bolted to the post. The shock absorber is of black elastic strands covered with thread.
Undercarriage well staggered forward; the 'vee' struts are of streamlined steel tubing.
Between the 'V's is an aluminium box through which the axle passes and on each end of the box there are two lugs. The shock absorber, which is of the same type as on the tail skid is bound around the lugs and over the axle (see PLATES II, III, and IV).
Petrol tank placed in front of pilot had a capacity of approximately 18 gallons.
Engine used was a 110 Le Rhone No 3247 type J, was missing in an English Nieuport early this year; it had a Bosche Magneto fitted, No 2070815, type DA, and REV plugs.
Propeller AXIAL manufacture, diameter 2600mm
pitch 2300mm
Consists of 4 laminations of mahogany an inch thick.
Armament. Two Spandau guns, Nos. 5848 and 5849 were fitted to fire through the propeller with a direct flexible drive interrupter gear.
Instruments. Among the usual instruments a Le Rhone pattern revolution counter was found.

G Barfoot-Saunt
2nd Lt RFC

Advanced Headquarters (I)
Royal Flying Corps in the Field, 27 October 1917

Three points of interest arise from the above reports, the first being that the name of the man who killed Voss on 23 October was Rhys-Davids, not Rhys-Davis as given in the second report. The second is the description of the diameter of the steel tube used for construction of the fuselage as being '2mm'. This is obviously a typing error and should have read '20mm'. No mention is made of the thickness of the tube, but it certainly was not 2mm.

The third point arises from the description of the propeller fitted to this machine when it was captured. The four laminations of mahogany an inch thick contrast with most of the known photographs of F.I 103/17, where the construction seems to be of six or seven laminations of woods of contrasting appearance. It must have been damaged and changed at some time prior to its final flight.



The uncovered bottom wing of either the V.4 or V.5 showing construction details.
Peter Grosz

suffered damage from Voss's guns, some, it was found later, beyond repair.

Voss could have avoided this fight but chose to stay with it until his fuel (probably) ran out. The end came when, during very close combat with Rhys-Davids, Voss briefly flew in a straight line allowing Rhys-Davids to fire at him from very close quarters. Both machines turned at virtually the same time, narrowly avoiding a collision. Rhys-Davids next saw Voss flying nose down with his engine off and fired into him again. This time Voss's triplane was seen to crash into the ground and disintegrate in No Man's Land close to the British lines (for accounts by the British pilots involved, *see* pages 97–8). Voss was buried by British soldiers at Plum Farm, close to where he fell.

Development of the triplane continued and the first batch of twenty machines (which included the two prototypes and two pre-production machines) was accepted on 13 September 1917. Production aircraft differed slightly in detail to the original V.5 machines. They had slightly longer wingspans and there were other small structural differences. Visually, the most significant of these was the fitting of wooden 'skids' under the tips of the lower wings. The Fokker triplane was never an easy machine to handle, particularly when landing. With the nose up and the tail down the flat sides of the fuselage masked the rudder so that it had little effect on direction. Further, over-enthusiastic blipping of the engine would result in the right wing dipping violently with damage to the wing-tip a probable result.

By now the official designation had changed. The 'F.I' used for the first three machines was dropped and all production triplanes were to be 'Dr.I's where the 'Dr' came from *Dreidecker* – German for triplane.

Fokker appeared to have regained at least some of the confidence of the authorities and was once more a major supplier of fighter aircraft for the German Air Service. In September 1917, Idflieg placed a firm order for the second production batch of triplanes, 100 aircraft intended to re-equip Jagdgeschwader I. Delivery of these started in October 1917. On 15 October 1917, Dr.I 141/17 passed its acceptance tests; ten days later it was delivered to Adlershof for type testing. It passed this without difficulty between 2–5 November 1917.

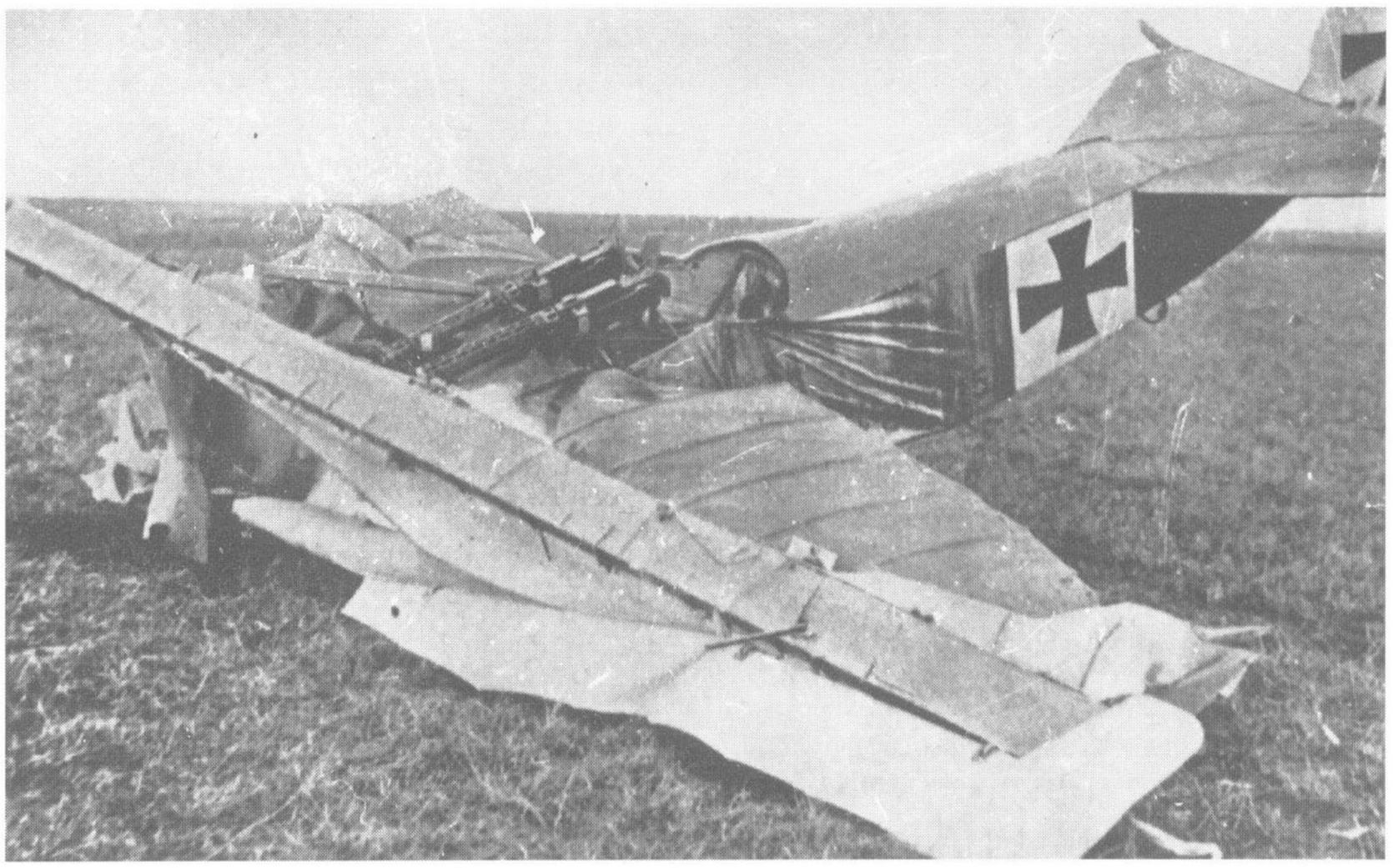
Production batches of triplanes started to reach Jagdgeschwader 1 in the middle of October and by the end of the month there were seventeen listed as being on strength. By this date, most of the Jasta's experienced pilots were used to their relatively heavy water-cooled Mercedes-engined Albatros and Pfalz biplanes. Rotary-engined Fokker D.IV and D.V aircraft were issued to help them re-adjust but, apart from its rotary engine, the Dr.I was much lighter, and had three wings and totally different flying characteristics. Further familiarization was essential and it was expected to be several days before they felt ready for combat with their new machines. Events were to prove that this delay was fortunate for them, as there were serious (if familiar) problems to come.

Structural Problems

Fokker Dr.I 115/17 had been delivered to Jasta 15 on 22 October and was taken over by the *Staffelführer*, Ltn Heinrich

A typical Fokker-style demonstration of strength. The wing is that of either a V.4 or V.5. Peter Grosz

Gontermann. Because of bad weather conditions, Gontermann delayed his first flight in it until 28 October. He flew it again on the 29th with the intention of demonstrating its manoeuvrability to his pilots. While he was side-slipping from an altitude of some 15,000ft during this flight his top wing was seen to collapse, with a number of fragments breaking away from it. Gontermann lost control and was badly injured in the crash that followed. He was rushed to hospital but died the next day.



The wreckage of Fokker Dr.I 115/17, in which Ltn Gontermann was killed.
Cross and Cockade International

Heinrich Gontermann

Ltn Heinrich Gontermann was born at Siegen in southern Westphalia on 25 February 1896. He joined the Army on 14 August 1914 and served with the 6th Uhlan Regiment in Hanau. He was wounded in action at the front and, on recovery, was commissioned in 1915 and moved to the 80th Fusilier Regiment. He requested transfer to the Air Services and trained as a pilot. He served with Kampfstaffel Tergnier as both pilot and observer before being sent to Jasta 5. After a promising start, his score initially mounted slowly, but picked up after the spring of 1917.

He was given command of Jasta 15 on 30 April 1917 and continued in that role until 30 October 1917 when he died after his Fokker Dr.I 115/17 broke up in the air and crashed to the ground while he was testing it over his own aerodrome at La Neuville. At the time of his death, his score stood at thirty-nine, of which eighteen were observation balloons (he brought four down in three minutes on 19 August 1917). His awards included Iron Cross 1st Class, the Knights Cross with Swords of the Royal House of Hohenzollern Order, the Bavarian Order of Max Josef and the Orden Pour le Mérite. Although all of his victories were scored in aircraft other than the triplane, the circumstances leading to his death were responsible for the inquiry into Dr.I 'faults', and so he merits inclusion here.

Leutnant Heinrich Gontermann.
Cross and Cockade International

Two days later, Ltn Gunther Pastor of Jasta 11 was landing after a flight in Dr.I 121/17 when his top wing collapsed, and he crashed and was killed. Manfred von Richthofen had been on the aerodrome and a witness to this crash: after examining the wreckage together with Ltn Krefft, his Technical Officer, he ordered that all of JGI's remaining Dr.Is should have their wings stripped of fabric and their structures examined. Numerous examples of faulty workmanship were discovered and reported back to Idflieg. Idflieg acted promptly, and ordered the immediate grounding of all Fokker triplanes. A special commission of experts was formed and were sent to JGI to examine the two crashed examples, plus the other grounded machines. At the same time, a thorough critical examination of further examples of the type was carried out at Adlershof.

Critical examination of the crashed machines and further 'sample' triplanes chosen because they had the greatest airtime revealed a number of faulty areas. Some of these were due to poor basic design but others were caused by poor manufacturing practice.

Examination of the wreckage of Dr.Is 115/17 and 121/17, plus a number of other Jasta 11 machines chosen because of their (relatively) high number of flying hours, revealed a number of faults that were reported in two main reports.

The first was by Ltn Arntzen, the Technical Officer of Jagdstaffel 15. He described the crash that he had witnessed. Continuing and describing the wreckage he had found, he commented upon the broken right aileron, the detached wing ribs and wing-tip, and the balanced portion of the aileron that was bent up by 20 degrees. Concluding, he said that he considered that the material used in the wings was not faulty and that there had been no over-stressing of the components. He felt that construction of three vital components had been careless and that this fault had to be rectified. He recommended that the following modifications should be made:

- The wing-tips and ribs needed to be braced against side pressure.
- The spar from which the aileron was hinged needed to be stronger, as did its attachment (by seven thin ribs) to the main wing spar.
- The balanced portions of the ailerons needed to be of stronger construction.

The second report was from the ZAK Crash Commission and signed by Oblt dR Hoff, Ing. Stellv Betsch, Ing. Diebel and Ing Dienst Fleckig. They reported on the wreckage of Dr.I 121/17 and on the other aircraft examined at Jasta 11.

Regarding Dr.I 121/17, they reported that the ribs appeared to have broken away from the main spar and that the left aileron had broken in the area behind the operating horn. They felt that the aileron/auxiliary spar hinges were satisfactory but noted that the end of the spar had pulled out of the wing-tip and that the balanced end of the aileron had been bent upwards.

Examining a second triplane (with the most flying hours) they had the upper wing dismantled and its fabric removed. They reported that:

- The auxiliary spar was not securely fastened to the wing-tip.
- The corner attachment was lightly held by a mortise and tenon joint with no plywood gusset.
- The ribs were let into the auxiliary spar by only a small amount, and were nailed.
- The wing had suffered from damp and the plywood webs had buckled, and the large round lightening holes had contributed to this.
- The fabric was nailed to the ribs (which were generally too thin to allow this).

Examining a third triplane, they had the fabric removed from a bottom wing and reported that:

- The gluing of the wing ribs and their booms had loosened, so that the webs had come out of the booms.
- The triangular blocks in the corners between the rib webs and the spar had been loosened by damp.
- The whole wing had lost its structural integrity.

The fabric was removed from the bottom wing of a fourth Dr.I, and this was found to exhibit the same faults. In all cases, the painting of the structures seen had been insufficient to ensure waterproofing of their components.

The commission concluded that, in this condition, the Fokker Dr.I was not acceptable for use at the front and recommended that the factory should provide all repairs needed free of charge.

To resolve the problem, Idflieg insisted on the removal of fabric from the wings of all existing triplanes and the implementation of an extensive programme of modifications intended to rectify the reported faults. All Dr.Is, either on Jasta strength, en route to the Flugpark, or still at Fokker's works were included in this programme, which was to be paid for by Fokker. Only after these modifications had been completed and the wings passed a rigorous inspection would Idflieg consider lifting the grounding order.

The modifications required by Idflieg before production of the triplane could be resumed were that:

- The wing-tip formers were strengthened by the addition of a second rib to form a box rib at this point.
- A third box rib be added to provide a more robust attachment for the auxiliary spar.
- The auxiliary spar to wing-tip former joint be improved.
- The joint between the auxiliary spar and the cap strips of the ribs that were attached to it be improved.
- The joints between the rib webs and their cap strips be improved.
- The rib webs to be stiffened by the addition of vertical stays.
- The lightening holes in the rib webs to be deleted to lessen possible absorption of moisture.
- The covering fabric to be sewn to the ribs, not nailed as previously.
- Means of supporting the covering fabric, particularly in the centre of the upper wing, to be provided.
- The wing structure to be coated with lacquer to protect it against moisture.
- Experiments to be carried out to check the size of aileron horn balances with a view to their modification if considered necessary.

In the event, Fokker carried out all of the modifications except the deletion of the rib lightening holes, as he argued that the lacquer coating now being applied to the wing structures would provide sufficient protection against moisture.

Although the implementation of these modifications (and the rigorous examinations that followed) appeared to solve the problem of the structural strength of the wings, three further instances of upper-wing failure were to follow before the type was withdrawn from use. Fortunately for the Dr.I's pilots, none resulted in a fatal crash.

Operational Service

The third and final order, for a further 200 Dr.Is, was placed with Fokker in November 1917. With the problems apparently resolved, the German pilots' initial reactions to it were full of enthusiasm. Manfred von Richthofen was reported as telling his pilots that the new Fokker triplane was 'as manoeuvrable as the devil' and that they could 'climb like monkeys'. In letters home, Adolf von Tutschek said that it was 'a quite fine machine, extremely manoeuvrable and climbs steadily', that it was a 'really outstanding aircraft just made for air fighting'. Rudolf Stark, a pilot with Jasta 34 which was re-equipped with 'handed down' triplanes commented:

> There is great competition as to who is to fly them, and finally we let the dice decide who shall be the first and in what order the others shall have their turns. At first we find these new machines a bit strange to fly. But they are extremely sensitive to the controls and rise up in the air like a lift. You climb a few hundred metres in the twinkling of a second and can then go round and round one spot like a top. The rotary engine takes some learning before you can manage it, and is rather a difficult business at first. But it is not long before we are all at home in them, and everyone wants to be flying a 'tripe' when an English bombing squadron comes across.

Carl Degelow, who, served briefly with Jasta 36 and later commanded Jasta 40, described the triplane as 'remarkable'. Ltn Wilhelm Papenheymer, a fairly new pilot of Jasta Boelke wrote home saying how pleased the pilots were with their new machines. These sentiments were echoed by other pilots writing home and, for a while, they were delighted with their new machines. It was indeed extremely manoeuvrable and could climb rapidly up to their normal operating altitude and, while it was not as fast as some contemporary Allied machines, in combat it could trade height gained in a rapid climb for speed in a dive.

For the British view of Fokker's triplane, we can do worse than to look at comments made by McCudden, Bowman and Cronyn of 56 Squadron, and Hammersley and Chidlaw-Roberts of 60 Squadron – all experienced pilots flying the S.E.5a – after their epic fight with Voss on 23 September 1917.

Hammersley was the first to be attacked by Voss, who quickly out-manoeuvred him, got onto his tail and put a burst of fire into him causing severe damage. Hammersley

threw the S.E. into a spin but was followed down by Voss, forcing him to turn over into an inverted dive to escape. Chidlaw-Roberts attempted to rescue Hammersley but Voss barely hesitated. 'In seconds he was on my tail and had shot my rudder bar about. I retired from the fray and that is all I saw of it.' McCudden, with 56 Squadron's 'B' Flight then joined in, McCudden attacking Voss from the right and Rhys-Davids from the left. McCudden later said that:

> [Voss turned] in a most disconcertingly quick manner, not a climbing or Immelmann turn, but a sort of flat half spin. By now the German triplane was in the middle of our formation and its handling was wonderful to behold. The pilot seemed to be firing at all of us simultaneously, and although I got behind him a second time I could hardly stay there for a second. His movements were so quick and uncertain that none of us could hold him in sight at all for any decisive time.
>
> I now got a good opportunity as he was coming towards me nose on, and slightly underneath, and had apparently not seen me. I dropped my nose, got him well in my sights, and pressed both triggers. As soon as I fired up came his nose at me, and I heard clack-clack-clack-clack, as his bullets passed close to me and through my wings. I distinctly noticed the red-yellow flashes from his parallel Spandau guns. As he flashed by me I caught a glimpse of a black head in the triplane with no hat on at all.

Bowman later said:

> We were then at about 2,000ft and a mile behind the German front line. This left Voss in the middle of six of us, which did not appear to deter him in the slightest. At that altitude he had a much better rate of climb, or rather zoom, than we had and frequently he was the highest machine of the seven and could have turned east and got away had he wished to, but he was not that type and always came down on us again. His machine was exceptionally manoeuvrable and he appeared to be able to take flying liberties with impunity. I, myself, had only one crack at him: he was about to pass broadside across my bows and slightly lower. I put my nose down to give him a good burst and opened fire, perhaps too soon; to my amazement he kicked on full rudder, without bank, pulled his nose up slightly, gave me a burst while he was skidding sideways, and then kicked on opposite rudder before the results of this amazing stunt appeared to have any effect on the controllability of his machine.

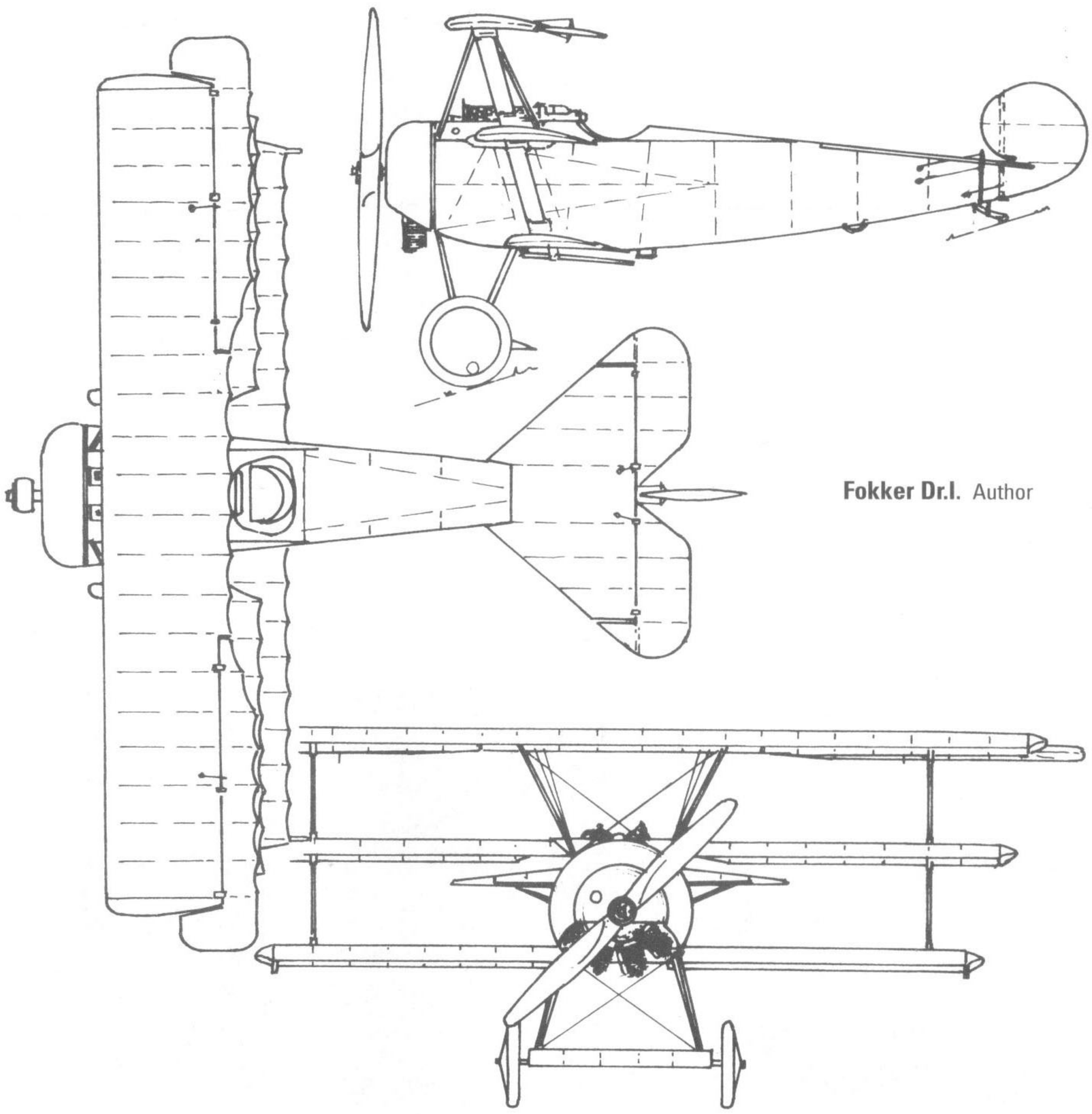
Cronyn wrote:

> I take my hat off to that Hun, as he was a most skilful pilot, but he did give me a rough passage. On seeing my feeble attempt, he whipped round in an extraordinary way, using no bank at all, but just throwing his tail behind him. He attacked me from the side, and I had the opportunity of observing that he was one of the latest design, being a triplane. He was at very close quarters and could hardly miss me. The bullets ripped all around me. I did not stick my machine down in an attempt to run, trusting to my dodging ability, as I certainly would have done two months ago: but dived just enough to give me speed to turn under him to prevent his getting on my tail. I do not know how many times I turned under him; I did not stop to count, but it seemed an eternity. He finally got too close for me, and I resorted in desperation to the old method of shaking a pursuing machine. On the completion of my second spin, I flattened out, and to my intense relief the Hun was no longer following me.

In his book *Wings Over the Somme* Gwilym Lewis sums up the situation. On 24 April 1918 he was leading his flight into an attack on four Pfalz D.IIIs he had spotted below them. He says:

> I increased the angle of descent and was just getting a lovely bead into what seemed like pretty good meat, when I happened to lift my eyes a little and there were eight stupid little Tripehounds diving on us with considerable zeal. I had but one thought! Up I pulled, round and down the other side, and home as fast as possible. My patrol followed à la text book, and we did a most masterly wheel and dive out of danger's way. We never play around with Tripes, when they are above, and keep from close quarters whenever possible. They can manoeuvre much better than we can, but have not nearly so much speed. I can tell you I chuckled a bit on that rush down-hill for home.

Although the initial reaction of the German pilots to their new machines was one of enthusiasm, by the time that deliveries of production triplanes to the front-line units began, the air war had passed beyond the need for light, manoeuvrable machines

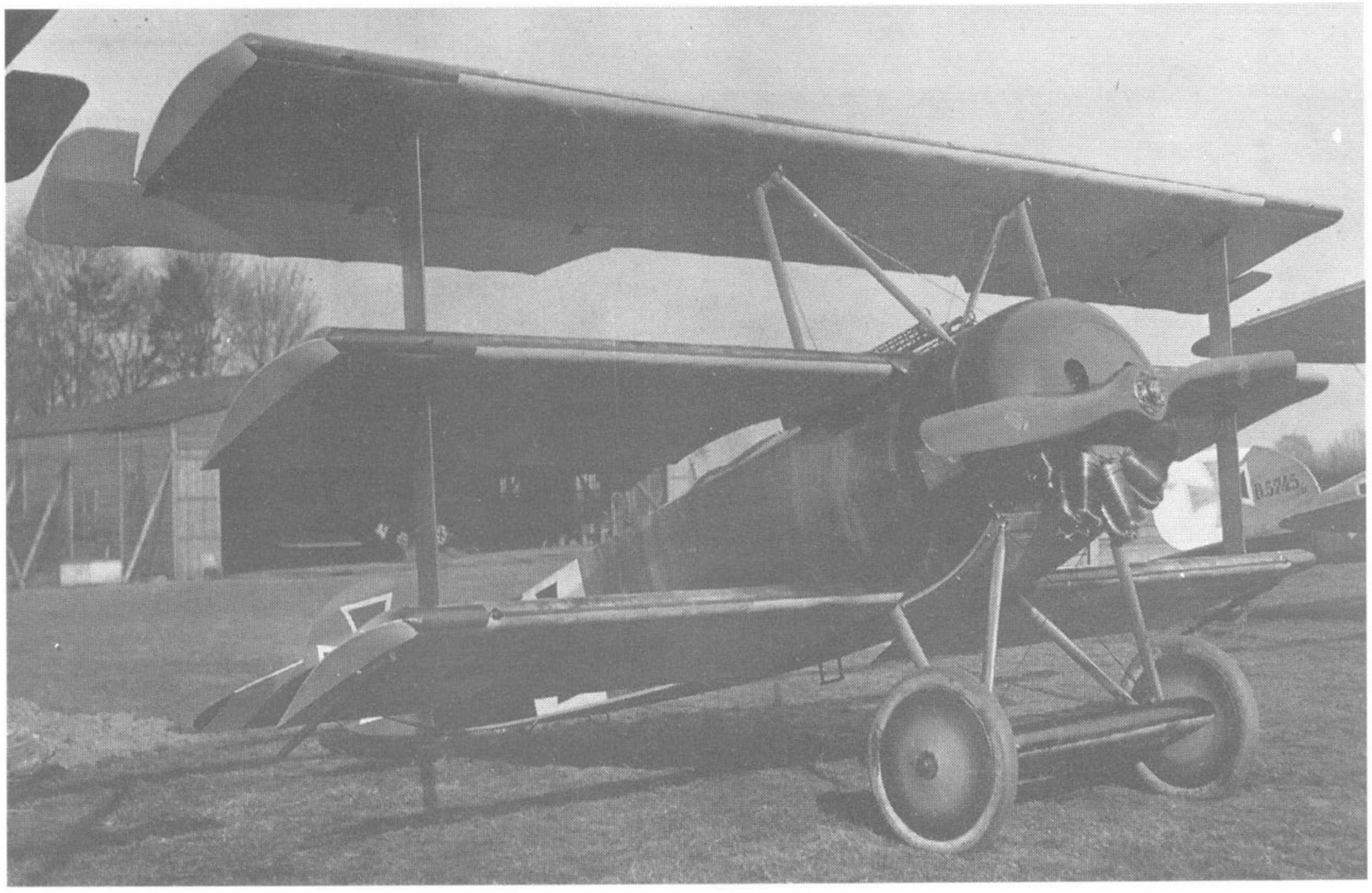


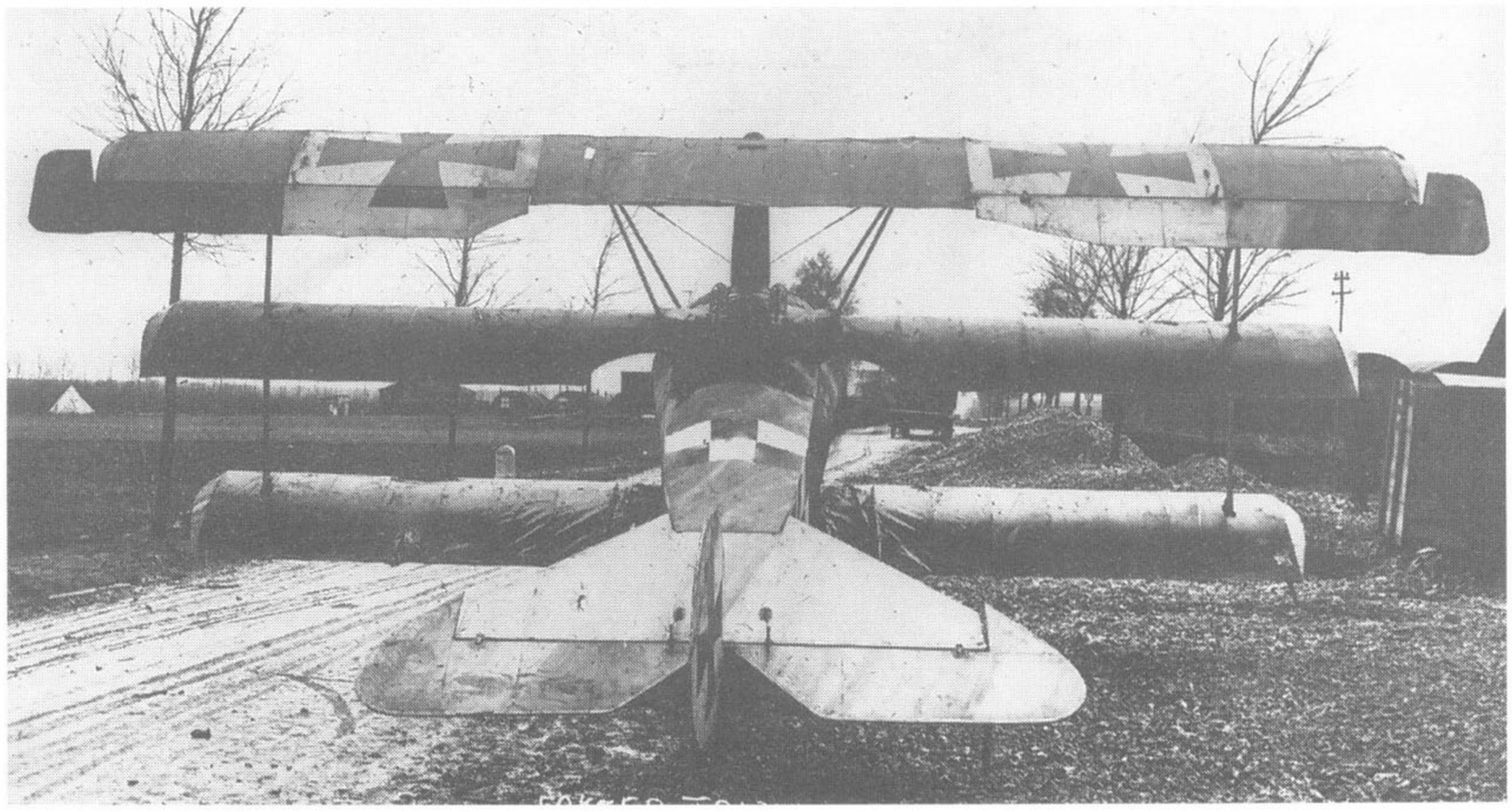
Fokker Dr.I. Author

and, in reality, it was obsolescent. Its ceiling was less than that of the latest generation of Allied machines and its top speed slower. It was powered by a 110hp rotary engine (based upon an engine that had been phased out of Allied service because of its unreliability) that lacked sufficient horsepower and had a tendency to overheat at lower altitudes and warmer weather. This latter trait was to prove a handicap as summer approached and triplanes were frequently grounded by engine problems. Allied pilots soon got the measure of the triplane and learned not to engage it at close quarters, but to rely upon their own superior speed to keep it at a distance.

The heyday of the Fokker triplane was the period between Christmas 1917 and May 1918 although, because of the lack of an acceptable replacement, it was retained in service and soldiered on into the summer months. As the anticipated replacements became available, these were supplied to the 'better' units, starting with JGI, and the triplanes they replaced were passed down to lesser units on quieter sections of the front.

Despite its growing inferiority to new Allied fighter aircraft, it remained the preferred mount of at least one German pilot, Ltn dR Josef Jacobs, leader of Jasta 7, who, by choice, was still flying one in October 1918. This aircraft, Dr.I 450/17, was destroyed in combat during an attack on Jasta 7's airfield by aircraft of an unidentified RAF squadron. Jacobs, who managed to take off during the attack, was shot down but survived both the crash that followed and the rest of the war.



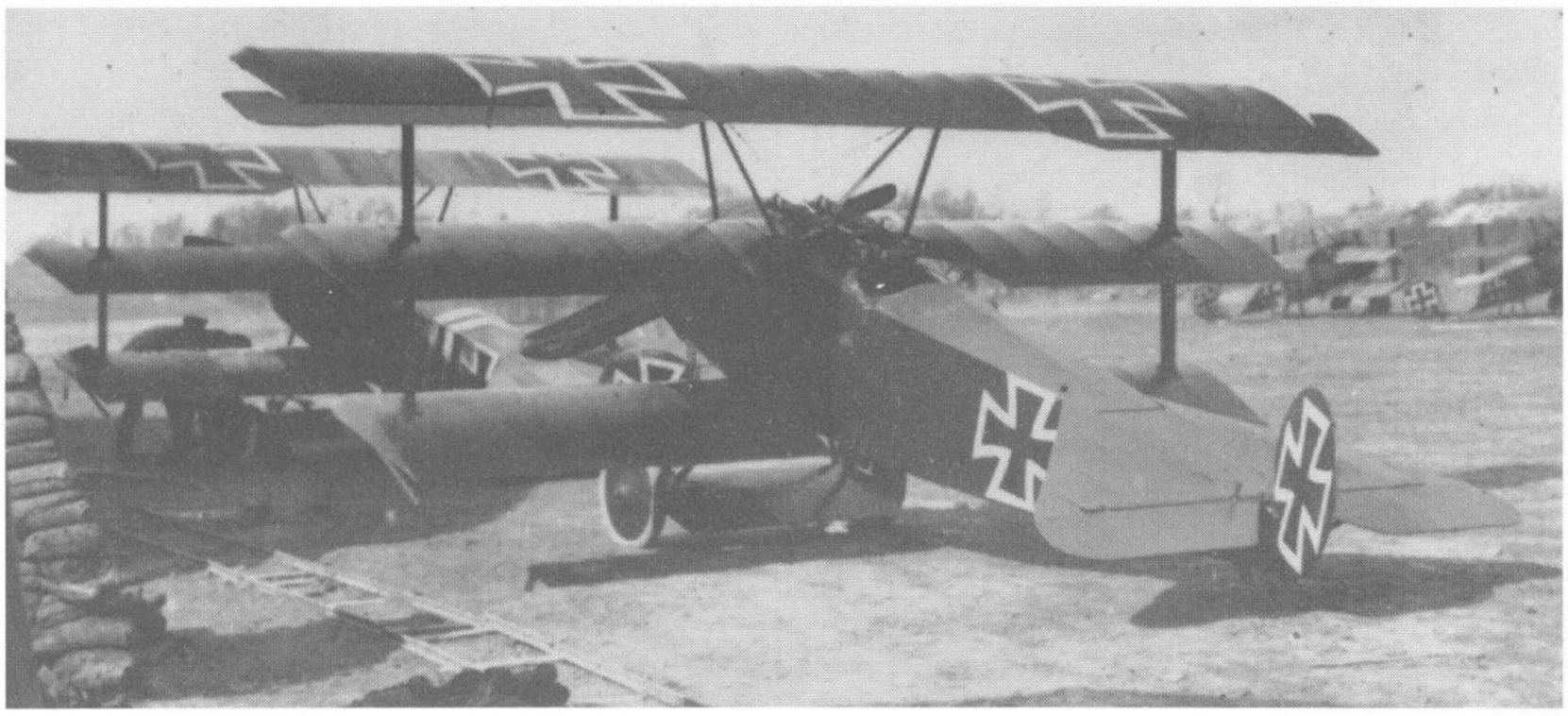


(Above) **Fokker Dr.I 525/17, seen here with the black and white striped tailplane of Jasta 6. This machine was used by von Richthofen during a visit to Jasta 5 on 17 March 1918.** Peter Grosz

Dr.I 144/17. Flown by Ltn Eberhardt von Stapenhörst of Jasta 11, it is seen here after being brought down by British ground fire. At the time of its capture it was fitted with a replacement aileron of an early type on its right wing. Cross and Cockade International

(Below) **Oblt Hermann Göring in an unidentified Fokker Dr.I (possibly 206/17). The metal object behind the ammunition feed tray was intended to deflect spent cartridges away from the cockpit. Signal flares were carried in simple racks outside the cockpit to reduce the chance of accidental fire.** Cross and Cockade International

Consideration of the triplane's structure suggests that field repairs were fairly impractical. It is possible that welded steel assemblies – the fuselage and the tail structures – could have been stripped of their fabric and some degree of repair work carried out. To an extent, the same is possible with the wings. However, by the time that the triplane actually entered service it was obsolescent and, to some extent, expendable. Out-performed in most areas by contemporary Allied types, it served as a stopgap until the new types to be chosen from the January/February 1918 Fighter Trials became available. Because of this, a seriously damaged triplane could be replaced by another, newer, machine. Less serious



All-red Dr.I 477/17 flown by Manfred von Richthofen and seen here at Lechelle aerodrome. Cross and Cockade International

Manfred von Richthofen

Rittmeister Manfred von Richthofen was born in Breslau on 2 May 1892 and became a cadet in 1909. After graduation, he joined the 1st Uhlan Regiment as an officer trainee. He attended the War Academy and was promoted to Leutnant in the autumn of 1912. His regiment was sent to the Eastern Front at the outbreak of war. He returned to the Western Front and requested transfer to the Air Service. Trained to be an observer at FEA7 and FEA6, he joined FA69 on the Eastern Front. His next posting was to Brieftauben-Abteilung-Ostend (literally 'Mail Carrier Pigeon Unit Ostend', a cover name for one of Germany's first long-distance bombing squadrons).

He applied for pilot's training and received this at Döberitz from where he was sent to KG2 on the Verdun front, mainly flying an AEG G.II but occasionally a Fokker monoplane. KG2 moved to Russia and, thanks to a chance meeting with Oswald Boelke, whom he impressed, Richthofen was recruited for Jasta 2. His score rose rapidly and on 14 January 1917 he took command of Jasta 11, being promoted to Oberleutnant. On 25 June 1917 he was given command of the newly formed Jagdgeschwader I, comprising Jastas 4, 6, 10 and 11. Richthofen was killed in action on 21 April 1918 while flying Fokker Dr.I 425/17, possibly by Capt Roy Brown of 210 Squadron RAF.

He was initially buried by the British at Bertangles. After the war his body was moved to Berlin and given a state funeral. Finally, because of its proximity to the Berlin Wall, it was moved to a family grave in Mainz. At the time of his death Manfred von Richthofen's confirmed score stood at eighty, the highest of any pilot during World War One. He had received many awards including the Iron Cross 1st and 2nd Class and, of course, the Orden Pour le Mérite.

Von Richthofen gained nineteen victories flying a Fokker Dr.I Triplane. In sequence they were:

No	*Date*	*Target Type*	*Target Seriel*	*Target Unit*	*Dr.I Used*
60	1 Sep 17	RAF R.E.8	B.782	6 Sqn RFC	F.I 102/17
61	3 Sep 17	Sopwith Pup	B.1795	46 Sqn RFC	F.I 102/17
64	12 Mar 18	Bristol F.2b	B.1251	62 Sqn RFC	Dr.I 152/17
65	13 Mar 18	Sopwith Camel	B.2523	73 Sqn RFC	Dr.I 152/17
66	18 Mar 18	Sopwith Camel	B.5243	54 Sqn RFC	Dr.I 152/17
67	24 Mar 18	RAF S.E.5a	C.1054	41 Sqn RFC	Dr.I 477/17
68	25 Mar 18	Sopwith Camel	C.1562	3 Sqn RFC	Dr.I 477/17
69	26 Mar 18	RAF S.E.5a	B.511	1 Sqn RFC	Dr.I 477/17
70	26 Mar 18	RAF R.E.8	B.742	15 Sqn RFC	Dr.I 477/17
71	27 Mar 18	Sopwith Camel	C.6733	73 Sqn RFC	Dr.I 127/17
72	27 Mar 18	D.H.4	D. 8379	5(N) Sqn RNAS	Dr.I 477/17
73	27 Mar 18	Sopwith Dolphin	C.4016	79 Sqn RFC	Dr.I 477/17
74	28 Mar 18	A.W. F.K.8	C.8444	82 Sqn RFC	Dr.I 127/17
75	2 Apr 18	RAF R.E.8	A.3868	52 Sqn RAF	Dr.I 477/17
76	6 Apr 18	Sopwith Camel	D.6491	46 Sqn RAF	Dr.I 127/17
77	7 Apr 18	Sopwith Camel	D.6550	73 Sqn RAF	Dr.I 477/17
78	7 Apr 18	SPAD	(not known – possibly French)		Dr.I 477/17
79	20 Apr 18	Sopwith Camel	D.6439	3 Sqn RAF	Dr.I 425/17
80	20 Apr 18	Sopwith Camel	B.7393	3 Sqn RAF	Dr.I 425/17

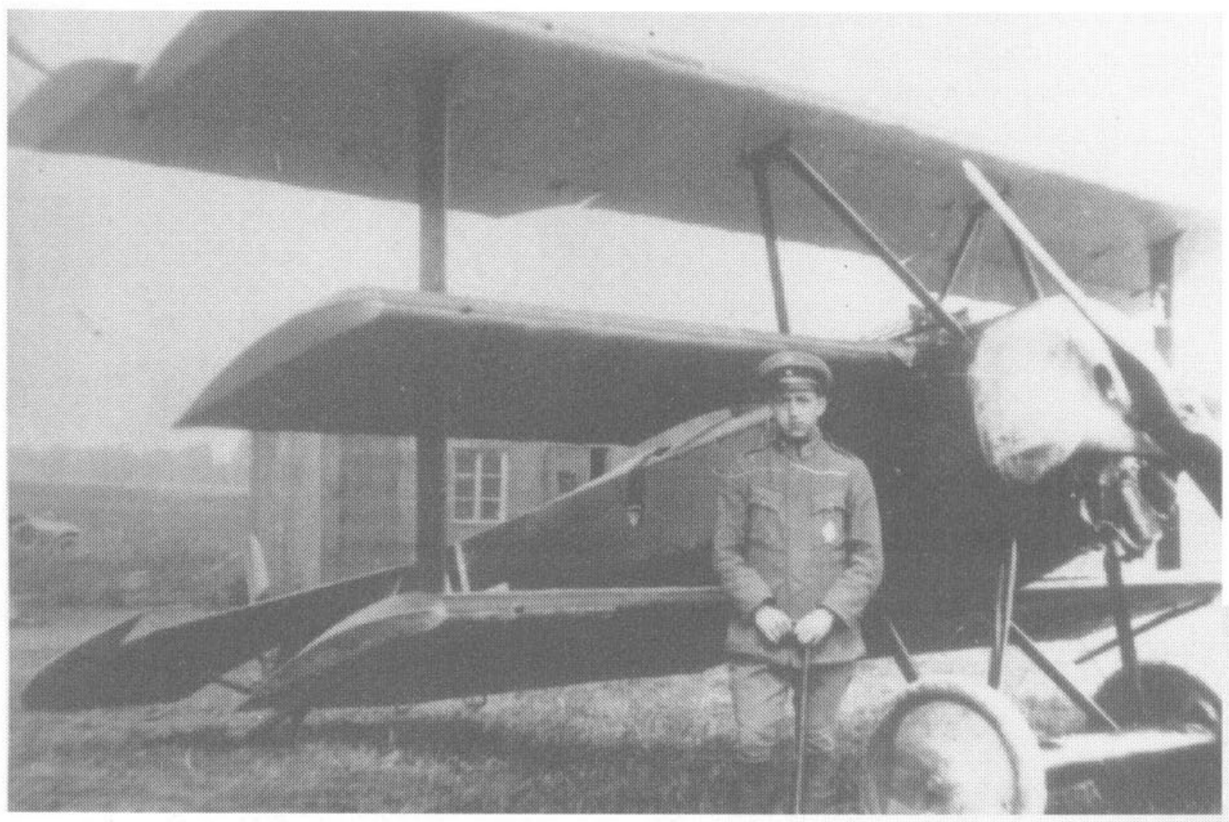
(Victories 62 and 63 were gained while flying an Albatros D.III.)

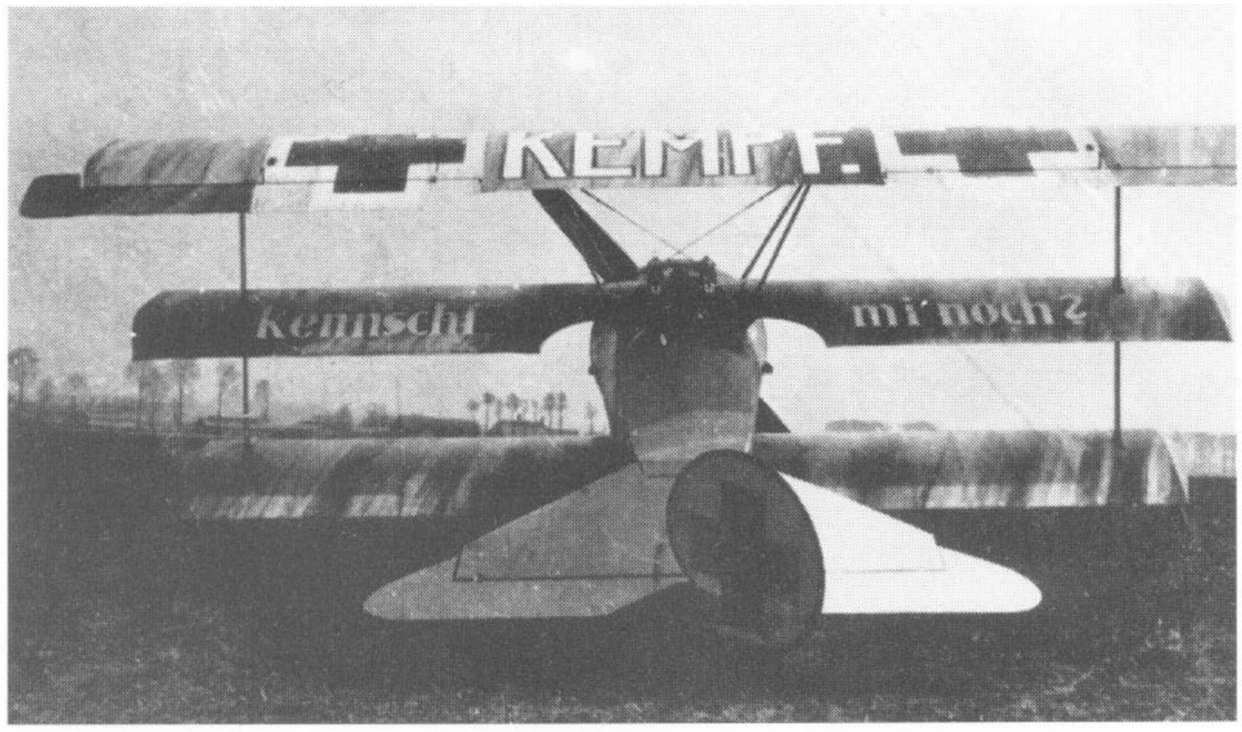
Rittmeister Manfred Freiherr von Richthofen. Cross and Cockade International

It is thought that this is the wreckage of Dr.I 114/17 of Jasta 11 which Manfred von Richthofen crashed on 30 October 1917. The high gloss finish of the wings shows that it was still fairly new at the time. Ferko Collection UTD

(Right) **Ltn Ernst Udet in the cockpit of Dr.I 593/17 on Lechelle aerodrome in March 1918. 'Lo' was Udet's name for his then fiancée and has been chalked on the fuselage side to show the painter how he wanted it applied to his new aircraft.** Peter Grosz

(Below) **An unidentified Fokker Dr.I triplane and pilot.** Cross and Cockade International





Fokker Dr.I flown by Ltn Friedrich Kempf of Jasta 2 'Boelke'. The motif on the middle wing translates as 'Do you remember me?'. This aircraft is *not* Dr.I 213/17 which carried the same wing painting but had the black and white Jasta markings on its tailplane reversed. It may be 493/17 which Kempf is known to have flown on 8 May 1918. Cross and Cockade International

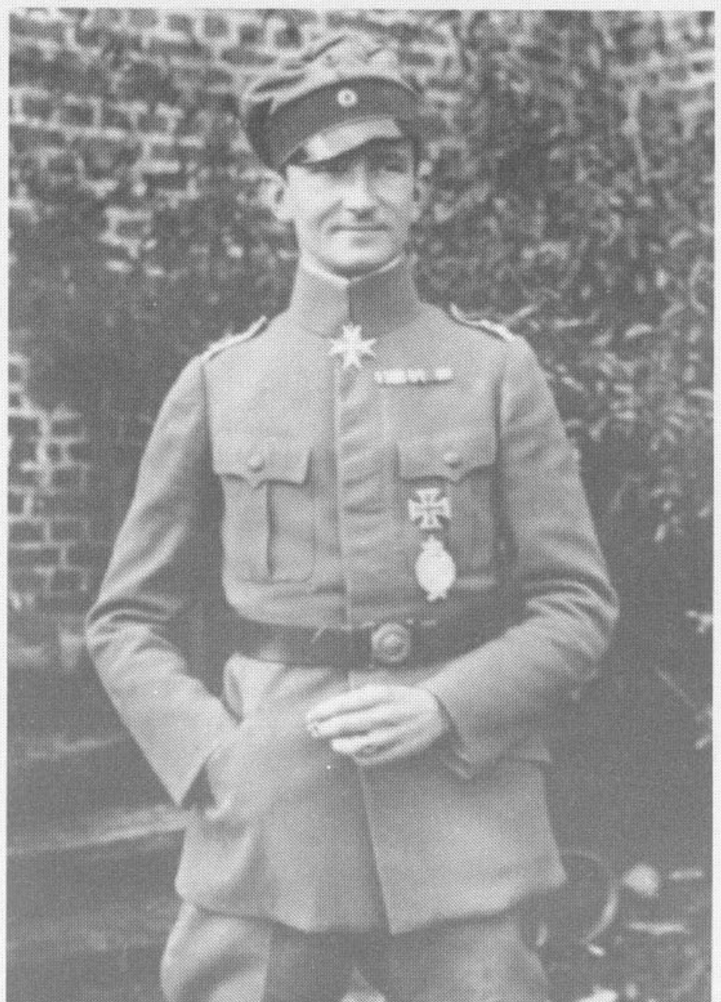
Vfw Otto Esswein of Jasta 26 poses in front of Dr.I 426/17 in early April 1917. Cross and Cockade International

Dr.I 163/17 of Jasta 11. Flown by a number of the unit's pilots, it is usually associated with Ltn Hans-Karl von Linsingen. Cross and Cockade International

An unidentified Fokker triplane thought to belong to Jasta 2. Peter Kilduff

A triplane of Jasta 12 being moved by 'pony-power'. Cross and Cockade International

Adolf von Tutschek



Hauptmann Adolf Ritter von Tutschek.
Cross and Cockade International

Hptmn Adolf Ritter von Tutschek was born on 16 May 1891 at Ingoldstadt, Bavaria. His military service started in 1910 when he joined the 3rd Bavarian Infantry Regiment as a cadet. He was commissioned in 1912 and, at the start of the war, joined the 40th Infantry Regiment, at first on the Western Front and then on the Eastern Front. He was wounded in action on 2 May 1915 but was awarded the Military Max Joseph Order which made him a *Ritter*. He was promoted to Oberleutnant and returned to the Western Front where he was gassed and hospitalized.

On recovery, he requested pilot training. This completed, he joined FA6b at the end of October 1916. He became a single-seater pilot and was sent to Jasta 2 on 25 January 1917. His score mounted slowly and he was severely wounded again on 11 August. He was promoted to Hauptmann on 6 December 1917 and, on 1 February 1918, given command of Jagdgeschwader II, comprising Jastas 12, 13, 15 and 19. Flying Fokker Dr.I 404/17, he was killed in combat by Lt Redler of 24 Squadron RFC on 15 March 1918.

At the time of his death his score stood at twenty-seven victories and his numerous awards included Iron Cross 1st Class, the Bavarian Military Merit Order 4th Class with Swords, the Bavarian Military Merit Order 4th Class with Crown and Swords, the Knight's Cross with Swords of the Royal House of Hohenzollern Order and the Orden Pour le Mérite.

Josef Jacobs

Ltn Josef Carl Peter Jacobs was born in Kreuzkapelle in the Rhineland on 15 May 1894 and learned to fly in 1912. He enlisted in the Air Service at the outbreak of war and trained as a pilot with FEA9. He was posted to FA11 and flew Fokker E.IIIs with Fokker Staffel West in 1916. Jasta 12 was formed from Fokker Staffel West on 25 October 1916, but a month later he moved to Jasta 22. He served as an instructor at Jastaschule 1 and then took command of Jasta 7 on 2 August 1917. He held this post until the end of the war. Jasta 7 received triplanes at the beginning of 1918 and he chose to fly the type up until October 1918 after the unit had been re-equipped with Fokker D.VIIs.

At the end of World War One, Jacob's score stood at forty-eight victories, of which thirty were gained while flying a Fokker Dr.I, proving his choice of mount was right and making him the greatest exponent of the type. His numerous awards included the Iron Cross 1st and 2nd Class, the Knight's Cross with Swords of the Royal House of Hohenzollern Order and the Orden Pour le Mérite.

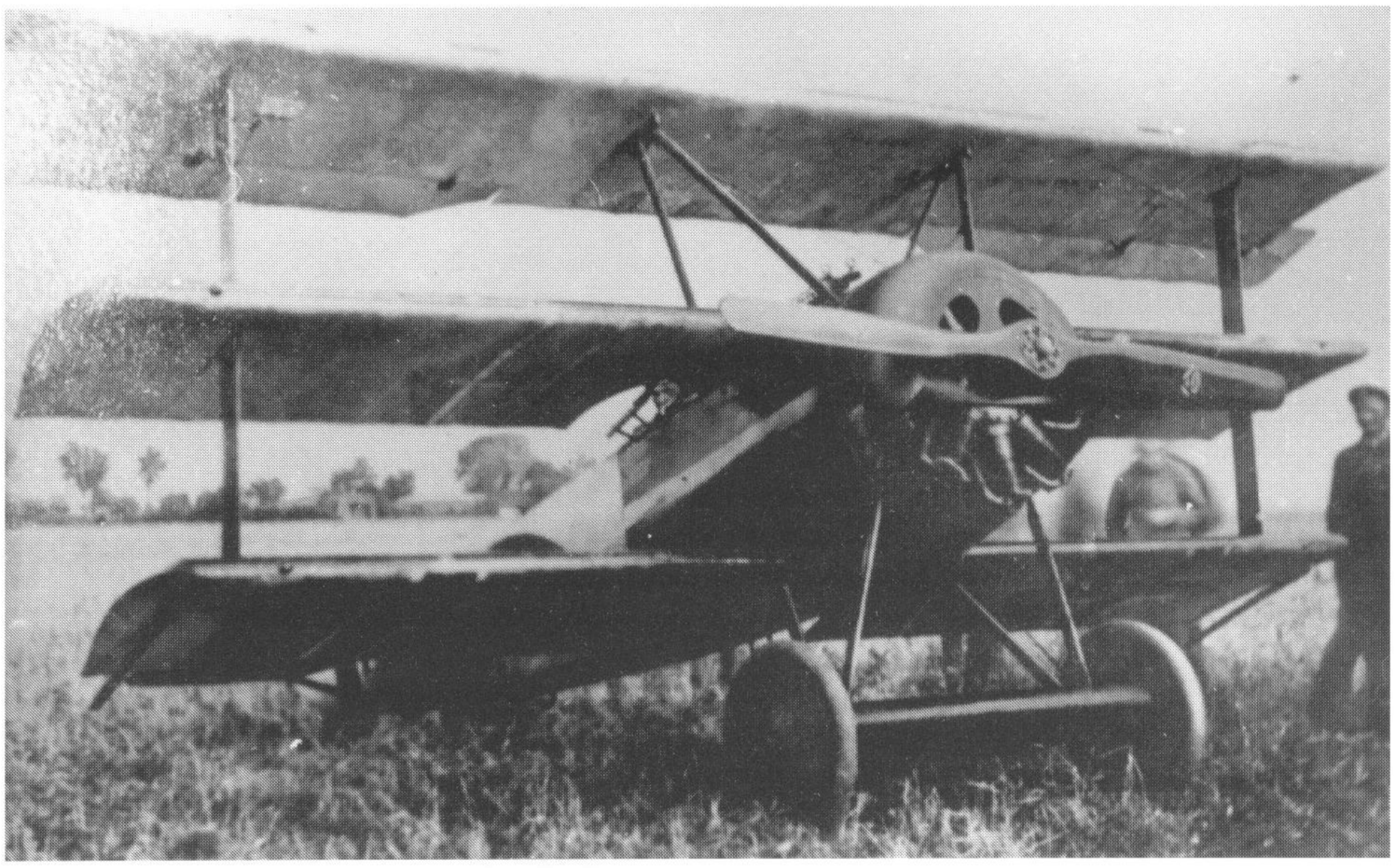
After the war, he fought against the Bolsheviks in the Baltic in 1919 and later became an instructor with the Turkish Army. He continued his interest in aviation and, in the 1930s, owned an aircraft manufacturing factory in Erfurt. He was an enthusiastic sportsman and participated in bobsleighing, motor car and speedboat racing. He held strong anti-National Socialist views and, although granted a commission as Major der Reserve, did not join the newly formed Luftwaffe. He moved his company to Holland and, on one occasion, went into hiding to avoid Göring. After World War Two he owned a crane operating company and became president of the German Bobsleigh Society. He died in Bavaria, where he had lived since the end of World War Two, on 29 July 1978.

Leutnant Josef Carl Peter Jacobs.
Cross and Cockade International

Fokker Dr.I 152/17, flown extensively by Manfred von Richthofen and painted with red surfaces to its upper wing, rear fuselage and tail assembly, wheel covers and cowling. Cross and Cockade International

Ground staff starting up a Fokker triplane at Jasta 27's aerodrome, Soissons Ferme, in June 1918. Cross and Cockade International

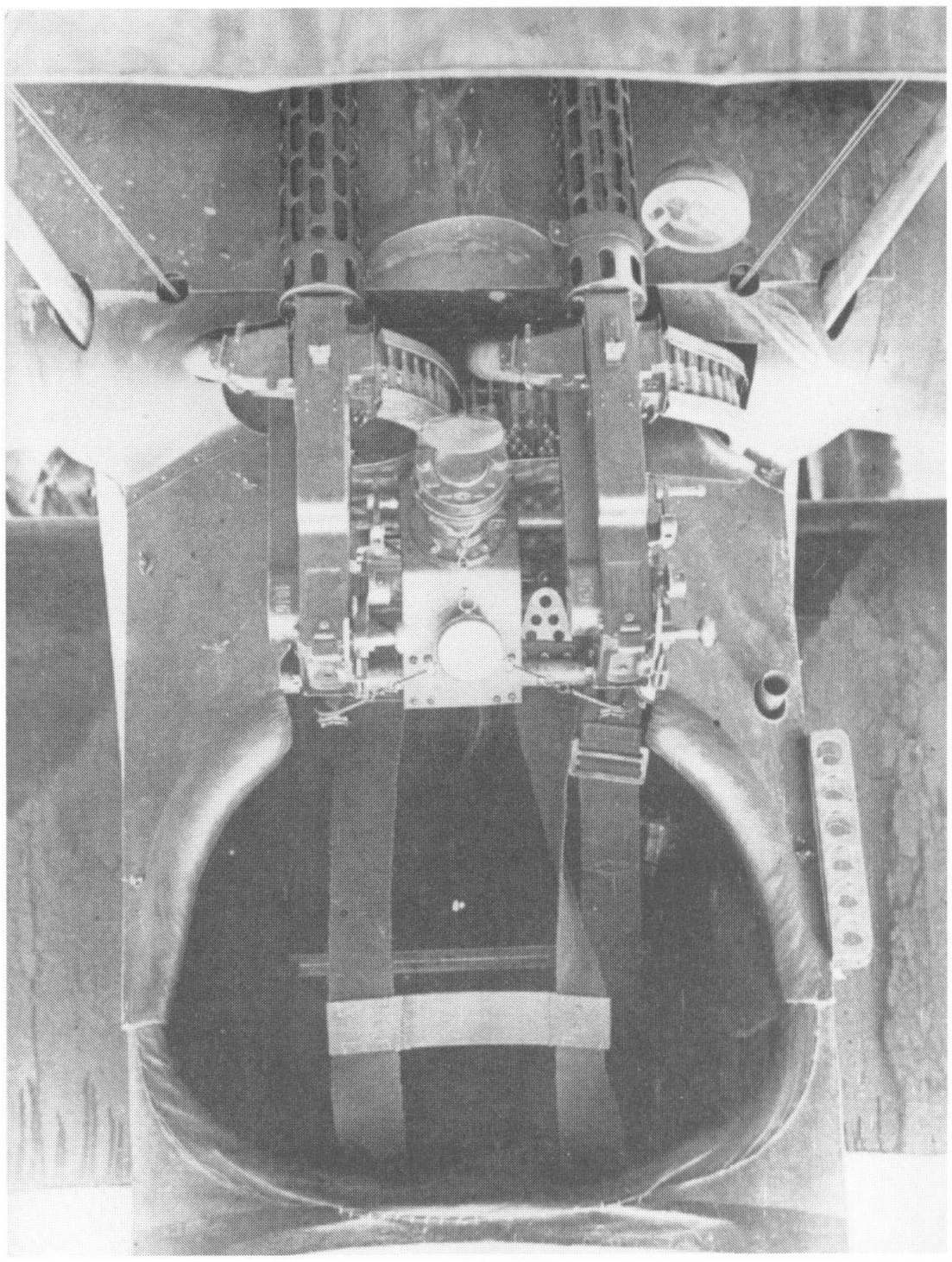
Fokker triplanes of Jasta 26. Cross and Cockade International



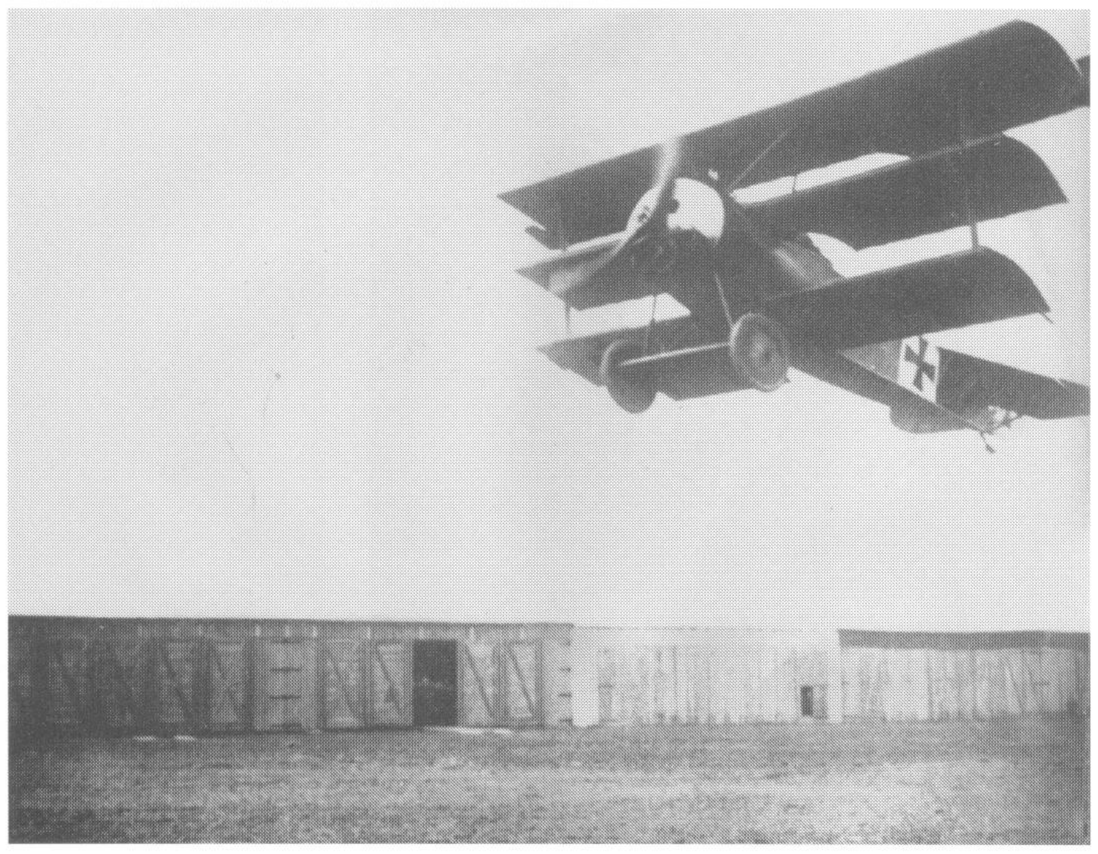
damage would result in an exchange of sub-assemblies – wings, undercarriage, tail units and so on, either from existing spares stock or acquired by the cannibalization of other damaged machines.

An unidentified triplane with enlarged holes in its cowling intended to improve engine cooling. It was probably photographed during the summer of 1918. Cross and Cockade International

(Below) **Manfred von Richthofen with his dog Moritz and Ltn Loewenhardt on 21 April 1918, just prior to his final flight. The triplane in the background belonged to Jasta 4.** Cross and Cockade International



(Above) **The cockpit and armament of Ltn Alfred Greven's triplane of Jasta 12. Non-standard fittings include an Oigee reflector sight, an altimeter (held by coil springs), a rear view mirror, a flare cartridge rack and a holding tube for a flare pistol.** Cross and Cockade International



A Fokker triplane taking off. Cross and Cockade International

Allotted R.F.C. No. 125.

REPORT ON FOKKER TRIPLANE

BROUGHT DOWN BY A.A. FIRE IN THE FIFTH ARMY AREA ON 13th JAN. 1918.

GENERAL.

The construction of this machines is the same as G.72.
It is camouflaged light and dark green on the upper surfaces and light blue on the lower, the rudder is white with a black cross on it. A black and white check band is painted on the fuselage half way between the rudder and the pilot's seat; the squares are about 9½" in size.

Makers Number	...	1856
Military Number	...	FOK. D.R.I. 144/17.
Date of construction		20-10-17

WEIGHT.

(According to figures painted on the fuselage)

Weight empty	...	829 lbs.
Permissable weight, including full tanks	... ...	430 lbs.
Total weight	...	1,259 lbs.

DIMENSIONS.

Span of top plane along main spar	23′ 1″
Chord, including ailerons	4′ 2″
Gap between top and centre plane	2′ 6″
Span of centre planes (each)	9′ 0″
Chord	3′ 3″
Gap between centre and bottom plane	2′ 6″
Span of bottom planes (each)	8′ 2½″
Chord	3′ 3″
Length overall	19′ 0″

CONSTRUCTION.

Fuselage. This consists of steel tubes welded togther, braced with a light piano wire (see Report on G.72) and covered with fabric.

Planes are wooden spars and ribs; there is only one main spar in each plane, these are 8″ wide, box type. From the leading edge to the main spar is reinforced with three-ply. The tips of the planes instead of tapering away gradually are cut away at a sharp angle from the last rib, giving a clipped appearance:

Dimensions

Top Plane

Distance from leading edge to centre of main spar	1′ 11″
Distance from trailing edge to centre of main spar	2′ 3″

Middle Plane.

Distance from leading edge to centre of main spar	1′ 0″
Distance from trailing edge to centre of main spar	3′ 3″

Bottom Plane.

Distance from leading edge to centre of main spar	1′ 0″
Distance from trailing edge to centre of main spar	3′ 3″

Ailerons are in the top plane only and are balanced, the balance piece projecting beyond the plane itself as in the Gotha; the controls run direct through the top plane.
Dimensions:-

Span	... ...	8′ 2″
Chord	... ...	1′ 0″
Balance Piece		1′ 0″ x 1′ 9″.

Interplane struts. These consist of one large strut 5¼″ wide between each plane with no cross bracing wires; the centre section struts are inverted "V" struts.

Tail unit is all of tubular construction; the elevators and rudder are balanced, there is no fin.
Dimensions:-

Tail plane

Span along trailing edge	6′ 7″
Fore and aft measurement (average) ...	3′0½″

Elevators (each)

Span	3′ 8″
Chord	1′ 4½″
Balance piece is a triangle	1′ 4½″ x 1′ 10½″

Rudder	2′ 10″ x 2′ 11″

Tail Skid. The post is ash with a small steel shoe bolted to its extremity in the shape of a knife edge as in G.72. The shock absorber is the thick black elastic type.

Undercarriage, "V" struts of streamline steel tubing; shock-absorber the same type as on the tail skid and is put on in the same way as G.72. (see plates II, III & IV of that report).
The axle has a large streamline fairing built around it, 2′ 10″ wide.
The tyres* are by METZELER, size 710 x 86. Wheel track 5′ 3½″

ENGINE.

The engine is an imitation of the 100 h.p. Le Rhone, by the Oberursel Company, and only differs from the French engine in very small points, i.e. the rocker arms are rounded off at the ends, instead of being square, thus:-

French.

German.

The nose piece is in two portions instead of one, the propeller shaft being separate from and bolted to the circular plate, forming the front plate of the engine.

The carburetter used is a Tampier bloctube of French make; the oil pump from external appearance is of the usual Le Rhone design but German made.

The Magneto is a Bosch.

The general finish of the engine is very rough.

Engine No. 2429
Magneto No. 2206670.

Propeller. The propeller is an AXIAL make No.103(?)14.
Diameter 2620. Pitch 2300.
This consists of 3 laminations of walnut and 4 of birch.

* misspelt 'types' in original report. (?) Not clear on report; may be an 8

ENGINE.

Weight 334 lbs. (including propeller boss, magneto, oil pump and carburetter).

Note. The weight of a French Le Rhone engine is 330 lbs.

CHAPTER FIVE

Triplane Developments

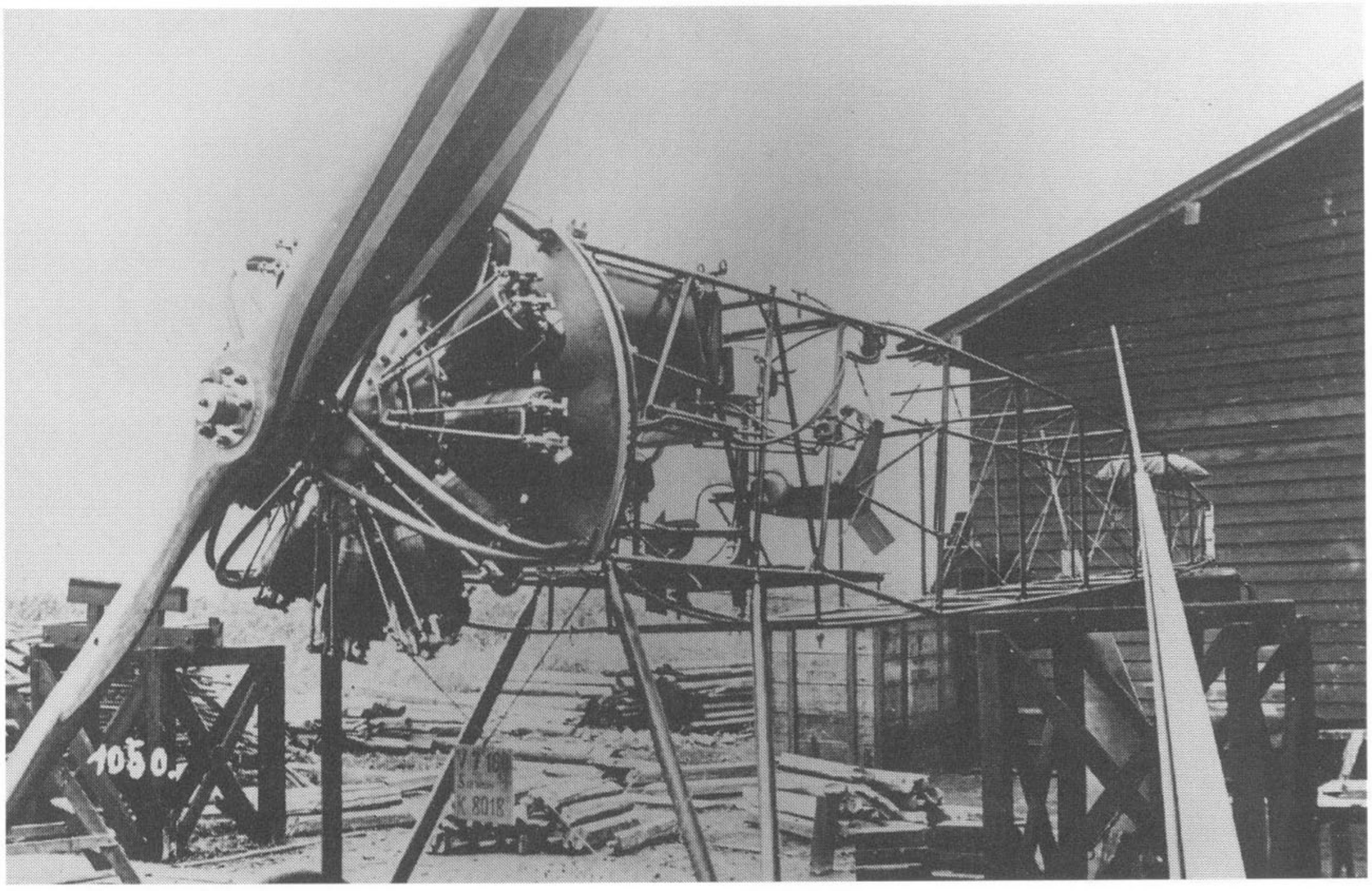
The V.7

While development of the triplane had brought Fokker back into the mainstream of aircraft production, as we have seen, it had its limitations. These were mostly associated with the engines fitted to production aircraft – the 110hp Oberursal UR.II, 110hp Oberursal UR.II(Rh) or captured Le Rhône 110hp engines. Development of more powerful rotary engines was taking place but progress was slow, partly due to the shortage of suitable lubricating oils: castor oil was all but unobtainable and a synthetic replacement, Voltol, was proving less than satisfactory (*see* box on page 108).

One engine that was available was the 160hp Siemens & Halske Sh.III, a counter-rotating engine. This was more powerful than the 110hp Le Rhône engine and its higher compression ratio promised improved performance at higher altitudes. It drove a large, efficient, slow-running, four-bladed propeller. To provide a test bed for this engine a modified airframe was ordered from Fokker and given the designation V.7. While the basic structure originally remained the same as that of the production Dr.Is, it had a revised engine mounting with a front bearing, a larger engine cowling and undercarriage legs of increased length to accommodate the larger propeller diameter.

Initial trials with this were carried out under Fokker's control but his self interest (brought about by ownership of the Oberursal factory) caused him to place endless obstructions in the way of Sh.III development. Staff at Adlershof assumed responsibility for further trials and, under their control, the Adlershof workshops modified one or two further Dr.I airframes to accept the Sh.III engine. Modifications aimed at improving handling included the lengthening of their rear fuselage by some 55cm and deletion of the faired undercarriage axle in an attempt to cure the aircraft's tendency to 'float' as it came in to land.

V.7 enjoyed a remarkable climbing performance and a greatly enhanced ceiling,



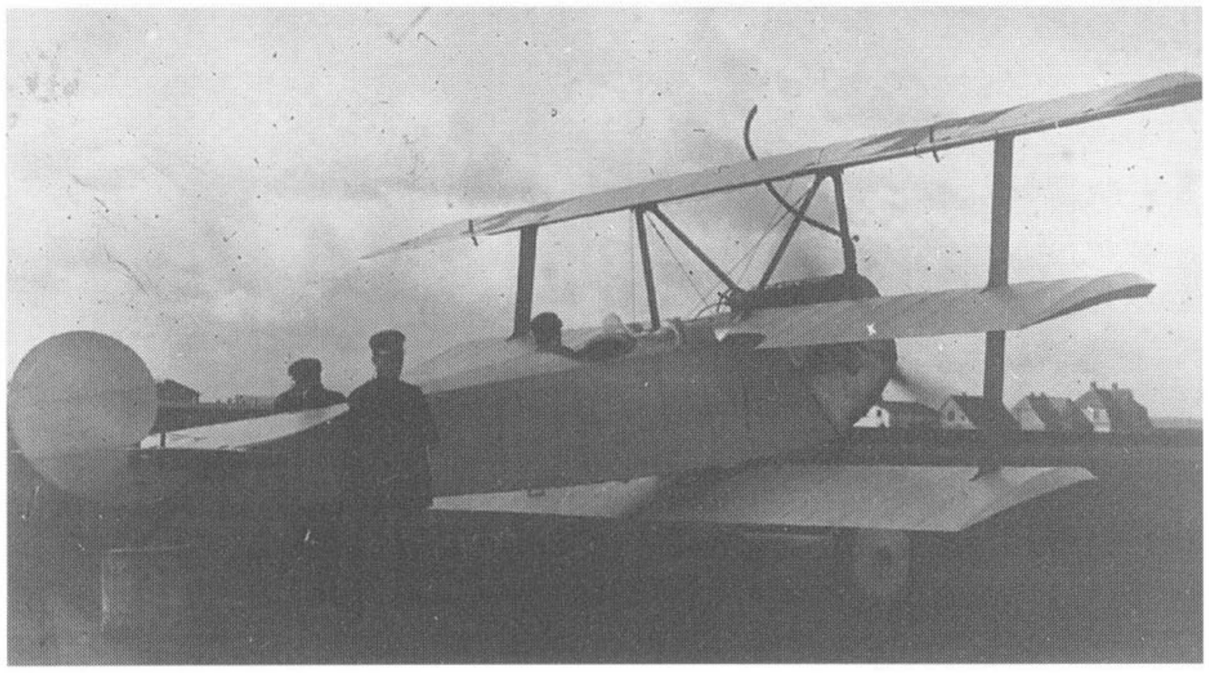
The uncovered forward fuselage of V.7 (factory number 1788) showing its Siemens & Halske Sh.III engine and the positioning of the fuel and oil tanks, the pilot's seat and the cockpit instruments, the latter being common with standard production triplanes.
Peter Grosz

The complete V.7 with its large four-bladed propeller and 'tall' undercarriage.
Cross and Cockade International

The Castor Oil Problem

One of the many problems that beset the Central Powers during World War One was the effect of the Allied blockade of German ports and the shortage of certain raw materials that resulted. Amongst these was castor oil, that was pressed from the seeds of plants grown in India. This vegetable oil was important because it could be mixed with petrol but would not dissolve in it, making it an ideal lubricant for rotary engines.

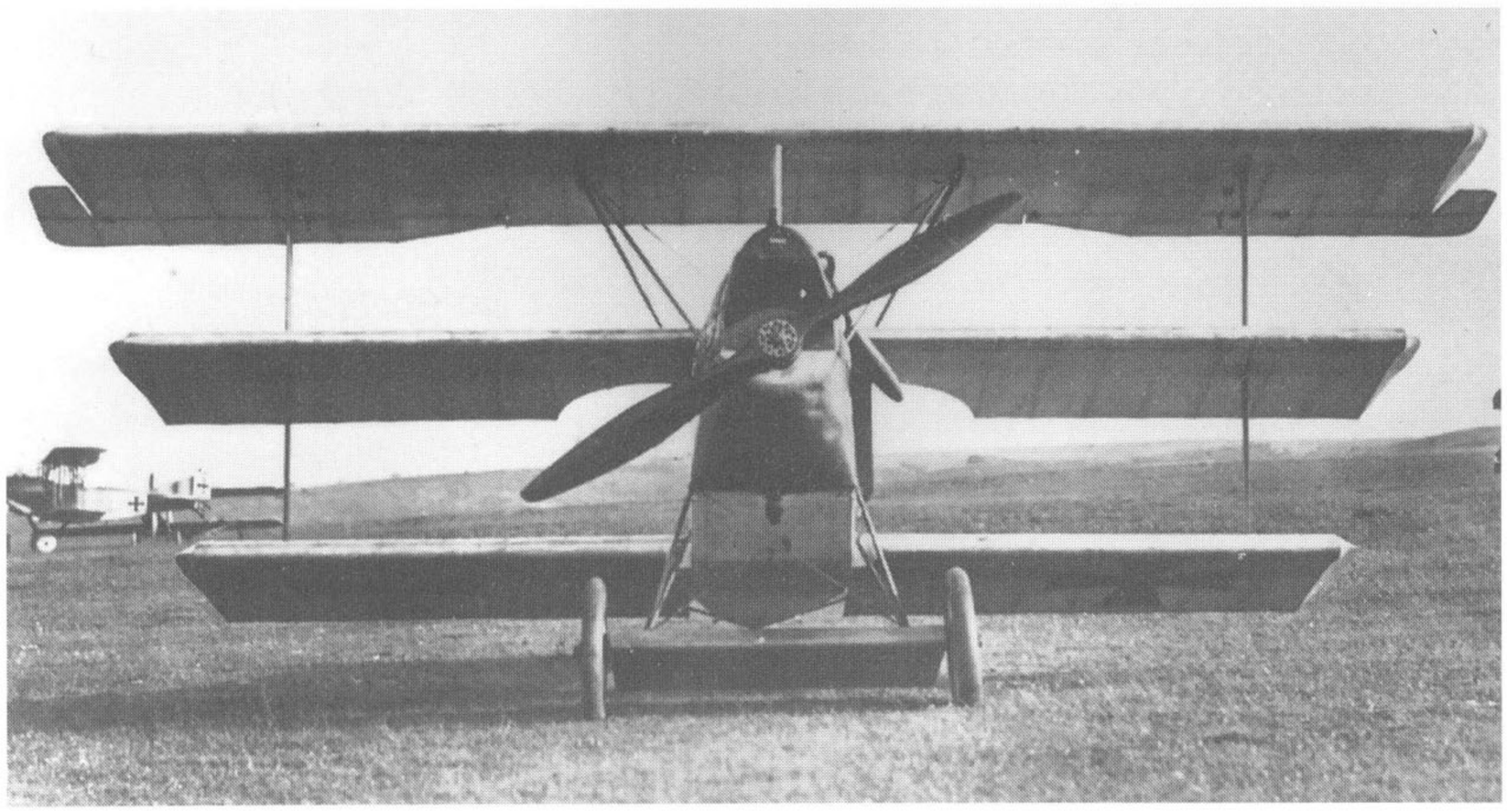
The Germans had found a large stock of castor oil when they captured Antwerp in 1914 and this was sufficient to last them until the summer of 1917. Although rotary-engined aircraft were in a minority in German service, there were still enough of them in use to make development of a synthetic substitute for castor oil essential. The result was 'Voltol', a lubricating oil manufactured by the polymerization of basic mineral oil under electrical discharges. Its good point was that it was less soluble in petrol than was castor oil, but against this was the fact that it was not as good a lubricant as castor oil and its quality was unreliable. Design of German engines allowed for this, though many of the problems they experienced were undoubtedly caused by use of this oil. French and British engines were thought to be less tolerant of it and experiments to establish the degree of this were carried out using a number of Fokker Dr.I Triplanes fitted with Le Rhône or Clerget engines.



V.6 (factory number 1698), the 120hp Mercedes-engined triplane in its original form before the lower wing was faired into the fuselage. Cross and Cockade International

***(Below)* V.6 after the lower wing was faired into its fuselage.** Peter Grosz

and could have fulfilled the Idflieg requirement to extend the service life of the Dr.I. Against this was the fact that, because the torque reaction from its large propeller and heavy rotating engine was not compensated for by the short span of its wings, it was difficult to handle. This was particularly true near the ground, when careless sudden use of the blip switch would inevitably end in an accident. Attractive though its performance was, its control was beyond the capabilities of all but the most experienced rotary-engine pilots. Further, relying on unsatisfactory synthetic lubricating oils, the Sh.III engine had not yet reached the stage where it could be considered reliable enough for service use. So, despite its apparent advantages, the Sh.III-engined triplane did not see front-line service.



Test Bed Triplanes

Another move by Idflieg to extend the active life of the Dr.I was the installation of a Goebel Goe.III engine with a nominal output of 170hp. A later version, the Goebel Goe.IIIa, could achieve 200hp for short bursts. This improved the standard Dr.I's performance to the level achieved by the V.7 models, though at the cost of greatly increased fuel and lubricating oil consumption. Some thirty triplanes fitted with these engines were delivered during early 1918, but all seem to have been delivered to home-defence units and training establishments.

The Oberursal UR.III became available in December 1917 and the first example was installed in an early triplane airframe, Dr.I 469/17. Based upon the Le Rhône engine, this could develop 145hp. The aircraft was demonstrated by Fokker but the variant was not adopted for service use: instead, it continued to be flown as a test bed in the development of the UR.III engine.

Three further Dr.Is (485/17, 527/17 and 562/17) were used as flying test beds for the investigation of Clerget engine behaviour while using the synthetic lubricating oil. A number of other trials were carried out using Dr.I airframes. In the main these were aimed at improving the high-altitude performance of the triplane by development of a supercharger for the rotary engines. To this end, experiments were carried out with a number of Schwade & Siemens compressors fitted to UR.II and Siemens & Halske Sh.III engines. Some success was achieved, but details are not available.

The V.6

Fokker's policy had always been that he would explore both rotary and water-cooled engine avenues for his designs. Thus, in parallel with development of the V.4/V.5 design, he committed himself to a version based upon a 160hp Mercedes D.III engine. This was designated V.6. Although loosely 'similar' to the V.5 design, it differed in a number of ways. The length and weight of the six-cylinder engine dictated that the pilot's cockpit should be moved further to the rear than in V.5. Also, to maintain a similar wing loading, the wings of V.6 were of both greater span and chord than V.5. Larger wings needed larger gaps between them, so the upper wing was mounted higher above the fuselage and the bottom wing was initially mounted just below it. This positioning resulted in

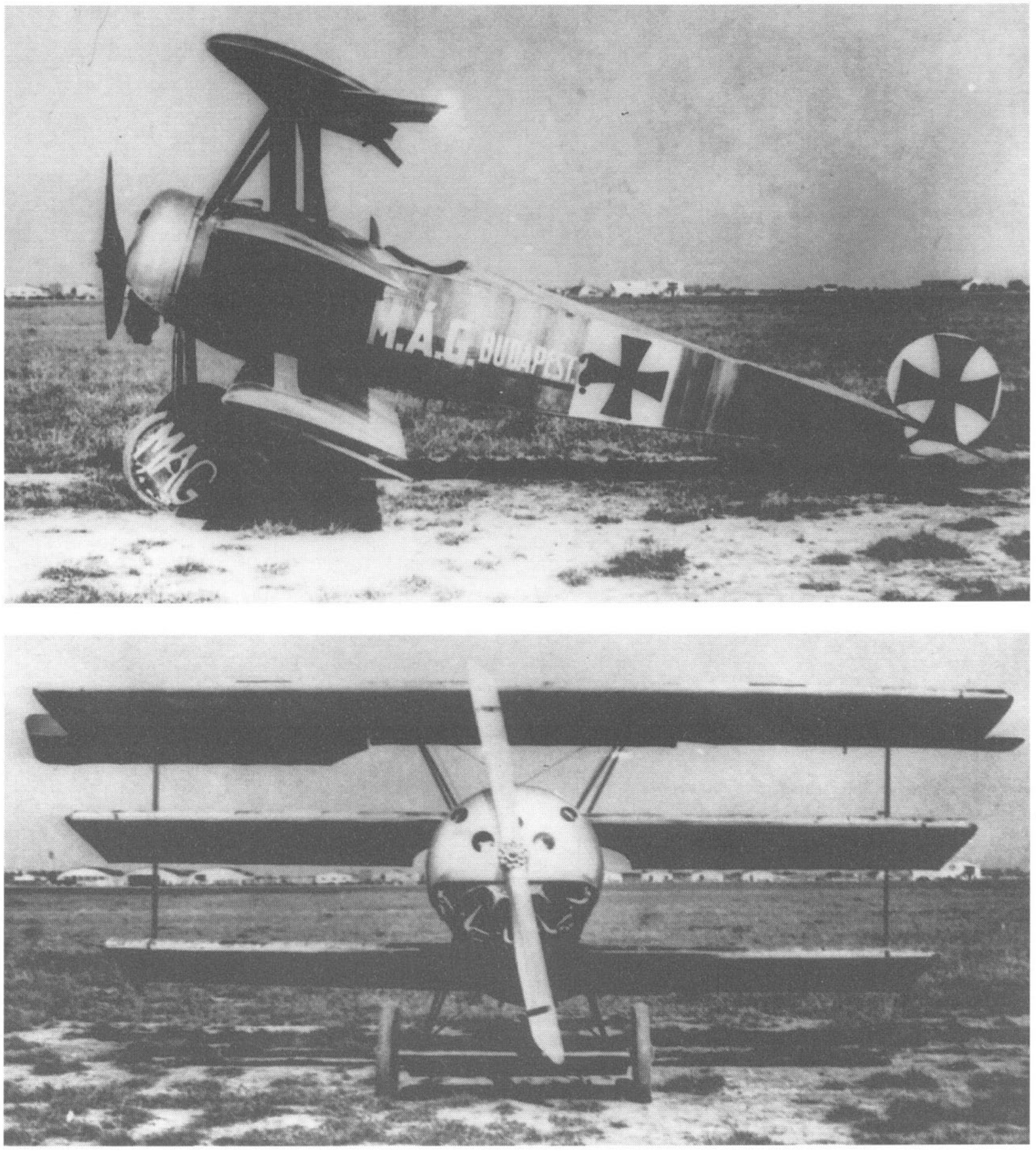
increased drag, early flow separation at the lower wing and a large vortex area behind it, the vortex area having an adverse effect on the effectiveness of the tail controls. In an attempt to cure this, the bottom wing was faired into the fuselage, adding to the overall depth of the fuselage and the weight of the airframe, but this made little difference. Further, its increased size itself reduced manoeuvrability. All in all, it was a bad design with poor handling characteristics. Recognizing this, Fokker abandoned the design and no further work was carried out upon it.

The only redeeming feature of V.6 was its use of a car-type radiator mounted in the nose directly behind the propeller. This caused less drag than either the wing-mounted radiators of the early Albatros and Pfalz D-series or radiators mounted on the fuselage sides. This radiator proved to be a great success and was to become a feature of later Fokker designs.

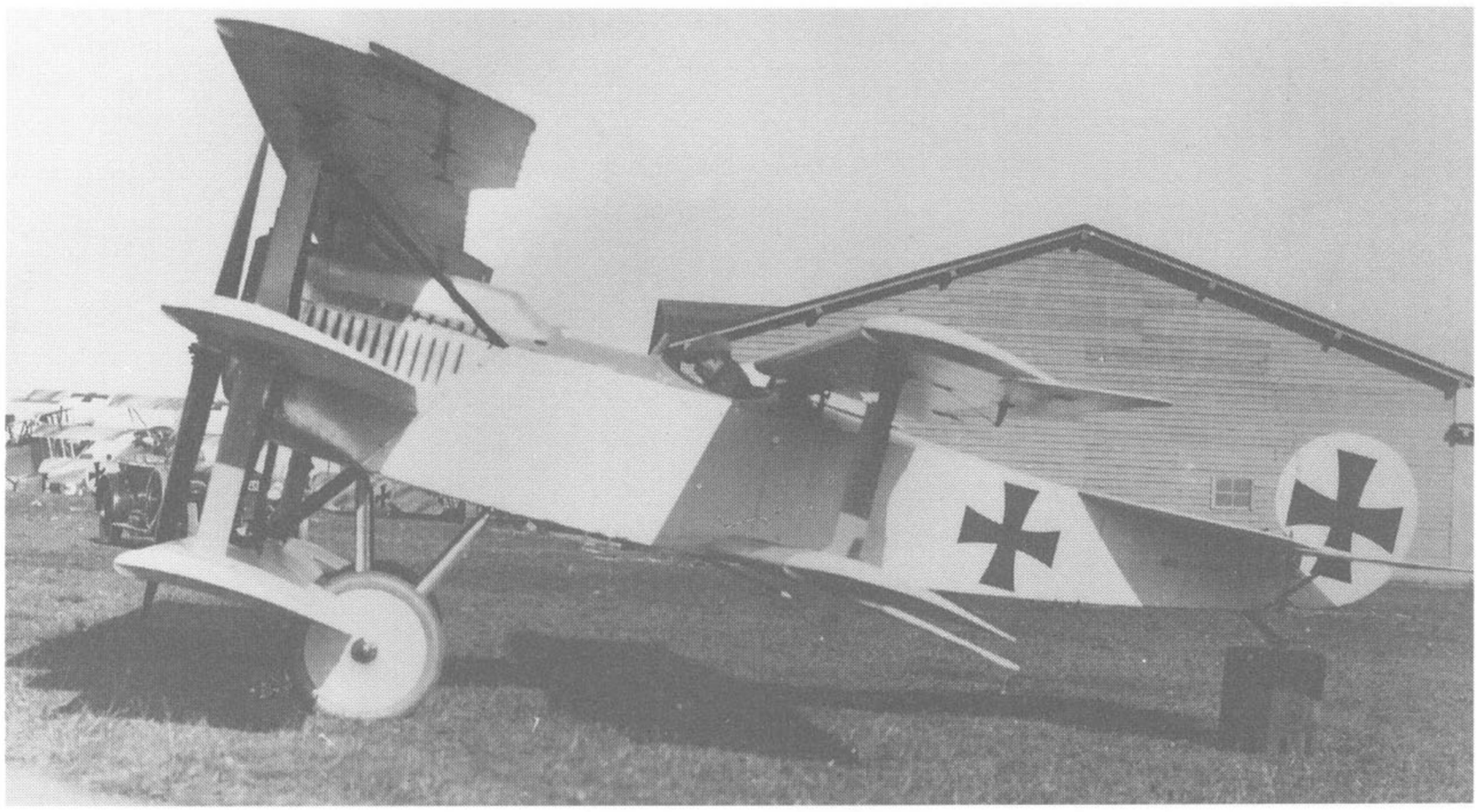
The V.8

The final development of the 'Triplane Era' was a private venture inspired by Fokker himself and designated V.8. It appears to have been based on the V.6 fuselage and, like that machine, was fitted with a 160hp Mercedes D.III engine. On the assumption that, if three wings were 'good', more wings would be 'better', it was fitted with five wings. Three of these were at the nose of the machine, the top wing immediately above the fuselage, the bottom wing some way below it and the middle wing fitted below the engine mounting. A further pair of wings were fitted amidships, immediately behind the pilot. Of these, the upper wing was mounted on the top longeron and the lower on the bottom longeron. All of the wings appear to have been similar in shape and dimension to those fitted to the standard triplane, but were not staggered at all. Only the upper wing of each assembly was fitted with ailerons and these, again, appear to have been those of the standard triplane. The design retained a conventional tailplane and rudder assembly.

Fokker made an initial short 'flight' – actually little more than a hop – in this machine and, having found problems, asked for modifications to be made. After these had been carried out, a further similar 'flight' proved that the design was a failure and it was scrapped.



MAG-Fokker 90.03. This was V.7 fitted with an eleven-cylinder 150hp Le Rhône rotary engine and with its fuselage lengthened to compensate for the additional weight of this engine. It was evaluated at Aspern and written off after failure of its rudder control and a subsequent rough landing. Ted Gee



Fokker V.8. Peter Grosz

The First Fighter Trials

Accepting that the overall performance of the Fokker Dr.I was, at best, disappointing and could not match that of new aircraft being introduced by the Allies, it was necessary for Idflieg to select the machines that were to replace it. To this end, it was proposed that a series of trials would be held at Adlershof in 1918 and that German manufacturers be invited to submit samples of their latest designs for competitive evaluation by pilots from front-line units. The first of these trials was scheduled for January and February 1918, and Idflieg had indicated that they wished to consider machines with both air-cooled (rotary) and water-cooled (in-line) engines.

Although, during the latter half of 1917, Fokker's main resources were committed to production of the triplane and rectification of its basic faults, he maintained his policy of the continued development of new designs with alternative engine installations. His brief, unsuccessful, involvement with Junkers had re-awakened his interest in monoplanes, leading to the construction of a pair of high cantilever-winged monoplanes, but the main thrust of this development programme was a series of variations of the biplane theme. He was therefore in a position to offer eight different models for evaluation at the trials. Fokker had cultivated friendships with a number of front-line pilots and, an intuitive pilot himself, was well aware of what was needed to meet their requirements. Thus, all of these prototypes had been built with this in mind and were intended to be reliable aircraft with good all-round performance, capable of meeting new Allied machines on at least level terms, rather than highly specialized aircraft of limited use.

For convenience, Fokker's submissions are described in numerical sequence, though it must be stressed that this is not necessarily the order in which they were built or tested. The fifth and sixth machines – V.17 and V.20 – will be discussed in Chapter Nine.

The V.9

The first, designated V.9, was a small and light biplane, a direct descendant of the earlier V.4. It used the same steel fuselage structure, tail unit, undercarriage and engine mounting as the triplane. Its wings were wooden cantilever structures. The lower wing was built around a single box-spar of similar construction to that of the triplane's and again fastened to the bottom longeron in a recess in the lower fuselage. The upper wing was of greater chord and span and built around two box-spars. It was fitted with balanced ailerons and mounted above the fuselage on steel tripods, each of which was bolted to a wing spar. Both wings were of the same aerofoil section as that used for the original V.4. Although both wings were designed as cantilever structures, they were joined by steel V-struts, the purpose of which was to reduce their flexing when loaded. The tops of the struts were bolted to the front and rear spars of the top wing, and the lower ends were wide enough to enable them to be fastened firmly across the lower box spar. The mounting of the upper wing well above the fuselage gave the pilot a good field of view, and this was enhanced by a large cut-out in the trailing edge above him. V.9 was initially fitted with a 80hp Oberursal engine; this was later changed to a 110hp Le Rhône engine and then, finally, to a 110hp Oberursal UR.II engine. As demonstrated at Adlershof, V.9 was not fitted with armament or any other military load. It proved to be light and manoeuvrable, but remained simply a prototype and was not offered for any official structural testing.

Fokker's Submissions to the First Fighter Trials, January/February 1918

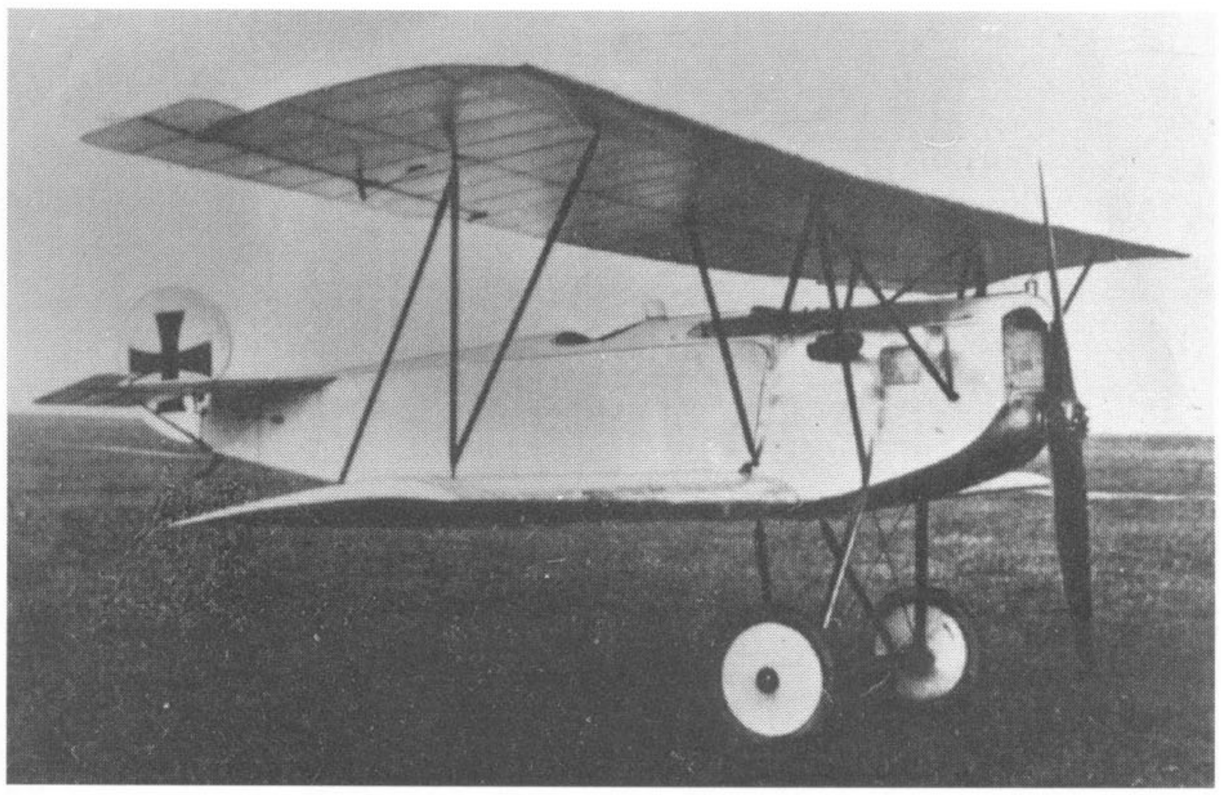
V-number	*Engine*	*Type*
V.9	80hp Oberursal UR 110hp Le Rhône 110hp Oberursal UR.II	biplane
V.11	160hp Mercedes D.IIIau	biplane
V.11/II	160hp Mercedes D.IIa	biplane
V.13/I	110hp Oberursal UR.II 145hp Oberursal UR.III	biplane
V.13/II	160hp Siemens & Halske Sh.III	biplane
V.17	110hp Oberursal UR.II	mid-winged monoplane
V.18	160hp Mercedes D.IIIau	biplane
V.20	160hp Mercedes D.IIIa	mid-winged monoplane

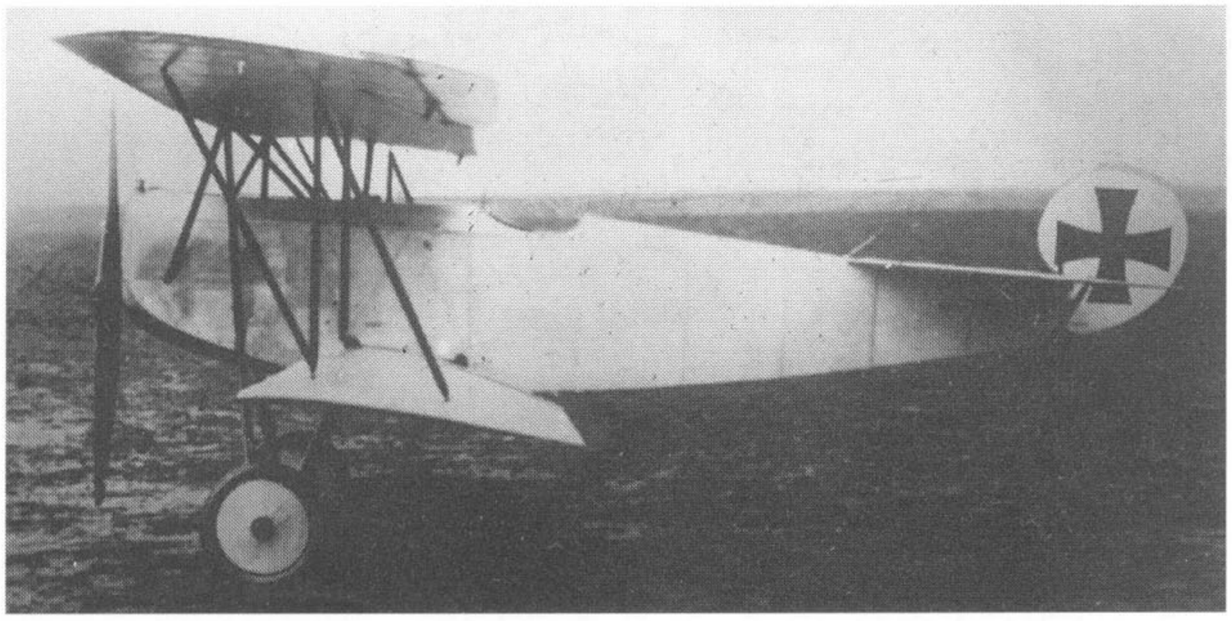
V.9 at Adlershof. Harry Woodman

The V.11

Fokker's second biplane prototype was designated V.11. Although of similar shape and structure to V.9, it was fitted with a 160hp Mercedes D.IIIau engine and in consequence it was larger and heavier. To compensate for this, both of its wings were of greater chord and span. Because of its increased chord, the lower wing was built around two box-spars, requiring a revision of its mounting to the lower fuselage longeron. The upper wing mounting was also revised. The front spar remained fixed to a steel tripod and the rear spar was attached to the fuselage by a single, removable, steel strut. The design of the front tripod differed from that of V.9 in that its front leg was welded to the engine bearer, its middle to the lower longeron and the rear to the upper longeron. Although the wings were again designed as cantilevers, as with V.9, they were fitted with interplane struts. In this case these were of 'N' configuration with attachments to both spars in both wings. There was no cut-out in the rear of the upper wing.

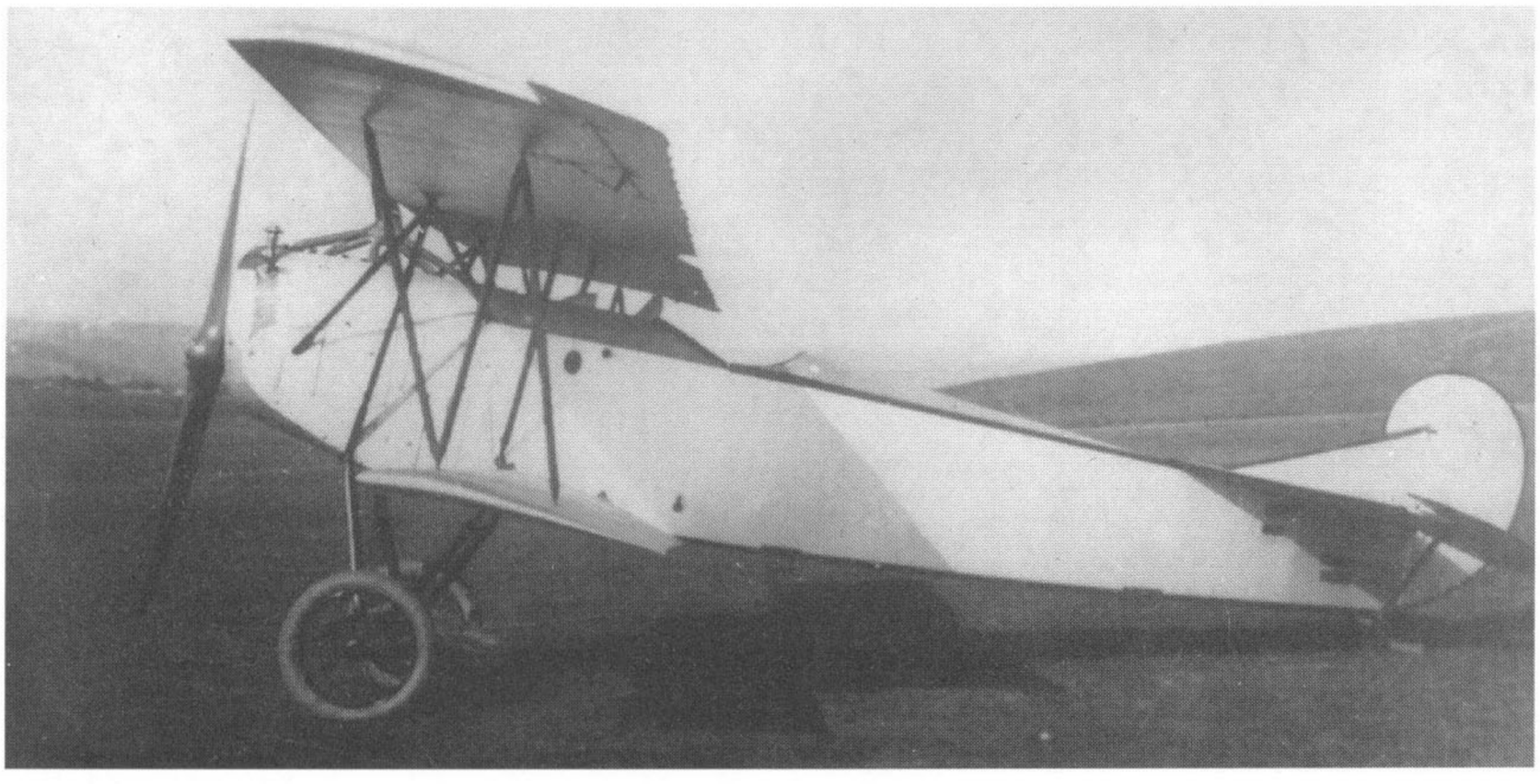
V.11 in its original form. Harry Woodman





V.11 in its original form. Cross and Cockade International

***(Below)* V.11 with modified fin and rudder.** Cross and Cockade International



The engine installation was compact and practical. It used a radiator similar to that fitted to V.8 that was mounted on the engine bearers and that could be replaced without removing the propeller. Its expansion tank was an integral part of the radiator, needing no vulnerable external pipework.

In its original form, V.11 was similar to V.9 with the same shaped tail unit, horn-balanced ailerons on the upper wing only and a short rear fuselage that took no account of the increased side area of the lengthened nose required by the bigger engine. When Fokker came to fly it immediately prior to the trials he found that it was unstable with a tendency to spin, and dangerous to fly. As he later said, 'a machine to breaks one's neck with'. This view was shared by Manfred von Richthofen, who also flew it. In his book, *Flying Dutchman*, Fokker says that because of this he called up his best welders from Schwerin and secretly

modified the machine over the weekend before the trials proper commenced. It seems unlikely that these modifications – including a lengthened rear fuselage and a repositioning of the wings with provision of a cut-out to improve the pilot's view – could have been achieved in the time available. It seems more likely that his experience with the machine had caused him to initiate these modifications to a second machine at Schwerin and that it was this that was submitted for the trials. Even so, V.11/II was still basically unstable, so Fokker took the precaution of telling the pilots who would fly it that its controls were extremely sensitive, stressing the advantages of this to them.

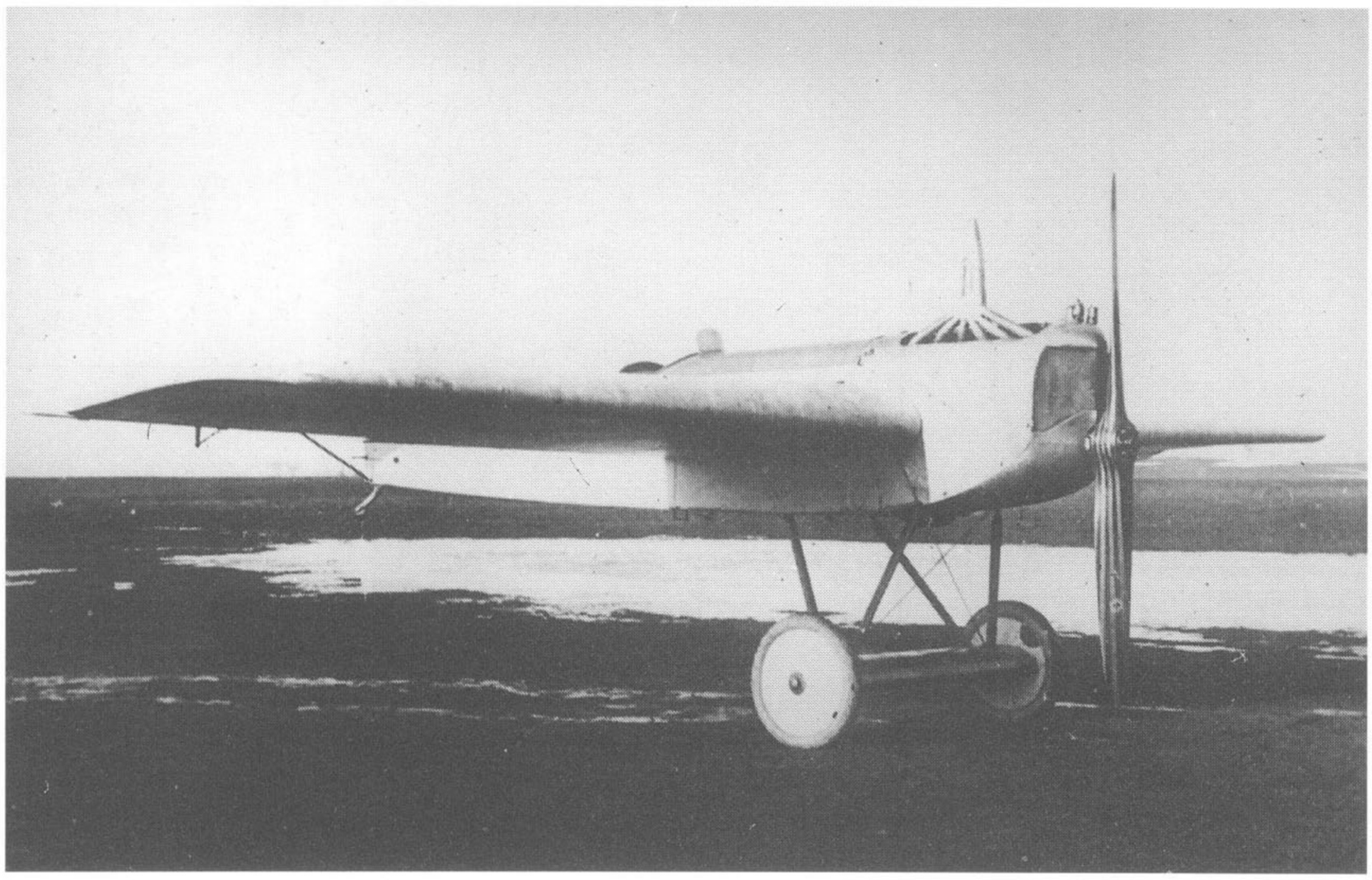
The V.13

The third and fourth biplane prototypes were V.13/I and V.13/II. In most respects they were similar to V.9, sharing the same basic structure. Because it was intended to climb faster than V.9, V.13 had wings of wider chord, needing two box spars and 'N' struts similar to those of V.11. The upper wing also was larger than that of V.9 and was carried on a similar cabane arrangement to that of V.11. The differences between the two were to cater for the different engine installations. V.13/I was fitted first with an 110hp Oberursal UR.II engine and then with a 145hp Oberursal UR.III; V.13/II was fitted with a 160hp Siemens & Halske Sh.III engine needing a larger diameter propeller and hence longer undercarriage legs. Both machines performed well at the trials but, because of his interest in the Oberursal factory, Fokker made little effort to promote the Siemens-powered V.13/II, putting most of his resources into the Oberursal-powered V.13/I.

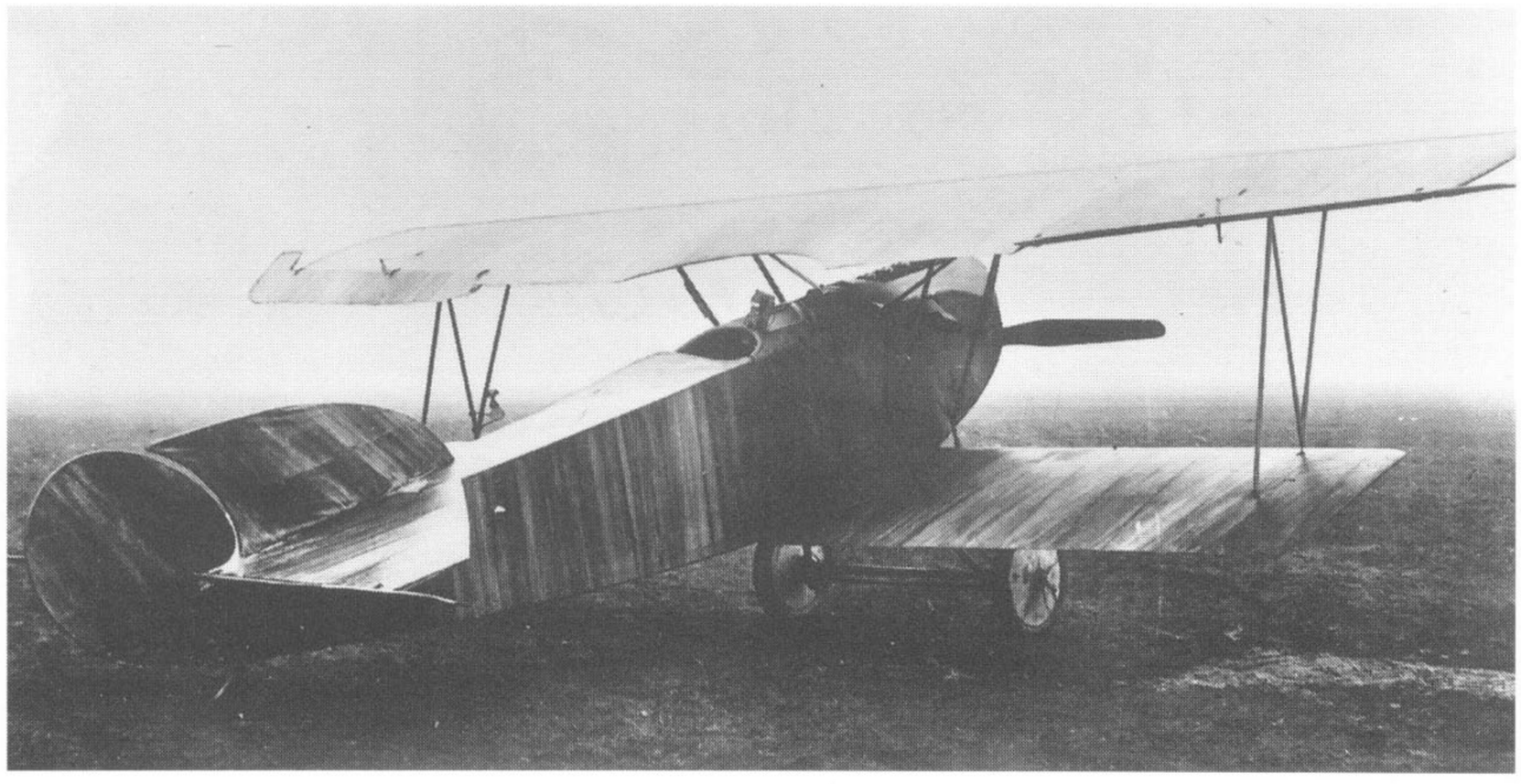
The V.18

Next in the list was biplane V.18. This was similar to V.11 but differed in a number of areas. It was probably slightly larger and heavier than V.11 and incorporated a lengthened fuselage, modified and repositioned wings with a large cut-out in the trailing edge of the upper wing, and an undercarriage with a wider track. Powered by a 160hp Mercedes D.IIIau engine, its performance was inferior to that of V.11. During the trials it was damaged in collision with V.13 and not rebuilt.

V.13/II in the winter of 1917–18. Harry Woodman



V.20 at Adlershof. Harry Woodman



V.18. Harry Woodman

The Trials

The formal trials started on 21 January 1918 and continued until 12 February 1918. Pre-trial planning was comprehensive. All eventualities had been considered and provided for. To ensure that the results obtained were accurate and unbiased by any sharp practice from unscrupulous contractors, very strict procedures were adopted. Once machines had been handed over to the Adlershof staff, they were essentially in bond and no modifications or adjustments were to be made. They were checked and weighed before each flight, and details of the type of propeller fitted noted. The fuel provided and consumed during each flight was carefully monitored. Two calibrated and sealed barometers were fitted to each aircraft and these were checked before and after every flight.

Overall, Fokker put more into these fighter trials than any of his main rivals. The other companies, Albatros, Siemens-Schuckert, Pfalz, Junkers, LFG-Roland, Rumpler and Schütte-Lanz had all either submitted prototypes intended to meet specific aspects of the stated requirement or upgrades of existing types. All (including Fokker) spent large amounts of money on 'entertainment' of the pilots and officials, but Fokker's long established cultivation of Jasta pilots gave him a distinct advantage that was difficult to beat. Relying on his knowledge of the fighter pilots' requirements, his prototypes were intended to be good all-round machines, rather than designed only for specialist applications. Also, he submitted a greater number of prototypes and of wider variety than his competitors. His final advantage was his back-up both at Adlershof and back at Schwerin, which were second to none.

Left to right: Bruno Loerzer, Anthony Fokker and Hermann Göring at the Fighter Competition. Cross and Cockade International

Bruno Loerzer

Bruno Loerzer was born in Berlin on 22 January 1891. He enlisted as a cadet with Infantry Regiment No. 112. He attended Military School and was commissioned as a Leutnant with his regiment in January 1913. He started flying training just before war broke out and in October 1914 was posted to FA25, where he was joined by Ltn Hermann Göring, who became his observer. Their friendship was to last their lifetimes. In June 1915, Loerzer went to FA60 and then FA(A)203, and then trained as a single-seater pilot. Flying with Kek Jametz, he was awarded the Iron Cross 2nd Class and then moved to Jasta 5 on its formation. Late in 1916, he was posted to Jasta 17. He took over command of Jasta 26 on 18 January 1918 and then was given command of JGIII on 21 February 1918. He was promoted to Hauptmann on 10 October 1918 and survived the war with his score standing at forty-four victories.

During World War Two he served with the Luftwaffe and rose to the rank of Generaloberst. He died on 23 August 1960. His decorations included the Iron Cross 1st Class, the Knight's Cross with Swords of the Royal House of Hohenzollern, the Orden Pour le Mérite and, during the later war, the World War Two Iron Cross 1st Class.

Hauptmann Bruno Loerzer. Cross and Cockade International

In the first part of the trials, each aircraft would be put through its paces by its parent company's pilots, under the close supervision of the Adlershof staff. Records of these flights and the impressions gained from them would be taken into account when the final decisions were made.

In the second part of the trial, the aircraft were to be flown by Adlershof staff pilots and combat-experienced pilots provided for the purpose by the Jastas. As would be expected, these would include all of the great and famous, and Manfred von Richthofen was to be the first to fly Fokker's V.11. Others there included Oblt Bruno Loerzer, Hptmn Adolf von Tutschek, Oblt Hermann Göring and Ltn Ernst Udet.

These pilots would fly the machines for the main part of the trials, which would include climbing performance, speed at altitude and at lower levels, manoeuvrability and mock combat with other trial prototype machines and in-service types. Robustness of construction as well as reliability and ease of maintenance would be taken into account.

Left to right: Ernst Udet, Bruno Loerzer and Carl Menckhoff at the Fighter Competition. Cross and Cockade International

Non-Fokker Aircraft at the First Fighter Trials

Aircraft	*Engine*	*Type*
Albatros D.Va	185hp BMW IIIa	biplane
Junkers J.7	160hp Mercedes D.III	low-winged monoplane
Pfalz D.VI	110hp Oberursal UR.II	biplane
Pfalz D.VII	160hp Siemens & Halske Sh.III	biplane
Roland D.VIa	160hp Mercedes D.III	biplane
Rumpler 7D4	160hp Mercedes D.III	biplane
Rumpler 7D5	160hp Mercedes D.III	biplane
Schütte-Lanz D.III	160hp Mercedes D.III	biplane
Siemens-Schuckert D.III	160hp Siemens & Halske Sh.III	biplane
Fokker Dr.I	145hp Oberursal UR.III	triplane – prepared by Adlershof triplane workshops
Fokker Dr.I	200hp Goebel Goe.III	triplane – prepared by Adlershof triplane workshops

Hermann Göring

Oblt Hermann Wilhelm Göring was born in Rosenheim in Upper Bavaria on 12 January 1893. His father was a distinguished army officer who had also been Governor of German South-West Africa. He became a cadet before the war, was commissioned in March 1912 and joined Infantry Regiment No. 112. He served in the Vosges at the start of the war but suffered rheumatoid arthritis and was hospitalized.

At Loerzer's suggestion, he joined the Air Service and trained as an observer with FEA3. He became Loerzer's observer in FA25 in 1915 and then trained as a pilot between June and October 1915. He returned to FA25 where he gained two victories and then transferred, first to Kek Stenay to fly Fokker E.IIIs and then to Kek Metz. He returned briefly to FA25 but then went back to Kek Metz before joining Jasta 7. Transferred to Jasta 5, he was shot down and wounded. In February 1917 he was posted to Jasta 26, commanded by Bruno Loerzer. His score rose and he joined Jasta 27 on 17 May 1917. He took over JGI on 8 July 1918 and gained only one further victory before the end of the war. By this time, his score had risen to twenty-two victories and his wartime decorations included the Iron Cross 1st Class, the Knight's Cross with Swords of the Royal House of Hohenzollern Order, the Bavarian Order of Max Josef and the Orden Pour le Mérite.

He fought briefly in the post-war revolution and then went to Denmark as a flight instructor. He returned to Germany in the early 1920s and became associated with Adolf Hitler, helping in the formation of the Nazi party. Put in charge of the newly formed Luftwaffe, he rose to the rank of Reichsmarschall. He was captured by US forces at the end of the war and put on trial at Nuremberg where he was found guilty of war crimes and sentenced to death. He committed suicide by poison on 15 October 1946.

Oberleutnant Hermann Wilhelm Göring. Cross and Cockade International

The Competition

Apart from Fokker's submissions, the other main aircraft submitted for the trials were the following.

Albatros D.Va

This otherwise standard machine was fitted with a 185hp BMW IIIa engine, the quantity production of which was just beginning so the engine was, at that time, in short supply. This D.Va was said to have achieved a ceiling of 10,500m (34,000ft) in February 1918. No figures are available for its other performance. The Albatros Company had prepared an Albatros D.IX powered by a 160hp Mercedes D.IIIa engine for the trial, but this was destroyed in a crash on 18 January 1918 and was thus not available for consideration.

Junkers J.7

The J.7 was a low-winged monoplane of all-metal construction with the entire outer surfaces covered in corrugated duralumin, and powered by a 160hp Mercedes D.III engine. It was flown by Fokker in a comparative trial with the Albatros D.Va and proved to be slower in level flight. Fokker claimed that this was because the propeller was of too fine a pitch, and that because of this the engine was in danger of running away. Fokker demonstrated the J.7 on a number of occasions. On one he

was forced to land when the propeller disintegrated in the air, and he managed to do so without damage to the machine. On another occasion he turned it over on landing – fortunately the damage on this occasion was slight. Prior to the trials, and with a full military load, the J.7 climbed to 5,000m (16,000ft) in 24.1 minutes.

Pfalz D.VI

The Pfalz D.VI was powered by the 110hp Oberursal UR.II engine. The fuselage construction was of wrapped plywood similar (but not in shape) to that of the D.III. The wings were of similar shape and construction to those of the D.III, as were the V-shaped wing struts. The engine was fitted with a circular cowling and its propeller with a large spinner that left little space for cooling air to pass through the engine. At the competition it climbed to 5,000m in 25 minutes, and its service ceiling was 5,600m (18,000ft). The pilots liked the fact that it was fitted with the UR.II engine, with which they were familiar, but its overall performance was felt to be inadequate.

Pfalz D.VII

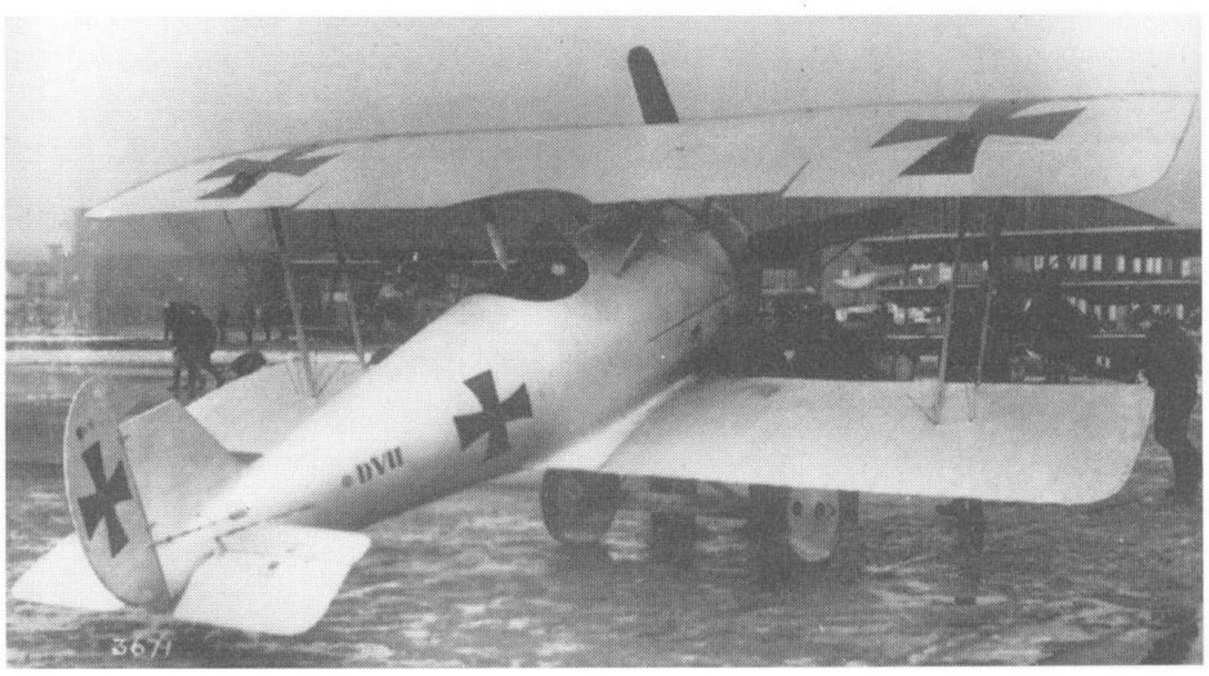
The D.VII was powered by a 160hp Siemens & Halske Sh.III engine. Of similar construction to the D.VI, its upper wing was higher above the fuselage than its predecessor, it had a pair of wing struts rather than the earlier V-type and its engine cowling, provided with cooling slots in its front, was open at the bottom. Its performance was better than that of the D.VI and it could climb to 6,000m (20,000ft) in 25.25 minutes. It was faster than the similarly powered Siemens-Schuckert prototypes, but it was felt that its as yet undeveloped engine could prove unreliable in service.

Roland D.VIa

Powered by a 160hp Mercedes D.III engine, its conventionally constructed wings were mounted on a fuselage of innovative design. Conventional formers were covered with overlapping wedge-shaped wooden strakes that varied in thickness from the nose to the tail. While reminiscent of the hull of a sailing vessel, the system gave a strong fuselage, lighter than would have been the case with the plywood wrapping techniques employed on earlier Roland machines and those manufactured by Pfalz. Two prototypes were entered in the trials, but while their manoeuvrability was said to be superior to that of their competitors, their overall performance was inferior. No performance figures are available for the early Mercedes-powered prototypes but a later model with a 200hp Benz Bz.IIIa had a maximum speed of 182.5km/h (113mph) and climbed to 6,000m in 28 minutes.

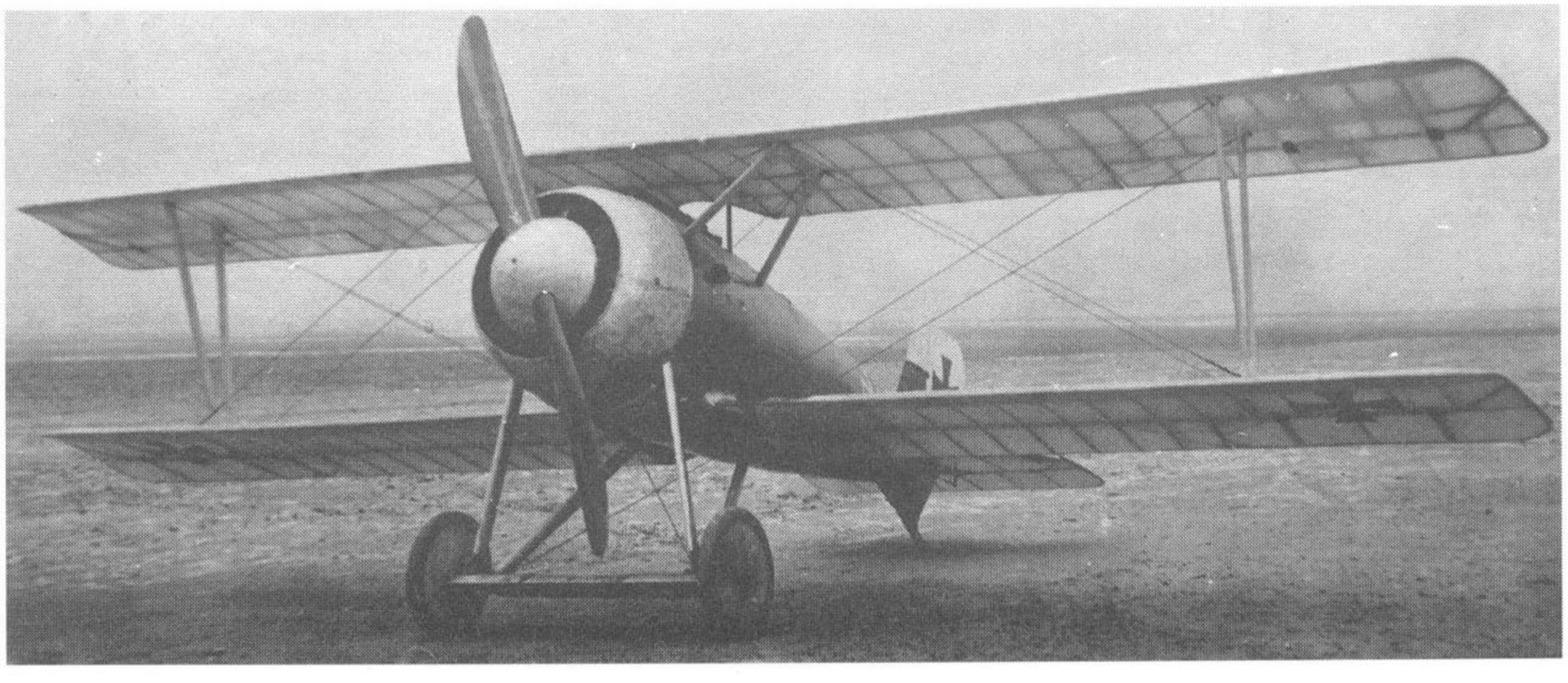
Rumpler 7D4 and 7D5

They were both of similar light construction and fitted with 160hp Mercedes D.III engines. While they had an exceptional rate of climb and impressive speed in level flight, the ear-type radiators fitted to their fuselage noses were found to cause turbulence and made control at speed difficult. As a result, they were prone to spin during sharp turns.



Pfalz D.VII at the Fighter Competition with a Fokker triplane in the background. Cross and Cockade International

Pfalz D.VI with Wilhelm Frankl in the cockpit. Cross and Cockade International



Siemens-Schuckert D.III. Cross and Cockade International

Schütte-Lanz D.III

Of conventional wood and fabric construction, this was powered by a 160hp Mercedes D.III engine. It was said to be a promising prototype, although its performance, as demonstrated at the trials, was not exceptional. One of the two submitted was wrecked early in the trials in a landing accident. It climbed to 5,000m in 31.9 minutes.

Siemens-Schuckert D.III

This was a conventionally built machine, powered by a 160hp Siemens & Halske

Fokker Dr.I 469/17 (factory number 2095) fitted with an Oberursal UR.II engine at the Fighter Competition. Peter Grosz

Sh.III engine driving a very large-diameter, two-bladed propeller that meant long undercarriage legs were needed. Four samples were submitted for the trials and one of these climbed to 6,000m in 21.5 minutes. Despite the type's good climbing performance, it was found to be less manoeuvrable in mock combat than Fokker's biplanes and pilots complained that control forces were high. Further, partly because of its long undercarriage legs, it was difficult to land. Two were damaged in landing accidents during the trials, one by Oblt Bruno Loerzer and the other by Ltn Busse, both experienced pilots. A final point against it at this stage was its Siemens & Halske Sh.III engine, which was at an early stage of development and not yet considered reliable enough for service use.

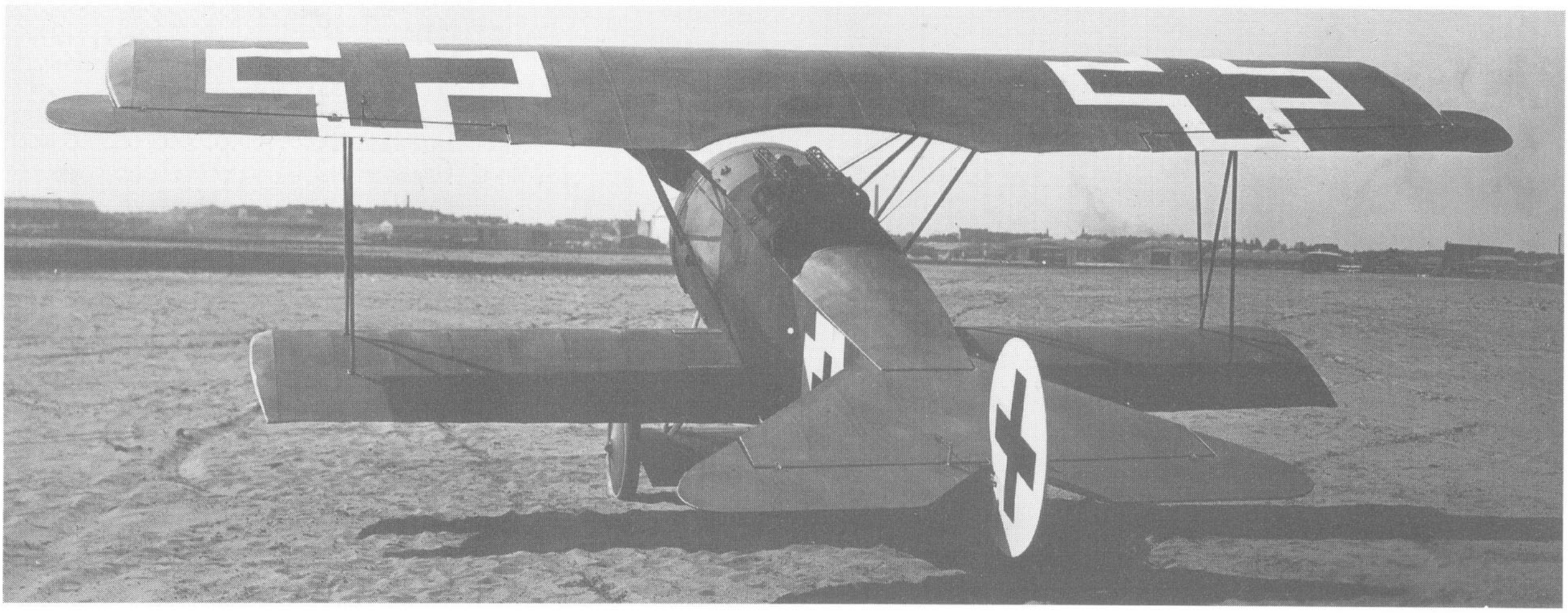
Fokker Dr.I

A pair of Dr.Is, fitted with the 145hp Oberursal UR.III engine and the 200hp Goebel Goe.III engine, had been prepared by Adlershof staff with a view to demonstrating the new engines and possibly to prove that, with a new more powerful engine, the Dr.I could have an extended life. Both gave excellent climb performances but neither was thought to be any real improvement on the in-service 110hp Oberursal-powered Dr.Is.

The Decision

With the conclusion of the trials it was time for Idflieg to decide which of the prototypes would be selected for development and production. Their policy dictated that there should be at least two and that these should be fitted with different engines, one rotary and the other in-line.

Of all of the types flown, V.11 had been popular with all who had flown it. Manfred von Richthofen, who had flown it before and after modification, recommended it to the other pilots and although, fitted with the 160hp Mercedes D.III engine, its rate of climb was slower than that of some of the other types fitted with more powerful engines, it was acknowledged that this would improve when the new 185hp BMW IIIa engines became available in production quantities. In its modified form, it handled well with no undue force needed to operate the controls. At medium altitude it was faster and more manoeuvrable than most other types. In a dive it accelerated quickly to high speed but remained steady while doing so. Another important advantage was its conventional construction and



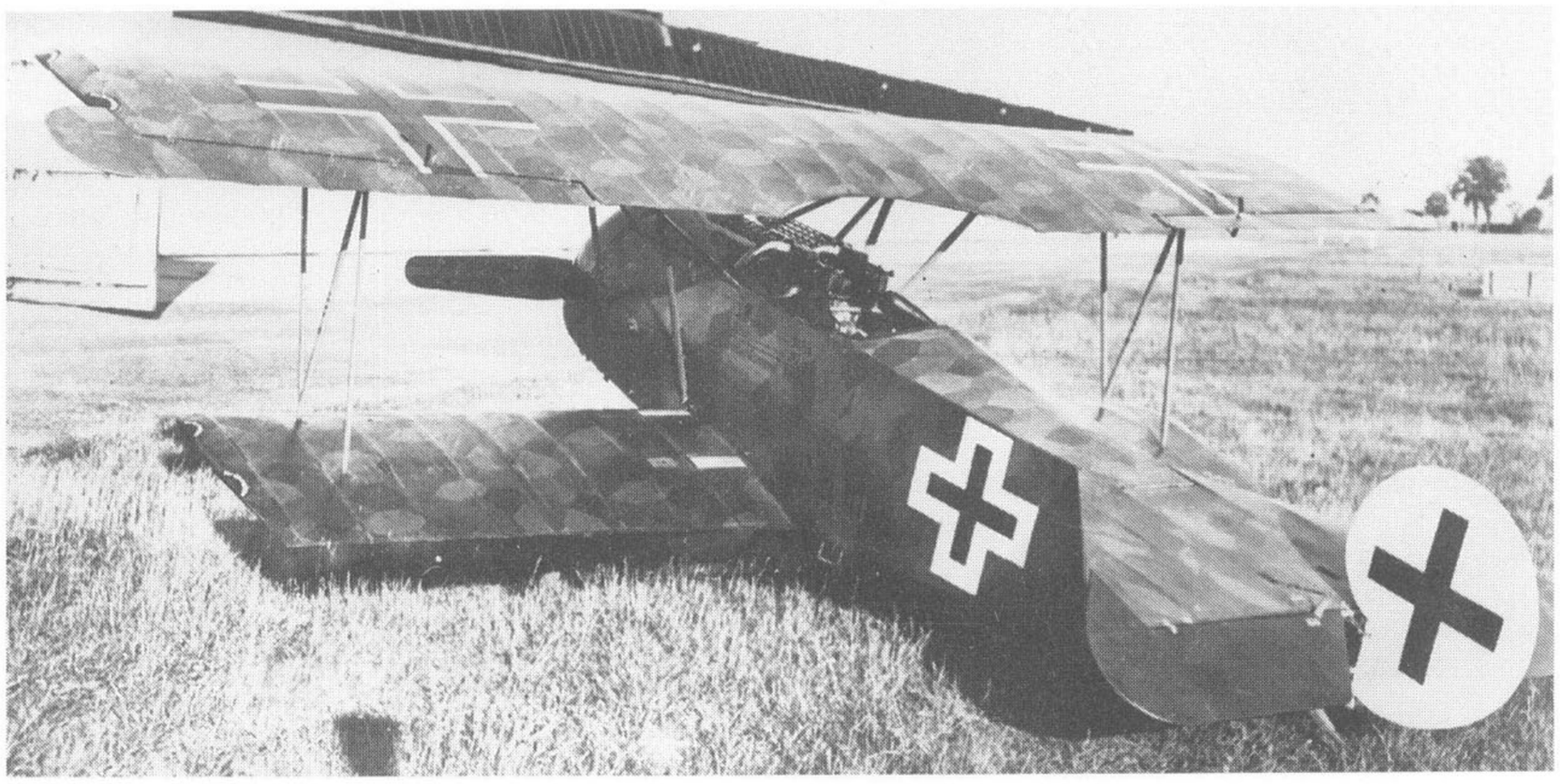
Fokker D.VI. Cross and Cockade International

ease of maintenance and repair. On the strength of these virtues, V.11 was chosen as the in-line-engined type to be developed for production, to enter service as the Fokker D.VII. The other in-line engined types considered at the trials were dismissed as being inadequate.

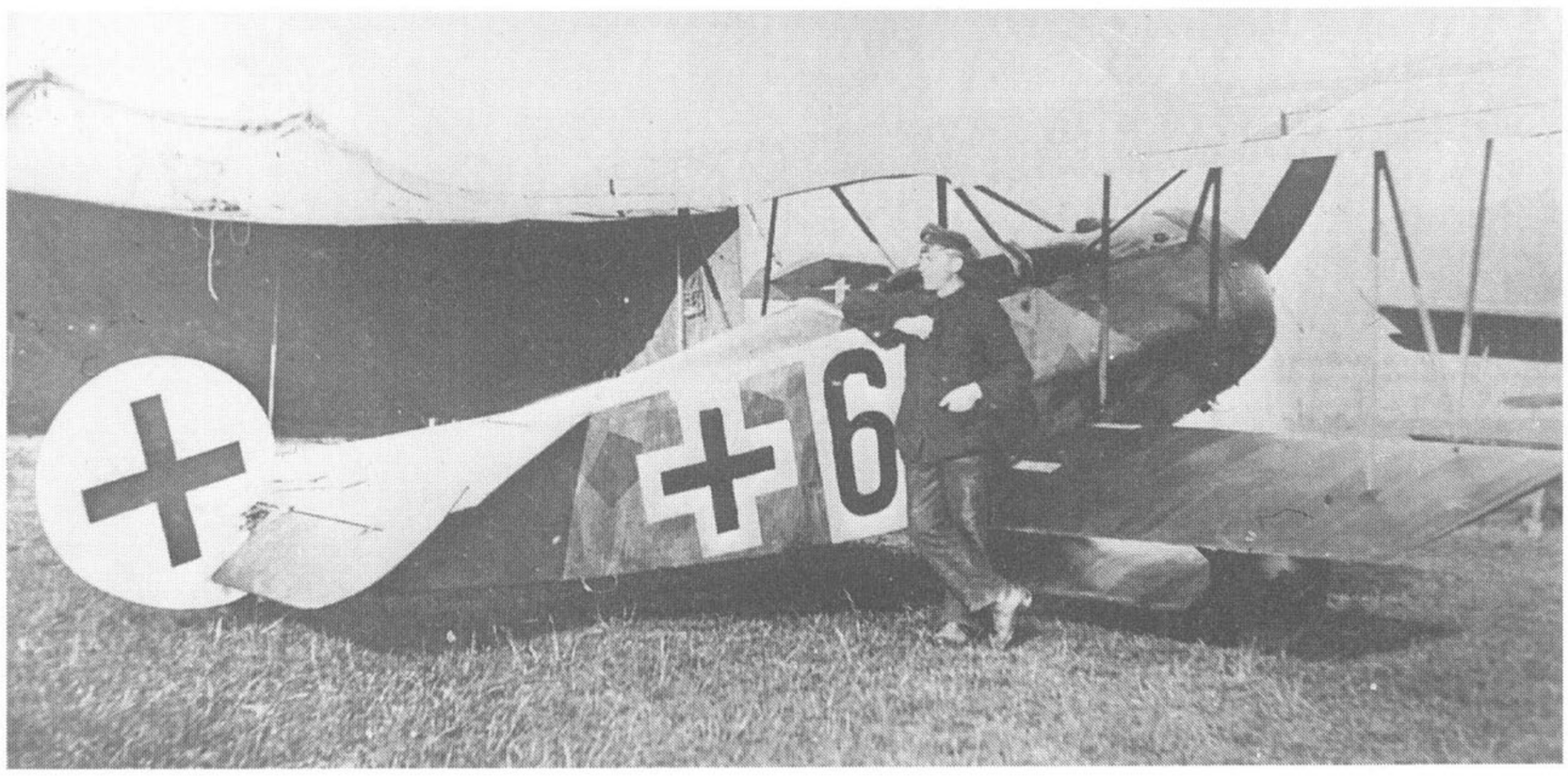
Choice of the rotary-engined machine to be developed was less easy. The Siemens-Schuckert prototypes had given excellent climbing performances and were proven to be acceptably fast at high altitude. However, their use of the undeveloped and potentially unreliable 160hp Siemens & Halske Sh.III engine was a problem to the service pilots, all of whom preferred the 110hp Oberursal UR.II engines to which they had become used and which they felt were more reliable. The same objection was raised against the Pfalz D.VII, that also used the Siemens & Halske engine. The Pfalz D.VI, which used the 110hp Oberursal UR.II engine, was felt to be slow and unwieldy. The choice therefore fell upon Fokker's 110hp Oberursal UR.II-powered V.13/I biplane, which had received Manfred von Richthofen's blessing. It was light, easy to fly and very manoeuvrable and, being of similar construction to Fokker's earlier types and the V.11, easy to maintain and repair. V.13/II fitted with the Siemens & Halske Sh.III engine had found favour with some pilots, but their objection to the new engine eliminated this from being a real contender.

However, before development and production orders could be placed, a number of serious questions had to be answered. First and foremost of these was the ability of the two machines to pass type tests at Adlershof. However, early in February, and before the trials had been completed, a V.13 airframe had been submitted for test to destruction at Adlershof. It passed these without problems and surpassed expectations in some areas. A report issued on 18 February cleared the type for production without any restriction. V.11 underwent type testing on 4 February 1918 and structural loading tests shortly afterwards. It passed both with ease. A machine from the first production batch of D.VIIs (D.VII 230/18) was submitted for the full structural test during March 1918 and passed this with ease, proving itself to be the structurally strongest fighter aircraft produced to that date.

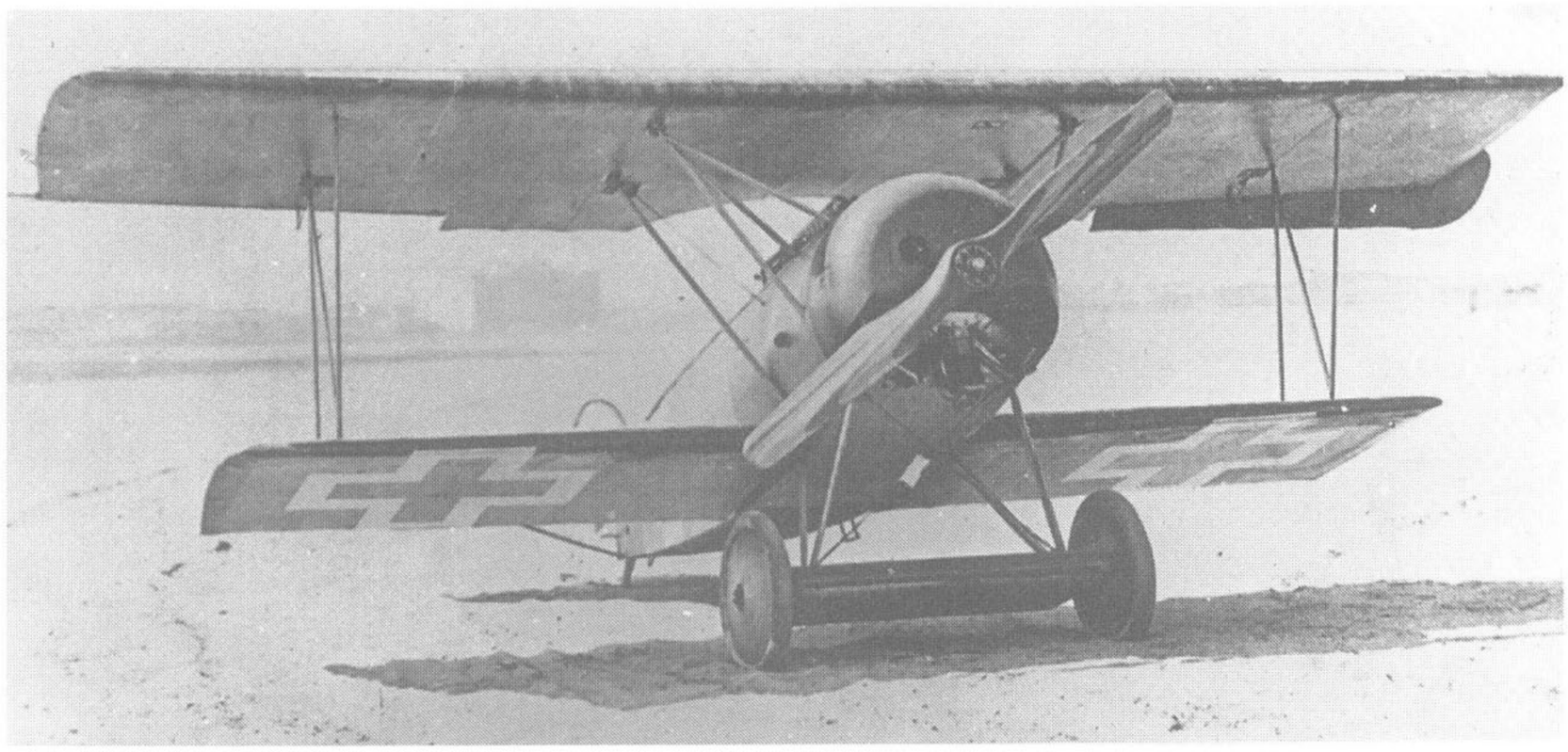
The second obstacle was the production capacity of Fokker's factory at Schwerin. As it existed, it was obviously inadequate to produce the large numbers of machines required and its rapid expansion to provide the resources required was impractical. Also, most of the existing production resources were committed to production of AEG C.IV training machines. Idflieg officials, who had already considered this, moved swiftly and cancelled the AEG order, thus freeing some of the available resources. They then split the total numbers of D.VII machines required into batches and placed an immediate order for 400



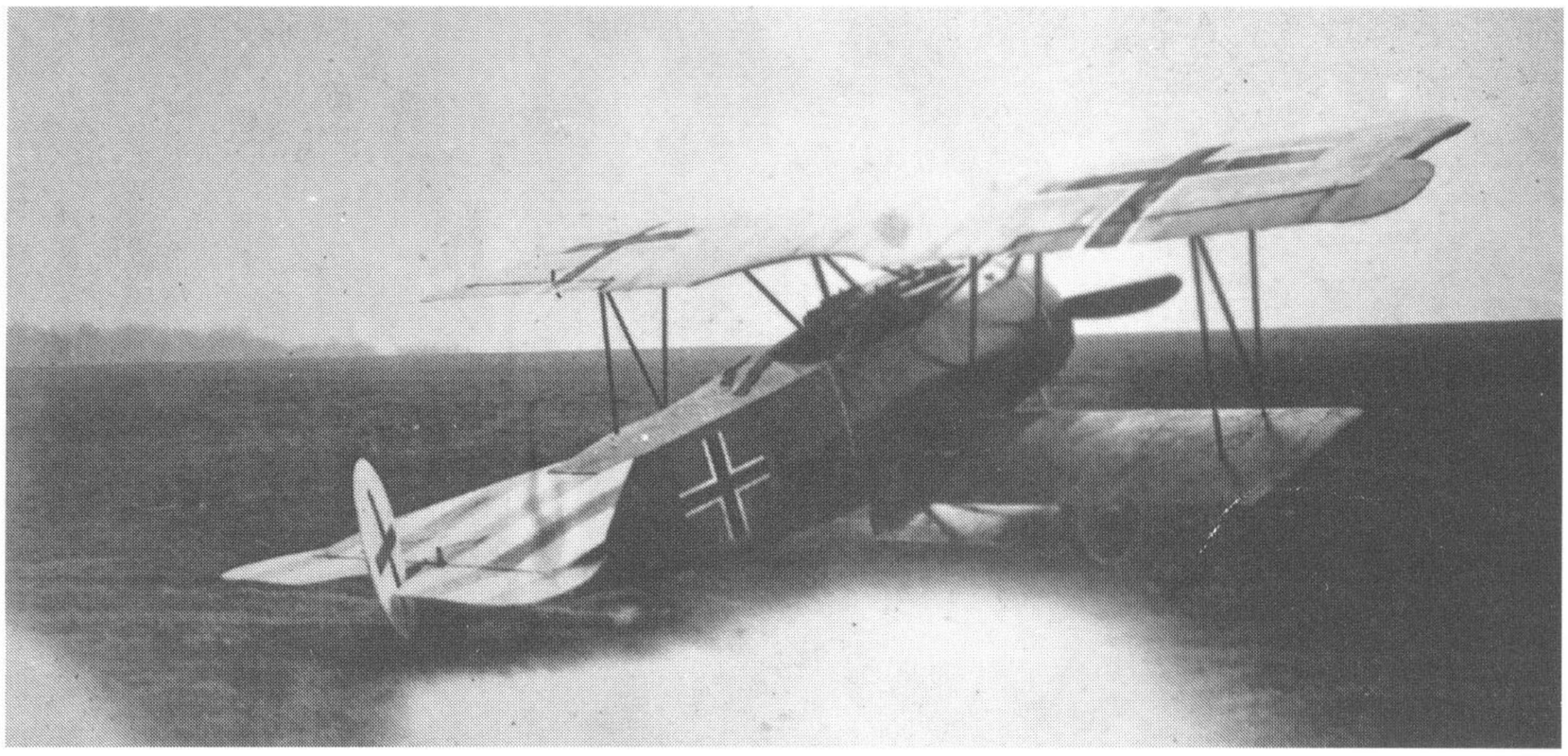
Production Fokker D.VI 1688/18. Cross and Cockade International



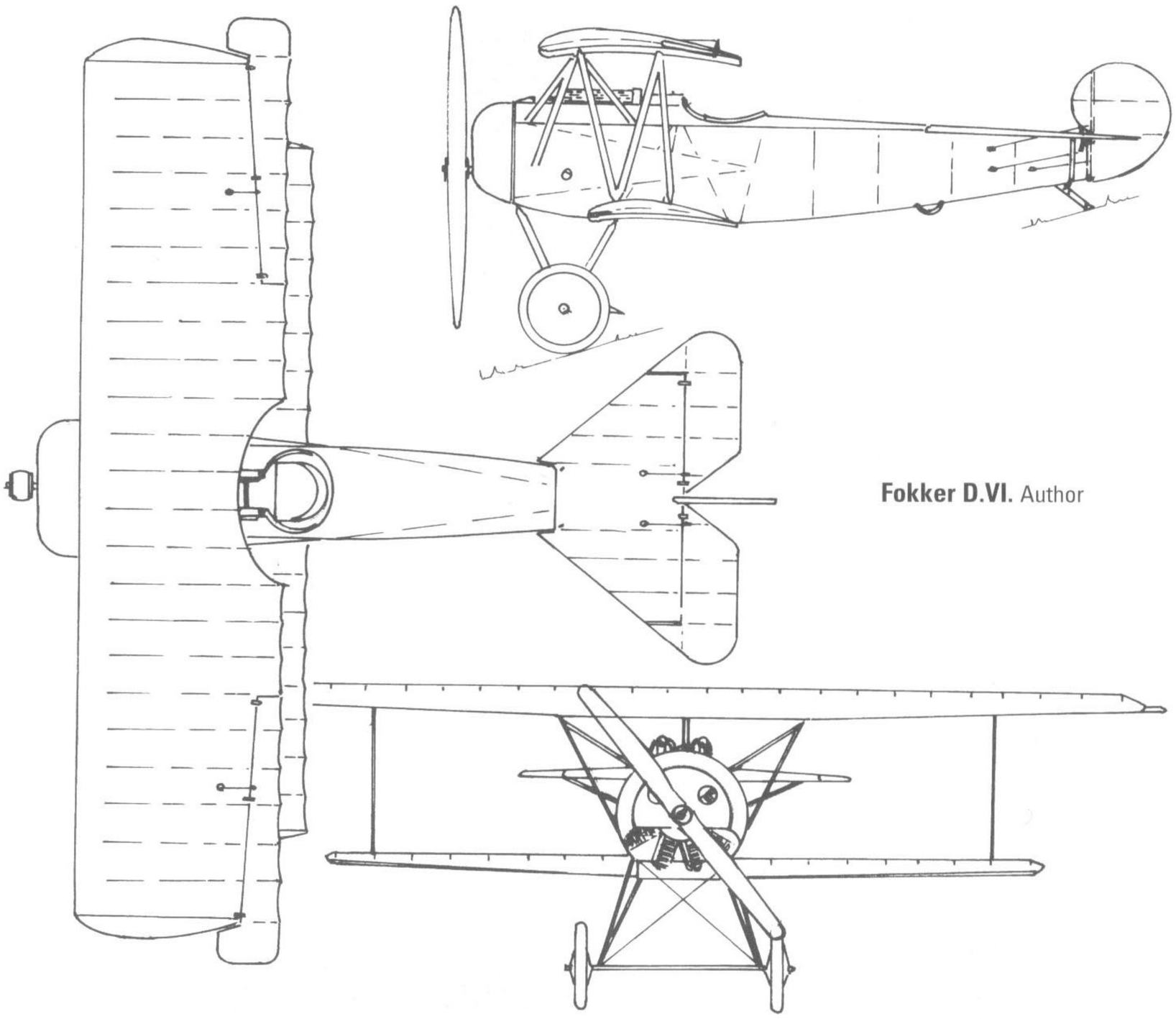
Fokker D.VI. Cross and Cockade International



Fokker D.VI. Harry Woodman



A Fokker D.VI, probably after November 1918. Cross and Cockade International



Fokker D.VI. Author

Specification – Fokker D.VI	
Engine:	110hp Oberursal UR.II
Weights:	Empty 393kg (870lb); loaded 583kg (1,290lb)
Dimensions:	Span 7.65m (25ft 1in); length 6.23m (20ft 5in); height 2.55m (8ft 4in)
Performance:	Maximum speed 196km/h (122mph) Rate of climb 1,000m (3,300ft) in 2.5 minutes, 5,000m (16,000ft) in 19 minutes
Armament:	Two LMG 08/15 synchronized to fire through the propeller arc

machines with Fokker. The balance of the order was to be shared between Albatros Gesellschaft für Flugzeugunternehmungen GmbH (Albatros), their subsidiary the Ostdeutsche Albatros Werke in Schneidemuhl (Albatros OAW) and Allgemeine Elektristats Gesellschaft (AEG), who would build the type under licence. (In the event, AEG did not build the D.VII, though they did do experimental work on the type.) Fokker was offered a very generous price for the D.VII airframes he produced and instructed to proceed at speed. He was also offered a generous percentage (5 per cent) of the value of all airframes built under licence.

A smaller initial order was placed for the V.13 design. Fitted with the 110hp Oberursal UR.II engine (in accordance with the stated preference of the service pilots at the trials) this was designated the Fokker D.VI. It was planned that the size of this order would be increased when reliable, more powerful, rotary engines became available. In the event, production of the D.VI was slow, as priority was given to the more powerful D.VII and, while some of the later D.VIs were fitted with the 145hp Oberursal URIII engine, production finished in June 1918 with fewer than sixty being manufactured. Few of these were used to equip frontline units, most being deployed either to the home defence Kestas or to the Jastaschulen. Seven D.VI aircraft were passed to the Austro-Hungarian Army, where they may have seen active service at the end of the war.

As would be expected, while the prototype V.11 had been successful overall at the trials, many detailed modifications were needed before it could be put into full-scale production. One only resulted from the structural test. In this the lower wing spars were reinforced at the point to which the inter-wing struts were fastened. The modification, while providing additional strength, was slight and added little to the overall weight of the machine. Other modifications were inspired by Fokker himself from his experiences while flying it. In the main, these were aimed at the improvement of both its climbing ability and its ease of handling, with a view to reducing pilot fatigue and producing a perfect fighting machine. Further, Fokker was aware that his design was to be produced by other manufacturers and had no wish to hand them something obviously in need of improvement.

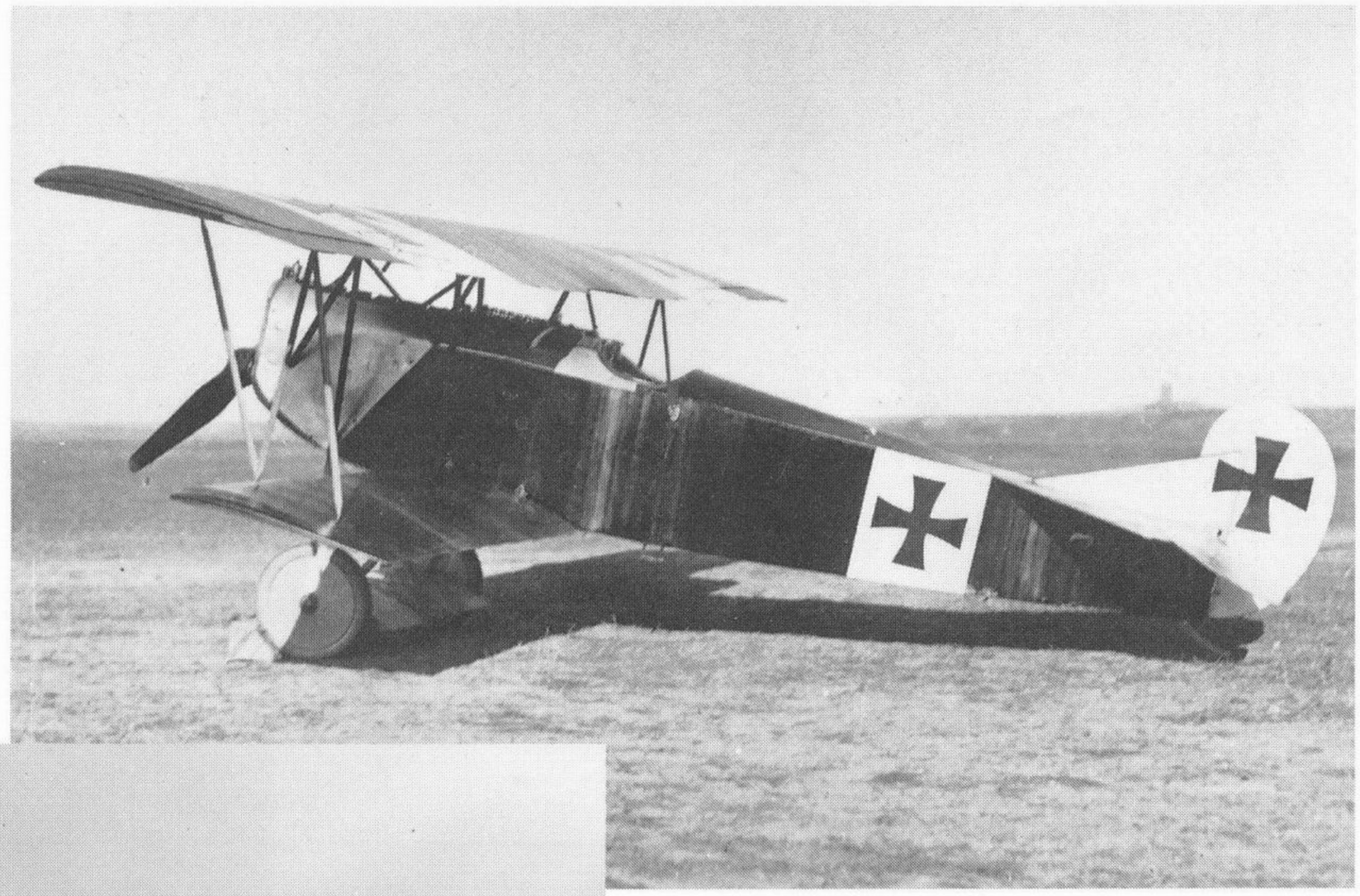
So the D.VII went into service; it remained simply the best fighter aircraft produced by any country until beyond the last days of the war.

CHAPTER SEVEN

The D.VII in Service

With production of the D.VII shared between the Fokker, Albatros and Albatros (OAW) factories, the numbers available rapidly built up and re-equipment of the leading front-line units was fast. By the end of April 1918, nineteen of the twenty-one D.VIIs accepted from Fokker had found their way to the front. This total continued to rise swiftly: by the end of June there were 407 in service, and by the end of August 828 D.VIIs were available.

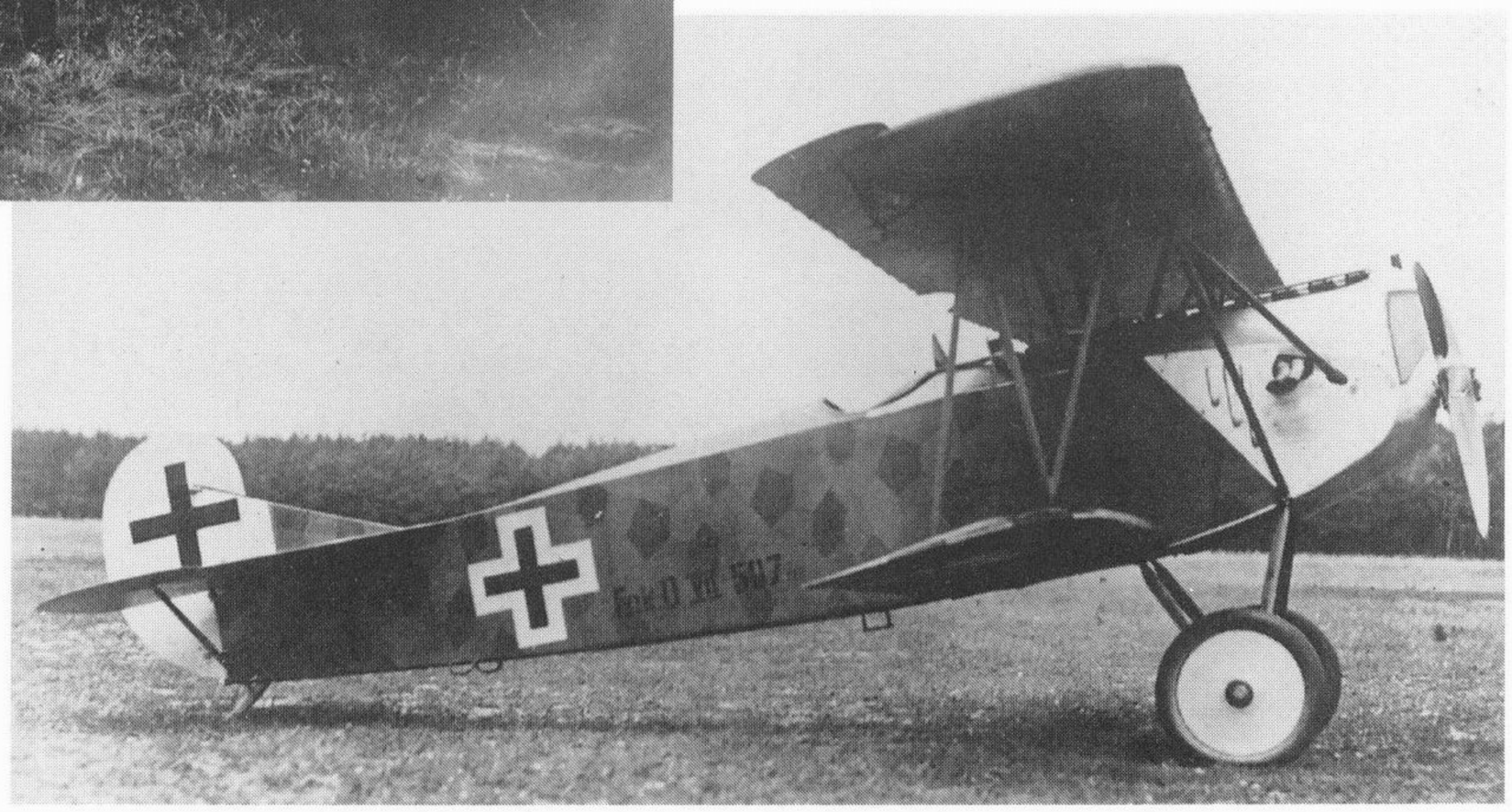
Priority for re-equipment was given to those elite units that were bearing the brunt of the fighting. Thus, Jastas 4, 6, 10 and 11, all components of Jagdgeschwader I, were the first to receive the type. JGII and JGIII followed. Within these fortunate units, the new machines were allocated first to the leading pilots, with lesser beings having to make do with the remaining Fokker Dr.Is, Albatros D.Vas and Pfalz D.IIIs until a more plentiful supply was available. The process continued until, by November 1918, forty-seven front-line Jastas and a number of home defence Kestas were equipped with a total of some 775 Fokker D.VIIs.

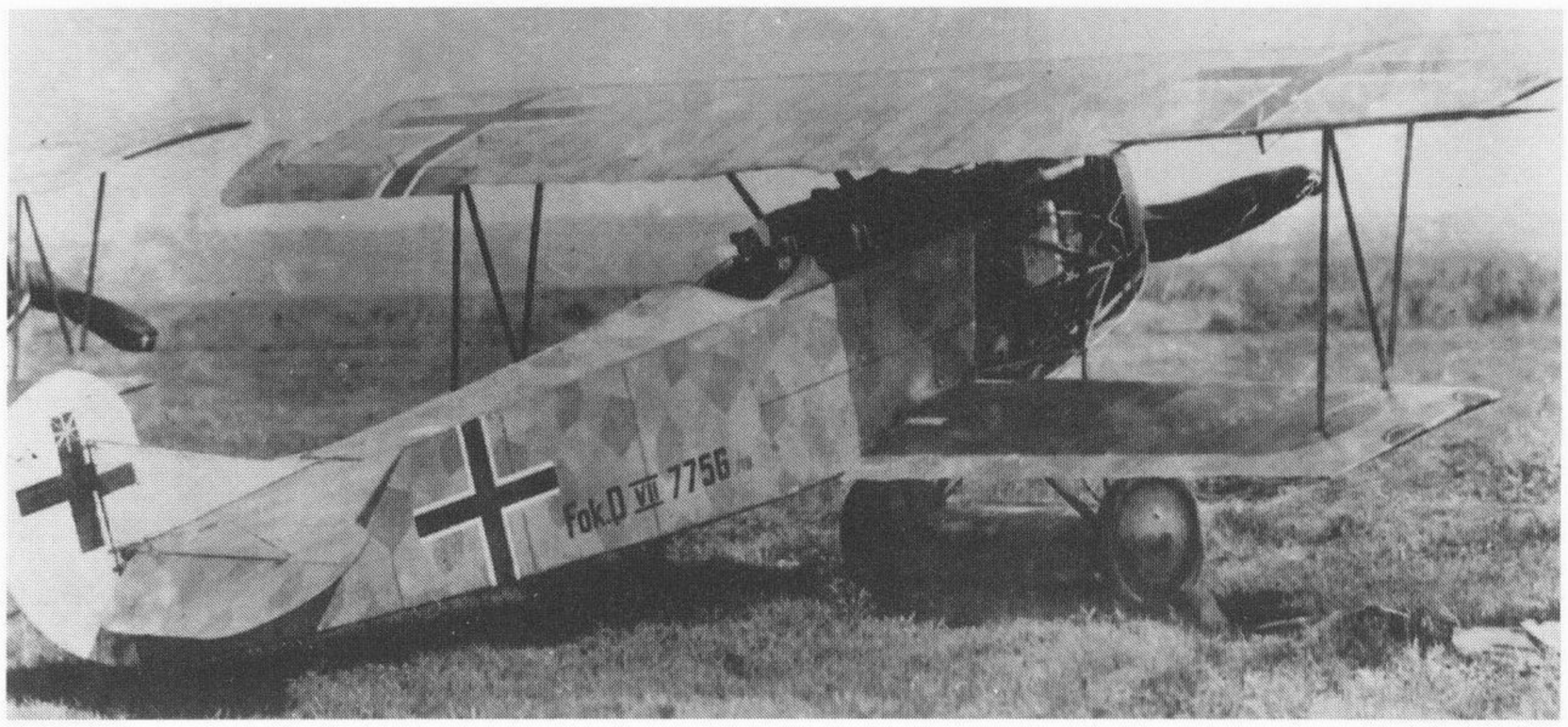


(Above) **An early production Fokker D.VII in streaked finish and with the original national markings.** Greg Van Wyngarden

(Left) **Lothar von Richthofen with his father Albrecht, possibly on 25 July 1918. The D.VII is D.VII 244/17, belonging to Ltn dR Alois Heldmann of Jasta 10.** Greg Van Wyngarden

Fokker D.VII 507/18 with lozenge-printed fabric and an aluminium cowling. Cross and Cockade International





Fokker D.VII 7756/18 fitted with a replacement rudder (note the misalignment of the national markings). Cross and Cockade International

***(Below)* This is probably Fokker D.VII 507/18.**
Cross and Cockade International

***(Bottom)* Fokker D.VII (Alb) 6810/18.**
Cross and Cockade International

The D.VII's Operators

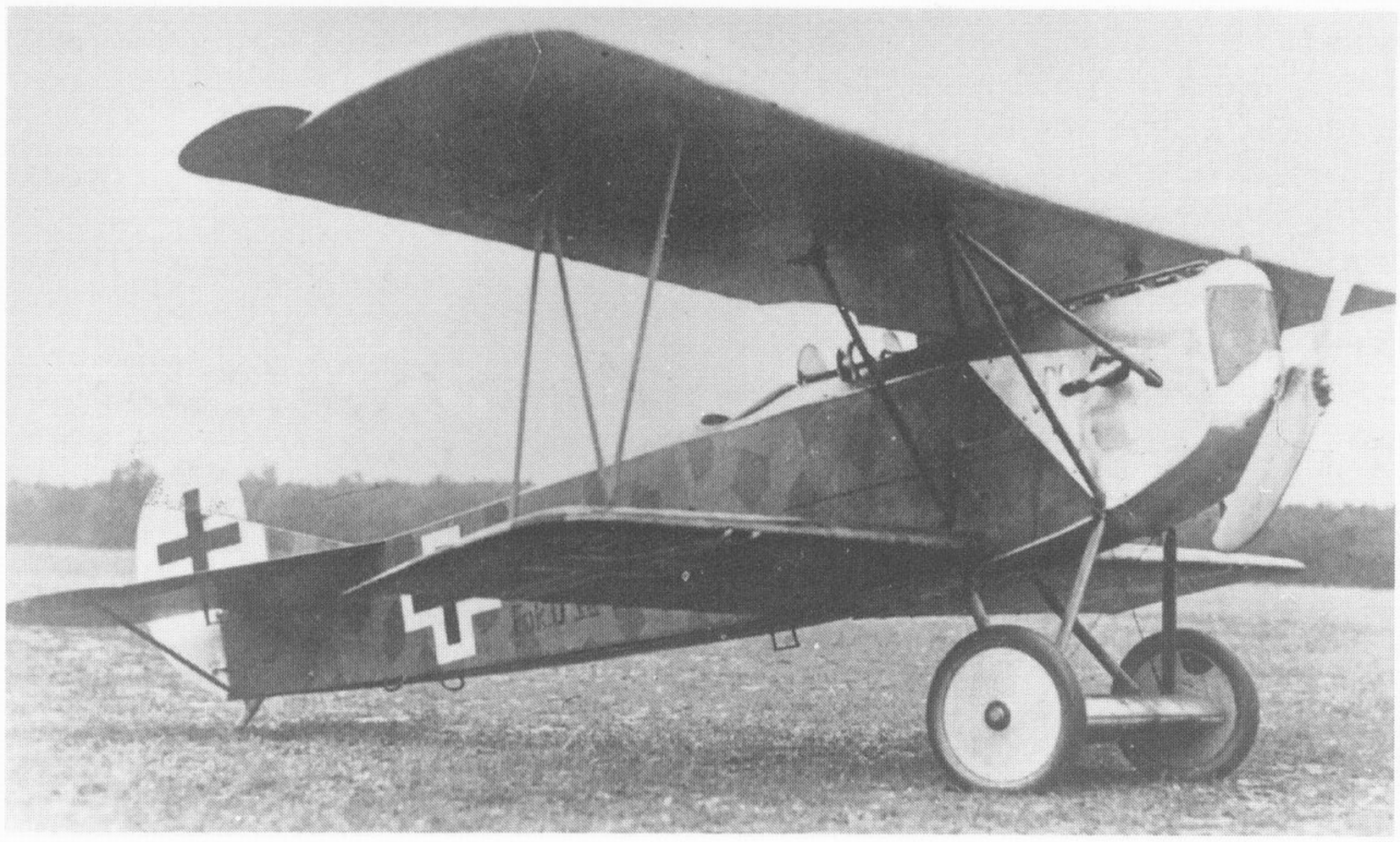
Fokker D.VII aircraft were eventually the main equipment of the following units:

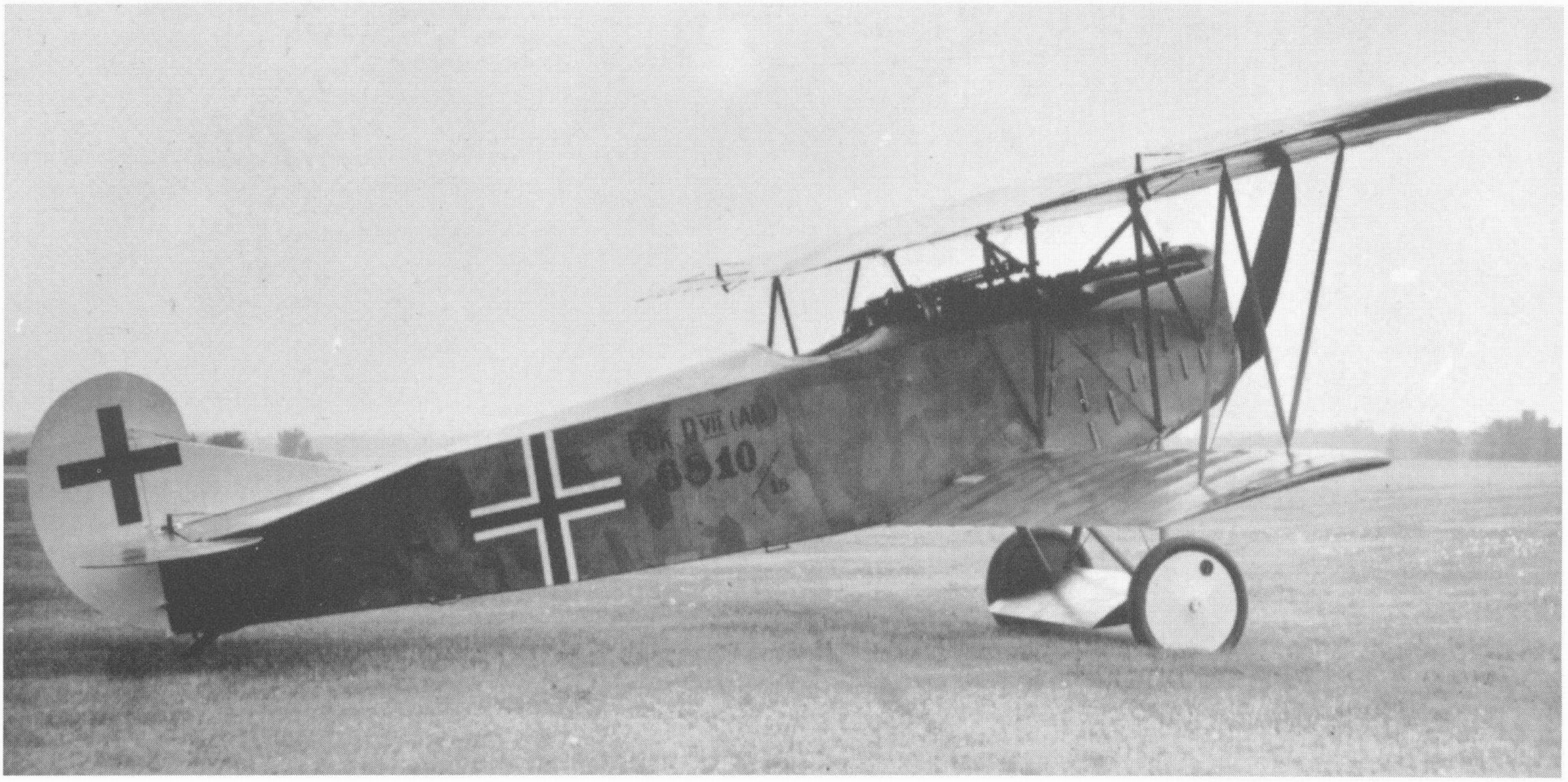
Jagdgeschwader I – Jasta 4, 6, 10 and 11
Jagdgeschwader II – Jasta 12, 13, 15 and 19
Jagdgeschwader III – Jasta 2, 26, 27 and 36

Also Jastas 5, 7, 8, 14, 16, 17, 20, 22, 23, 24, 28, 29, 30, 32, 35, 37, 40, 44, 46, 47, 48, 49, 51, 52, 53, 54, 56, 57, 58, 59, 66, 69, 71, 74, 79 and 80.

In a number of cases the unit was never completely equipped with D.VIIs but carried on using their older machines. Indeed, Ltn Josef Jacobs preferred the Fokker Dr.I and continued to use a pair of these as long as they survived, and lost the last in November 1918.

D.VIIs were also supplied to the Austro-Hungarian kuk Fliegertruppe, the Turkish Air Force and that of Bulgaria.





The German pilots took to their new Fokker D.VIIs and swiftly learned to exploit the type's strengths and advantages. It was a fairly easy machine to fly. It maintained its controllability at its ceiling of around 6,900m (13,000ft) and its slowness to stall at high angles of attack gave it the reputation of being able to 'hang' stationary on its propeller. This attribute was exploited by German pilots as it enabled them to climb up to 'hang' under the blind spot of Allied two-seaters and engage them without fear of retaliation from the rear gunner. It was reluctant to spin and almost had to be forced to do so. Recovery from a spin was easy and precise, in fact the aircraft would almost recover on its own. It accelerated quickly in a dive. Structurally

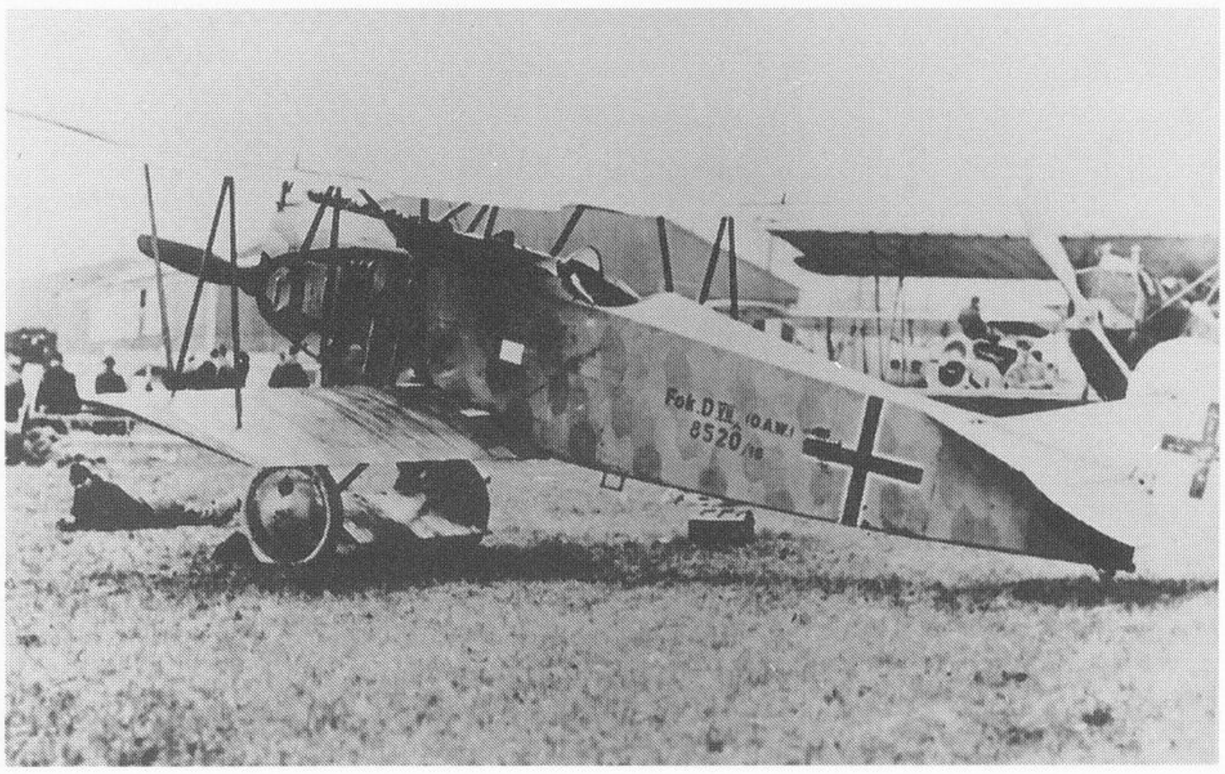
(Above) **Fokker D.VII (Alb) 5349/18 with national markings overpainted – probably either after the war or after capture during the war.**
Cross and Cockade International

A pair of unidentified Fokker D.VIIs of (probably) Jasta 36. HAC/UTD

(Below) **Fokker D.VII (Alb) 677/18.** Cross and Cockade International

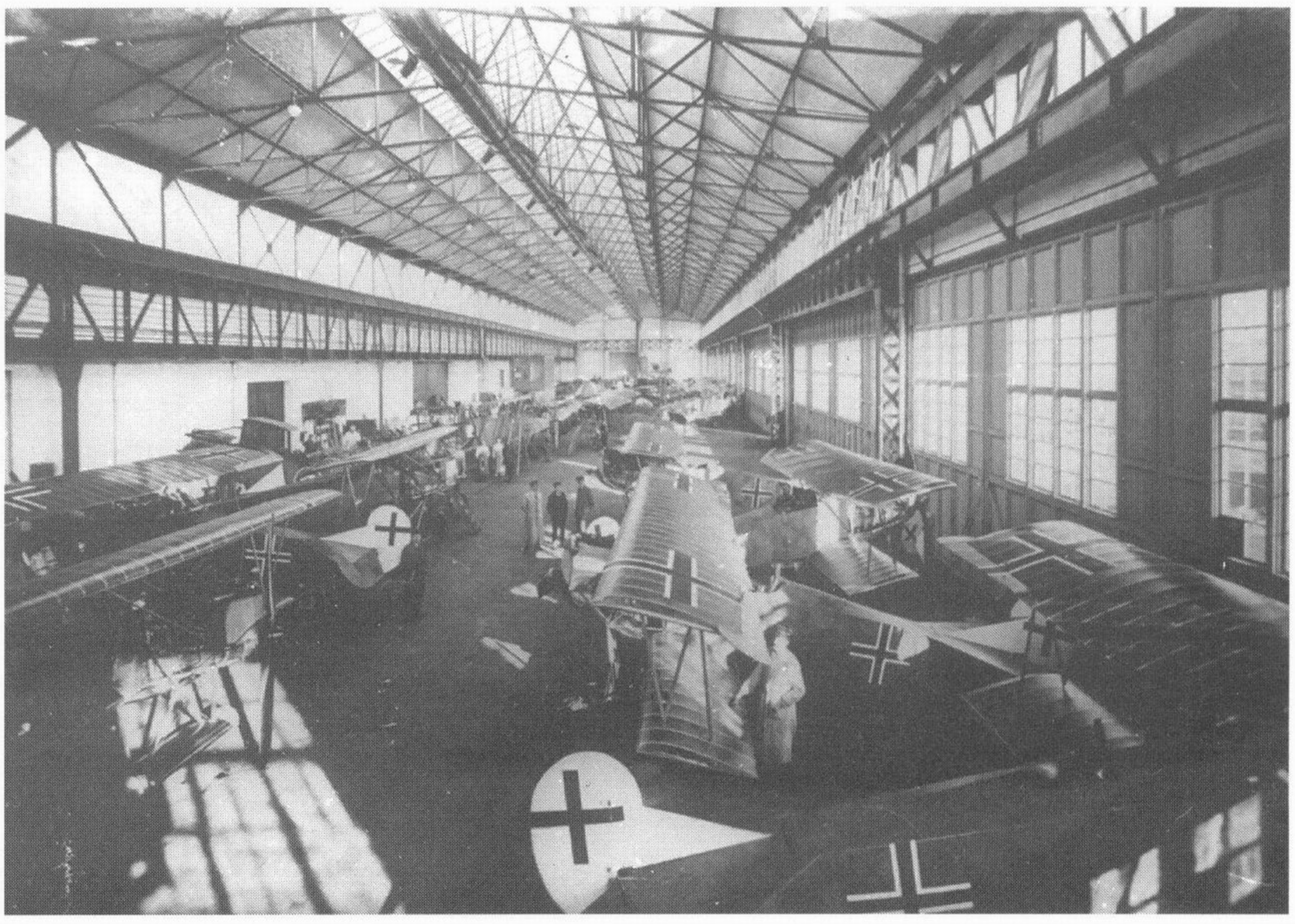
Specification – Fokker D.VII

Engine:	160hp Mercedes D.III/175hp Mercedes D.IIIa/185hp BMW IIIa
Weights:	Empty 700kg (1,540lb); loaded 850kg (1,870lb)
Dimensions:	Span 8.70m (28ft 6in); length 6.95m (22ft 9in); height 2.95m (9ft 8in)
Performance:	Maximum speed 186.5km/h (116mph) Rate of climb 1,000m (3,300ft) in 3.8 minutes (Mercedes), 2.5 minutes (BMW); 5,000m (16,000ft) in 31.5 minutes (Mercedes), 16 minutes (BMW)
Armament:	Two LMG 08/15 machine-guns synchronized to fire through the propeller arc



Fokker D.VII (OAW) 8529/18. Cross and Cockade International

***(Right)* Assembling a Fokker D.VII at Schwerin.** Cross and Cockade International

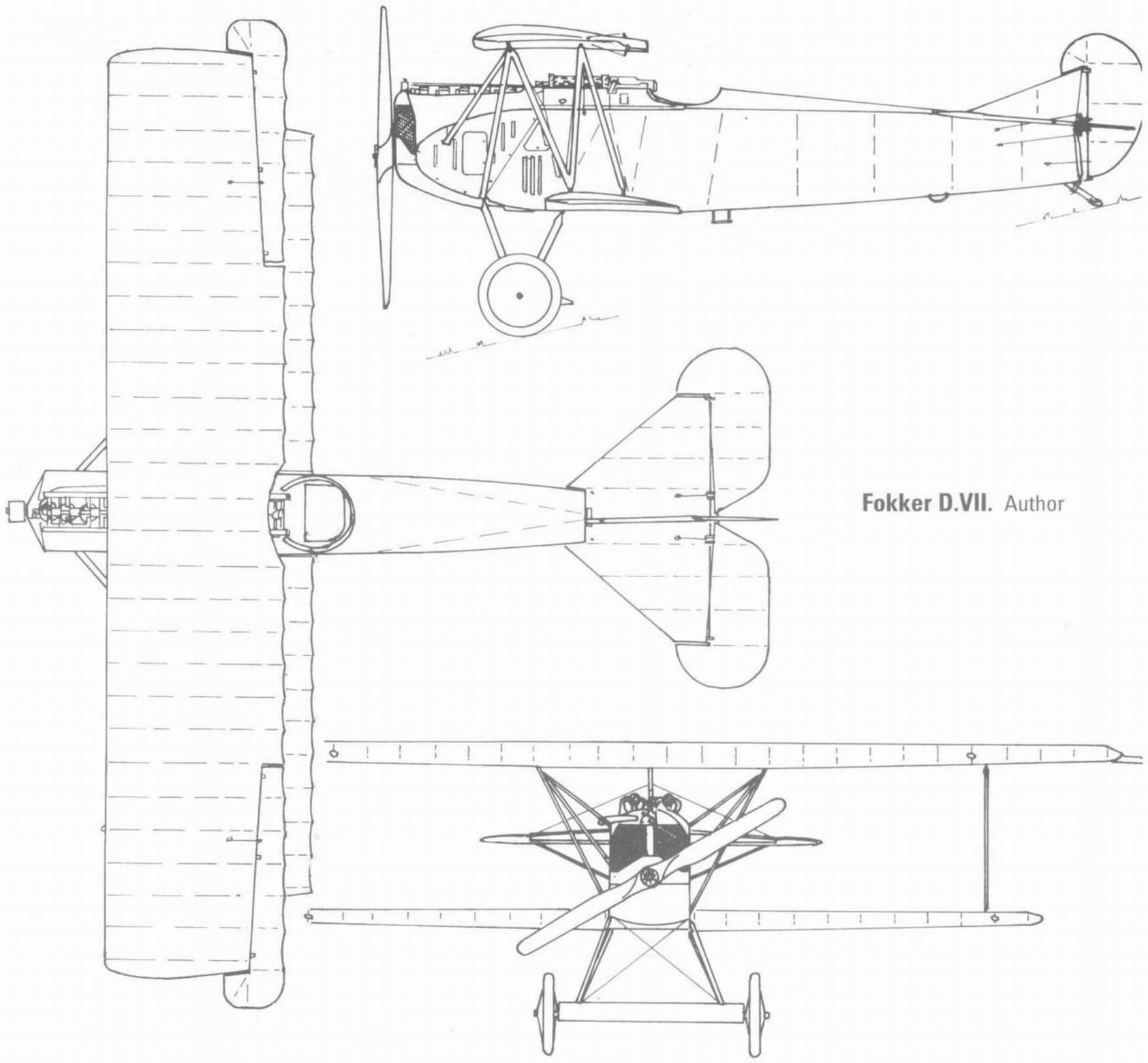


***(Left)* Albatros-built Fokker D.VIIs in the Albatros factory at Johannisthal. A De Havilland D.H.9 can be seen in the centre left of the photograph.** Cross and Cockade International

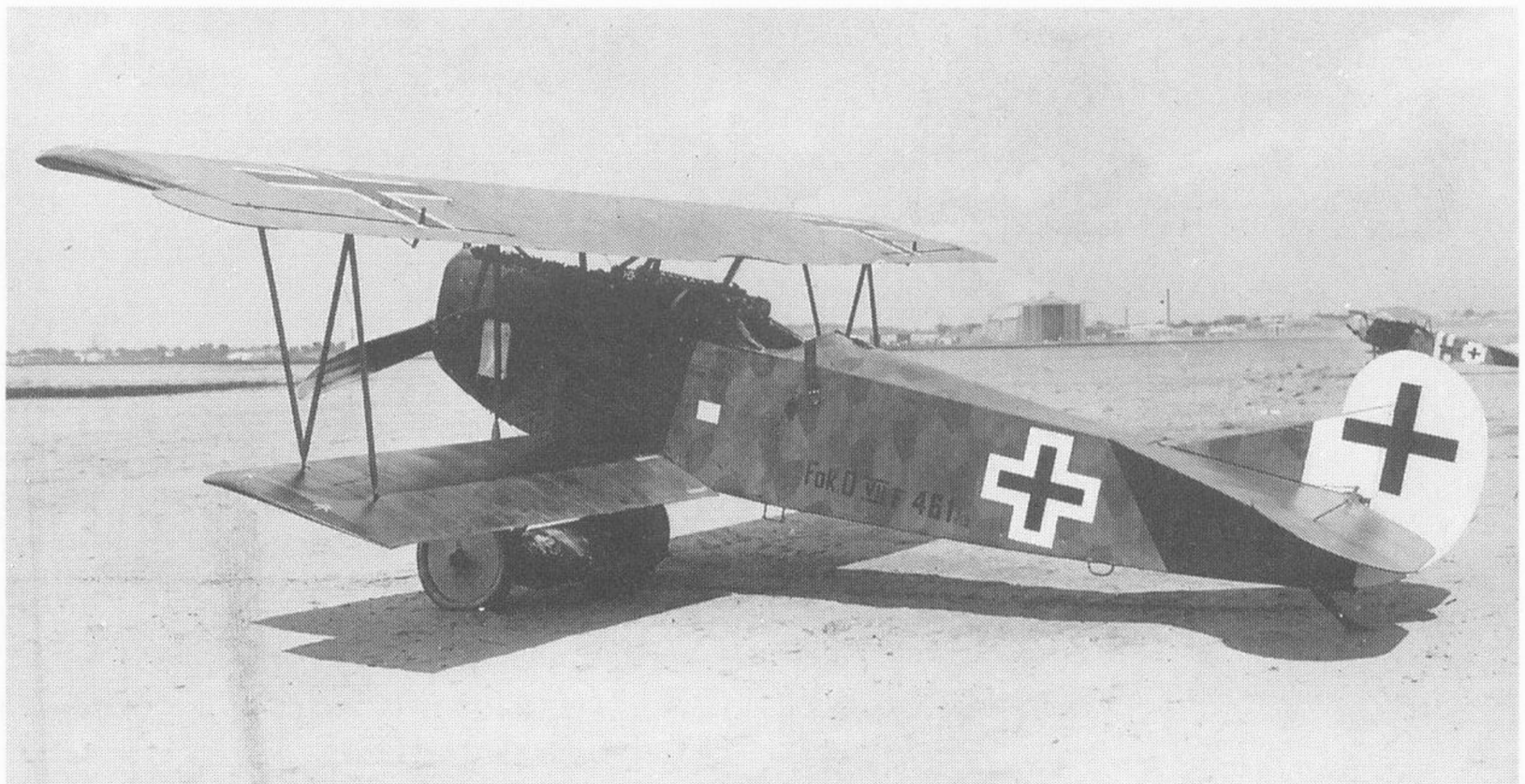
it was robust and capable of absorbing combat damage. There is no record of any D.VII suffering the structural problems that plagued the Dr.I.

But the early D.VIIs also had faults and some of these were serious. At first, the closely cowled 160hp Mercedes D.III engine proved to be prone to overheating. The solution to this was additional louvres in the cowling sides, and a number of variations of styles and patterns of louvres resulted. On later machines, some of these were factory-made but others were the product of the Jasta fitters in the field.

Another serious fault was that the aluminium ammunition tanks were placed close to the engine and consequently liable



Fokker D.VII. Author



Fokker D.VIIF 461/18. Cross and Cockade International

D.VII Variants

The main variations in the D.VII build standard arose simply from the fact that the production was spread between the three different companies and that, not surprisingly, each of these had their own way of doing things. Fokker's practice was to keep manufacturing drawings to a minimum and to rely upon jigs and fixtures to reproduce the main components. Albatros, a more sophisticated company, was used to working from manufacturing drawings and, upon receipt of the contract for production of the D.VII, set about producing its own drawings by reverse engineering from the sample aircraft provided. Albatros (OAW), as a subsidiary of Albatros, may have relied upon the parent company's drawings but equally may well have produced their own in a similar manner.

Other visible variations occurred because the D.VII could be powered by one of three engines; each had its own distinctive exhaust system. Next was the prominent nose-mounted radiator. These came in a variety of shapes, depending upon which subcontractor had manufactured a particular unit. The final and, perhaps, the most obvious but least important variation was in the finish applied to the complete product.

Very early, Fokker-produced D.VIIs were finished in a manner similar to the earlier Dr.I triplane. Upper surfaces were painted with a brushed-out, streaked khaki brown finish and under surfaces with a 'solid' turquoise finish. Cross fields were left in plain clear varnish and earlier machines carried the old style *Eisernekreuz* (iron cross) national markings. Later production machines were covered in four- or five-colour printed lozenge fabric and the later style *Balkenkreuz* (a straight edged-cross) outlined in white. The metal surfaces of the engine cowling were painted dark grey. Early Fokker-produced D.VIIs carried serials that were simple, such as 'Fok D.VII 244/18'. Later production models fitted with the 200hp Mercedes had serials with an additional 'F' – 'Fokker D.VII F 4330/18'.

Albatros-produced machines were all covered in four-colour lozenge fabric with *Balkenkreuz* markings outlined in white. Metal nose panels were painted in dark grey paint. Indicating the source of manufacture, serials were marked thus: 'Fok D.VII (Alb) 5220/18'.

Albatros (OAW)-produced machines were covered in four- or five-colour lozenge fabric with the *Balkenkreuz* markings outlined in white. Metal nose panels were usually painted in dark green with purple patches to match the lozenge fabric finish. Indicating the source of manufacture, serials were marked thus: 'Fok D.VII (OAW) 8414/18'.

In many cases, unit and personal markings were painted over the serial numbers, in which case it was not usual to repaint the serials over the markings.

to be heated by it. This caused a number of fires in the air, several resulting in fatalities and shaking the confidence of the pilots in their new machines. Machines were seen to trail phosphorous-coloured smoke before bursting into flames, and the ammunition became suspect. This was confirmed when one pilot, Ltn Bender of Jasta 4, escaped by parachute from his burning machine. Use of incendiary ammunition in the D.VII was banned for a time while a number of solutions were tried. These included wrapping the tank with insulating material and cutting yet more louvres in the cowling panels. The

The Pilots' View

This is one of the few personal mentions of the advent of the D.VII into service, by Rudolf Stark, who commanded Jasta 35b at the time. Here, having reported to the Technical Officer at the Park and signed the appropriate papers, his Jasta becomes the owner of six new Fokker D.VIIs. He continues:

Fokker is still the Old Fokker, for every new machine he brings out is a considerable improvement on the last. Other firms also bring out new machines, but they are generally content with a few superficial alterations that do not effect much improvement in the flying and fighting capacities.

Our machines are ready. Everything is in order. I climb into my seat, which wears a somewhat unfamiliar aspect. I try the stick. Everything works easily.

The engine roars. The ground whirls away from under me. Swiftly we rise; the aerodrome and its hangars dwindle rapidly. The machines climb wonderfully and answer to the slightest movement of the controls. That will be a joy when we try our first fight in them. So now homeward with all possible speed.

We cannot go to the front today, but we practise our new birds instead. The more we get to know them, the better we are pleased with them. Whatever one tries – steeply banked turns, dives, loops – they always answer the controls beautifully; one catches the machine at once. They give a magnificent feeling of safety.

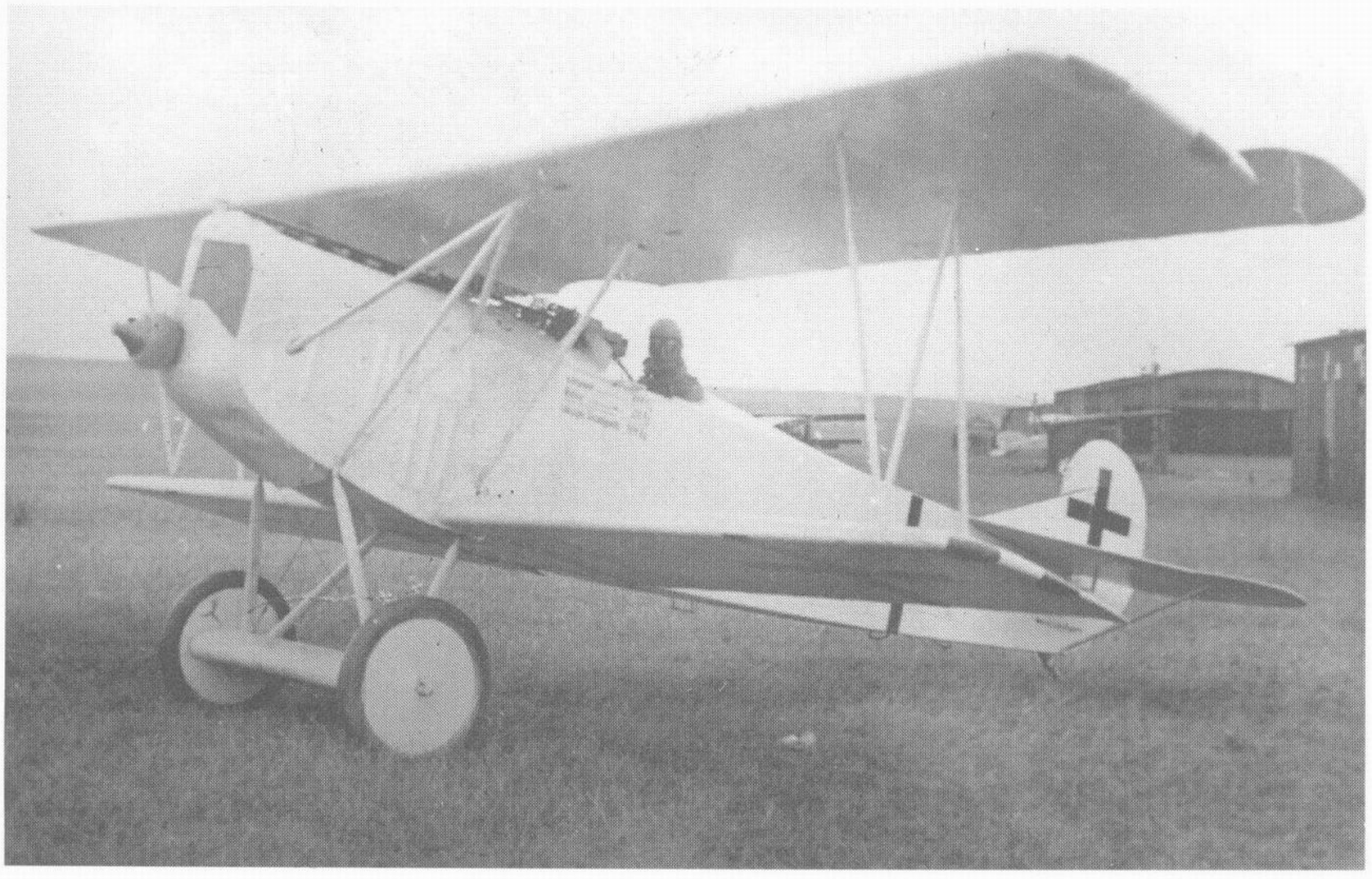
Rudolf Stark, *Wings of War*

(Right & below) **An unidentified Fokker D.VII (Alb) of Jasta 17; the pilot is not known.** HAC/UTD

problem was eventually solved when a cooling duct that passed through the radiator was introduced.

A further major, but curable, problem was the fact that the D.III engine was not really adequate for its task. As the summer months approached it became obvious that more powerful engines would be needed to enable the D.VII to continue to match the latest generation of Allied fighters. Here a solution was available, albeit in limited numbers: the over-compressed 180/200hp Mercedes D.IIIau and the 185hp BMW.IIIa engines. Production of the BMW engines was slow so their availability for installation in new D.VIIs suffered. During this period, Fokker bitterly complained that his

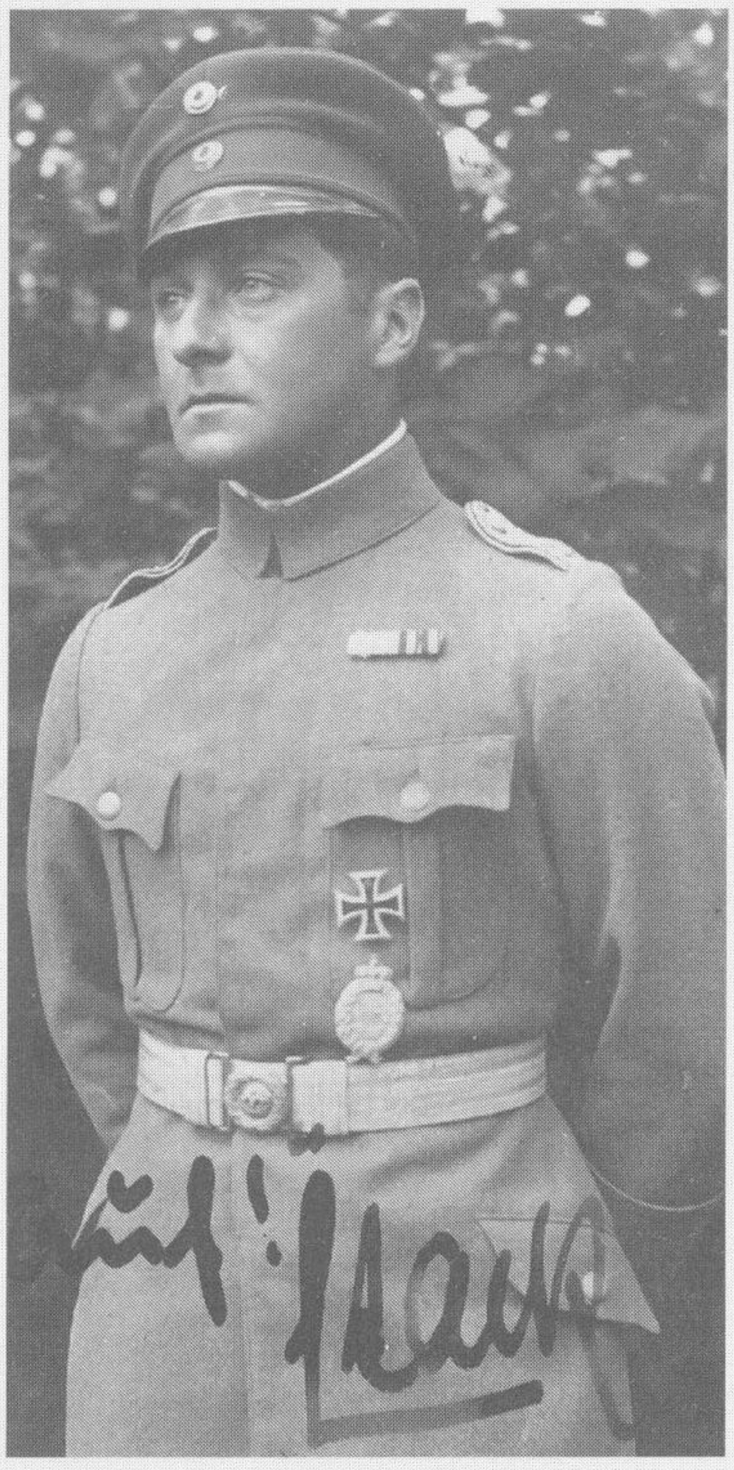
Hermann Göring's all-white D.VIIF 5125/18. Cross and Cockade International



Another view of Göring's D.VII. Cross and Cockade International

Rudolf Stark

Ltn Rudolf Stark was born on 11 February 1897. He served with the 2nd Bavarian Uhlan Regiment. He joined the Air Service, and after training was posted to FA(A)b296 on 15 November 1917, but requested a transfer to fighters. After training at Jastaschule 11, he joined Jasta 34b on 18 January 1918. He was posted to Jasta 77b as acting commander on 24 May 1918 and confirmed as commander of Jasta 35b on 7 June 1918. At the end of the war his score stood at eleven victories and he had been awarded the Iron Cross 1st and 2nd Class and the Bavarian Military Merit Order 4th Class with Swords. He survived the war and wrote *Wings of War*, which was first published in 1933. He was also a talented aviation artist.

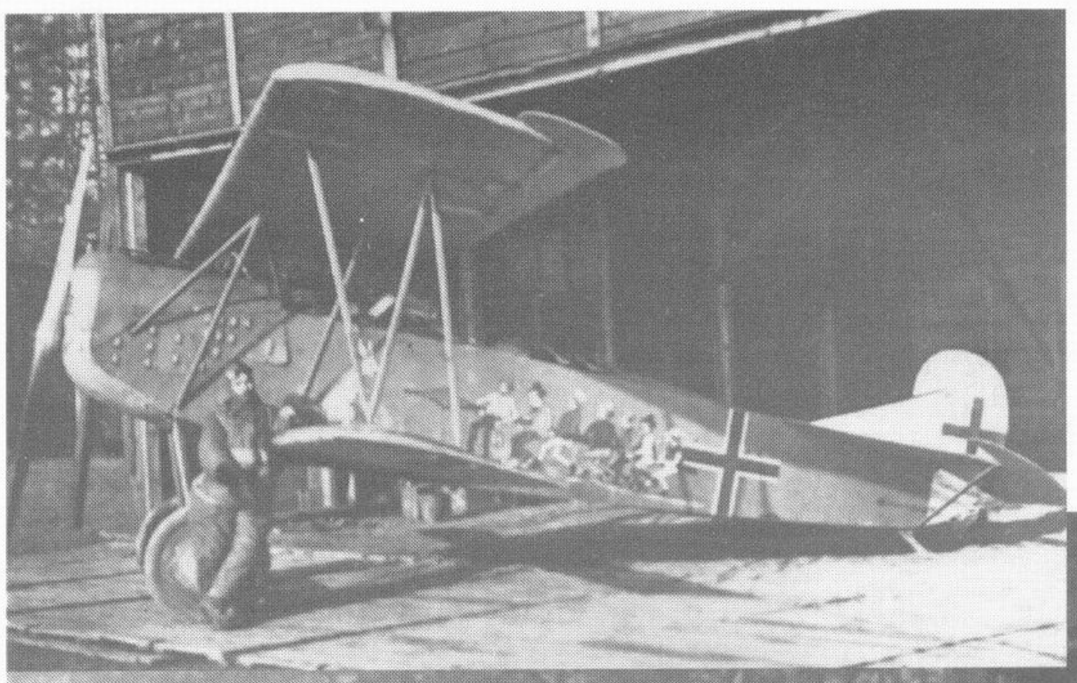


Leutnant Rudolf Stark.
Cross and Cockade International

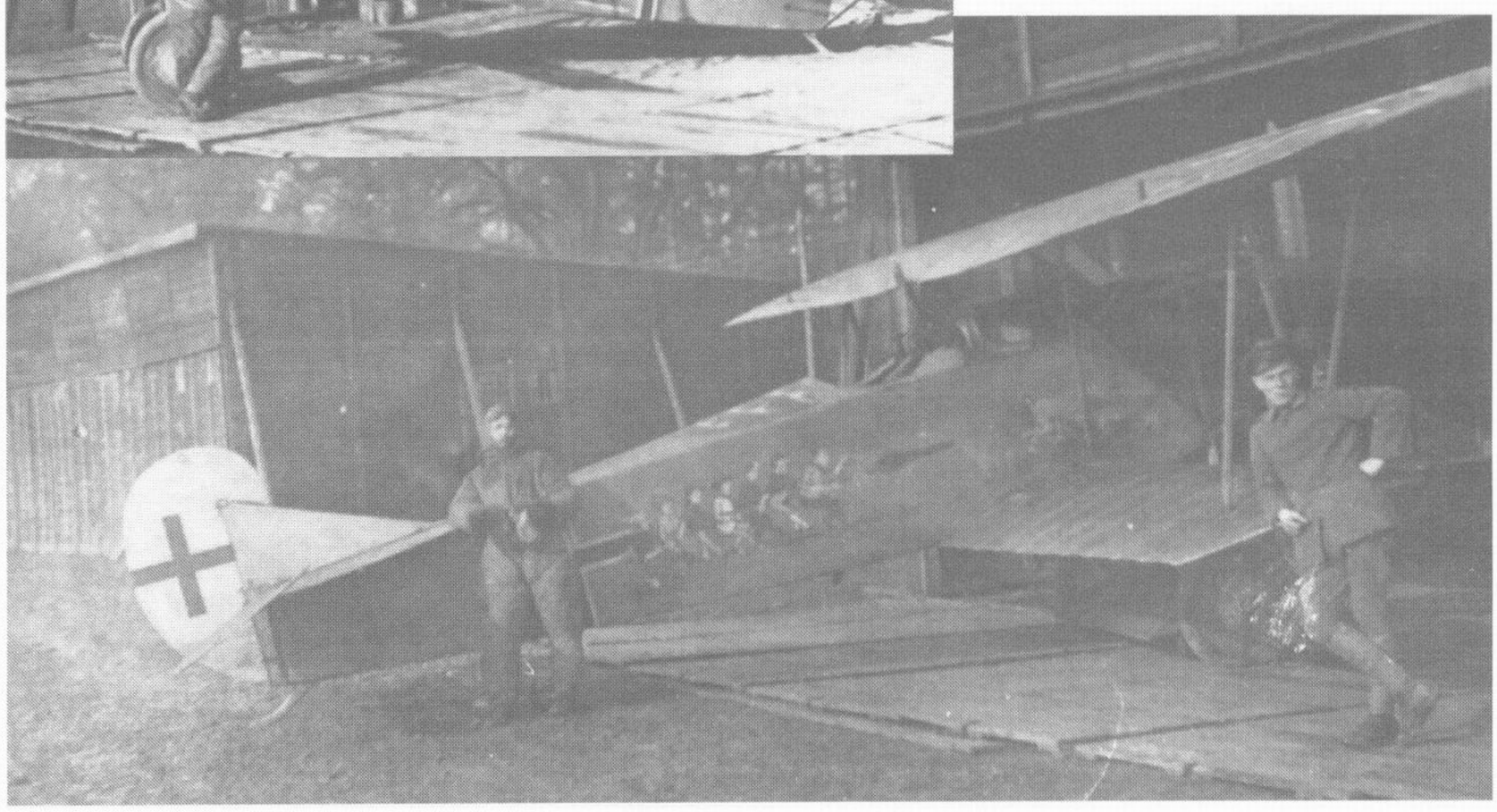
production line was starved of the BMW engines and that he had to make do with the 'less attractive' Mercedes products, the BMW engines being supplied to Albatros and Albatros (OAW). Contributing to this problem was the fact that some of the precious BMW engines were also being supplied to Pfalz for installation in their new D.XII biplane fighter.

Operational Service

The D.VII was an undoubted success and pilots in the lesser-known Jastas and Kestas waited impatiently for the numbers available to reach levels where their units could be re-equipped. It was a fairly easy machine to fly and it has been said that 'it made good pilots out of mediocre ones and aces out of the good'. Indeed, many German aces built up their scores while flying the D.VII. In their D.VIIs, German pilots could afford to attack any Allied machine that came their way, usually without fear of failure. Consequently, its impact on the pilots of the Allied air forces was immense and it was treated with great respect by all who came into contact with it – even to



Fokker D.VII (OAW) 4649/18 of Jasta 65's Gefr Scheutzel painted with 'The Seven Swabians' from the Grimm fairy tale. Cross and Cockade International



***(Above)* Ernst Udet with one of the Fokker D.VIIs that he flew.** Cross and Cockade International

Fokker D.VII (Alb) 642/18 flown by Hans Joachim von Hippel of Jasta 71. Cross and Cockade International

Josef Mai

Ltn Josef Mai was born in Berlin on 3 March 1887 and joined the Air Service in May 1915, qualifying as a pilot on 28 July 1916. He first served with Kasta 29 of KG5. After training as a fighter pilot he was promoted to *Offizierstellvertreter* and posted to Jasta 5 in March 1917. He became one of the unit's top scorers and was commissioned in August 1918 and recommended for the Orden Pour le Mérite (but failed to receive it because of the end of the war). At the end of the war, his score stood at thirty victories, the last fifteen of which were when flying a Fokker D.VII. His awards included the Iron Cross 1st and 2nd Class, and the Golden Military Merit Cross. He died in Germany in 1982.

Leutnant Josef Mai.
Cross and Cockade International

the extent that its performance was greatly exaggerated by those who came up against it and survived.

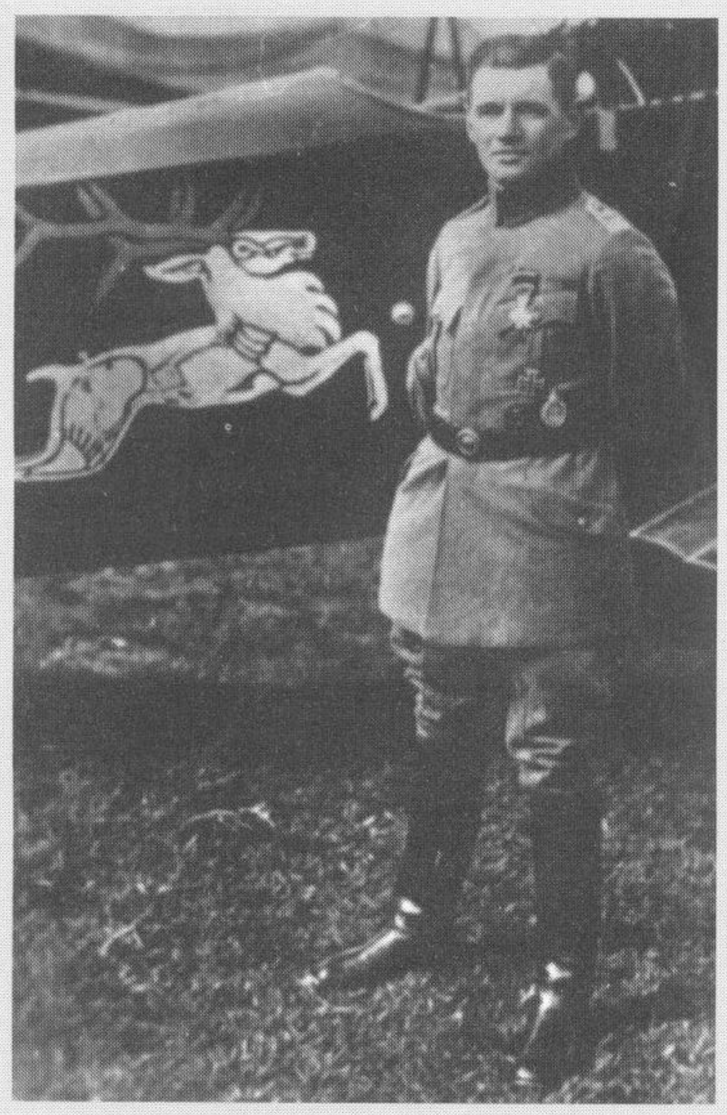
Jagdgeschwader I being the first unit to be equipped with the type, in early April 1918, it is not surprising that Manfred von Richthofen was one of the first service pilots to fly the D.VII. What is surprising is that, as an enthusiastic supporter of V.11 during the January/February competition, he does not appear to have flown the machine in combat, but simply used it to visit other units while continuing to use his Dr.Is for combat. We must resist the temptation to speculate as to why this should be but, as a great fighter leader and superb tactician, he must have appreciated the advantages that the D.VII would have given him. Possibly he felt more at home in his Dr.I or,

Carl Degelow

Ltn Carl Degelow was born in Munsterdorf on 5 January 1891. He worked in cement factories in the USA between 1912 and 1913 and then returned to Germany to enlist when war was declared. He joined Infantry Regiment No. 88 and saw action on both the Western and Eastern Fronts.

Commissioned on 31 July 1915, he transferred to the Air Service in 1916. After training, he joined FA(A)216 on the Somme, flying Albatros C.Vs on artillery co-operation missions. After scoring two victories, he transferred to Jasta 36 but wounded ground personnel during air-to-ground firing practice and was transferred to Jasta 7 where he continued until 16 May 1918, when he went to Jasta 40. He took command of this unit on 11 July 1918 and continued to fly with it until the end of the war, by which time his score stood at thirty victories. He was the last pilot to receive the Orden Pour le Mérite and he had also received the Knight's Cross with Swords of the Royal House of Hohenzollern Order.

After the war he fought against the Bolsheviks with the Hamburger Zeitfretwilligen Korps. He served with the Luftwaffe during World War Two, reaching the rank of Major. After the war he went into business and died on 9 November 1970.



Leutnant Carl Degelow.
Cross and Cockade International

Fokker D.VII (Alb) 817/18 of Offstv Fritz Blumenthal of Jasta 53 was brought down by the British on 12 August 1918 and was allocated the RAF number G/5Bde/20.
Cross and Cockade International

Eric Loewenhardt

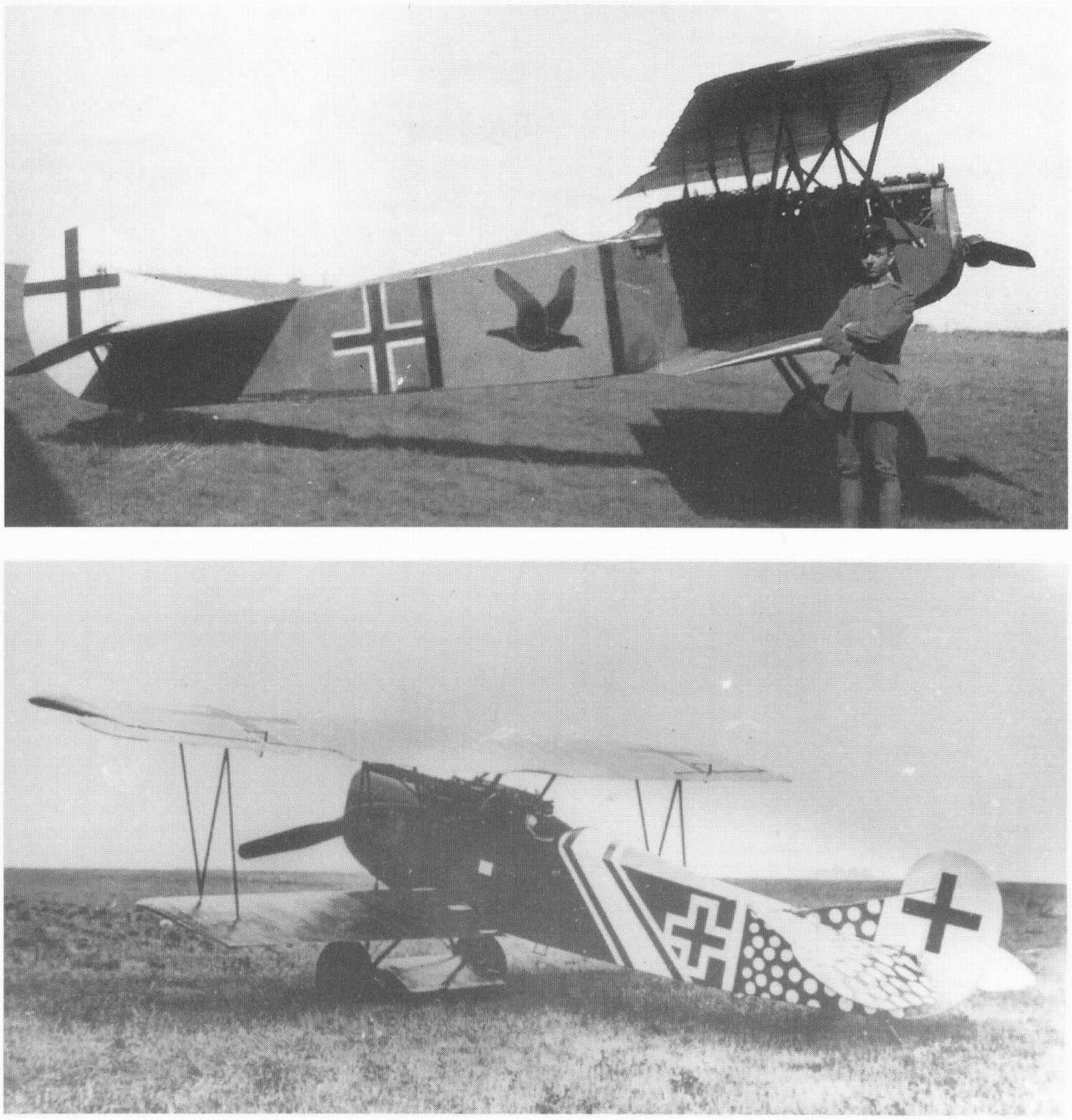
Ltn Eric Loewenhardt was born in Breslau on 7 April 1897. He was educated at the cadet school at Lichterfelde and posted to Infantry Regiment No. 141 on the outbreak of war. After service on the Eastern front, he was commissioned on 2 October 1914 and, later, wounded. Recovered, he returned to duty in the Carpathian Mountains and transferred to the Alpine Corps. He next transferred to the Air Service, first as an observer and then, after training, as a pilot. He served with FA(A)265 and then trained as a fighter pilot. Qualifying, he was posted to Jasta 10 where he became one of the unit's top scorers. Aged 21, he was given command of Jasta 10 on 1 April 1918 and took over as acting commander of JG1 when Richthofen was killed. Loewenhardt was killed after a collision with Ltn Alfred Wenz on 10 August 1918. Both pilots used their parachutes but Loewenhardt's failed to open. At the time of his death his score stood at fifty-four victories. His awards included the Iron Cross 1st Class, the Knight's Cross with Swords of the Royal House of Hohenzollern, the Austrian Verdienstkreuz 2nd Class and the Orden Pour le Mérite.

Leutnant Erich Loewenhardt.
Cross and Cockade International

equally possibly, he was waiting for the numbers available to be such that he could lead the complete group in combat in the type. It may also have been that the machines originally supplied were fitted with the 160hp Mercedes D.III engine, and that he was aware of their lack of performance and preferred to wait for the availability of the 185hp BMW IIIa engine.

***(Right)* Fokker D.VII (Alb) probably belonging to Jasta 36.** HAC/UTD

***(Below right)* A familiar photograph of an unidentified Fokker D.VII.** Cross and Cockade International



Rudolf Berthold

Hptmn Rudolf Berthold was born on 24 March at Ditterswind in northern Bavaria. He joined the 3rd Brandenburg Infantry Regiment No. 20 in 1910 and learned to fly in 1913. He joined the Air Service at the outbreak of war and flew as an observer with FFA23.

Changing to single-seaters, he joined Kek Vaux in 1916 but was injured when he crashed his Pfalz E.IV. In August 1916, he formed Jasta 4 and then, handing this over to Hans Buddeke, he took command of Jasta 14. In May 1917, he was shot down and again seriously injured. He commanded Jasta 18 from August 1917 until he was wounded again in October 1917. He was given command of JGII in March 1918 and continued in that role until injured again on 10 August 1918.

By the end of the war his decorations included the Iron Cross 1st and 2nd Class, Saxon Albert Order, Knight 2nd Class with Swords, the Knight's Cross of the Royal House of Hohenzollern Order and the Orden Pour le Mérite, and his score stood at forty-four victories. After the war, he joined the *Freikorps* and was killed in Harburg on the Elbe by rioters.

Hauptmann Rudolf Berthold.
Cross and Cockade International

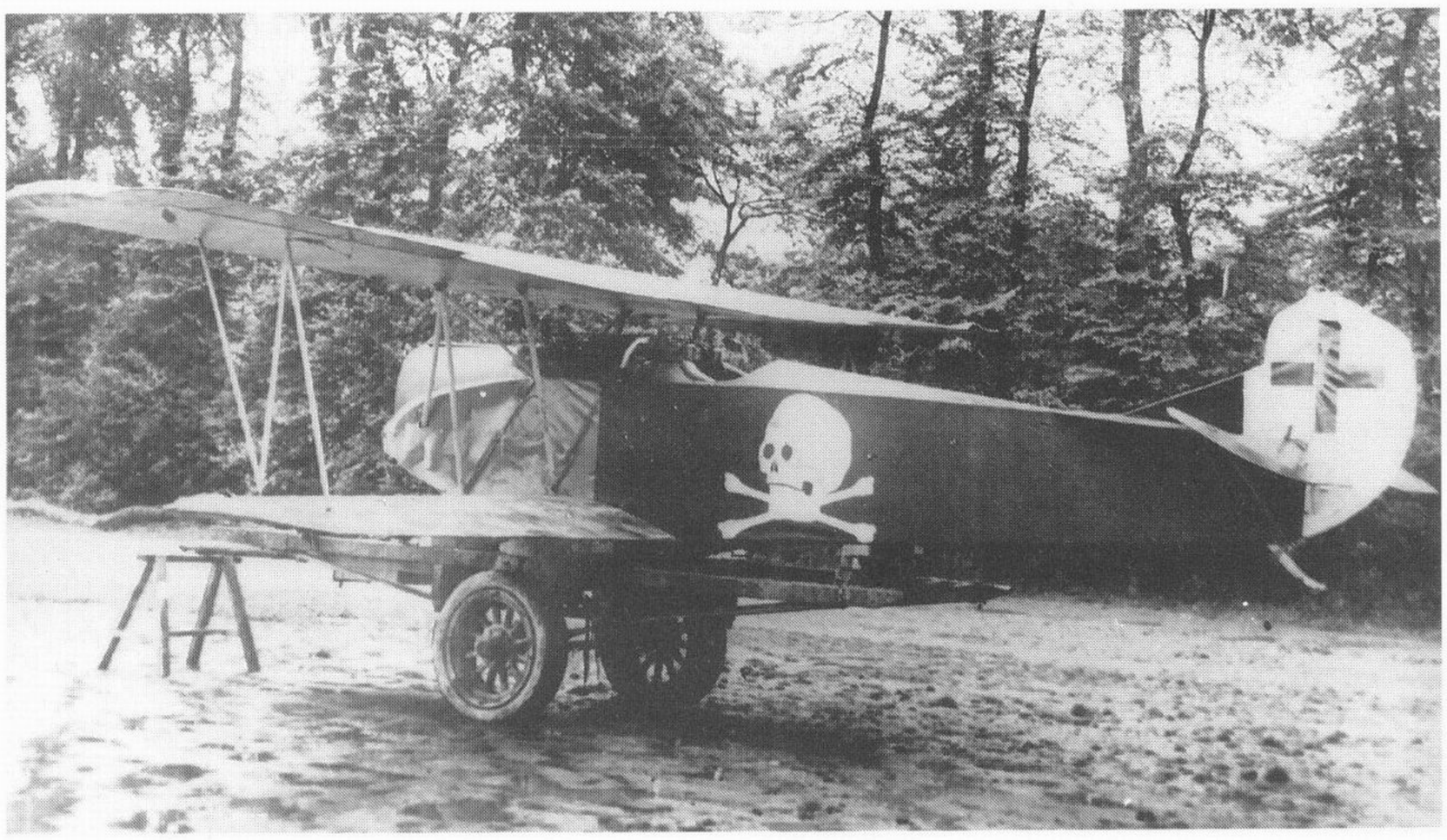
Emil Thuy

Ltn Emil Thuy was born in Hagen, Westphalia on 11 March 1894. He volunteered for duty when war was declared and served with the 3rd Rhineland Pioneer Regiment on the Western Front. He was wounded in October and declared unfit for military service.

He successfully applied to the Air Service and trained as a pilot. He was posted to FFA53 on 10 July 1915 and commissioned on 26 March 1916. He continued to serve with FFA53 until November 1916, when he went to Jastaschule. He was posted to Jasta 21 on 28 January 1917. He was given command of Jasta 28 on 26 September 1917 and of Jagdgruppe 7 on 6 June 1918. He continued to lead it until the end of the war. By this time, his score stood at thirty-five victories and he had been awarded the Iron Cross 1st and 2nd Class, the Knight's Cross with Swords of the Royal House of Hohenzollern Order, the Knight's Cross of the Military Merit Order of Wurttemburg and the Orden Pour le Mérite.

After the war, he continued in aviation; he was killed in a flying accident in Russia on 11 June 1930 while training pilots for the newly formed Luftwaffe.

Leutnant Emil Thuy.
Cross and Cockade International



Another familiar photograph. Fokker D.VII 382/18 belonging to Ltn Georg Hantelmann of Jasta 15, but brought down by the British while being borrowed by Ltn Kurt Wusthoff. The fuselage was overpainted with a red nose and a dark blue rear including tailplane and rudder. The wheel covers were also red. The skull and cross bones were white. After landing close to the French lines the machine was handed over to the RAF, who allocated it the number G/5Bde/17. Cross and Cockade International

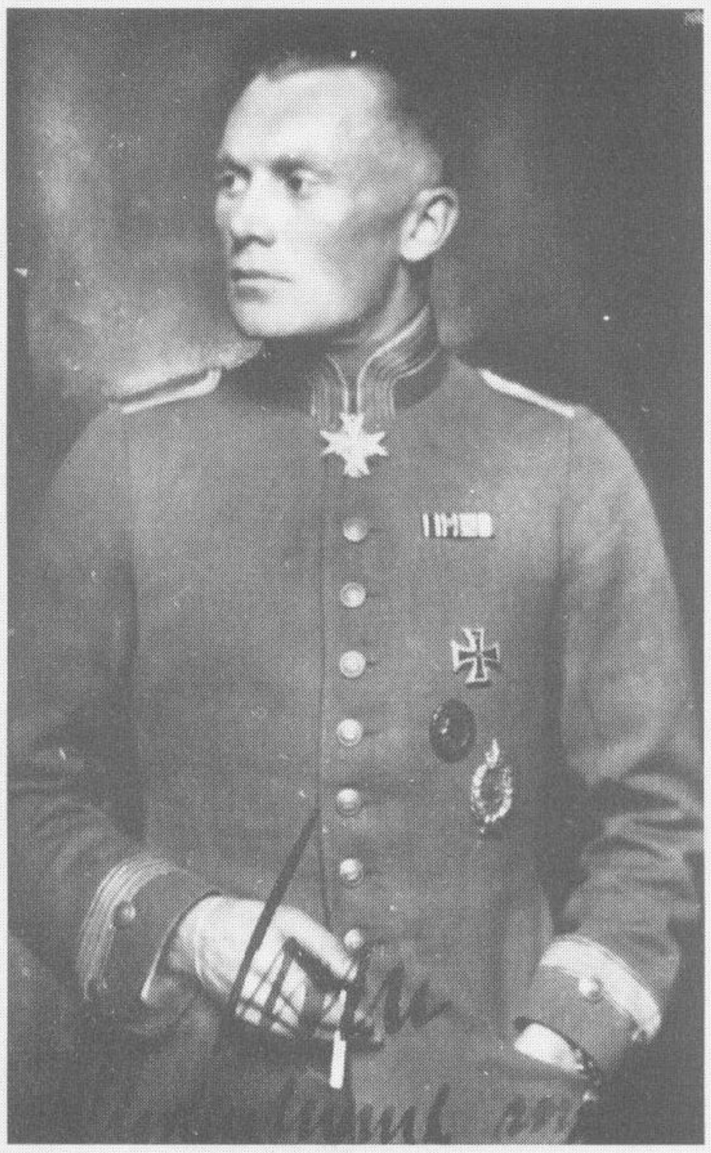
Karl Bolle

Rittmeister Karl Bolle was born in Berlin on 20 June 1893 and read economics at Oxford University. In 1914 he served with the 7th von Seydlitz Kurassier Regiment, first in France and then in Poland.

He transferred to the Air Service in 1915. He was with KG4 in July 1916 and then in Kampstaffel 23 with Lothar von Richthofen as his observer. He was wounded in October 1916 and joined Jasta 28 on his recovery in the summer of 1917. He was given command of Jasta 2 on 2 February 1918 and continued in that role until November 1918.

By the end of the war his score stood at thirty-six victories and he had been awarded Iron Cross 1st and 2nd Class, the Order of Max Josef, the Mecklenburg Military Cross of Honour with Swords, the Knight's Cross with Swords of the Royal House of Hohenzollern Order, the Wurttemburg Friedrich Order, Knight 2nd Class with Swords and the Orden Pour le Mérite.

After the war he remained in aviation and was given the post of Director of the German Transport Flying School in the early 1920s. He was later in charge of all pilot training and became an advisor to the Luftwaffe in the 1930s. He died in Berlin on 9 October 1955.



Rittmeister Karl Bolle.
Cross and Cockade International

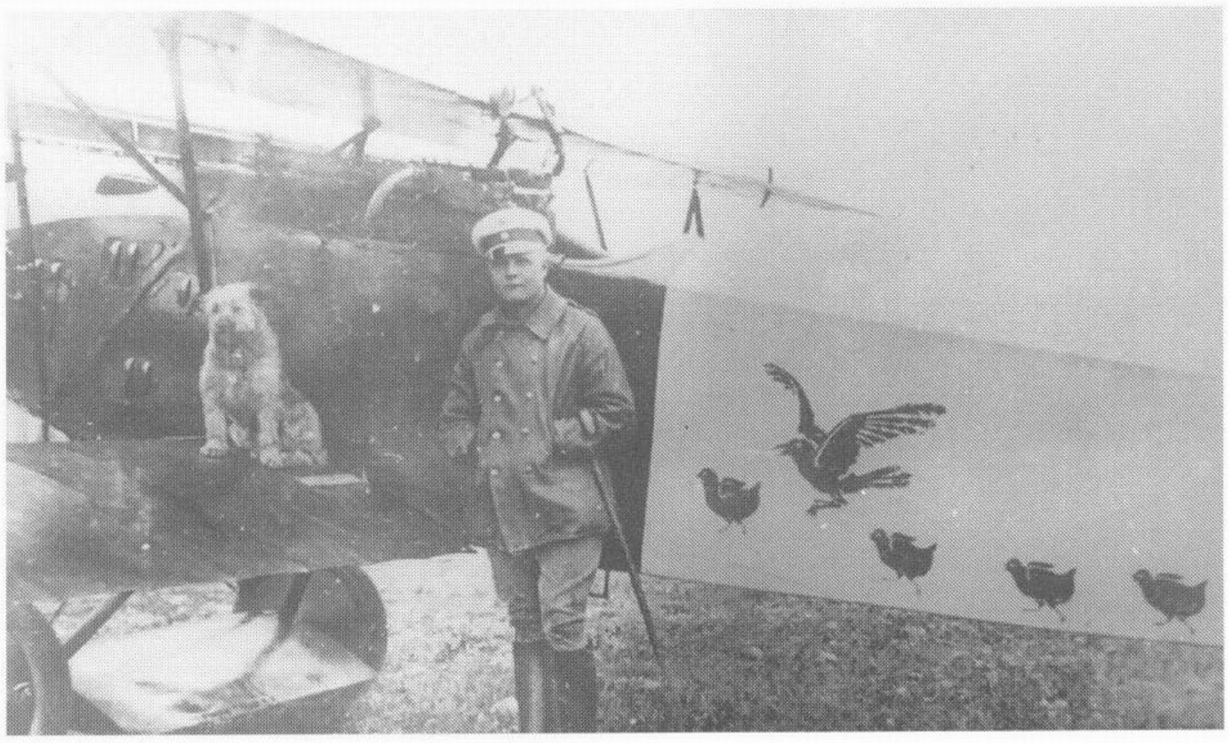
Carl Menckhoff

Oblt Carl Menckhoff was born in Herford, Westphalia, on 14 April 1883. He joined the Army in 1903 and was discharged with appendicitis soon afterwards. He joined Infantry Regiment No. 106 when war was declared but, after being wounded, was declared unfit for infantry service and transferred to the Air Service.

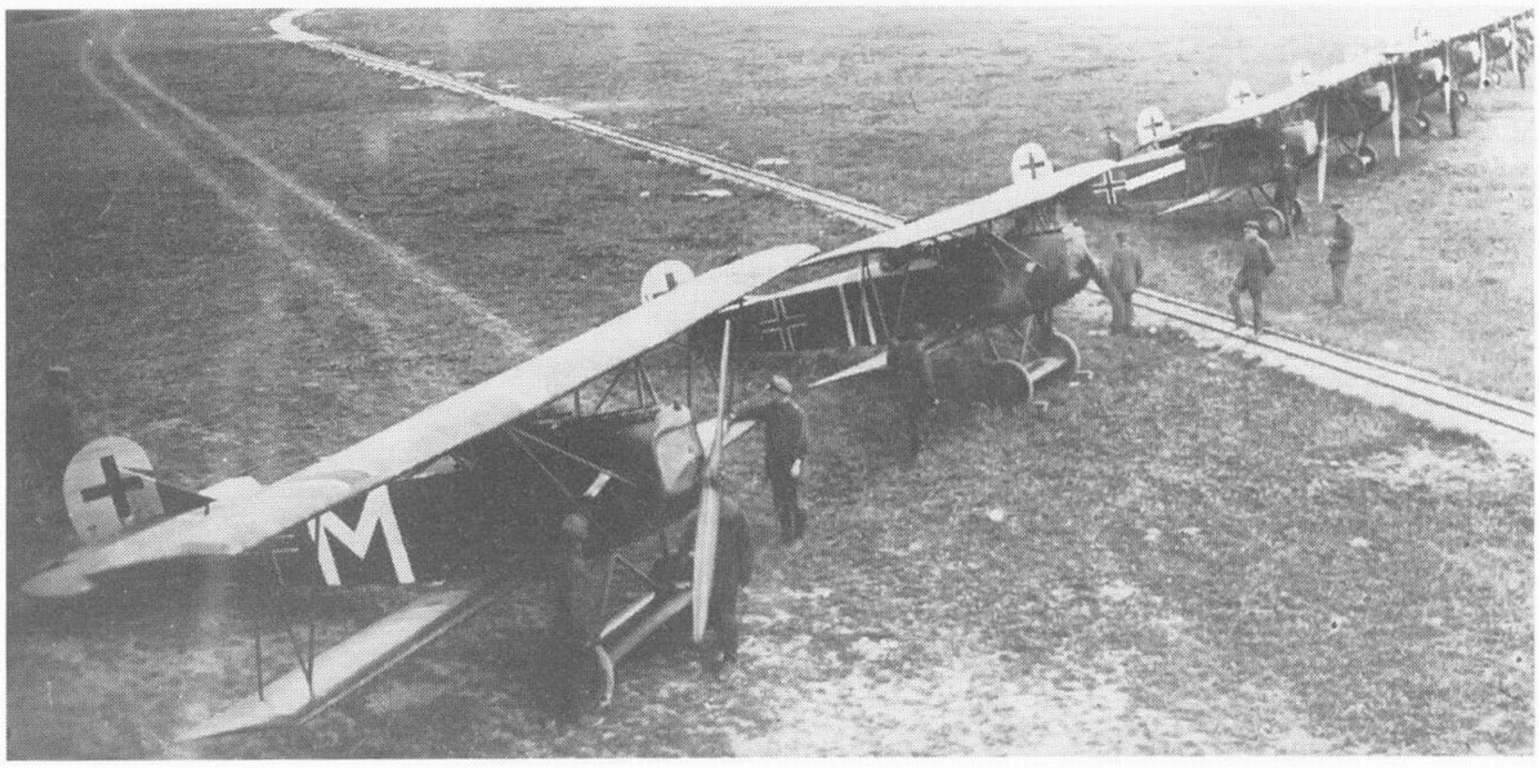
He served in Russia and then for a period as an instructor until joining Jasta 3 early in 1917. He was shot down and wounded on 28 September 1917 and again early in 1918. He was commissioned and given command of Jasta 72 on 11 February 1918. He was shot down by 1st Lt W. L. Avery of the 95th Aero Squadron on 25 July 1918, spending the rest of the war as a POW in France.

By this time his score stood at thirty-nine victories and he had been awarded Iron Cross 1st Class, the Knight's Cross with Swords of the Royal House of Hohenzollern Order and the Orden Pour le Mérite. He was still in a POW camp in August 1919 but escaped into Switzerland where he stayed and settled down. He died there in 1948.

Oberleutnant Carl Menckhoff.
Cross and Cockade International

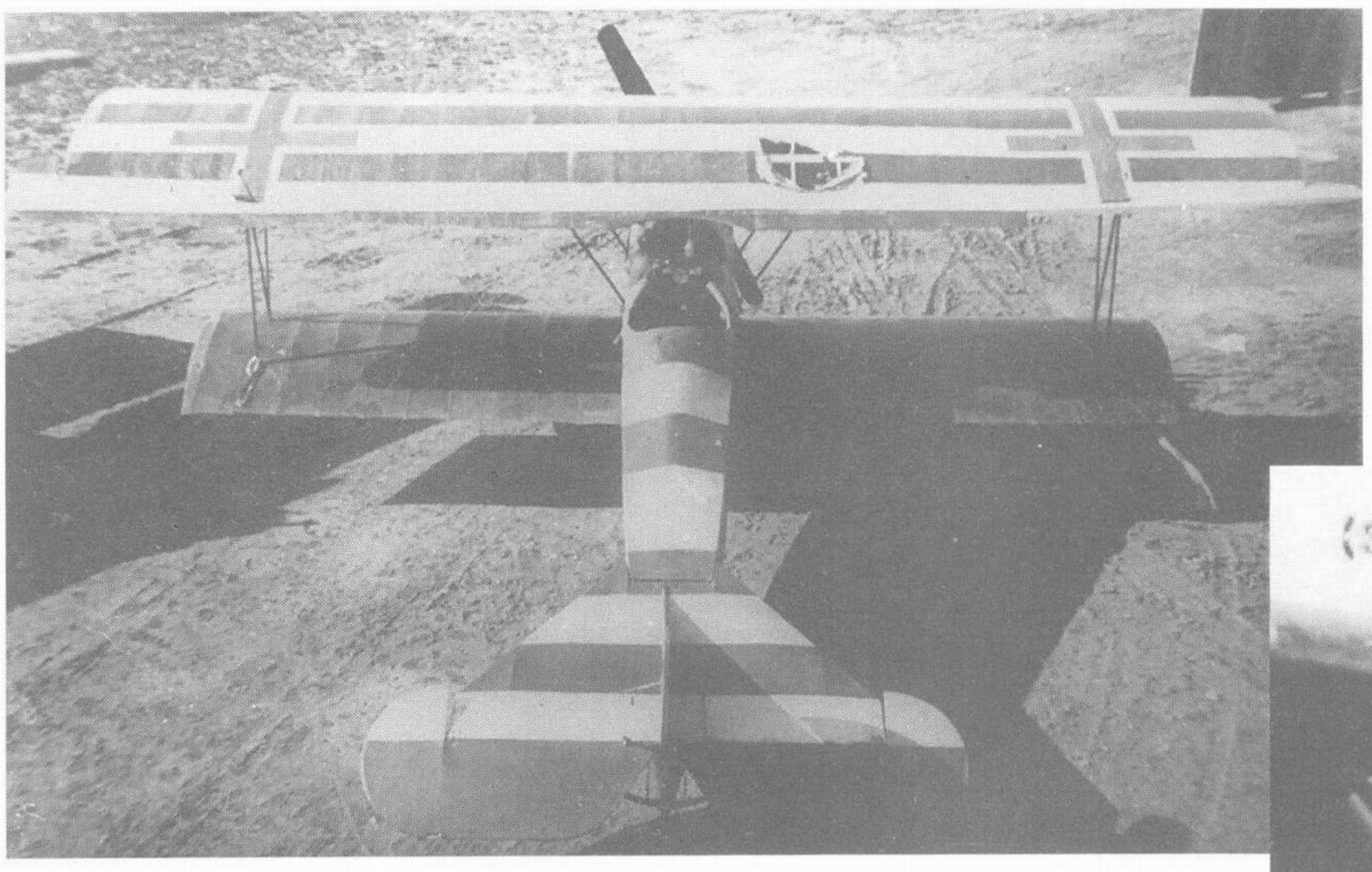


Fokker D.VII flown by Ltn Gunther von Buren of Jasta 18. All forward areas of Jasta 18 machines (including upper surfaces only of the wings) were painted bright red, and the rear areas white. The raven and chicks were in black. Cross and Cockade International

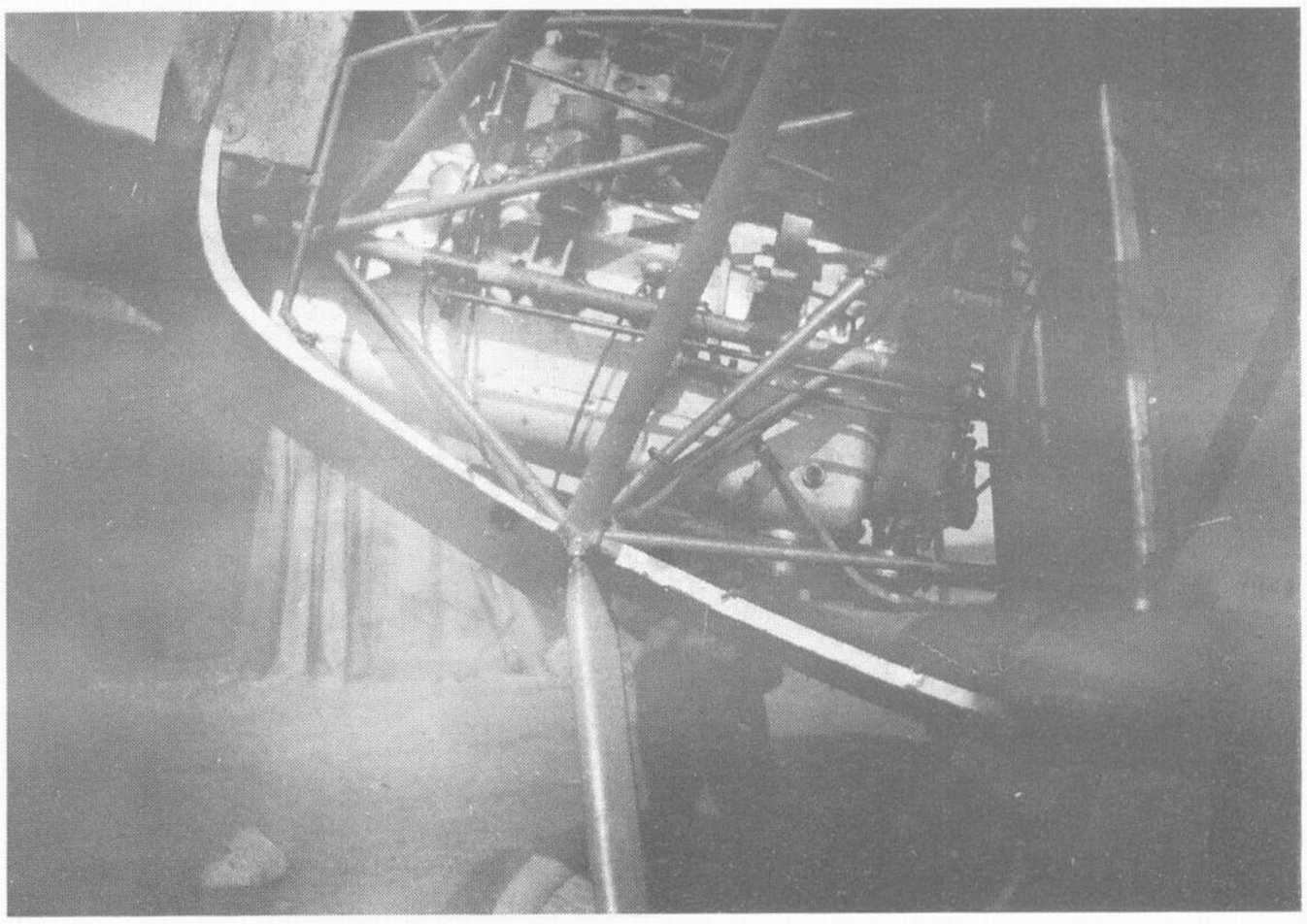


Fokker D.VIIs of Jasta 72. The machine nearest the camera is that belonging to Ltn Karl Menckhoff, the Staffelführer. Cross and Cockade International

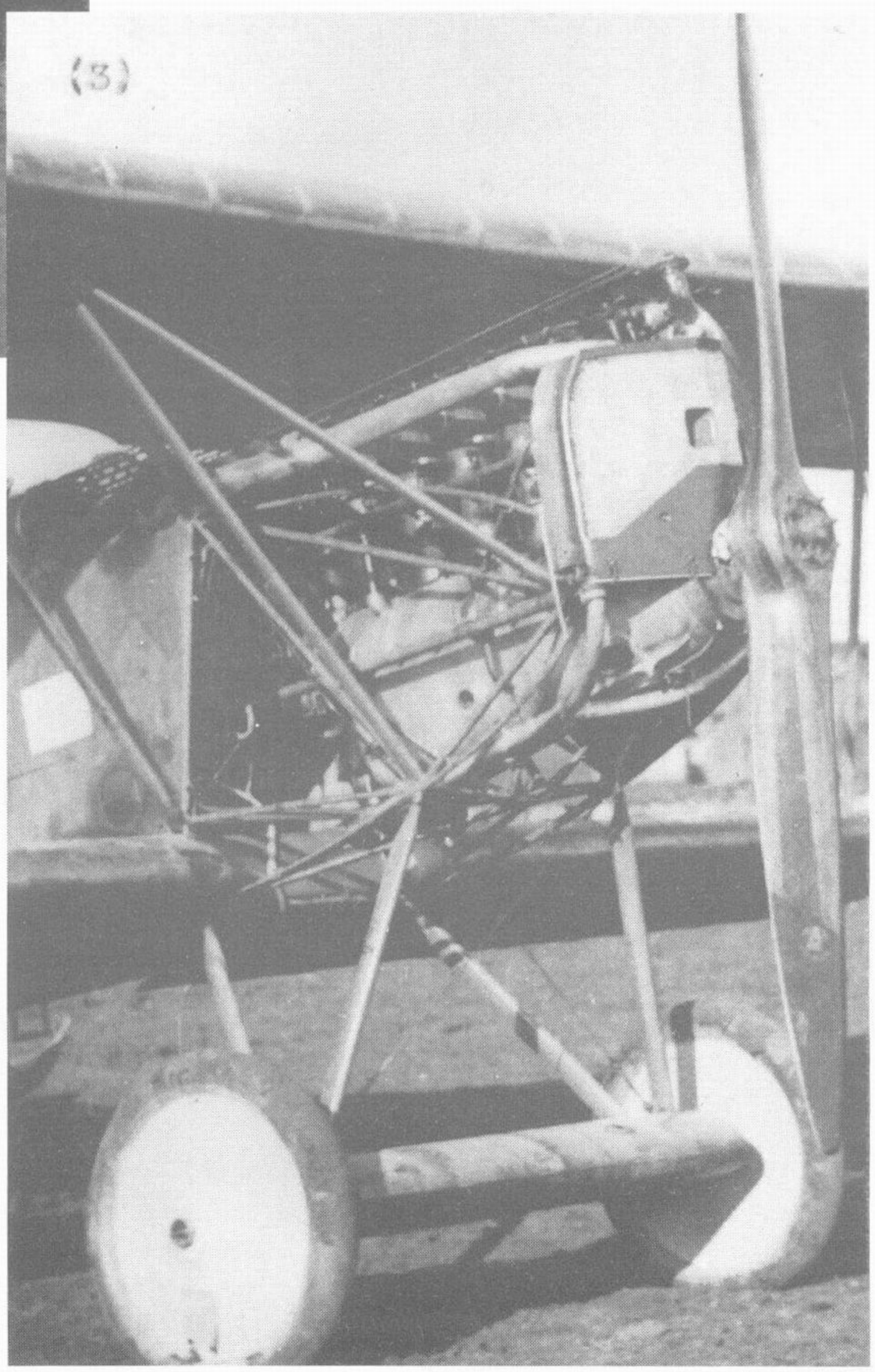
(Right) **Ltn Hans Joachim von Hippel of Jasta 71 seated in his Albatros-built D.VII.** Cross and Cockade International

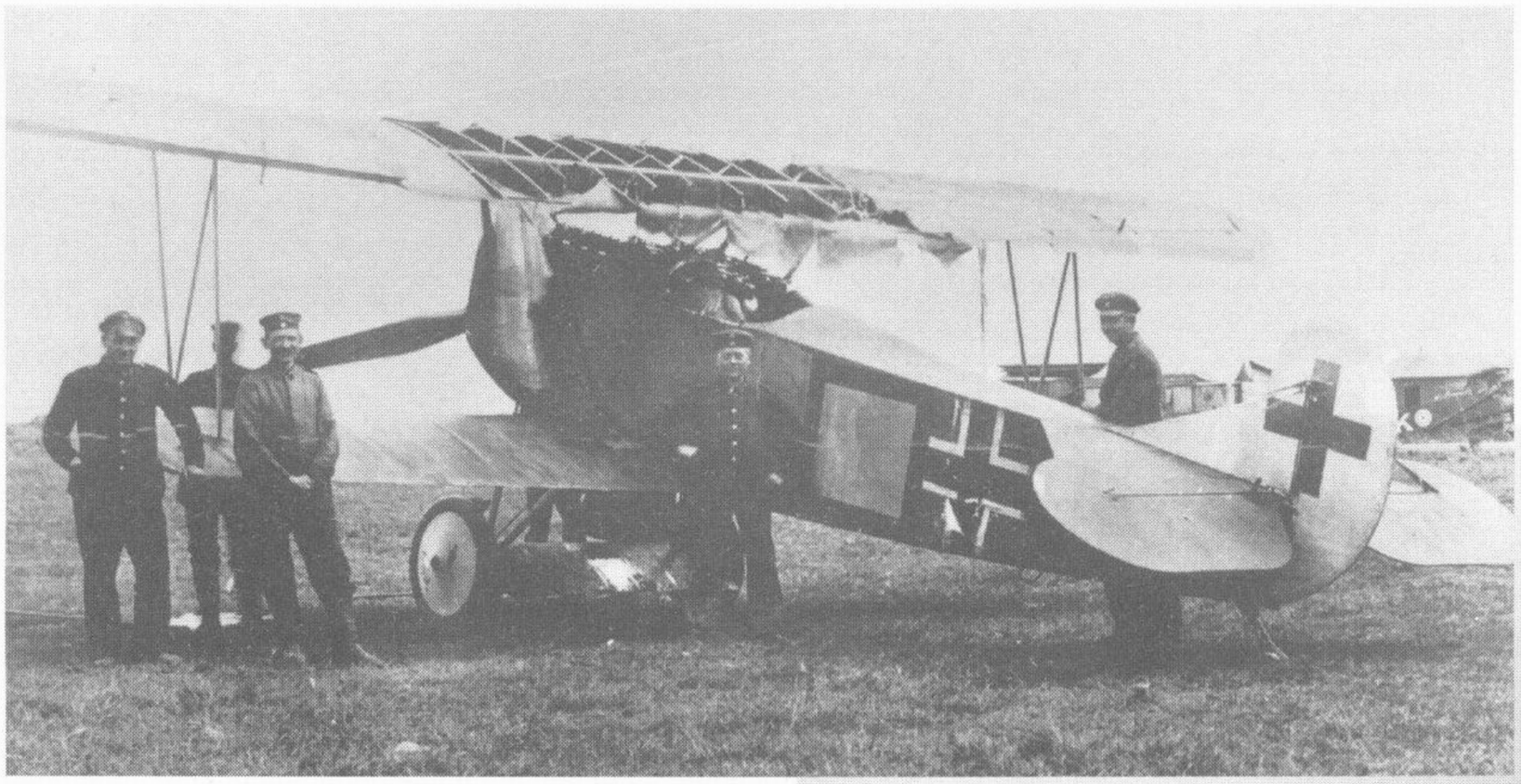


Fokker-built D.VII flown by Oblt Bruno Loerzer, commander of Jagdgeschwader III. It is marked here in the black and white stripes of Jasta 26, his former command. The left offset of the tail fin can be seen clearly. Cross and Cockade International



Close-up of the nose of Fokker D.VIIF 7788/18 held by the American 85th Aero Squadron after November 1918. Cross and Cockade International

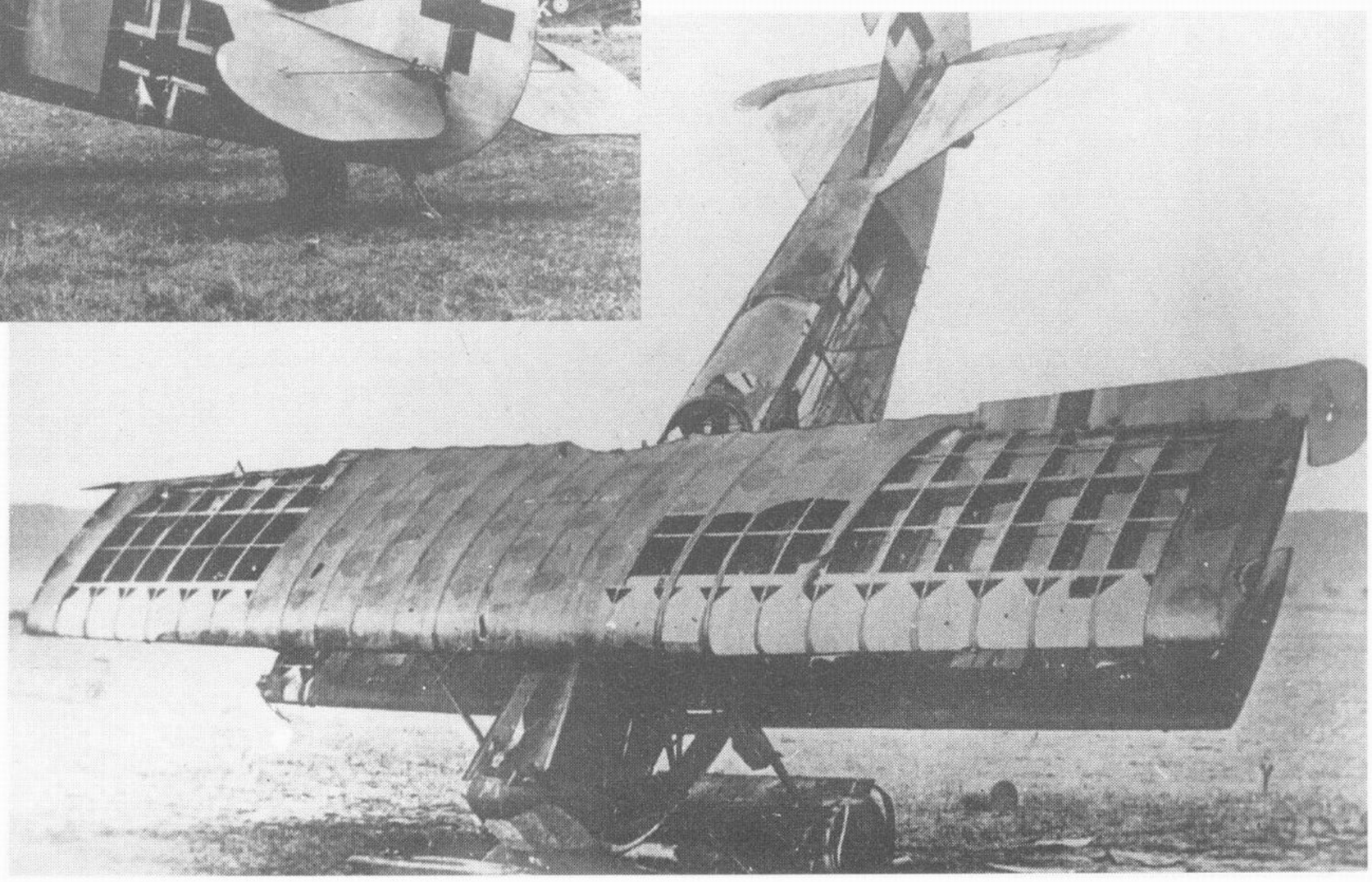




(Above left) **A pilot with high altitude equipment and a parachute.** Cross and Cockade International

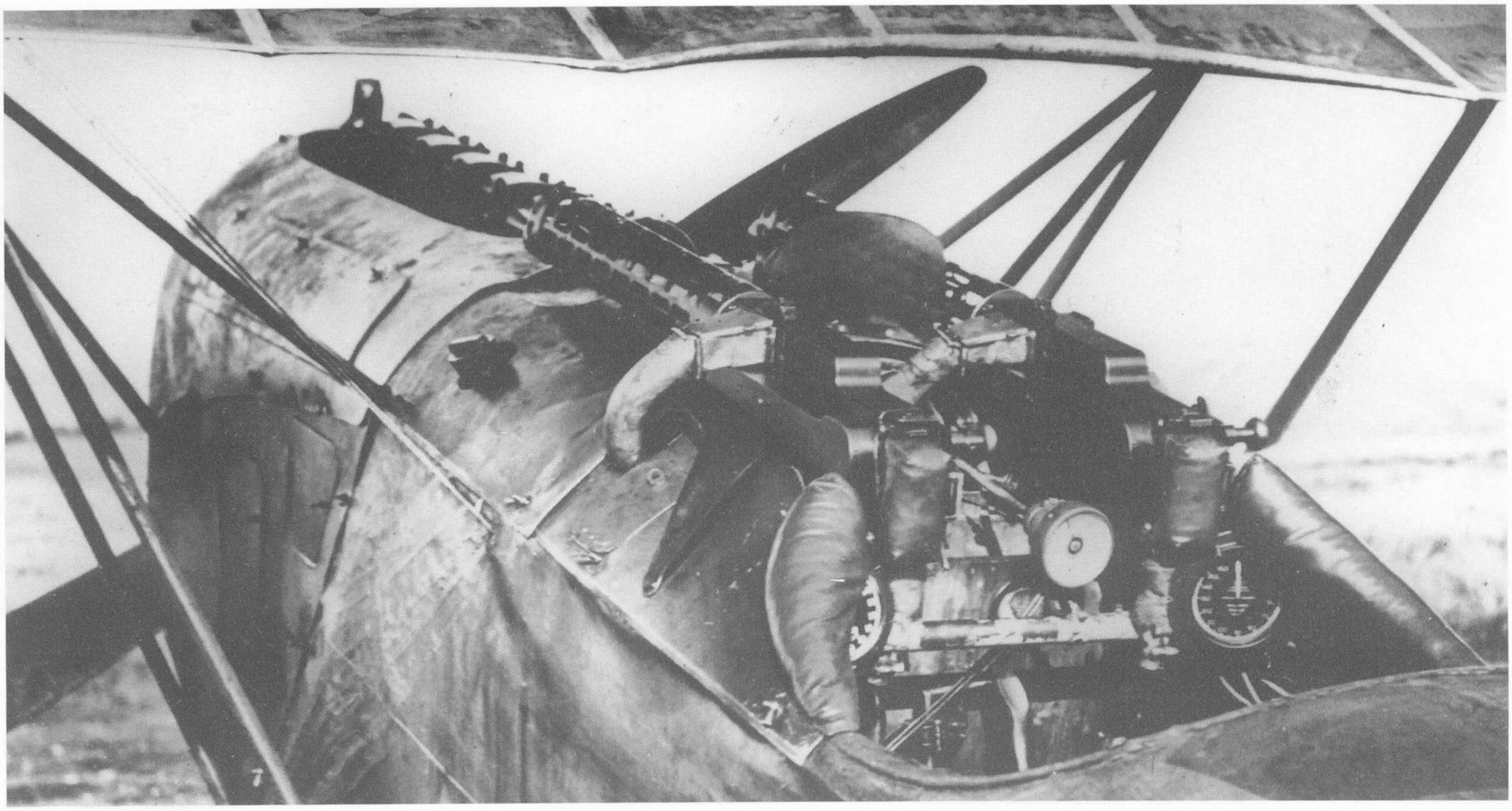
(Above) **A Fokker pilot being assisted into his parachute.** Cross and Cockade International

(Left) **Fine view of a damaged Fokker D.VII showing clearly the structure of the upper wing.** Cross and Cockade International



(Right) **The fabric from the centre section of this Jasta 27 D.VII was probably lost when it was being flown by Ltn dR Friedrich Noltenius in combat with a formation of British Sopwith Camels.** HAC/UTD

(Opposite page) **Close-up of the nose of Fokker D.VII (Alb) 5324/18 which was discovered and evaluated by the RAF in Bulgaria in February 1919.** Public Record Office



The D.VII at the End of the War

Such was the superiority of the D.VII that, although newer aircraft from a variety of manufacturers (including Fokker) came along, it remained in service until the end of the war. Such was the impression it made on the Allied pilots that the terms of the Armistice included the statement: 'Surrender in good condition by the German armies of the following equipment ... 2,000 aeroplanes – above all, every Fokker D.VII.'

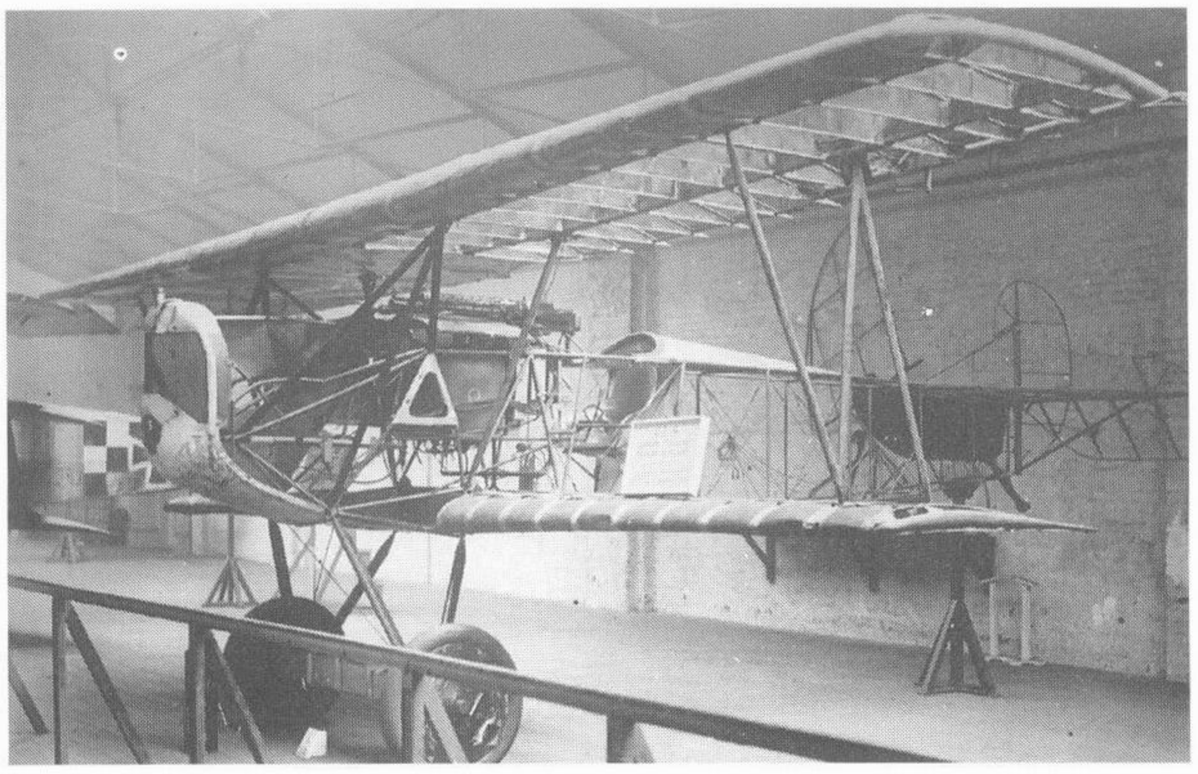
The precise number of D.VIIs that were handed over is not known. It certainly was not all of those on strength at the Armistice, as many were flown back to Germany by their pilots and then deliberately wrecked to deny their use to their former enemies.

Even so, a large number were handed over and the air forces of a number of European countries including The Netherlands, Belgium, Switzerland and Poland had them in their equipment. Some were taken over by the newly formed Canadian Air Force and over 140 went to the USA, first serving with the Army Air Service and a number later finding their way to Hollywood and employment in films. Seven examples of the type remain in existence to day, four in Europe, two in Canada, and one in the USA.

Close-up of the cockpit area of an unidentified Fokker D.VII. Cross and Cockade International

***(Below)* Fokker D.VII 368/18 flown by Ltn dR Hans Schultz who was brought down on 6 June 1918 by Lt C.H.R. Largesse of 29 Squadron RAF. Allocated the number G/2Bde/14 by the RAF, it was exhibited at Agricultural Hall in Islington during 1918–19 and formed the basis of a number of detailed reports.** Cross and Cockade International

Ready for the off! A happy group of Jasta 10 pilots sit in front of their Fokker D.VIIs. Cross and Cockade International



REPORT ON FOKKER BIPLANE

BROUGHT DOWN BY THE FRENCH.

General. This machine has many points in its construction and design similar to the Triplane. It is camouflaged completely in patchwork designs of the usual colours.

Machine No. 2009/18. Type D.7

Weight (according to figures painted on the fuselage)

Weight empty	1543½	lbs.
Useful load	396½	"
Total weight	1940	"

Dimensions.

Spaøn of top plane, including balance pieces of aileron .. 29′ 0″
The top plane has an extension, including balance piece, of 3′ at each end over the bottom plane.

Chord of top plane	5′ 4″
Gap..	4′ 3″
Span of lower planes (each)	10′ 5″
Chord of lower planes	3′ 11″
Overall length...	22′ 10″

CONSTRUCTION.

Fuselage is constructed of steel tubing and braced with thin piano wire; the system of fixing the wires to the struts is similar to that on the Fokker Triplane, i.e. a piece of tubing is welded across the angles made by the struts and longerons, and the wire is then bent round these, the ends being made fast to a turn-buckle in the centre of the span. (see Plate No. 1 in Report on G.72). The top of the fuselage has a 3-ply fairing; the whole is then covered with fabric which is laced along the bottom.

Planes. The top plane is in one piece, like that of the Triplane; the bottom plane is also in one piece, and passes through the fuselage which is cut away to take it. On each spar there are two V-shaped fittings which bolt on to four lugs which are bolted to the bottom longerons.

The planes consist of wood spars and ribs internally braced by cable wire. The spars are box type, constructed of 3-ply and spruce, reinforced at the corners with fabric, which is glued on; they are exceptionally deep at the centre, and taper away towards the wing tips to about 1". The leading edge of the front main spar is reinforced with 3-ply.

Dimensions

Front spar at centre ...	8¾" x 3"
Rear " " "	6" x 3"

The ribs have spruce flanges and 3-ply webs, every 6th rib being box-type, i.e. top and bottom spruce and sides of 3-ply. The fabric is tacked, not sewn on to the ribs. The interplane struts are shaped, and consist of streamline steel tubes. There are no interplane cross-bracing wires.

Ailerons. These are fitted to the top planes only, and consist of steel tubular frames. The controls go up through the centre section and along the top plane.

Span	7′ 2″
Chord (average) ..	9″
Balance piece ..	9″ x 1′ 0½″

Tail unit. This consists of steel tubular frames bound with tape to which the fabric is sewn.

The Tail Plane is triangular in shape, similar to the Triplane, and is fitted on top of the fuselage, which is cut away so that the plane when in position is flush with the rest of the fuselage.

Elevators. These are balanced and on one axle, and are similar in shape to those on the Triplane.

Span	4′ 6″
Chord (average).	1′ 9″
Balance piece..	1′ x 1′ 3″.

Fin and Rudder. The fin is small and triangular in shape. The Rudder is balanced and is larger than that of the Triplane. Size – 4′ 1½″ high by 9½″ wide.

Undercarriage. The V struts are of streamline steel tubes, and the axle is fitted with a wide fairing like the Triplane.

The shock absorber is of the double coil spring type, one coil being inside the other, the whole covered with black thread. There are two lugs cast on the outside of either V struts; the shock absorber is bound round these and over the axle, as in the Triplane (see Plates III, III, and IV in Report on G.72).

The Tyres are CONTINENTAL, size 760 x 100.

Tailskid. The post is ash with a knife edge skid fixed to its extremity; the centre of the post is hinged to the extreme bottom rear of the fuselage, the top being supported by two coil springs to the top rear cross strut of the fuselage.

Engine. The engine is a 180 hp. Mercedes, No.40860, BN.773, MN.61, fitted with two Bosch ZH.6 type magnetos Nos. 2294316, 2294477 and a Bosch starting magneto No.11288. This engine is a re modelled 160 hp. Mercedes.

The chief points are – the bore and stroke, & the carburettor are the same as the 160 hp., but the valve gear has been modified; the oil pump has been replaced by a larger pump similar to that on the 260 hp, and the water-pump of that engine has also been adopted. The air pump has been re-designed and is driven off the front end of the camshaft as in the 260 hp. engine. The throttle is worked by moving the lefthand arm of the control lever backwards and forwards.

Propeller. The propeller is a WOLF No. 12004, pitch 2100, diameter 2800. It consists of 3 laminations of walnut and 4 of ash.

Radiator. The radiator is situated in front of the engine; it is honeycomb type and has two shutters fitted on the rear surface for minimising the cooling of the engine. These are actuated from the pilot's seat through a system of rods.

Average height	...	1′ 5″
″ width	....	2′ 2½″
″ depth	....	3 15/16″

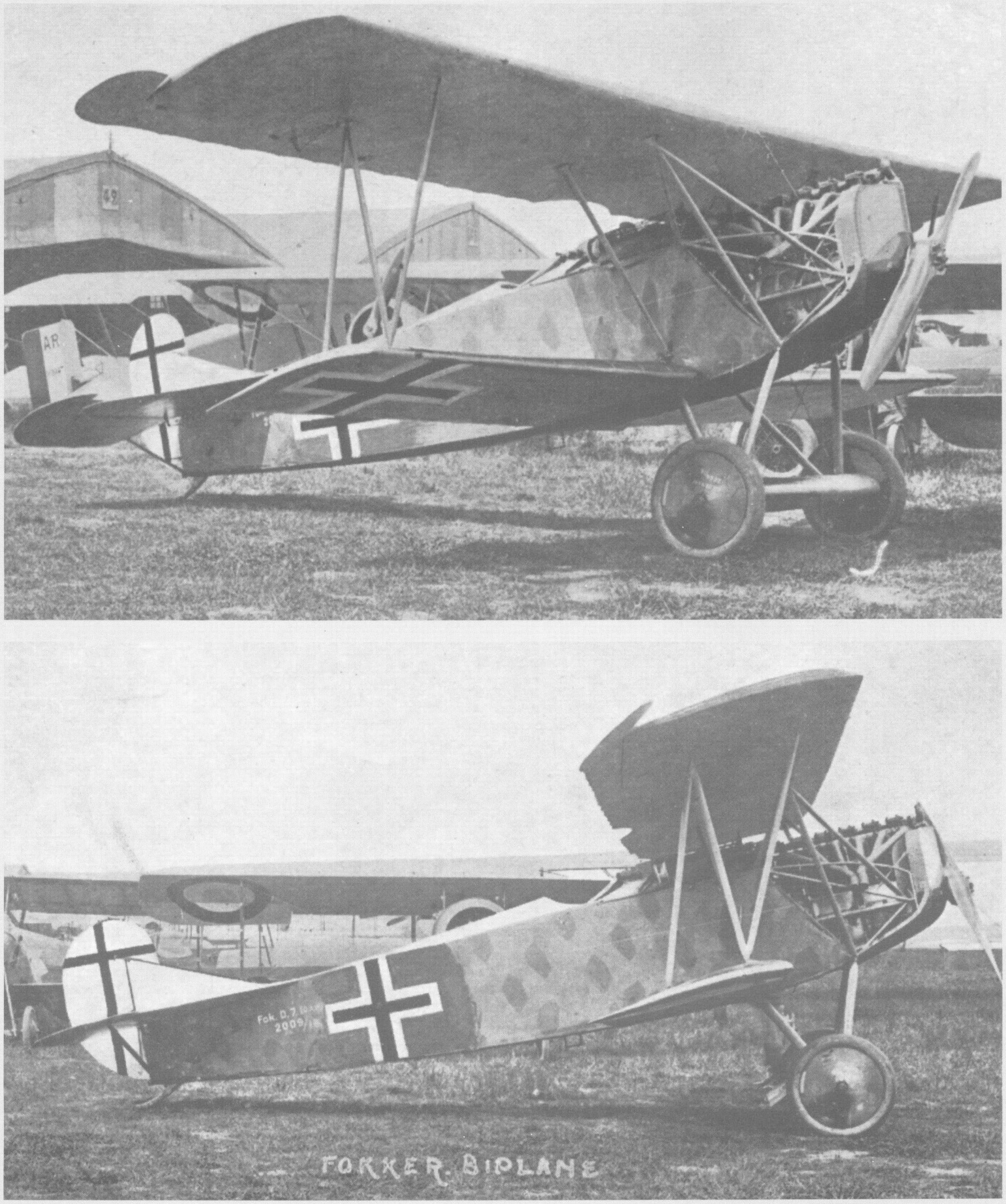
Tanks. The petrol and oil are contained in one tank at the rear of the engine; this tank is divided into three parts, two parts being for petrol and one for oil. It has the following capacity -

1st petrol compartment	..	13 gals
2nd ″ ″	..	7 ″
Oil compartment	..	2½″

Armament. Two Spandau guns Nos. 4268, 4059, firing through the propeller, actuated by a direct flexible drive interrupter gear. These guns were fitted with a lever on the righthand side of each gun for rectifying jambs; they are fired from thumb pushes on the control lever, through bowden wires.

Air Staff (Intelligence),
Headquarters, R. A. F.
13th June 1918.

G. BARFOOT SAUNT, 2nd Lieut.
for Lieut.Col., Air Staff.



Front three-quarter view (top) and side view (bottom) of Fokker D.VII (OAW) 2009/18 after its capture by the French. Cross and Cockade International

Fig 3

FOKKER D.7 No 2009

Tests on 5 and 6/ 6/18

Type C1.

160 HP Mercedes Engine

Span 9m (29' 5")
Length 7m (23' 0")
Height 2m80 (9' 2")
Area 20m² 40 (220 sq ft)

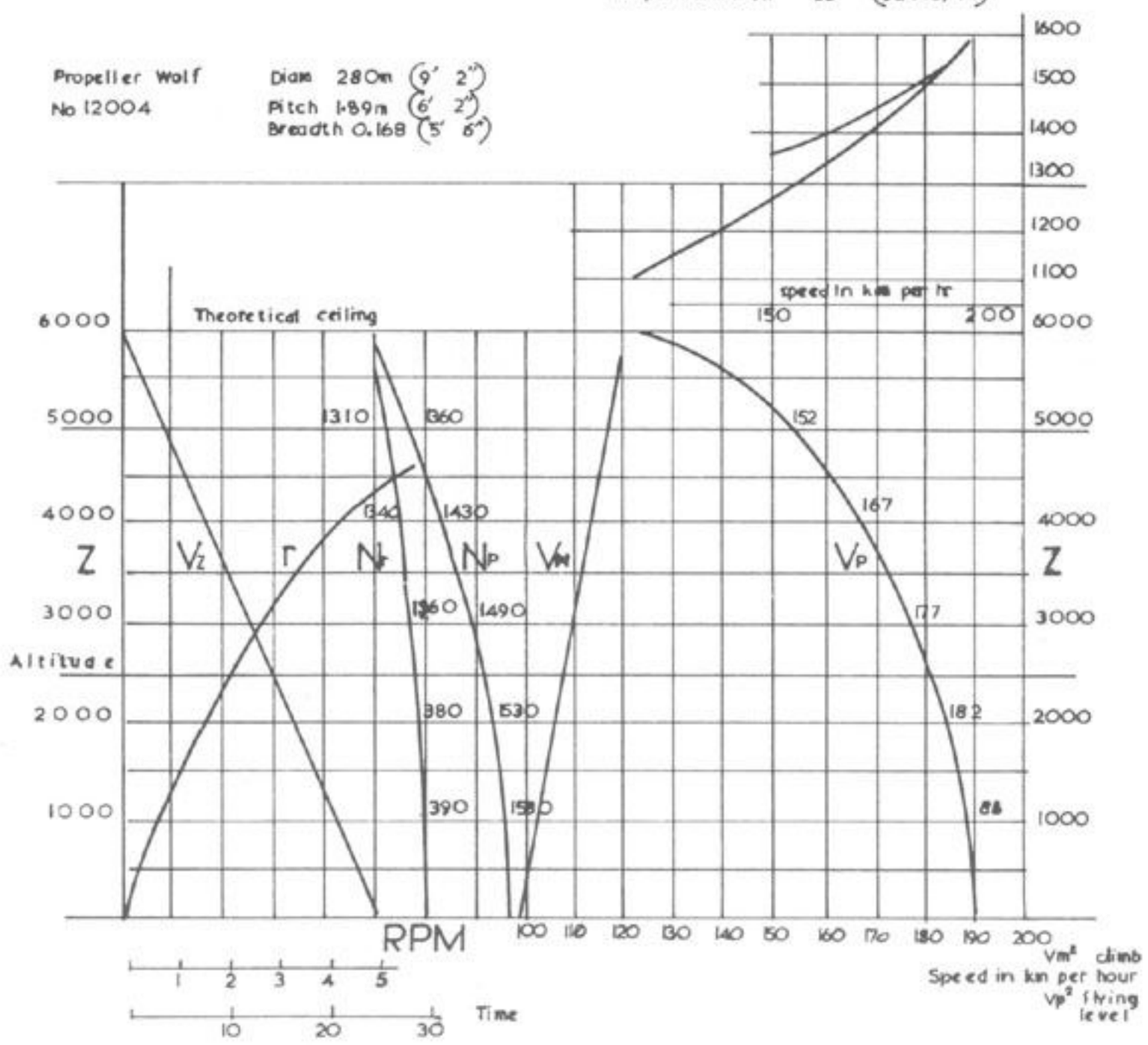
Weight empty 709 kg 40 (1564 lb) — Glider; Power unit; Tank and piping

Useful load 180 kg 600 (395 lb) — Fuel and oil 67 kg6 (149 lb); Military load 113 kg (249 lb)

Petrol capacity 95 litres approx (21 gal approx)
Oil " 25 " " (5.5 " ")
Endurance 1 3/4 hr

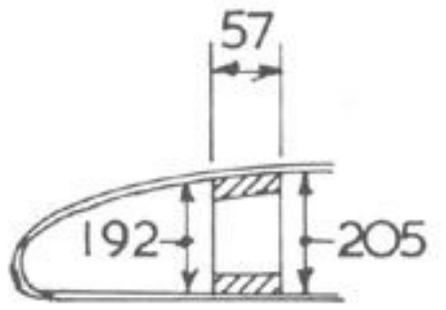
Total weight 890 kg (1960 lb)
Wt per unit area = 43.6 (89 lb)
Wt per nominal HP 55 (12.1 lb/ HP)

Propeller Wolf No 12004
Diam 2.80m (9' 2")
Pitch 1.89m (6' 2")
Breadth 0.168 (5' 6")

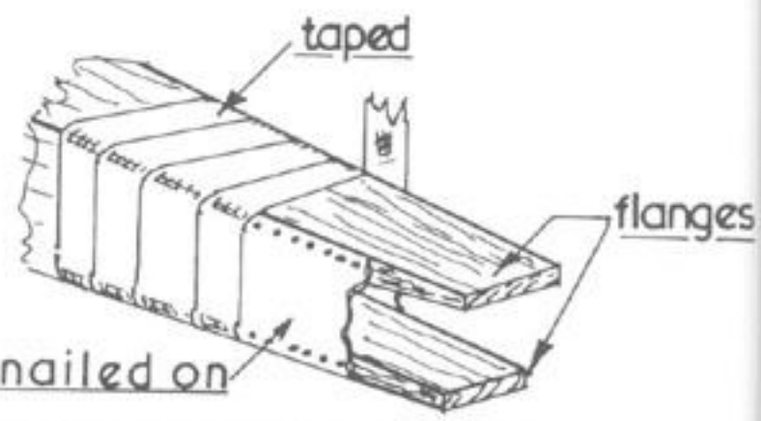


Power curves for Fokker D.VII 2009/18 captured and tested by the French.

Diagrams illustrating the construction methods and dimensions of Fokker D.VII (OAW) 2009/18. Author

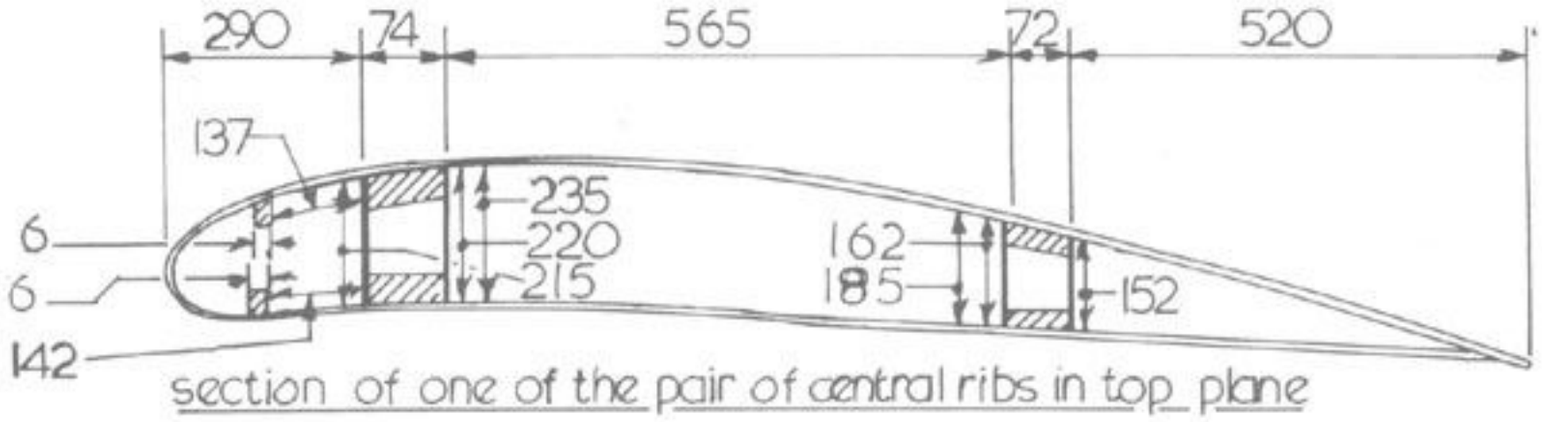


leading edge of top plane
2m from centre of machine



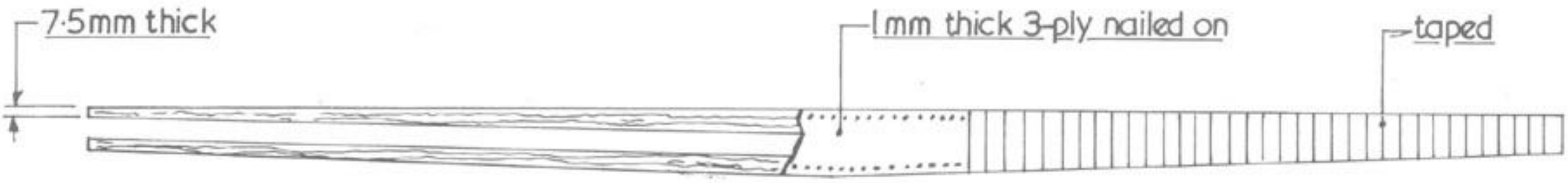
3-ply nailed on

method of construction of spar



section of one of the pair of central ribs in top plane

flange dimensions
7.5mm thick x 22mm wide at tip
22mm thick x 74 mm wide at centre



front spar top wing

CHAPTER EIGHT

D.VII Developments

The original D.VII that was put into production by Fokker and the two Albatros factories was not the end of the line for the basic V.11 design. A number of improved versions would follow up to the end of the war, but none was put into production. Most remained as experimental models or prototypes. The main sources of 'improvements' were the manufacturers, Fokker's factory at Schwerin, the Albatros factory, AEG, the Flugzeugmeisterei workshops at Adlershof and Maschinen-Fabrik AG (MAG) of Austria, who were preparing to manufacture D.VIIs for the Austrian Army in their factory near Budapest. In the main, Fokker's developments were the result of his instinctive desire to improve his basic design and thus to maintain his lead over his rivals.

V.22 fitted with a Jaray four-bladed propeller. Cross and Cockade International

The V.21

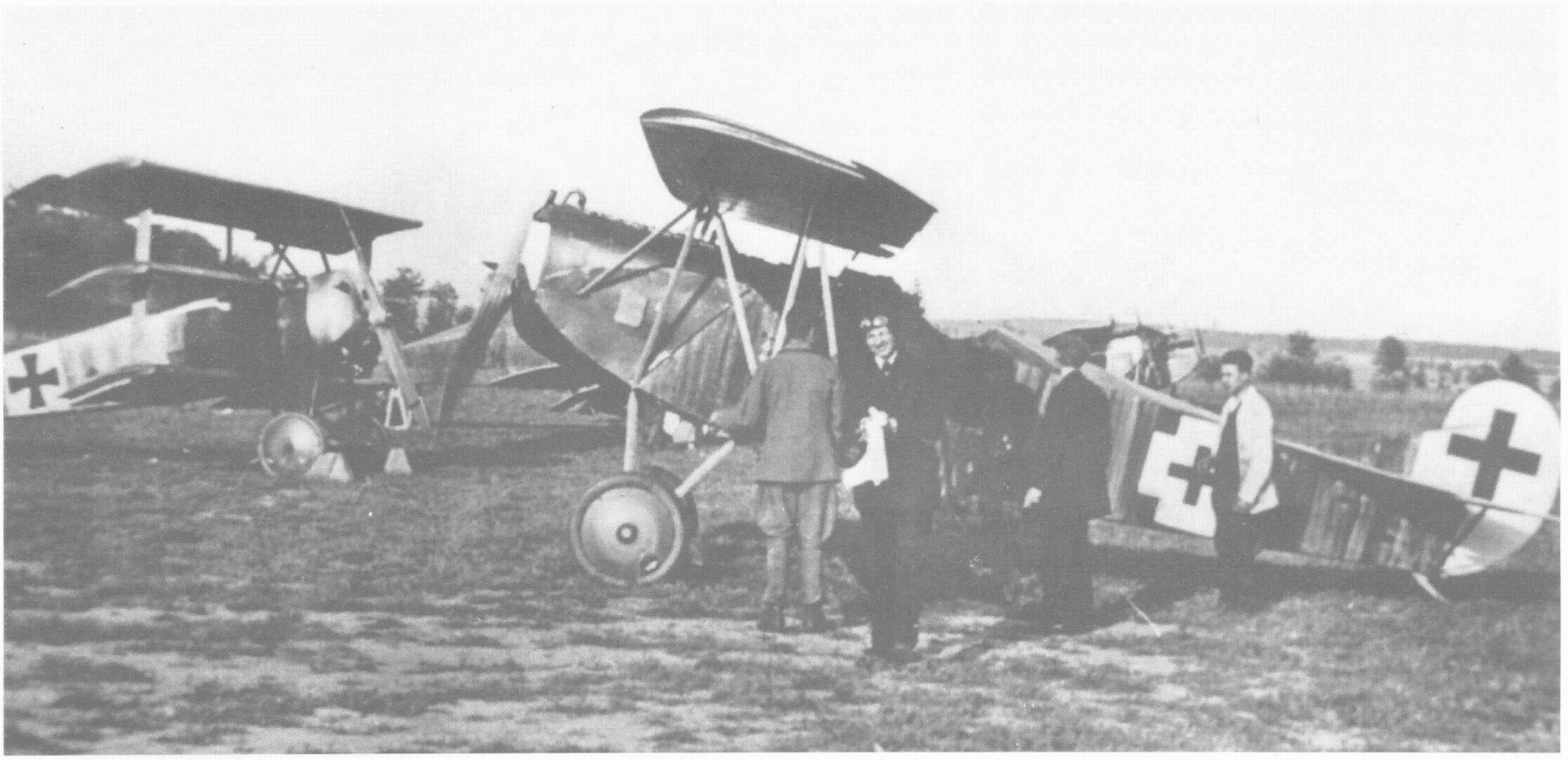
The first of his developments from V.11 was V.21. This employed the same fuselage as the D.VII but had tapered wings. It was fitted with the 200hp Mercedes D.IIIau engine and was marginally lighter than the D.VII. Despite this, its climbing performance and ceiling were worse than those of the standard machine. Also, its tapered wings would have been more expensive to produce than the standard D.VII wings. So, although it did take part in the second fighter competition (*see* Chapter Nine), the design was taken no further.

Another view of V.22. Cross and Cockade International

The V.22

Fokker's next development was V.22 for Austria. This was a standard D.VII airframe converted to accept the 200hp Austro-Daimler engine and fitted with an asymmetric four-bladed propeller. Armament was a pair of synchronized Schwarzlose M.16 machine-guns mounted conventionally in front of the pilot. V.22 was demonstrated to Fliegerarsenal (Flars) officials at Schwerin where it was flown by their test pilot, Stabsfeldwebel Franz Kuntner, who had earlier been employed as an instructor by Fokker. With its 200hp engine, V.22's performance was superior to that of the standard D.VII and, in his report, Kuntner praised not only this but also its manoeuvrability, the positioning of its guns and the view from its cockpit.

It may have been that, because of Kuntner's previous association with Fokker, Flars officials felt that his report was biased, or it may have been that they felt that they had to defend their own manufacturers. What-



Anthony Fokker after demonstrating V.22 at Matyasfold in May 1918. Fokker triplane 90.03 can be seen in the background.
Cross and Cockade International

ever the reason, they said that they were not impressed and raised a series of detailed objections to the purchase of V.22-based aircraft. Their objections were as follows:

- The performance of new 225hp Daimler- and 240hp-engined Austrian-designed and -manufactured fighters would match or even exceed that of V.22.
- Neither Fokker nor any Austrian manufacturer would be likely to reach full production of V.22 aircraft within five months. Austrian-designed and -manufactured fighters would be available within that time.
- The 200hp Daimler engine was no longer being produced.
- In its current form, V.22 had less range than Austrian single-seaters. Any increase in V.22's fuel capacity would have to be made at the expense of its war load.
- In its current form, V.22's basic weight was more than that of the Aviatik D.I and its warload less (190kg against 230kg).
- It was felt that, structurally, V.22 was not as strong as existing Austrian fighters.
- Although the installation of its weapons and visibility from its cockpit were accepted as 'excellent', new Austrian fighters would be at least as good.

Despite these objections, on 24 April 1918, V.22 was shipped to Matyasfold in Austria where it was given the designation '90.05'. Here it was subjected to a thorough evaluation and Flars personnel were treated to a demonstration of its flying performance by Fokker himself at his impressive best.

After careful consideration, Flars staff changed their minds and the decision was made to replace the ageing Albatros D.IIIs and Aviatik D.Is on the strength of the air force with D.VIIs built by Fokker, MAG, Aviatik and Thone and Fiala. Delivery of the first machines was to start in October 1918 and contracts were placed that would run from then until March 1919. The airframes of the first six D.VIIs were completed by Fokker and shipped to the MAG factory for installation of the 225hp Austro-Daimler engines and Schwarzlose machine-guns. They were to have been followed by a further seventy-five machines from the first order. Through delays caused by the chaos of the closing stages of the war, none of the machines was delivered to Matyasfold until they were too late to participate in the war. In March 1919 they were on the strength of the Hungarian 1st Flying Group and saw service against the Czechoslovakian forces. A number were captured and later used by the Czechs.

The V.34 and V.36

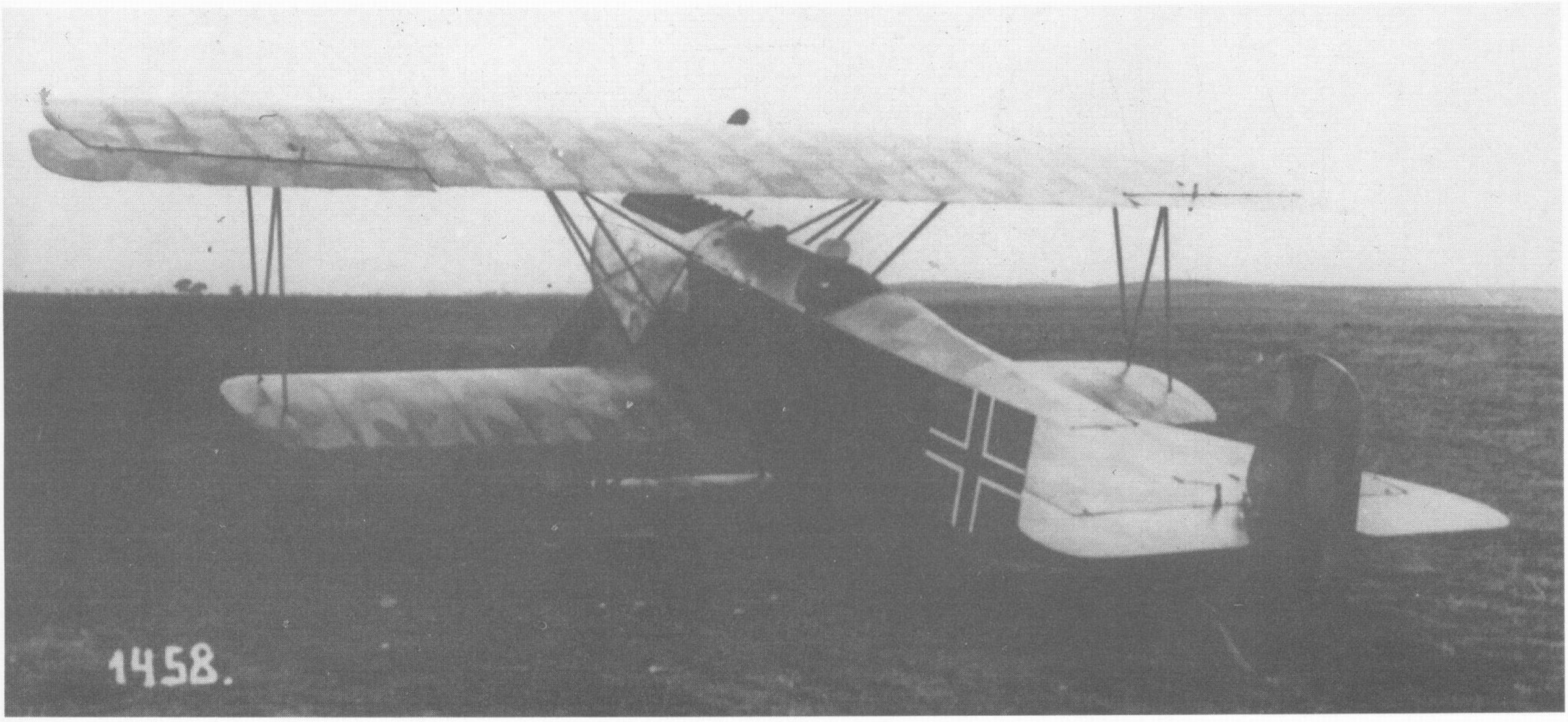
Next came two (probably) simultaneous developments, V.34 and V.36. It is thought that V.34 was originally powered by a high-compression 220/240hp Benz Bz Ivu engine, but that it was soon modified to accept the 185hp BMW IIIa engine. V.34 had wings of similar span to the D.VII but of less area. Its fuselage was shorter and it was fitted with a rectangular rudder with no fin. With the BMW engine it was fitted with a neat oval radiator and cowling. Although the length of its fuselage was shorter than that of the D.VII, it appears to have been fitted with the same undercarriage as that aircraft.

V.36 was also powered by the 185hp BMW IIIa engine and had the same radiator and cowling as V.34. Its fuselage length was again shorter than the D.VII, in this case being nearer to that of the D.VI. V.36 had a fin and rudder of similar shape and proportions to those of the D.VII. The V.36 enjoyed one major innovation that was a great step forward in that its fuel tank was removed from its original place in the fuselage in front of the pilot and located in an aerofoil-sectioned tank within the undercarriage sub-wing. The advantage of this was that it lessened the risk of a loss of the aircraft through a catastrophic fuel fire. In

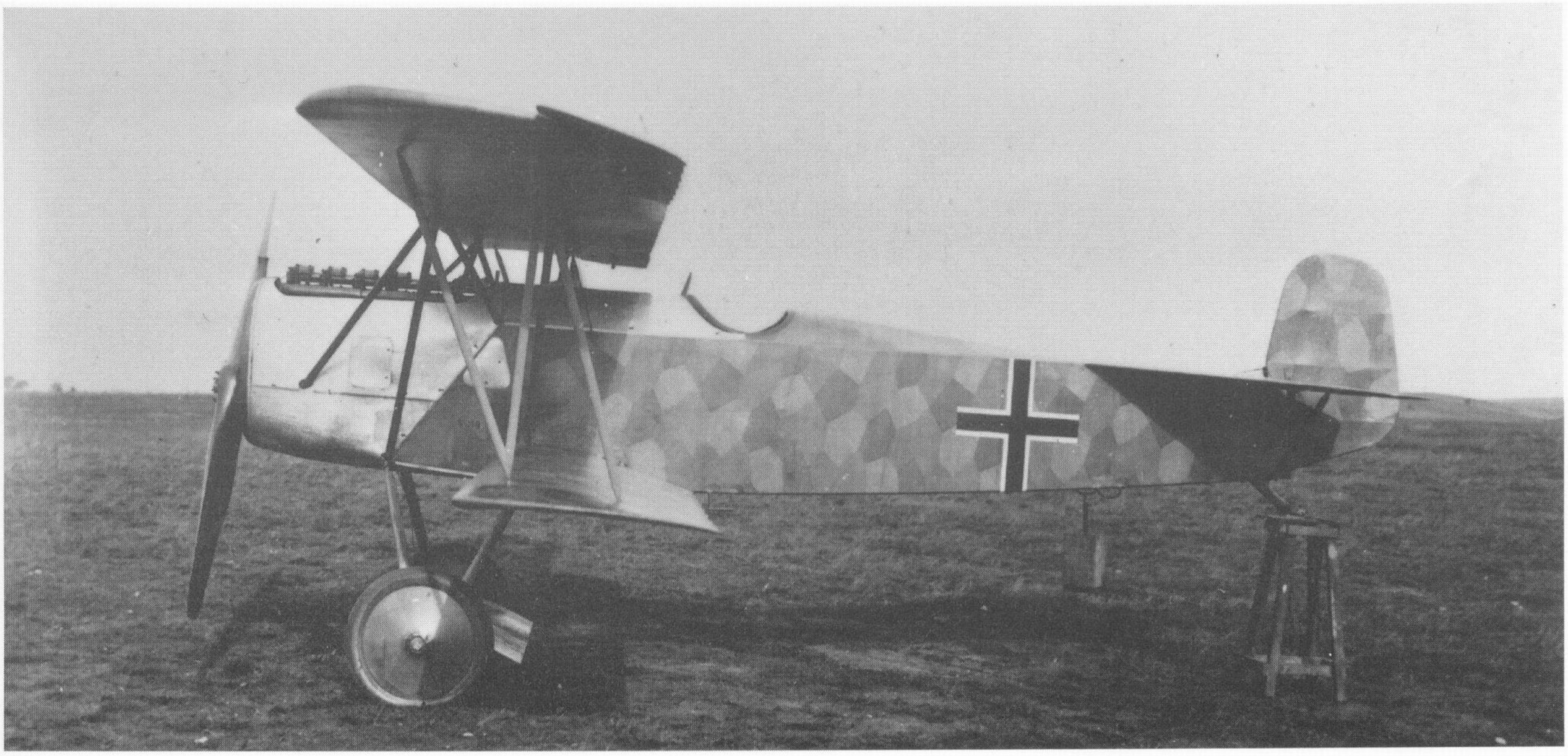
the event of the fuel in the tank being ignited by an incendiary or tracer bullet, the resulting flames would be carried away from the main structure, the pilot and the tail surfaces by the aircraft's slipstream. In the event of a hard crash landing, the undercarriage would be swept away by the impact and any spilt fuel left behind by the aircraft. V.36 took part in the third fighter trials during October 1918. While it was faster at altitude than the BMW IIIa-powered D.VIIF and had improved manoeuvrability, it was beaten by the Rumpler Ru D.I, an exceptionally light biplane that was intended to be put into production towards the end of 1918. V.36 had been entered too late in the race to acquire new fighters faster than the new Allied types.

Other Developments

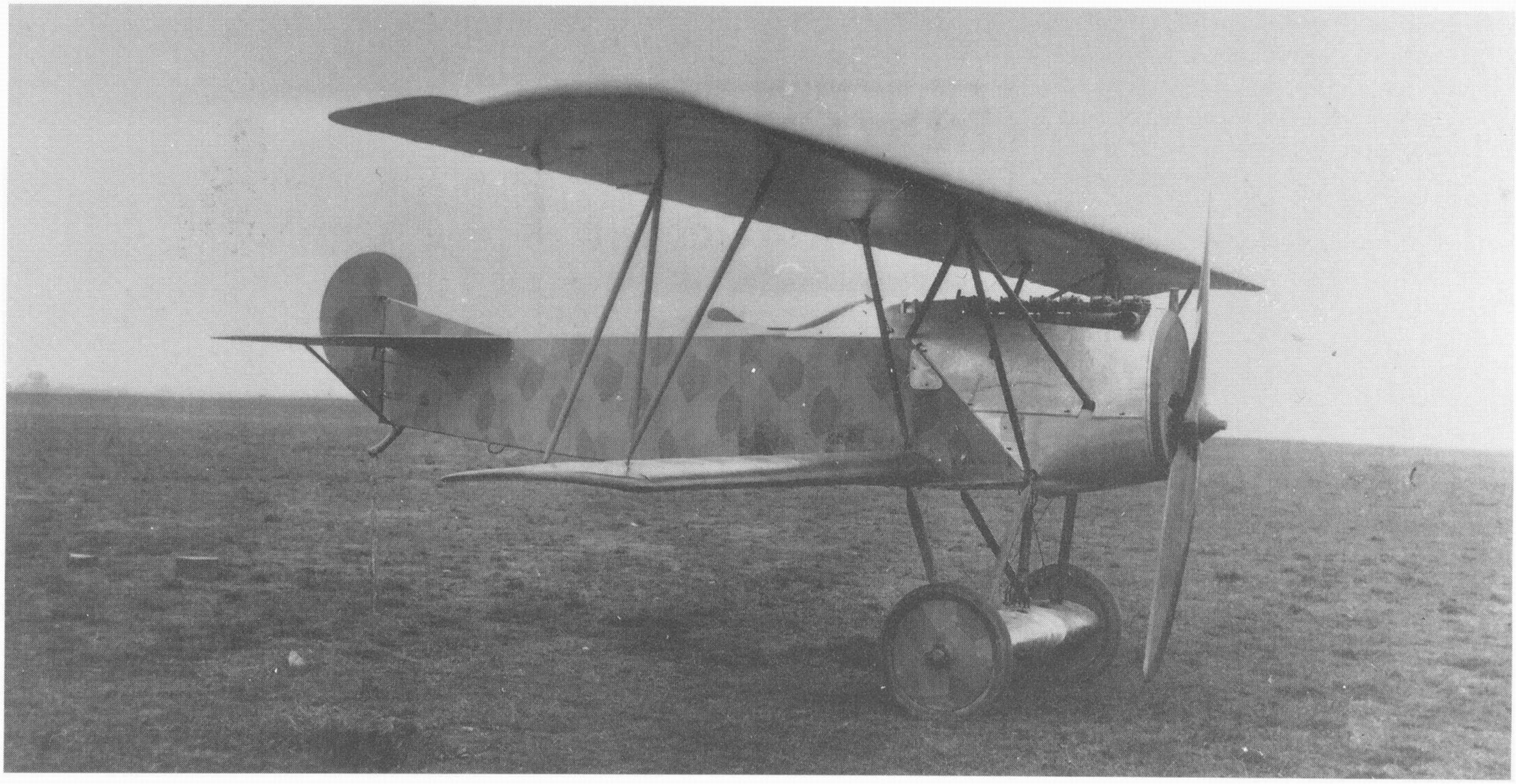
Albatros developments were mainly aimed at detail modifications to the existing D.VII airframe with a view to making it conform to Albatros standards. However, because Idflieg feared that a shortage of steel tubing was about to threaten production of the D.VII, Albatros were instructed to produce



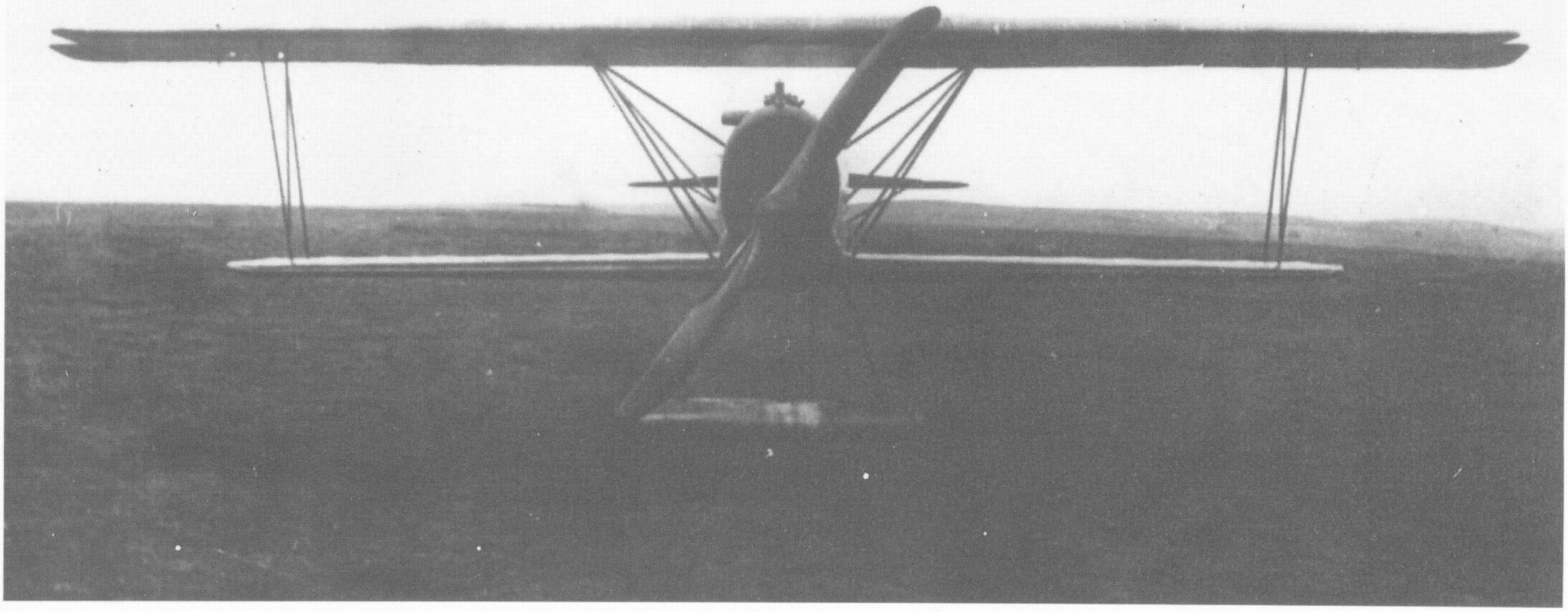
V.34. Cross and Cockade International



Another view of V.34. Cross and Cockade International



Fokker V.36 with a fuel tank on its undercarriage sub-wing. Harry Woodman



V.36 from the front. Cross and Cockade International

an example of the fuselage based upon a wooden structure covered with plywood. The wings, undercarriage and tail surfaces were to be standard D.VII components supplied by Fokker and the engine was to be a standard 160hp Mercedes D.III. The fuselage was built by Albatros but final assembly was made by Fokker at Schwerin. The completed machine, designated Fokker D.VII (Alb) 541/18 was successfully flown by the Fokker works pilot Gorse in April 1918. It was submitted for type test in May 1918 and, having passed satisfactorily, was recommended for front-line service. In the event, the steel tube crisis came to nothing so it was never built in quantity, and the standard machine continued in production until the Armistice.

A second D.VII with a mainly wooden structure was built by Fokker at his new factory at Lübeck-Travemunde. Powered by a

Fokker D.VII (Alb) 541/18 built by Albatros with a plywood-covered fuselage.
Cross and Cockade International

200hp Austro-Daimler engine, it was flight-tested at Schwerin and its performance proved to be the equal of the standard BMW-engined version. It was shipped out to Aspern in Austria in April 1918 but does not appear to have been flown there. Damaged in some way, by September 1918 it had been placed in store.

AEG were never to produce the D.VII but did carry out a number of aerodynamic experiments with the type. Staff of the Flugzeugmeisterei workshops at Adlershof also carried out a number of experiments with modified D.VIIs. Modifications tested included lengthening the fuselage, removing the tail fin with revision of the rudder shape, and removing the undercarriage sub-wing. The effects on the D.VII of these modifications were carefully noted with the intention of improving the overall flying characteristics and manoeuvrability of the type. Details of the results obtained are not available, but it seems unlikely that any significant improvement was achieved or fed through to production. Adlershof staff also flew a standard D.VII from which the interplane struts had been removed. They were disappointed to discover that for some reason it was slower in this mode than the standard machine. Further trials included flights with fully rigged wings, intended to determine the resulting increase in drag.

In the confusion of the time, little is known of the modifications made by MAG other than that they would have been aimed at the installation of the Austro-Daimler engine and the Schwarzlose machine-guns.

The V.35

Taking the V.11 design in a different direction, Fokker created V.35, a two-seat conversion of the D.VII airframe. The structural strength of the airframe was adequate for the purpose and only minor modifications were required. These included moving the fuel tanks from in front of the pilot to the undercarriage sub-wing, creating a second (passenger) cockpit in front of the pilot and a large cut-out in the trailing edge of the upper wing to give the passenger access to the front cockpit. The V.35 was powered by a 185hp BMW IIIa engine. The type was flown by Fokker and a number of others, including Ernst Udet. Its performance was adequate but not as good as that of the standard D.VII. Although its landing speed was faster than that of the standard D.VII, it was still at an acceptable level.

V.35, a two-seat version of the D.VII with a fuel tank in its undercarriage sub-wing. The pilot in this instance is Ernst Udet. Cross and Cockade International

The V.38

The final wartime development of the V.11 design was V.38. This was another two-seat version and was intended for use as an infantry liaison and observation machine. Unlike V.35, which was a simple conversion, V.38 was a new design based on D.VII components. The fuselage structure was similar to that of V.35 but with the pilot's cockpit moved to the forward location and the observer's to the rear. The pilot was to be armed with a single forward-firing machine-gun and the observer with another single gun on a flexible ring mounting in the rear cockpit. The main fuel tank was again located in the undercarriage sub-wing, but augmented by a gravity tank in the forward fuselage. Ammunition for the forward-firing gun was also located in the fuselage near the engine. Because of its increased weight, a larger wing area was necessary and, although using the same components as the D.VII, V.38's wings were of some two metres' greater span, giving a 30 per cent increase in wing area. V.38 was again powered by the 185hp BMW IIIa engine.

Because the design had been prompted by Idflieg's recommendations, Fokker was confident that V.38 would be successful and so he launched a production batch of sixty machines of this design. He was wrong: V.38

Ernst Udet in the pilot's cockpit of the two-seat V.35. The stencilled factory number, 3727, can be seen at the bottom of the original photograph.
Cross and Cockade International

Ernst Udet

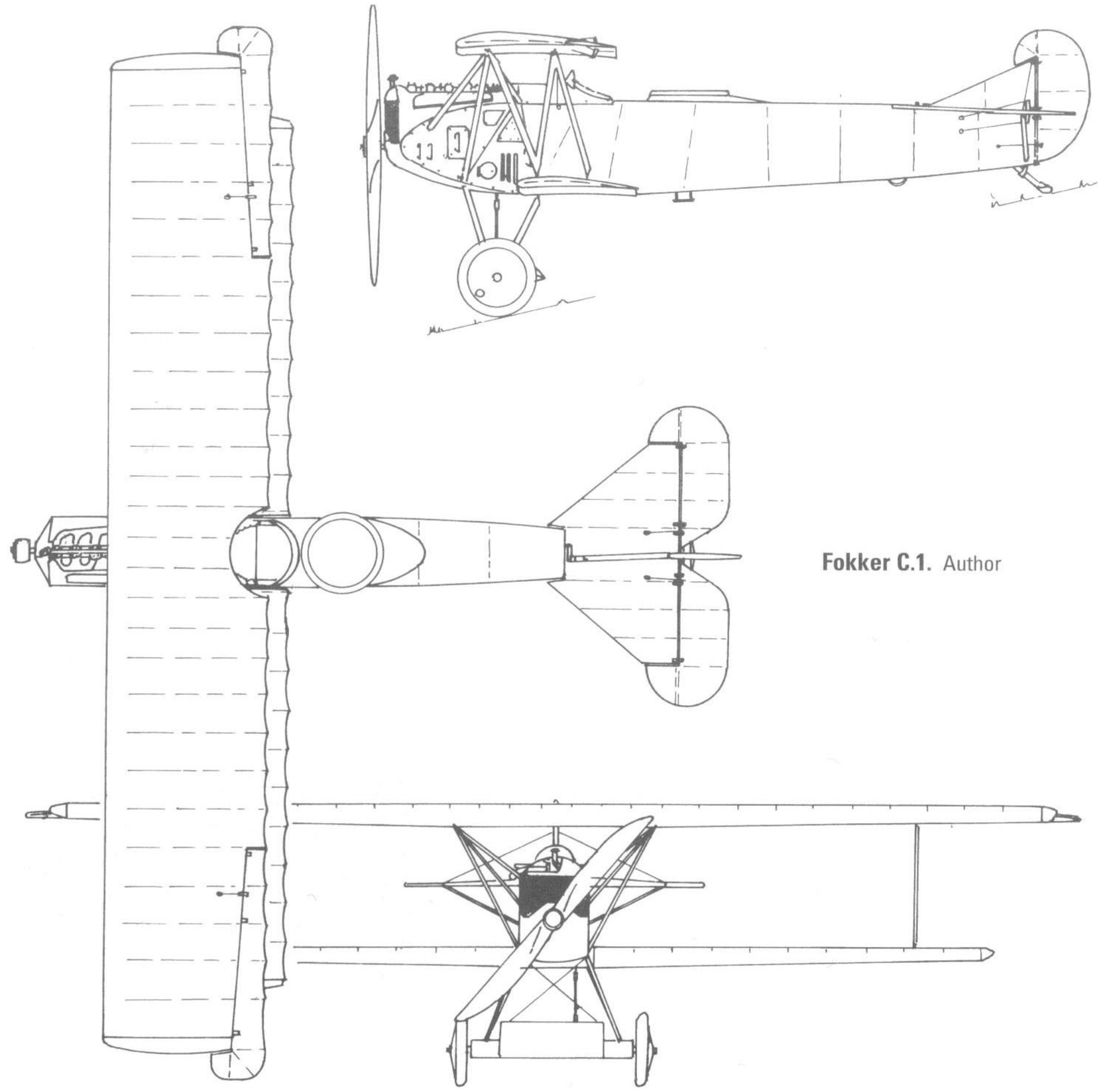
Oblt Ernst Udet was born in Frankfurt am Main on 26 April 1896. He enlisted in the Army on 21 August 1914 and served as a motorcyclist with the 26th Wurttemburg Reserve Division. After an injury he applied to join the Air Service but was initially rejected. After learning to fly at his own expense he applied again and was accepted in 1915.

He first served with FA(A)206 and then with FA68 at Habsheim. This was renamed Kek Habsheim and then Jasta 15. After several victories and the award of an Iron Cross 1st Class he was commissioned on 22 January 1917. At his request, he was transferred to Jasta 37 on 19 June 1917 and took over command of the unit on 7 November. After a short spell as acting commander of Jasta 11 he was given command of Jasta 4. He was shot down on 29 June 1918 and slightly injured, but escaped by parachute.

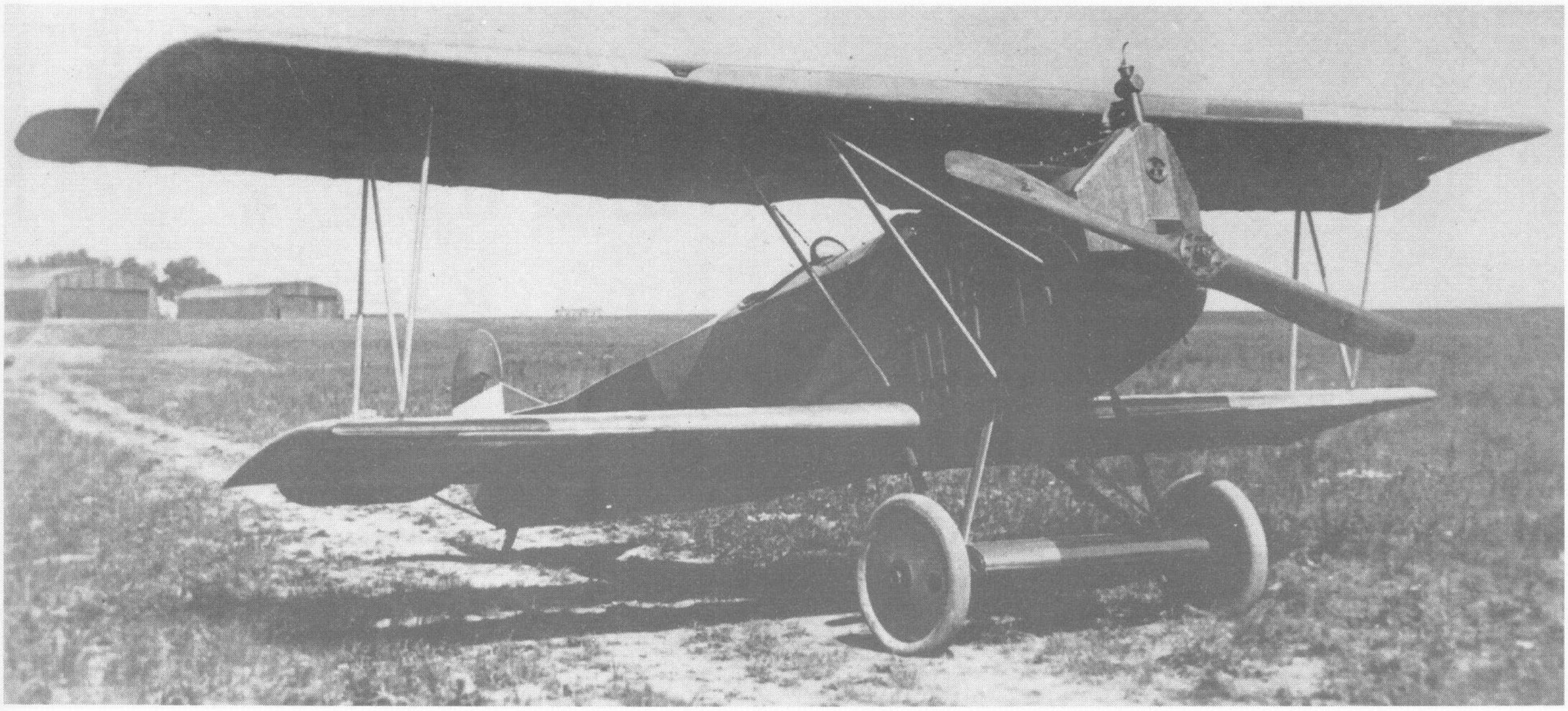
Always a daring pilot, he survived the war with a score of sixty-two victories, making him the second highest-scoring German of the war. His wartime awards included the Iron Cross 1st and 2nd Class, the Knight's Cross with Swords of the Royal House of Hohenzollern Order, the Lübeck Hanseatic Cross, the Hamburg Hanseatic Cross and the Orden Pour le Mérite.

Between the wars he enjoyed a varied career in aviation with stunt flying, gliding, exploration, and flying for the cinema and as a test pilot being included in his activities. He joined the Luftwaffe in World War Two and rose to the rank of Generaloberst, but committed suicide when the pressure of work and politics became too much for him.

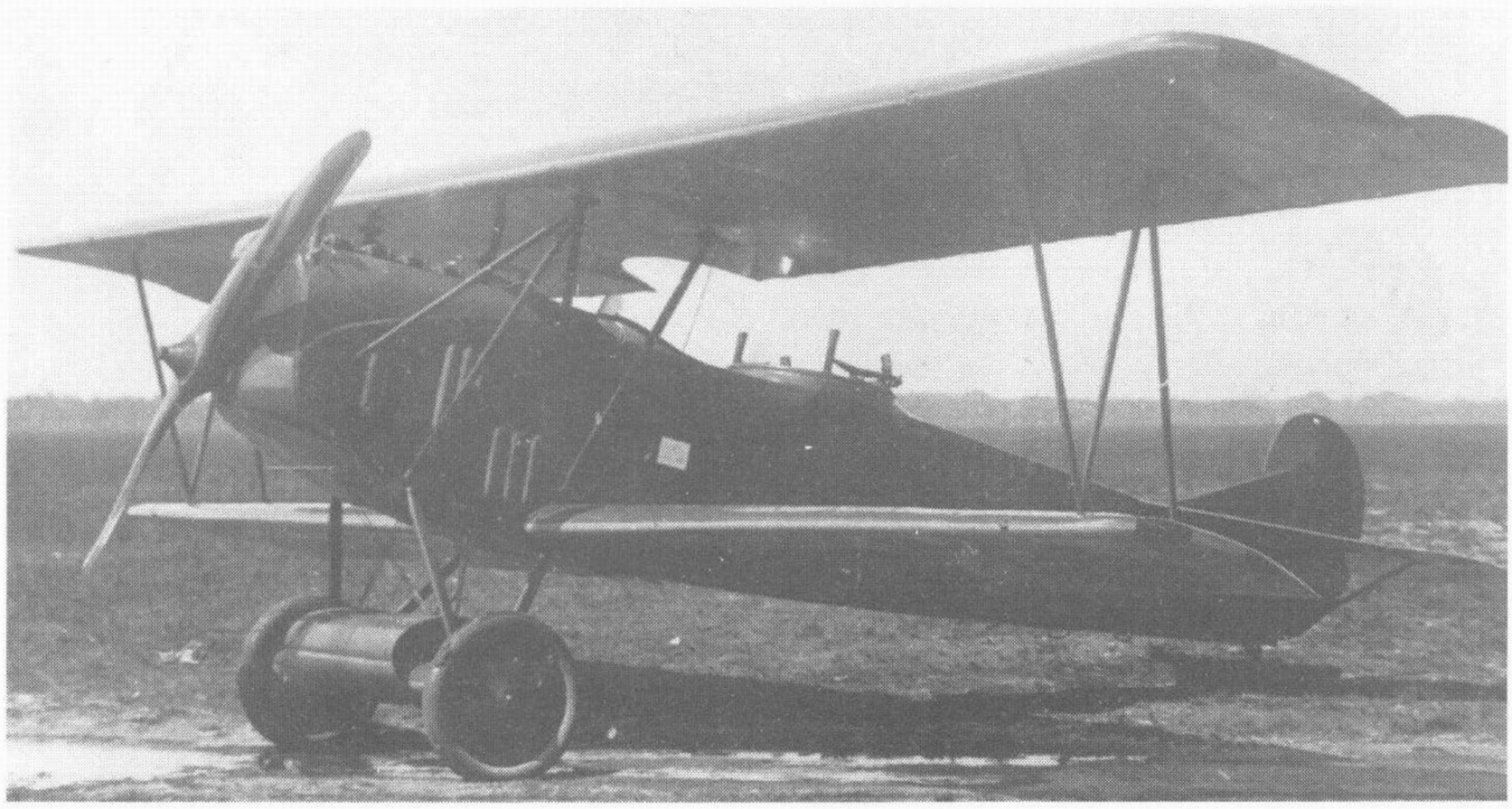
Oberleutnant Ernst Udet.
Cross and Cockade International



Fokker C.1. Author



(Above) **A 210hp Austro-Daimler-engined Fokker D.VII built by Fokker and seen here in 1922 after it had been captured from the Hungarians and put into use by the Czechoslovakian air service. The number on the fuselage side, 38.67, is adapted from the aircraft's original factory number 3867.** Cross and Cockade International

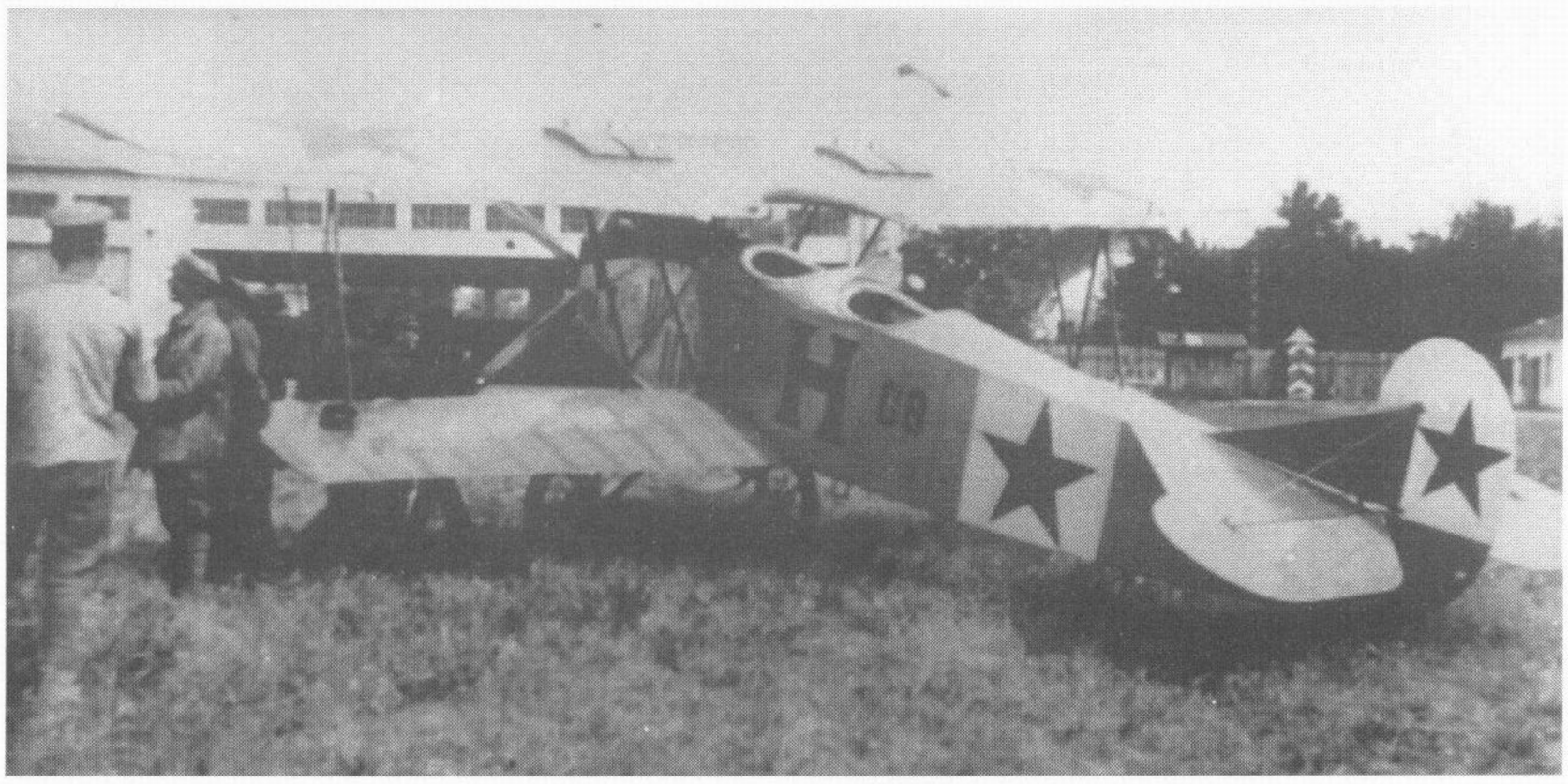


185hp BMW-engined Fokker C.1. Cross and Cockade International

failed to pass the type test and it was suggested to him that modifications should be made before it could be considered further. One of the objections to the design was the location of the ammunition tank near the engine and the consequent likelihood of a recurrence of the ammunition-fire problems that had plagued the early D.VIIs.

Even so, a number of V.38s were completed and it has been said that one with an enlarged fuel tank in the forward fuselage was kept at Schwerin by Fokker to enable him to escape to the Netherlands should the need arise. Other V.38s were converted to serve as glider tugs after the end of the war.

Sixty V.38s were smuggled into the Netherlands by Fokker at the end of the war, and designated C.1. A number were bought by the Dutch Army and three by the US Navy. Their subsequent history was marred by faults with the undercarriages, which were not really strong enough for military use, and the fact that their undercarriage-located fuel tanks suffered from leaks at faulty seams. Even so, they earned a reputation as safe machines.



Certainly post-1918, an unidentified two-seat version of the D.VII fitted with a four-bladed propeller. The markings appear to be Soviet but the date and place are not known. Cross and Cockade International

Monoplanes and the Second Fighter Trials

As mentioned in Chapter Six, Fokker submitted two monoplane designs for consideration at the first series of fighter trials held in January/February 1918. At the time, they were overshadowed by the successes of the V.11 and V.13 designs. Although they did not figure in the final list of machines considered for production, they cannot be ignored as they represented significant steps along the path that led to Fokker's final fighter plane of the war, the Fokker D.VIII.

The V.17

The first of these (and fifth of Fokker's submissions to the trials) was V.17, a mid-winged monoplane powered by a 110hp Oberursal UR.II rotary engine. Its single, one-piece, cantilever wing was based on the design developed for V.1 and V.2 but was thinner and of lighter construction. Built around two box spars to which were fitted the wing ribs, the whole was covered in thin plywood. This gave good torsional stiffness and allowed a smooth finish. Its fabric-covered fuselage was of similar steel tubular construction to V.9 and V.11, but had been adapted to allow the two wing spars to pass through it. The engine installation and tail assembly were again similar to those used for V.9. A novel feature was that its ailerons were cut out of the completed wing, thus saving the need for the provision of separate jigs and fixtures for their manufacture.

Fokker liked flying V.17 – it was light, responsive and handled well. To gain as much publicity for the machine as he could, he demonstrated it personally on 27 January, the Kaiser's birthday, a date of great importance to the German Army. V.17 proved to be the fastest machine at the trials and, in Fokker's hands, gave a spectacular performance at low altitude and high speed. Even so, it was not able to win a production order. With the low-powered engine installed, its rate of climb – 35 minutes to 5,500m (18,000ft) – was clearly not good enough. It was obvious that a more powerful engine was required.

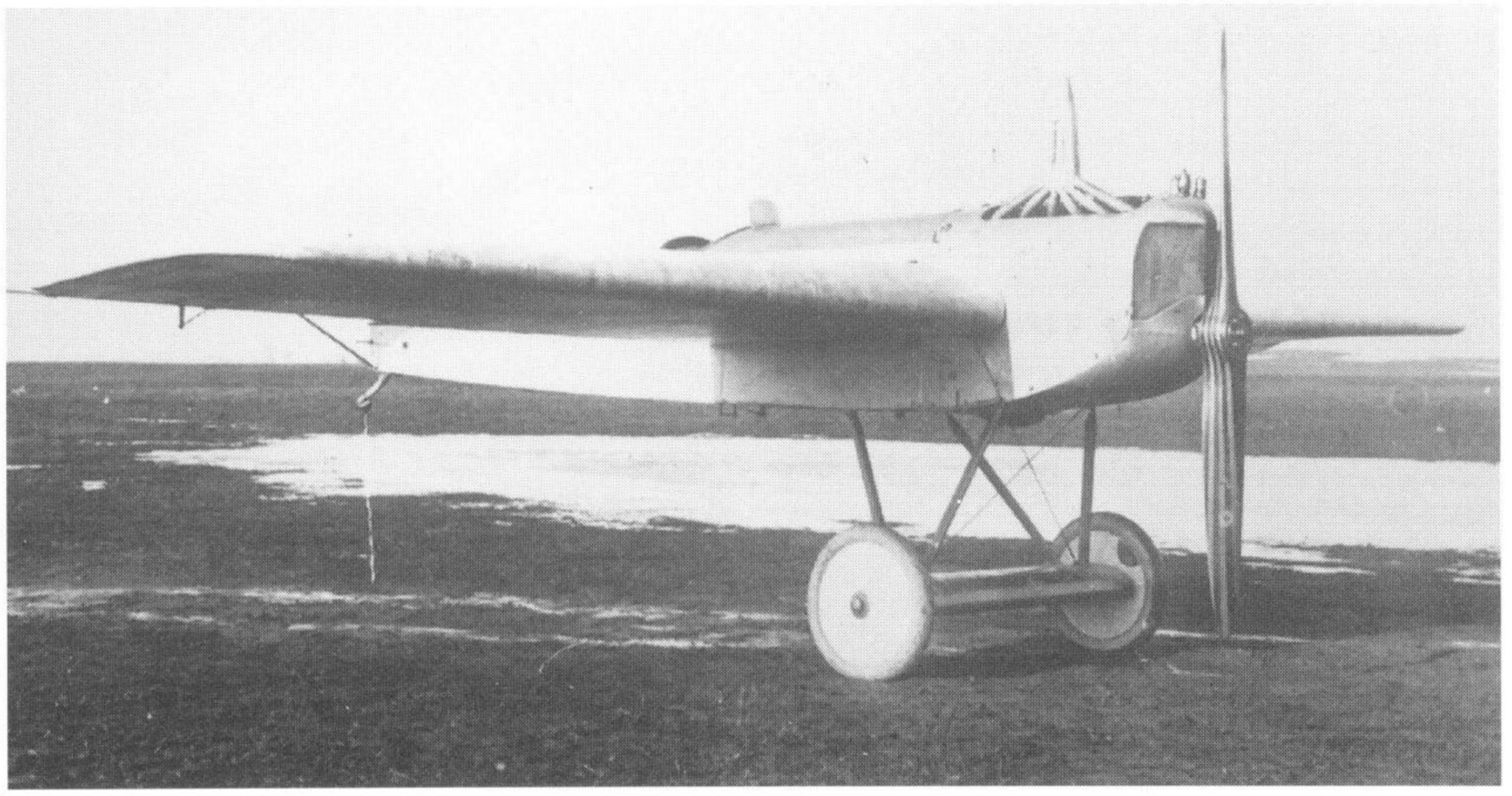
The V.20

Fokker's next monoplane was V.20, another mid-winged machine. Well aware that V.17's low power had stifled its performance, Fokker telephoned Platz, who remained at Schwerin. He instructed that a version fitted with a 160hp Mercedes D.IIIa engine be completed so that he could demonstrate it in the two weeks left of the trials. Although it was an almost impossible request, Platz achieved it and V.20 arrived at Adlershof one week later.

The Mercedes engine, with its liquid cooling system, was both larger and heavier than the air-cooled Oberursal engine. The airframe to support it therefore had to be both larger and stronger than that of V.17. Further, the additional weight of engine and fuselage required a larger wing area so, although similar to V.17, V.20 was virtually a new machine. The cantilever wings were of similar basic construction to those of V.17 but, in order to save time, were of simpler design with squared-off wing-tips. To save weight, the wing surfaces behind the rear spar were covered in fabric, as were the wing-tips and the steel tube-constructed horn-balanced ailerons. The plywood surfaces of the wing were French polished rather than painted, again to save time. V.20 used a similar radiator to that fitted to V.11, and a modified version of that machine's undercarriage.

As with V.17, V.20's performance was a disappointment, the additional power of the engine having been absorbed by the extra weight of the larger airframe. Although in general appearance it was a neat machine with no external wires, it suffered from a vertical chimney-like exhaust system that must have caused considerable drag and cannot have helped its performance.

Neither V.17 nor V.20 was submitted for type testing, although both enjoyed reserves of structural strength and would have passed without difficulty.



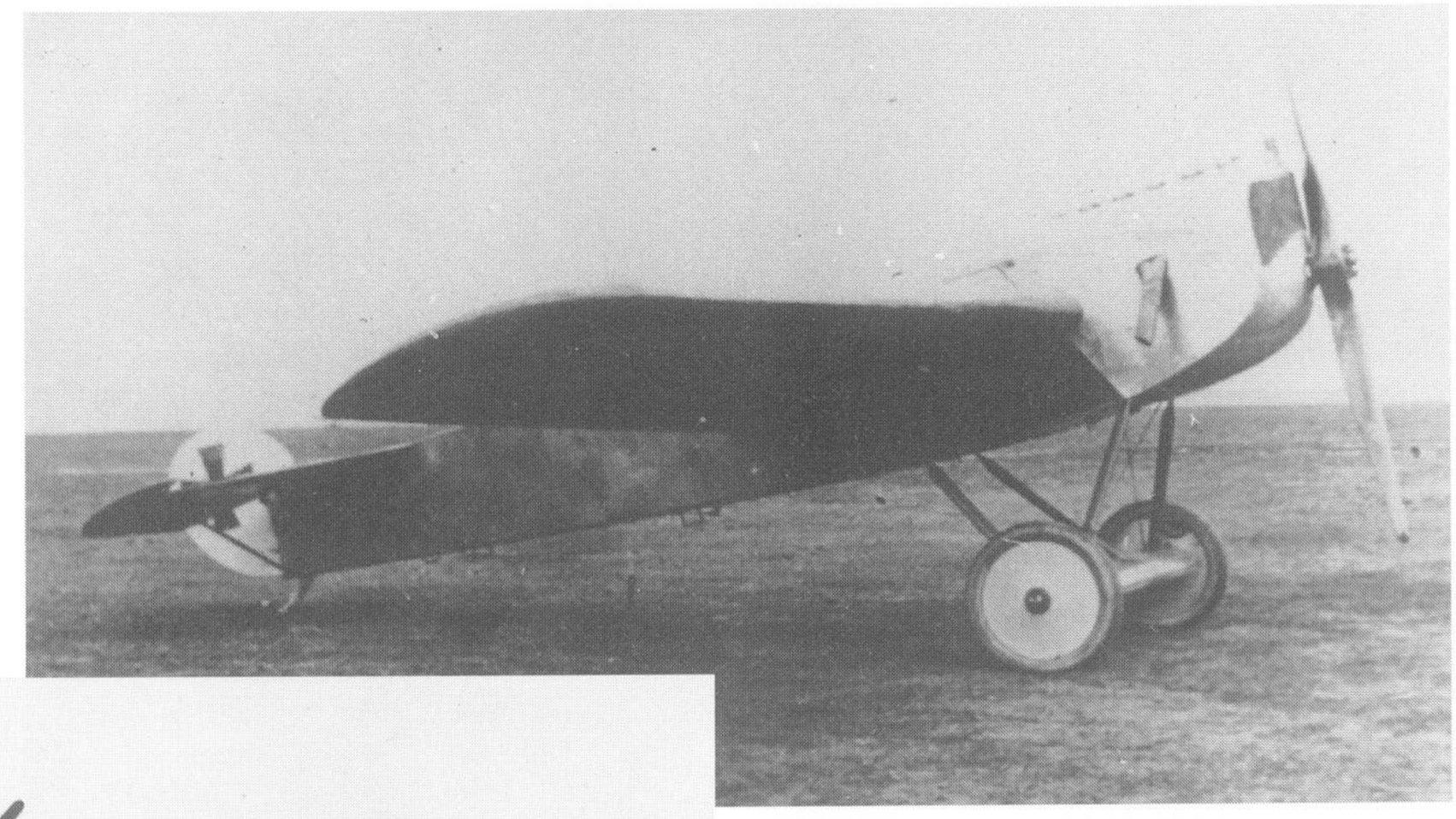
Fokker V.20 fitted with a 160hp Mercedes D.IIIa water-cooled engine. Cross and Cockade International

The V.23

Fokker's next monoplane was V.23. Although of similar appearance to its predecessors, its features were more refined. Its cantilever wing was completely plywood-covered and had rounded wing-tips and unbalanced ailerons (probably cut out of the completed wing). It was powered by a 160hp Mercedes D.IIIa engine and used the same radiator as V.20, but its engine cowling was of more rounded shape and the exhaust pipe reduced to a single outlet from the right-hand side of the nose, shaped and routed to ensure that gases would pass below the wing.

V.23 was submitted to the second fighter trials in June 1918. While slightly better than that of V.20, its performance was not impressive and it took 31.5 minutes to climb to 5,100m (16,700ft). Another failing was that though the pilot had an unobstructed view forward and upwards, his downwards view was obstructed by the large wing area and was clearly inadequate for combat.

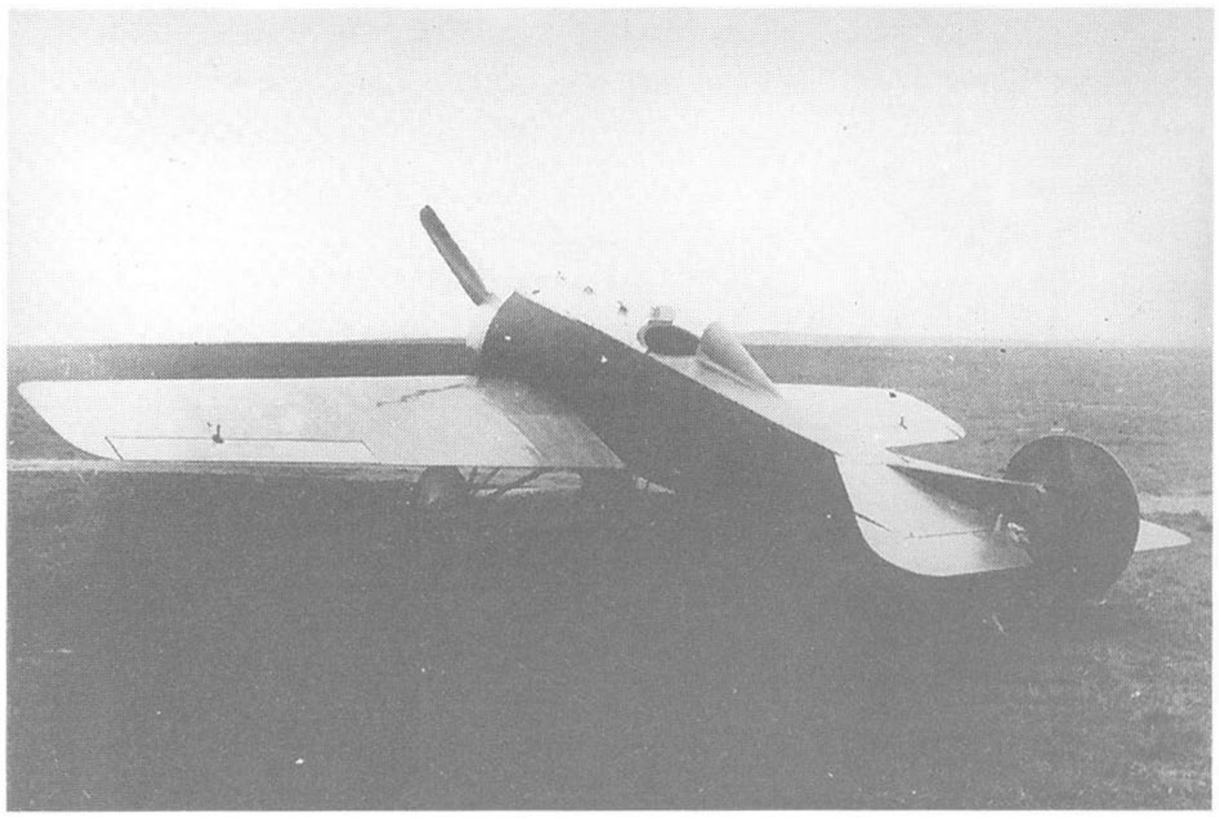
V.23 survived the war and was taken by Fokker to the Netherlands. It is understood that it was given to the German Air Museum in Berlin, but this author has found no record of this. If it was given to the museum, it may have been destroyed by bombing during World War Two or removed to safety in Eastern Europe with others in the collection.

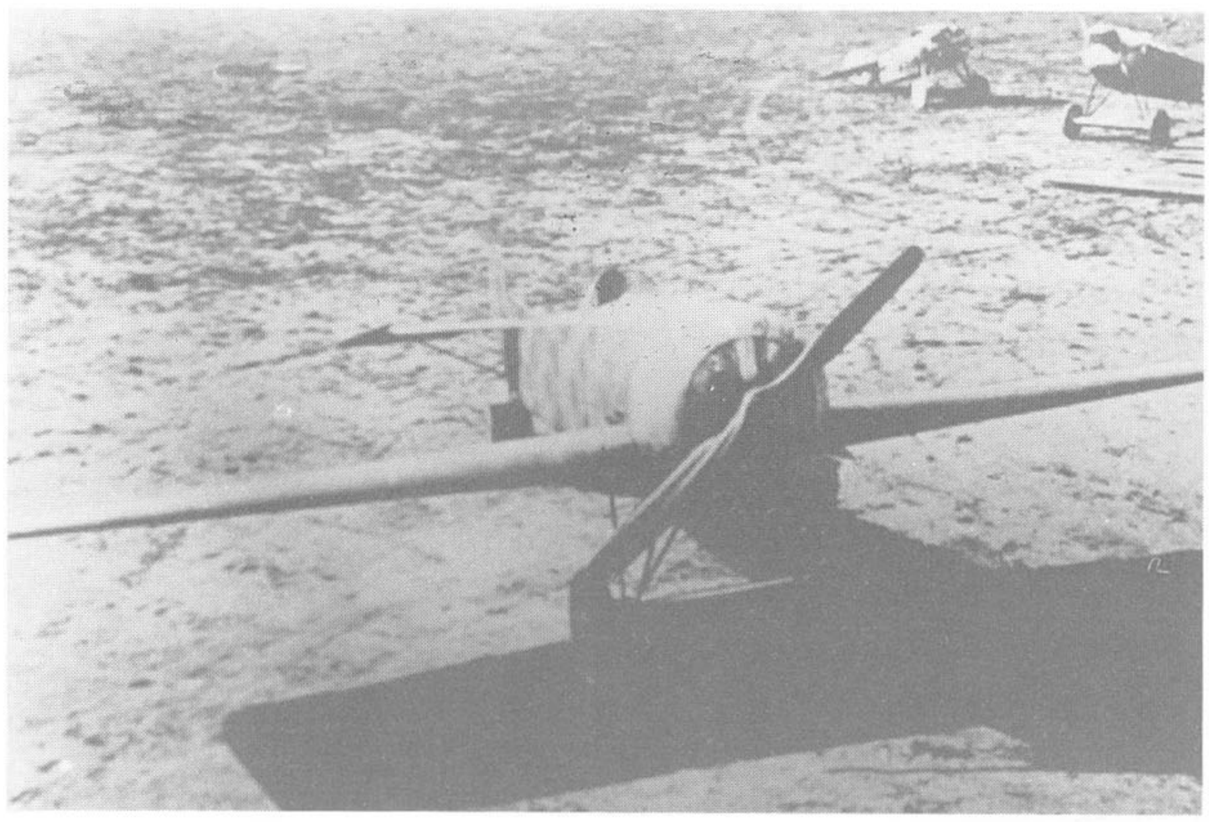


***(Top)* Fokker V.23 fitted with a 160hp Mercedes D.IIIa water-cooled engine.** Cross and Cockade International

***(Left)* V.23, seen from the rear.** Cross and Cockade International

***(Below)* Another view of V.23.** Cross and Cockade International

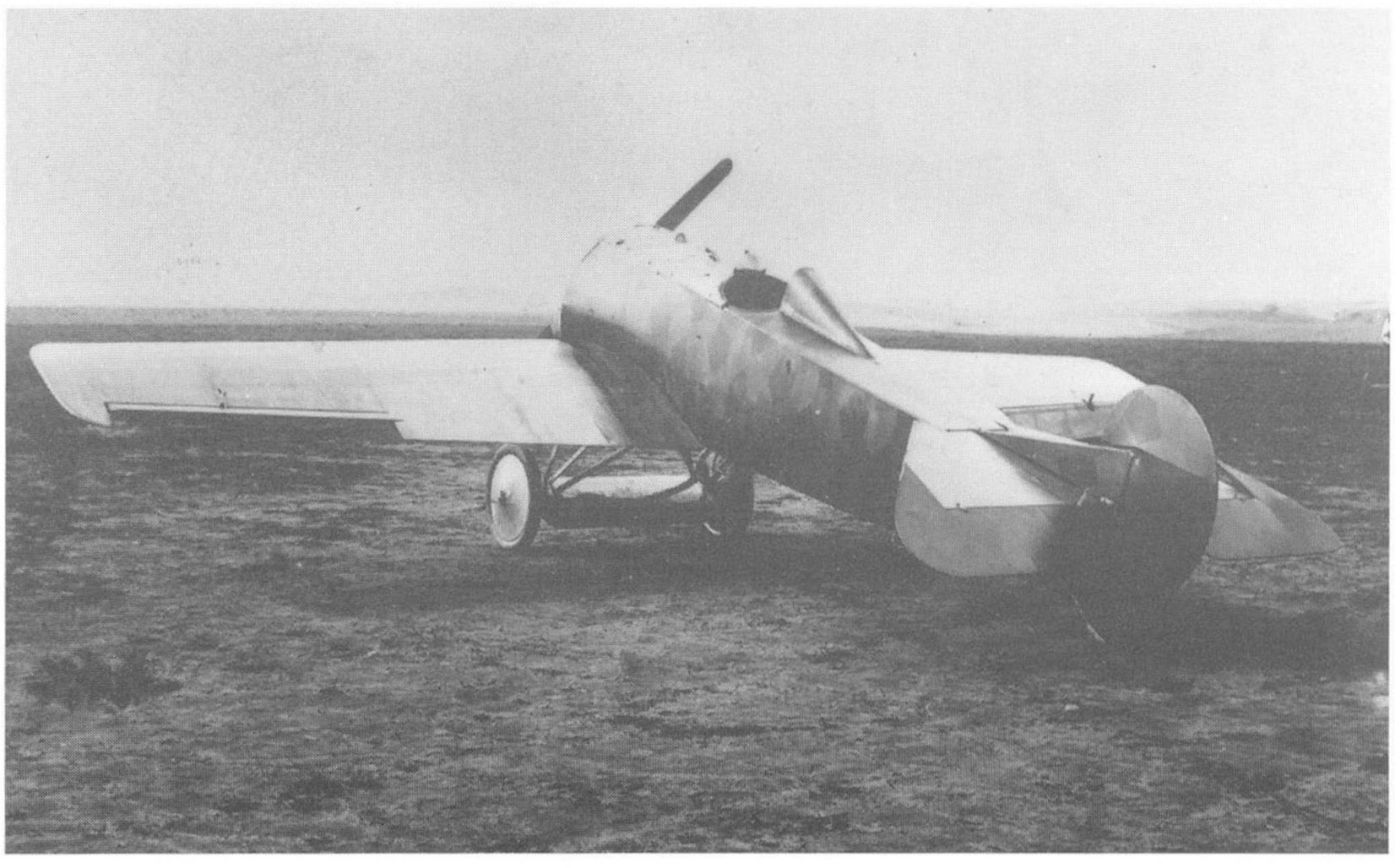




***(Above left)* Fokker V.25 fitted with a 110hp Oberursal UR.II rotary engine.** Cross and Cockade International

***(Above)* V.25.** Cross and Cockade International

***(Left)* V.25.** Cross and Cockade International



V.25. Harry Woodman

The V.25

The next monoplane development was V.25, a low-winged machine based on Fokker's experiences flying Junkers' J.7. Structurally, it was similar to V.17, V.20 and V.23 with a tubular steel-framed fuselage, tailplane, tail fin, rudder and undercarriage. Its all-wood cantilever one-piece wing followed the same design principles as those of its predecessors and had no dihedral. It was mounted in the bottom of the fuselage in a manner similar to that used for the Dr.I. In planform, the wing tapered gently from its root to its tips, which were square cut with rounded 'corners'. Its outer covering was again thin plywood. Its ailerons were cut from the nearly completed wing and, unusually for the period, they were inset from the tips. Because of the prevailing fear that the lack of an 'upper' wing put the pilot at risk in the event of the machine turning over, V.25 was fitted with a robust crash pylon immediately behind the cockpit that was faired and provided a head rest for him – another feature copied from Junkers' designs. Its 110hp Oberursal UR.II engine was covered by a horseshoe-shaped cowl and the result was a clean, neat monoplane, the appearance of which was well ahead of its time.

Fokker entered the V.25 in the second fighter trials in June 1918 but, with its

low-powered engine and inadequate performance, it had no chance of success. Normally, Fokker could have been expected to press ahead with the design and install a more powerful engine. However, as all of the examples of this second series of Fokker fighter monoplanes had wide-chord wings located in such a way as to obstruct the pilot's forward and downward view when landing, it is possible that this perceived handicap took him away from taking their development any further at this stage.

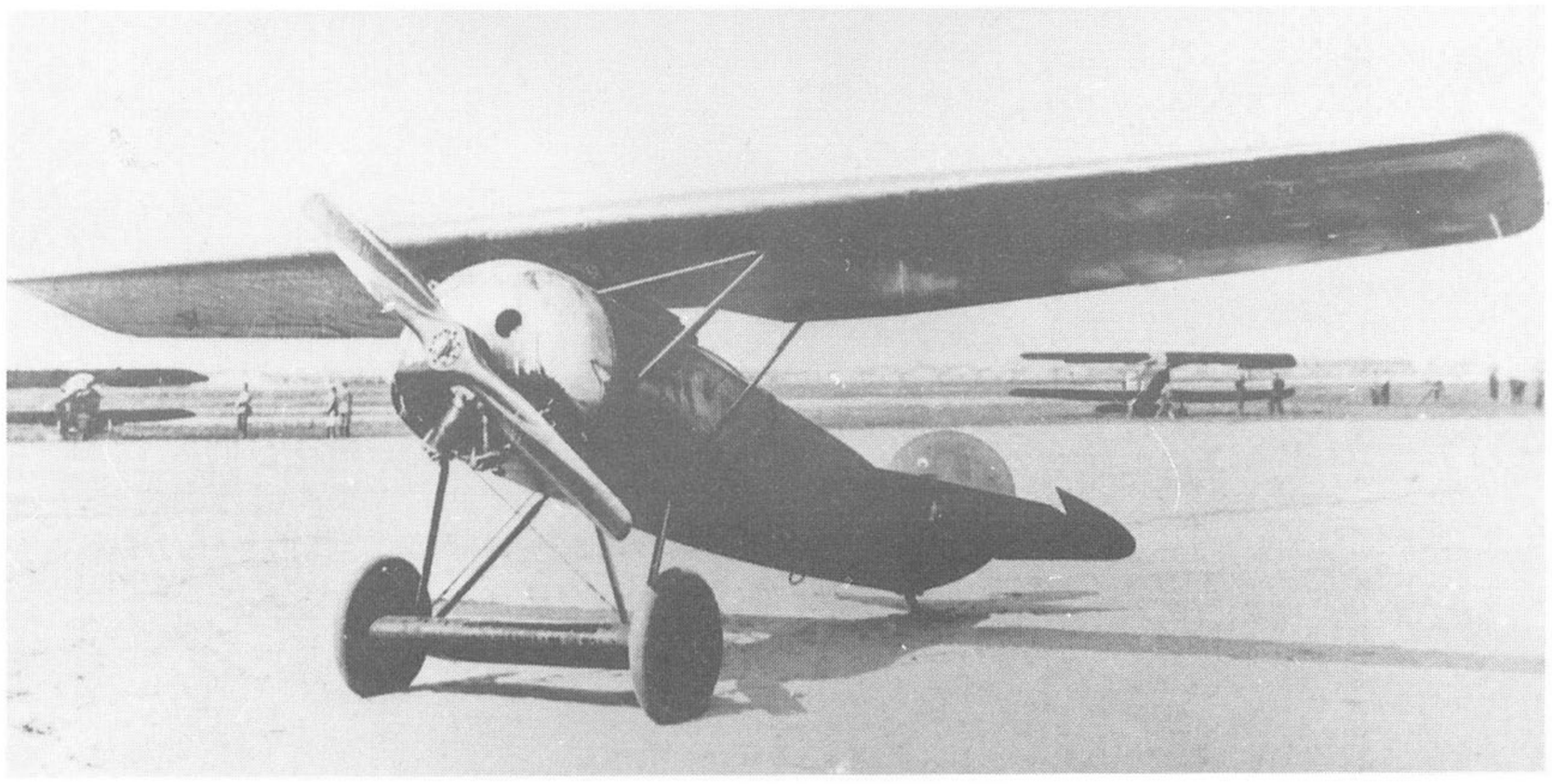
Birth of the E.V

Fokker's next prototype, V.26, did away with this disadvantage. Its single parasol wing was positioned closely above the fuselage on typically Fokker tripod and strut supports.

While it had much in common with the earlier monoplanes, its fabric-covered, tubular steel-framed fuselage and tailplane were virtually those of V.11. Its offset triangular fin and rudder were those of V.25. Its wing was a light plywood-covered cantilever on a robust wooden frame of similar construction and planform to that of V.25. It was powered by the ubiquitous 110hp Oberursal UR.II engine. Developed in parallel, V.28 had a similar airframe but with strengthened engine mountings and was flown with a variety of engines. These included the 145hp Oberursal UR.III, the 160hp Goebel Goe.III, the 200hp Goebel Goe.IIIa and (probably) the 110hp Oberursal UR.II. V.28 was submitted for type testing in April 1918 and, fitted with the 160hp Goebel Goe.III engine, was reported to have climbed to 5,000m (16,300ft) in eleven minutes – an extraordinary performance, even without a full military load. It was faster and more manoeuvrable than the production D.VII now equipping the Jastas and won swift approval, so much so that a part of Fokker's ongoing order for 120 D.VI types was cancelled and an immediate order for ten of the new machines was given and followed by an additional order for a further 200. All of this took place before the second in the series of fighter trials had been concluded.

The production version, now designated as the Fokker E.V, differed from the V.28 prototype in a number of ways. The production E.V was to be fitted with the least powerful engine of those tested on the V.28, the 110hp Oberursal UR.II. The reason for this is not known, but it can be surmised that the older engine was chosen because of its availability from the engines allocated to the shortened D.VI contract and its proven reliability. It was intended that, when more powerful engines became available in production quantities, a re-engining programme would be put in place. Another visual difference was that V.28's 'square' wing-tips were replaced by 'rounded' ones for the E.V.

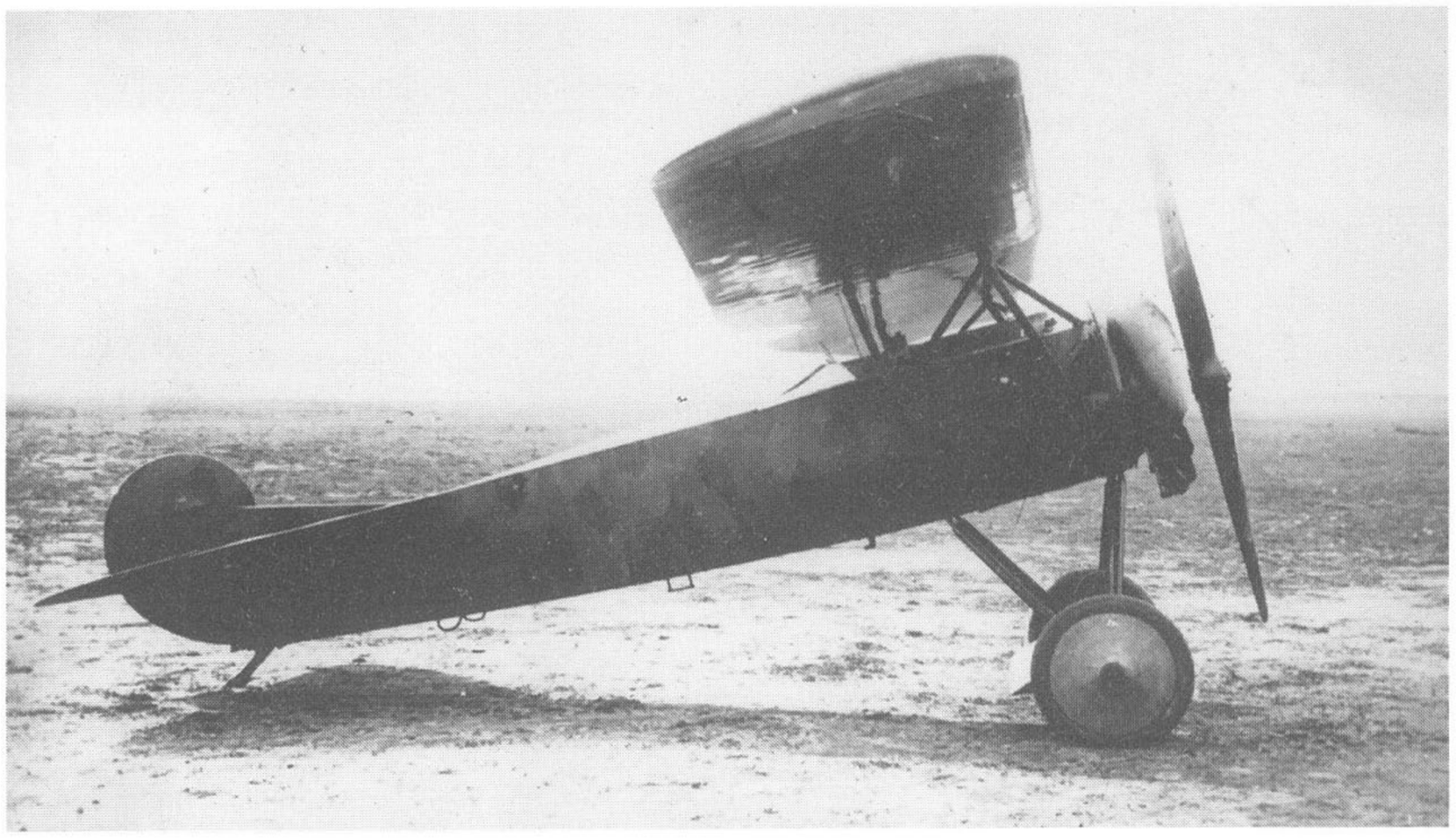
A complete airframe was submitted for static load testing at Adlershof between 7–12 June 1918 and followed shortly by a V.28 fuselage. The results of the tests were good and all structural requirements were met without difficulty. Minor modifications were required to only two components,



***(Above)* Fokker V.26 fitted with a 110hp Oberursal UR.II rotary engine.** Cross and Cockade International

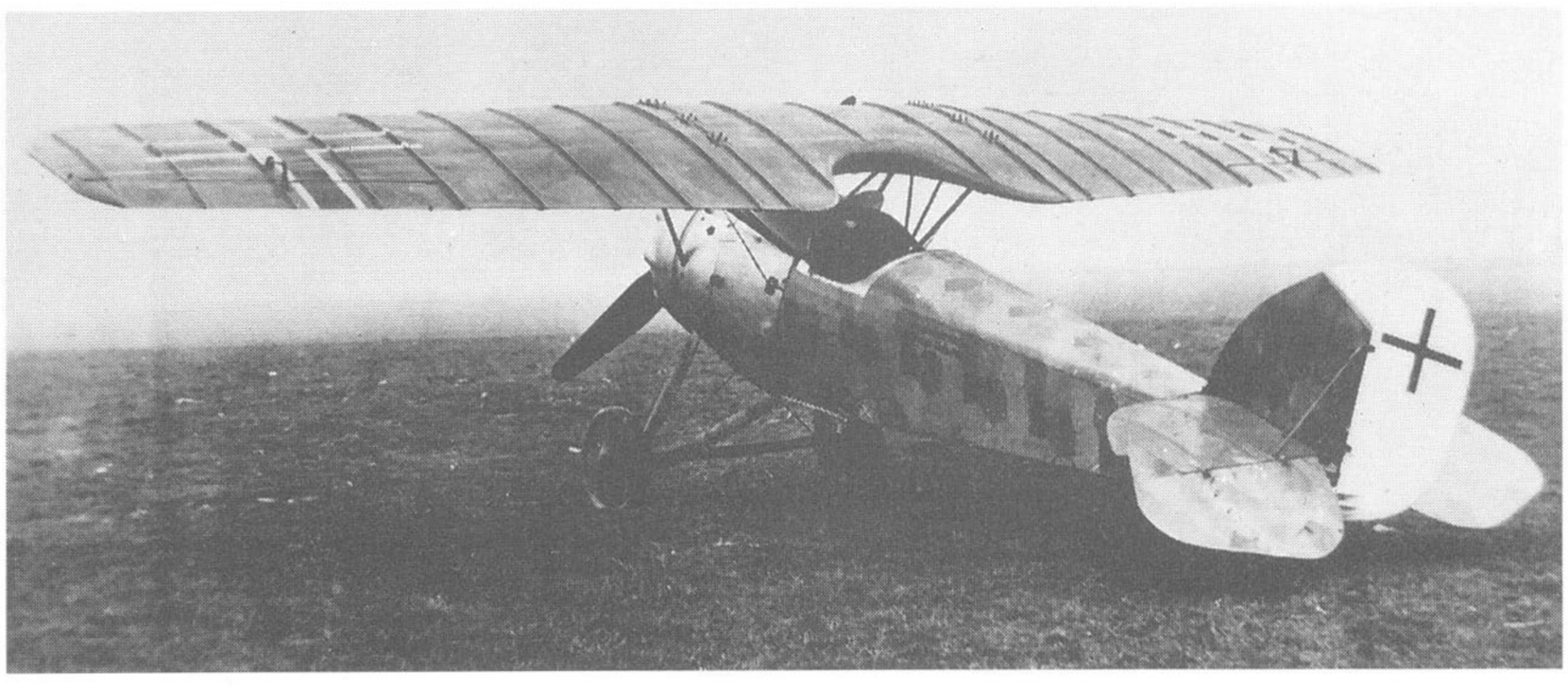
Fokker V.28 with a 145hp Oberursal UR.III engine. Cross and Cockade International

the rudder bar and the rear wing strut. Because of its unique plywood-covered wing, Idflieg officials required a series of weathering trials to be carried out to establish the aircraft's fitness for service in field conditions. As would be expected, these were extreme and, during them, the varnish finish and wooden surfaces showed some signs of deterioration but, when allowed to dry out again, regained their strength. It was recommended that Fokker improved the grade of varnish used for future production aircraft.



V.28. Cross and Cockade International

Fokker V.27 fitted with a 195hp Benz Bz.IIIb water-cooled engine. Cross and Cockade International



Kondor E.III. Cross and Cockade International

Following his established practice, Fokker instigated the development of a version fitted with a water-cooled engine. This was V.27 and it was fitted with the eight-cylinder, 195hp Benz Bz.IIIb engine, both geared and un-geared versions being tried. Based upon a French Hispano-Suiza engine, the Benz engine was shorter than the older Mercedes D.III range and allowed for a more compact installation. The radiator fitted was a neat circular unit fitted with shutters, unlike the large car-type radiators fitted to Fokker's earlier water-cooled machines. V.27's airframe was of similar construction to those of V.26 and V.28 but, because of its engine, was slightly larger and heavier. Also, in order to strengthen the wing mounting, its wing struts were more widely splayed than the earlier machines.

The Second Fighter Trials

The second fighter trials were scheduled for June 1918 and were controlled by strict rules. In mid-May all manufacturers were notified that their new machines had to be at Adlershof by 31 May. The first part of the programme called for the aircraft to be inspected, weighed and prepared for test. Performance testing, including monitored tests of climbing ability, would be carried out by Adlershof staff between 1–21 June. This would be followed by comparative testing by a number of combat-experienced service pilots. As with the previous trials, a number of in-service aircraft would be available for comparative purposes. It had been thought that up to fifty new or modified aircraft types would be submitted for the trials. But, by the decreed start date, only forty-two machines had arrived. Fokker's contribution was seven machines, two biplanes and five monoplanes.

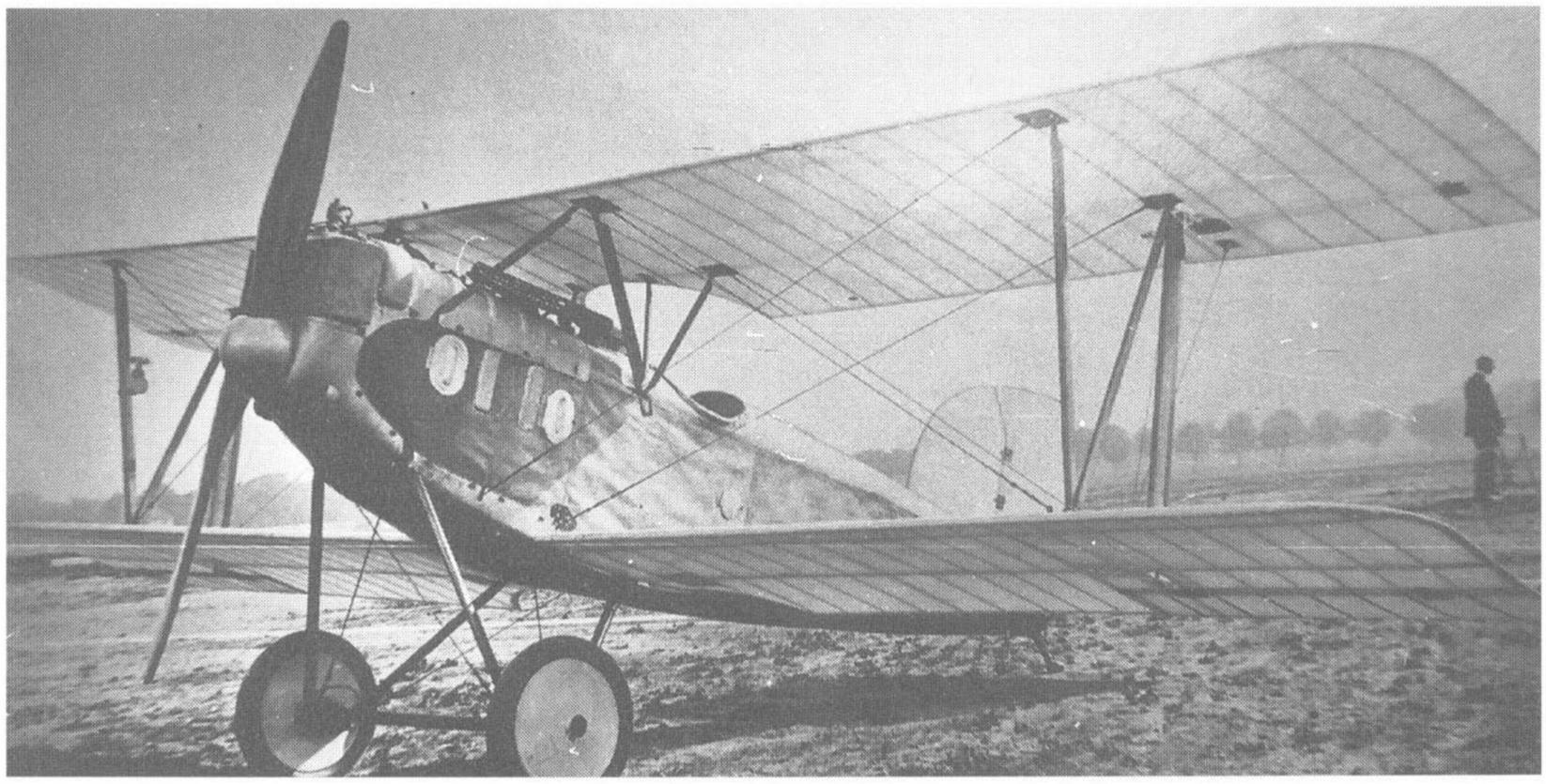
Company pilots and technical staff were present and allowed to demonstrate their equipment during the first part of the trials. They were totally excluded from the second part when service pilots would be flying their machines, evaluating them in combat conditions and comparing them with existing service aircraft. A final session with everybody present at the end of the trials was arranged to allow for discussion of the various machines and for any outstanding questions to be answered.

During the trials, the competitors were whittled away until only two machines in the rotary-engined group were left in the running. These were the Siemens-

Fokker's Submissions to the Second Fighter Trials, June 1918

'V' number	*Factory number*	*Engine*	*Type*
V.21	2310	Mercedes D.III	mid-wing monoplane – straight wings
V.23	2443	Mercedes D.IIIa	mid-wing monoplane – tapered wings
V.24	2612	Benz Bz.IV	biplane
V.25	2732	Oberursal UR.II	low-wing monoplane
V.27	2734	Benz Bz.IIIb	parasol-wing monoplane
V.28	2735	Oberursal UR.II Oberursal UR.III Goebel Goe.III	parasol-wing monoplane
D.VII	2268	Mercedes D.III	biplane – wooden fuselage

A view of V.24. Cross and Cockade International



Categories of Aircraft at the Second Fighter Competition

GROUP 1 (160HP MERCEDES D.III)
Fokker D.VII 230/18; Fokker D.VII (Alb); Fokker D.VII (OAW); Albatros D.XII; Rumpler D.I; Junkers D.I; Zeppelin D.I; Pfalz D.XII; Schütte Lanz D.VII; Naglo D.II Quadraplane (which included Albatros components and which was withdrawn before the trial at that company's request).

GROUP 2 (140/160HP ROTARY ENGINES)
Fokker V.28/1, 140hp Oberursal UR.III; eight Siemens-Schuckert biplanes D.III and D.IV types, Siemens & Halske Sh.III and IIIa; two Pfalz D.VIII, Siemens & Halske Sh.III; two LFG Roland D.IX biplanes, Siemens & Halske Sh.III.

GROUP 3 (UNGEARED 195HP BENZ BZ.IIIB)
Fokker V.27; Albatros D.X; Albatros D.XII; two Aviatik D.III; LFG Roland D.VII.

GROUP 4 (GEARED 195HP BENZ BZ.IIIA)
Fokker V.28/2; Albatros D.XII; LFG Roland D.XV/4; Daimler D.I (fitted with a 185hp Daimler D.IIIb).

GROUP 5 (185HP BMW.III)
Fokker D.VIIf; LFG Roland D.XV/3); Pfalz D.XII.

GROUP 6 (220HP BENZ BZ.IVU)
Fokker V.24; Pfalz D.XIV

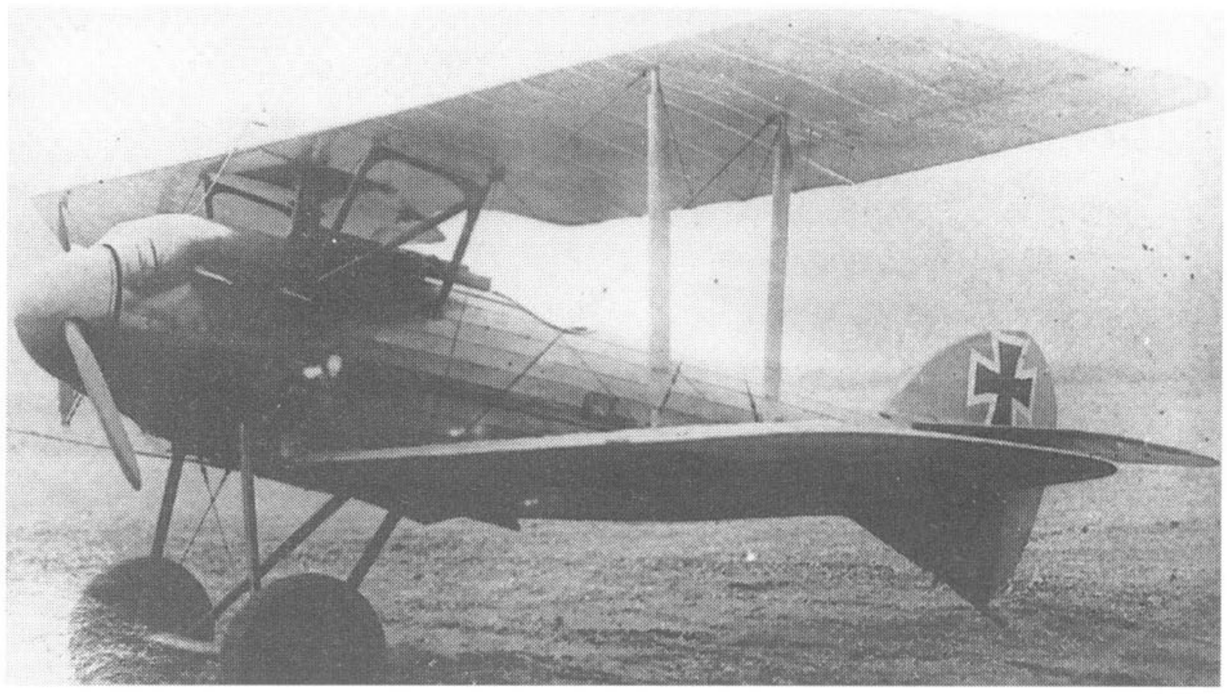
GROUP 7 (110HP OBERURSAL UR.II)
Fokker V.25; Fokker V.26; Kondor D.I; Kondor D.II

***(Top left)* Albatros D.XII.**
Cross and Cockade International

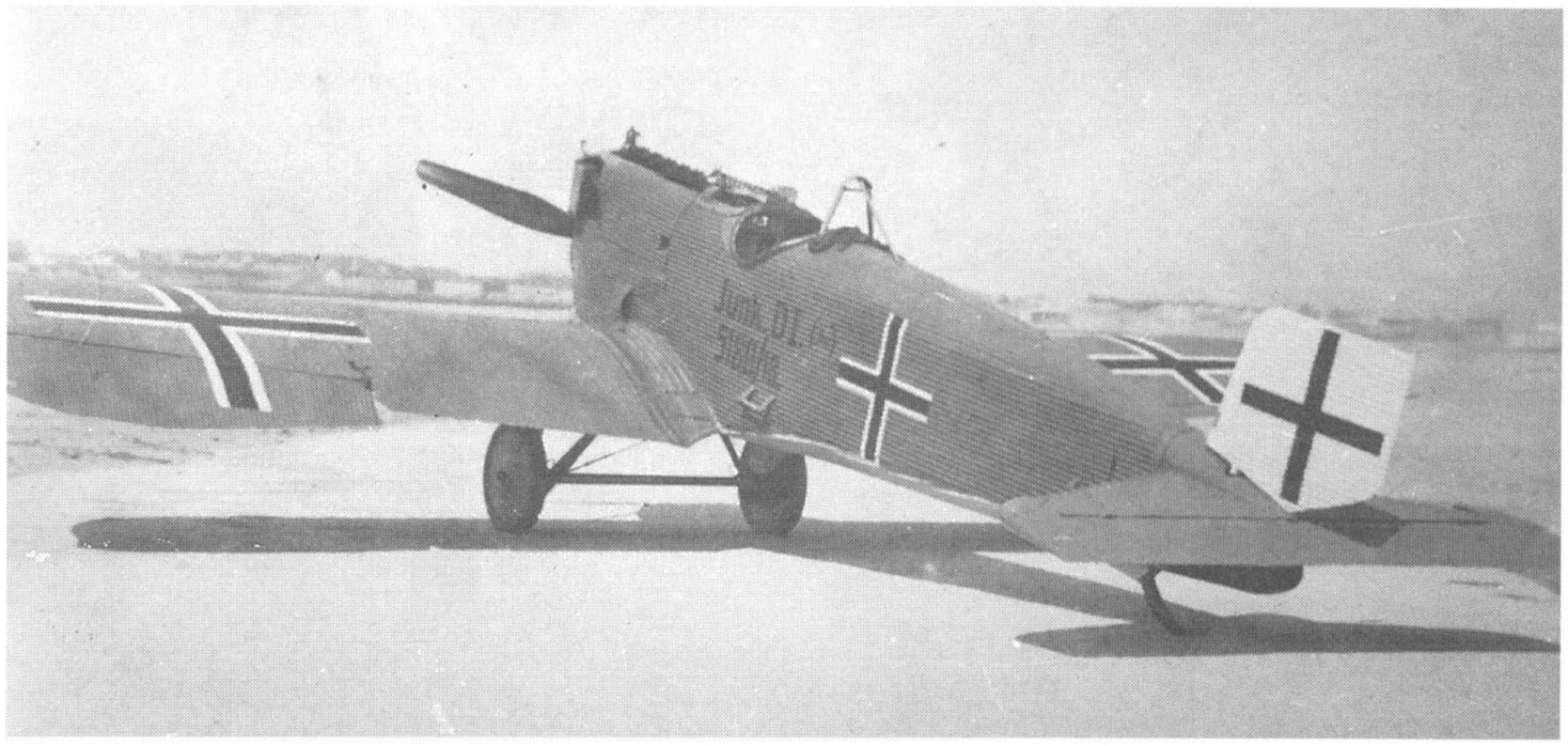
***(Bottom left)* Schütte-Lanz D.VII.**
Cross and Cockade International

Schuckert D.IV with its 160hp Siemens & Halske Sh.IIIa engine and Fokker's V.28 powered by the 145hp Oberursal UR.III. These were flown against each other and the D.IV proved superior in climb, manoeuvrability and speed at altitude. Fokker himself then flew V.28 with a view to proving that, in the hands of a good pilot, it could give a better performance than the D.IV. Although he failed to achieve this, V.28's performance created a good impression. The service pilots who had also flown it were enthusiastic about its advantages, particularly the excellent all-round view that it gave the pilot and even went so far as to say that they preferred it to the BMW-engined Fokker D.VIIF.

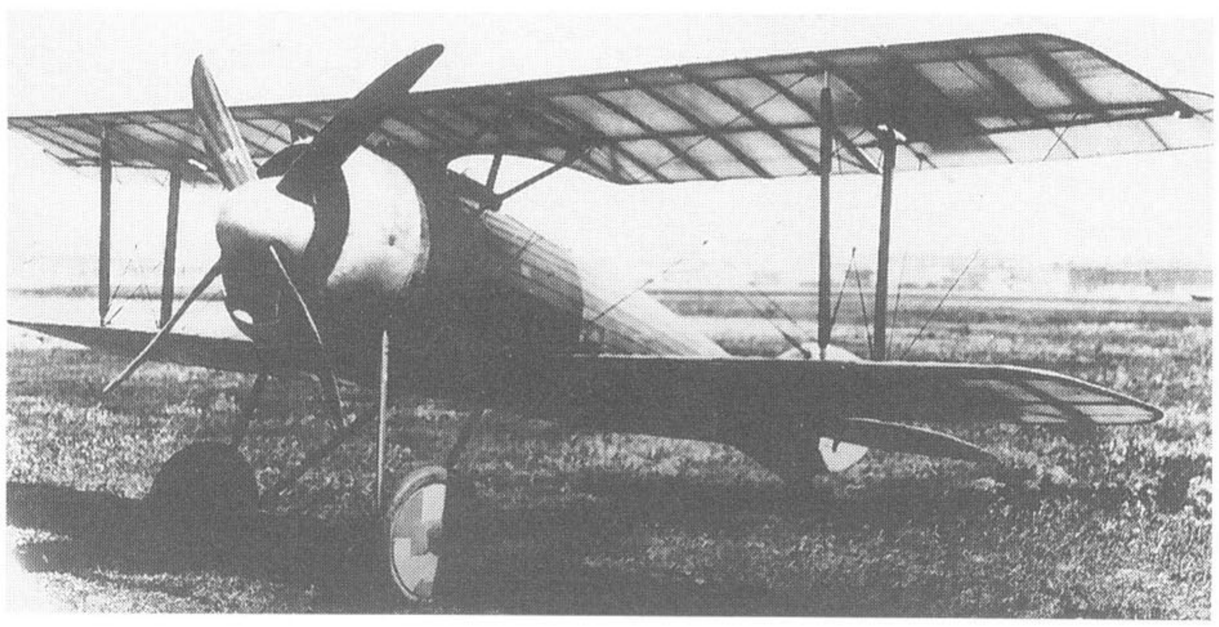
Idflieg's experience with the climatic trials of the wings made them cautious and they warned of problems that could arise from active service conditions and the



LFG Roland D.XV/3. Cross and Cockade International



Junkers D.I 5180/18. Cross and Cockade International



***(Left)* LFG Roland D.VIII/2.** Cross and Cockade International

***(Above)* LFG Roland D.IX/3.** Cross and Cockade International

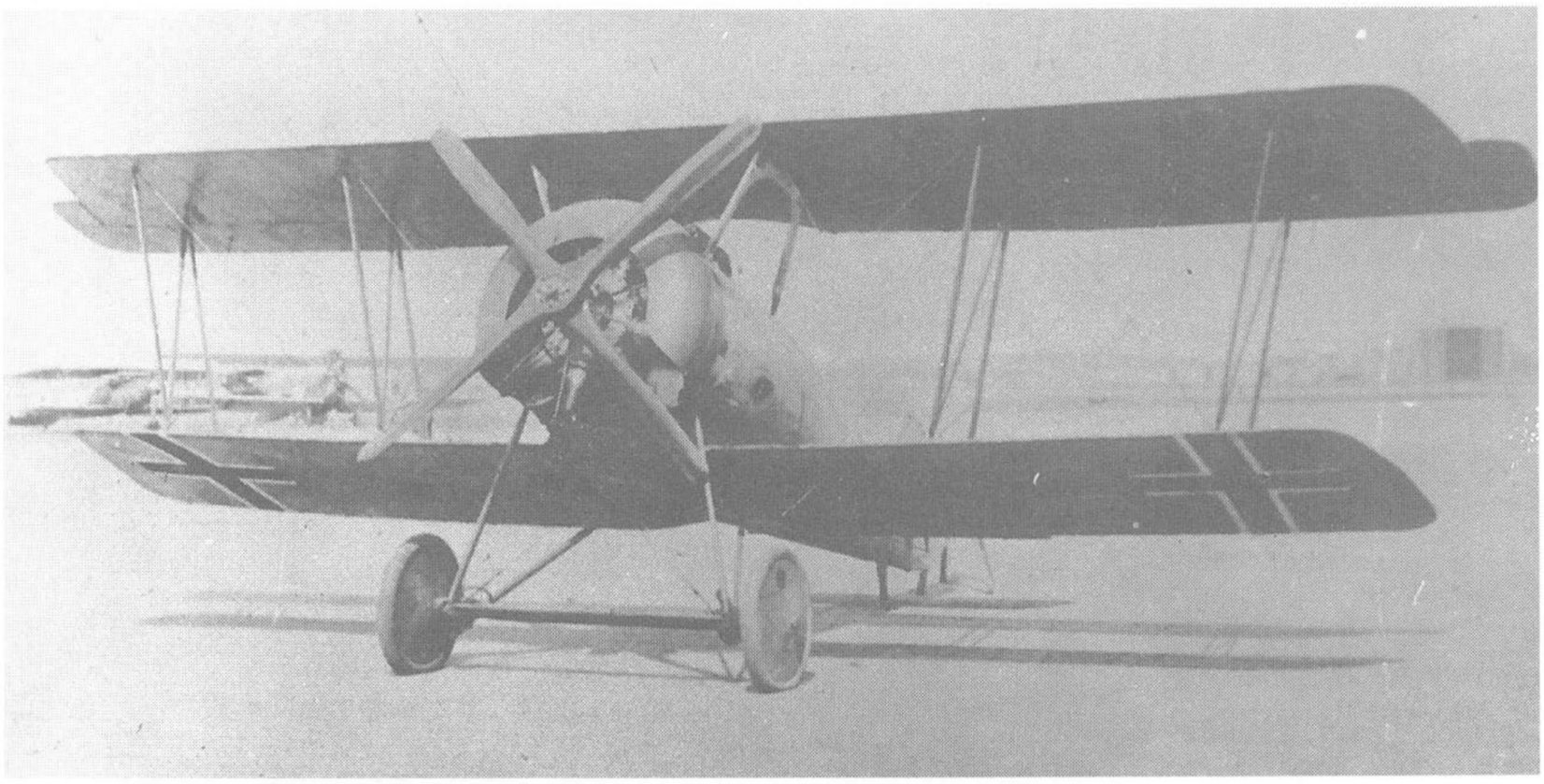
probability of the plywood surfaces deteriorating. But the pilots were adamant, they were prepared to accept these problems, so long as they could have the E.V. So Fokker's order was confirmed and production continued.

Good though it apparently was, the E.V was not the only machine to win contracts from the trials. The Siemens-Schuckert D.IV and also the Pfalz D.VIII, both powered by 160hp Siemens & Halske Sh.III engines, performed well and were therefore also awarded production contracts. The Siemens-Schuckert machine went into front-line service where it was well received, and the less manoeuvrable Pfalz machine went to home defence units.

In the water-cooled engine category, the service pilots chose the Pfalz D.XII fitted with the 185hp BMW engine, ignoring Idflieg's recommendation of the Fokker D.VII F. The Pfalz was fast and climbed well but was not as pleasant to fly as the D.VII F. A large order for the type was placed with Pfalz and it went into production, but it proved to be unpopular in service. Its wire-braced wings added to the workload of already extended technical staff and, where they had the choice, Jasta pilots soon rejected it for the Fokker D.VII. Fokker was angered that the Pfalz were being given priority delivery of the limited number of BMW engines being produced. In his biography, he claimed that pilots were deliberately writing off their D.XIIs so that their engines could be used to replace the older Mercedes D.III engines in Fokker D.VIIs, and so give them a new lease of life.

During the competition the Zeppelin-Lindau (Dornier) D.I suffered an unfortunate accident when, pulling out of a dive, a securing bolt sheared and its top wing broke away. Its pilot, Hauptmann Reinhard, a Dr.I pilot of some note and commander of Jagdgeschwader I, was killed in the crash that followed.

Although V.27 gave the best performance amongst those aircraft fitted with the new 195hp Benz Bz.IIIb engine, it was not awarded any production or development contract.



Wilhelm Reinhard

Hptmn Wilhelm Reinhard was born in Düsseldorf on 12 March 1891. He joined the Army as an officer trainee in 1909 and was posted to the 14th Bavarian Foot Artillery Regiment. He was wounded in November 1914, but was back at the front again by June 1915.

He applied for training as a pilot and, after passing, was posted to a front-line unit. He was seriously wounded again in December but, by February 1916, he had been promoted to Oberleutnant and joined FA(A)205, where he remained until he was transferred to FA28 in the Balkans. He returned to a Jastaschule in France early in 1917 and then, on 24 June 1917, was posted to Jasta 11. He was wounded in combat on 4 September but, on recovery, took command of Jasta 6 on 26 November. He was promoted to Hauptmann on 23 March 1918 and, when Richthofen was killed, took over command of JGI on 22 April.

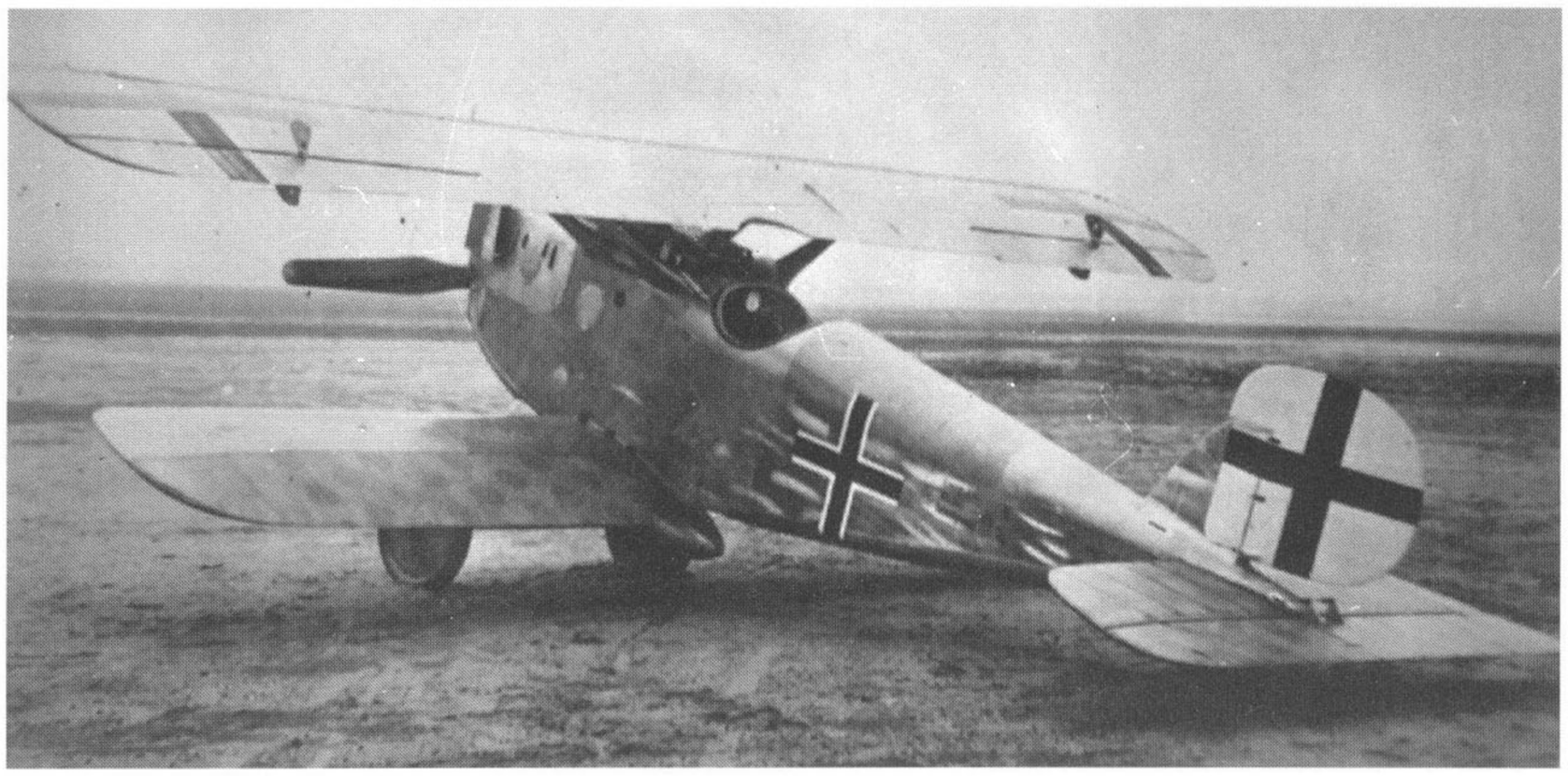
By the time that he went to Berlin to take part in the second fighter trials his score stood at twenty victories. His awards included the Iron Cross 1st and 2nd Class, the Bulgarian Bravery Order 4th Class in both 1st and 2nd Degrees, the Baden Order of the Zahringer Lion, Knight 2nd Class with Swords and the Knight's Cross with Swords of the Royal House of Hohenzollern Order. He was nominated for the Orden Pour le Mérite, but his death during the trials prevented it from being awarded to him. He was buried in Düsseldorf.

Hauptmann Wilhelm Reinhard.
Cross and Cockade International

***(Top)* Siemens-Schuckert D.IV.** Cross and Cockade International

***(Middle)* Pfalz D.VIII/3.** Cross and Cockade International

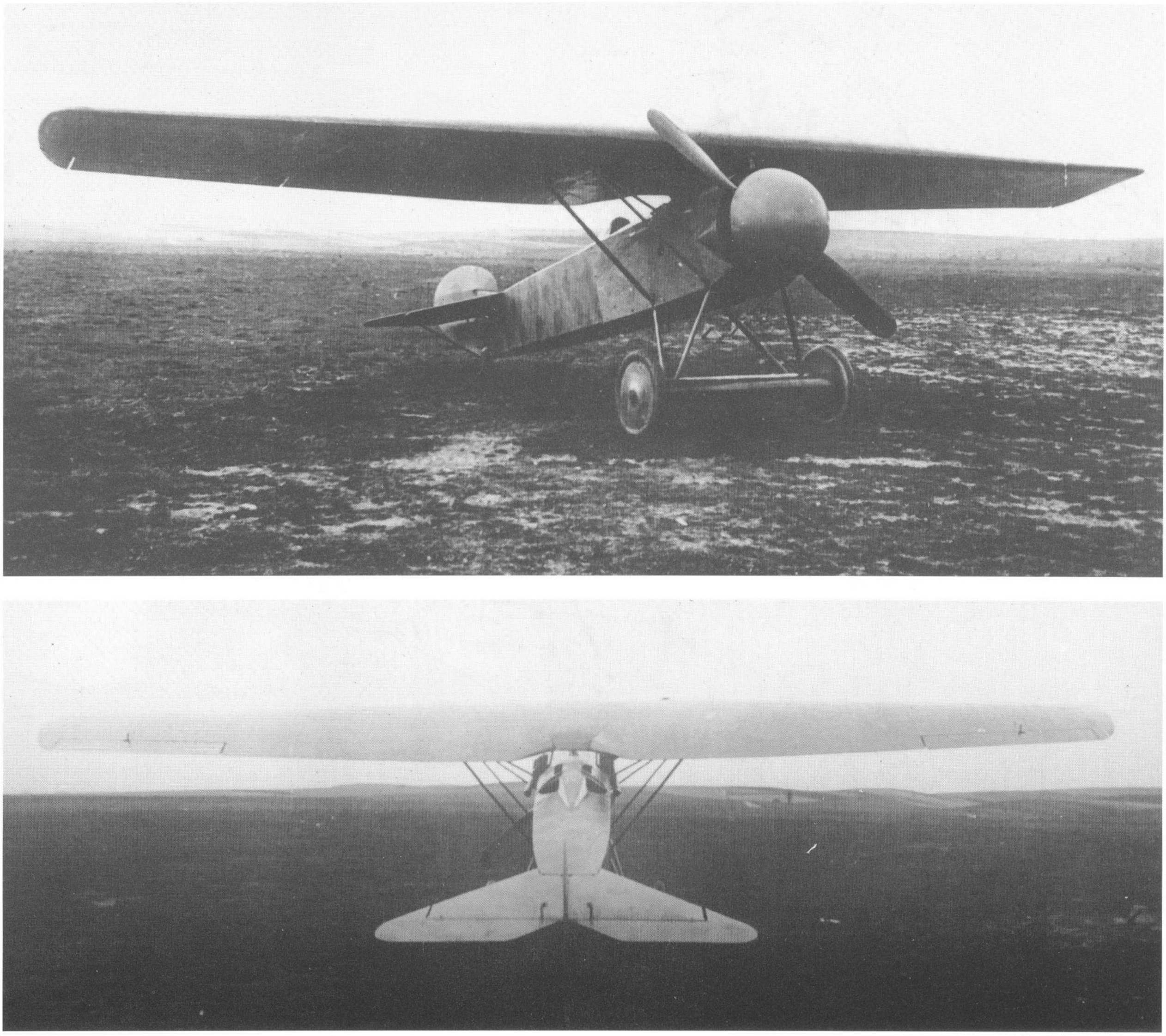
***(Bottom)* Pfalz D.XII.** Cross and Cockade International



Zeppelin (Dornier) D.I. Cross and Cockade International

(Below) **Fokker V.37, an armoured version of the V.27 fitted with a 195hp Benz Bz.IIIb water-cooled engine.** Cross and Cockade International

(Bottom) **Rear view of V.37.** Cross and Cockade International

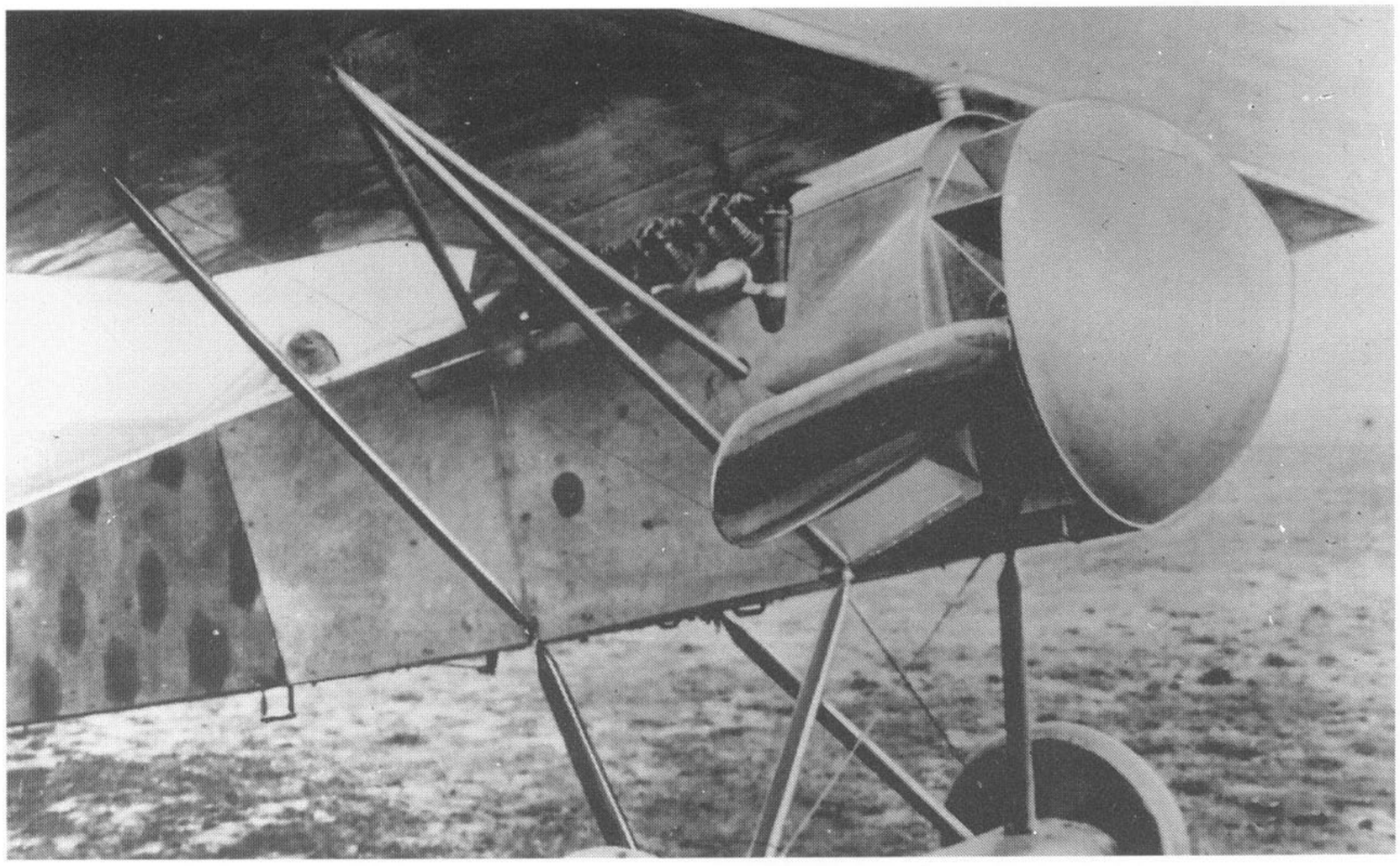


The V.37

At the end of the trials, the Army made known a requirement for an armoured single-seater to be used both to support ground-attack aircraft and to engage ground targets itself. The structure of this machine needed to be such that it could sustain hits without suffering catastrophic failure. Fokker felt that V.27's design lent itself to this though he acknowledged that, in its present configuration, its nose-mounted radiator was extremely vulnerable.

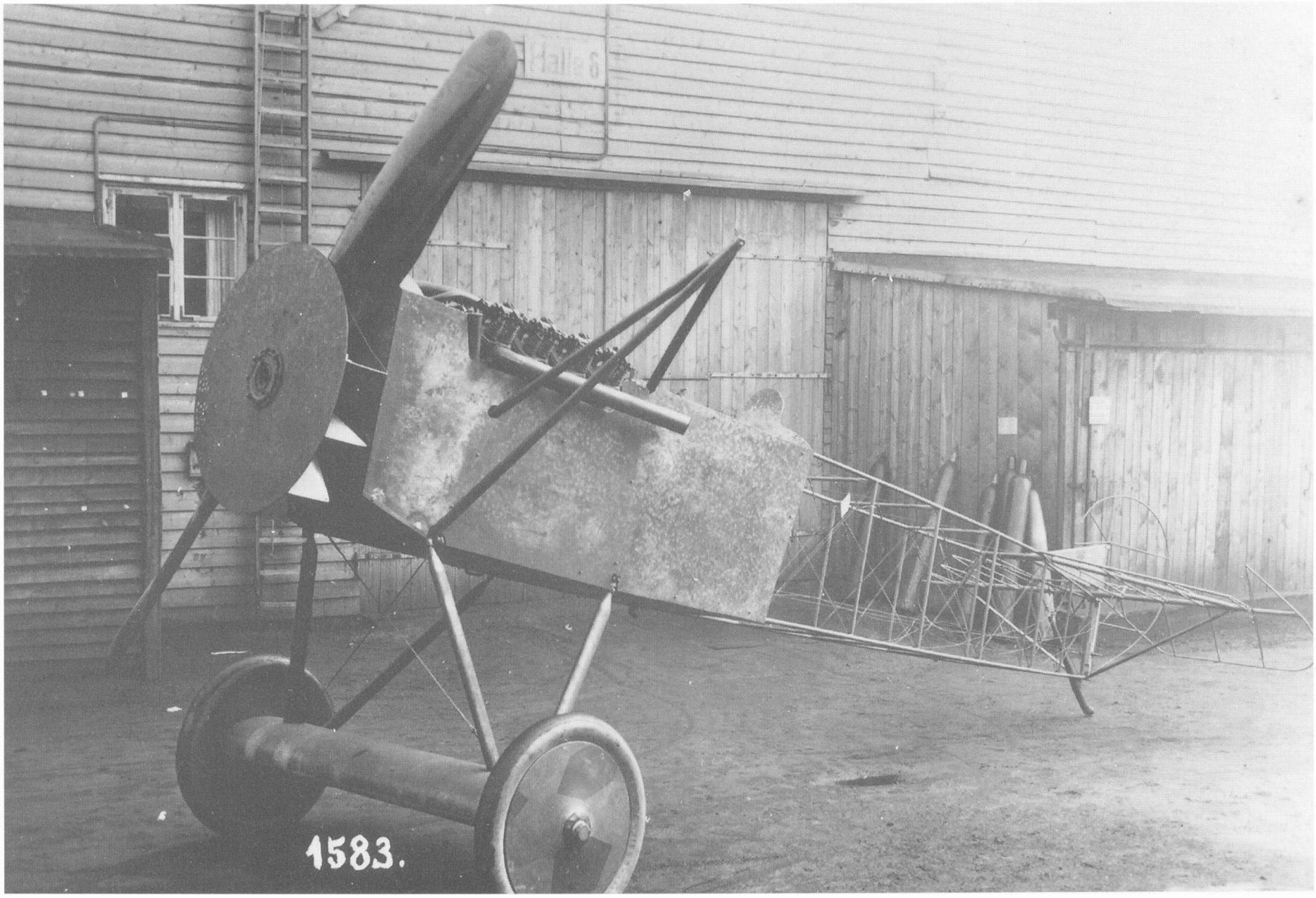
As ever, Platz had a solution to the problem. This comprised an armour-steel disc, of sufficient diameter to give complete protection to the radiator, fitted in front of the propeller. This was faired with a large, dome-shaped spinner. Behind it were six fan blades designed to maintain the essential cooling airflow through the radiator. The system worked well.

To provide the stipulated level of protection for the pilot, it was necessary to fit

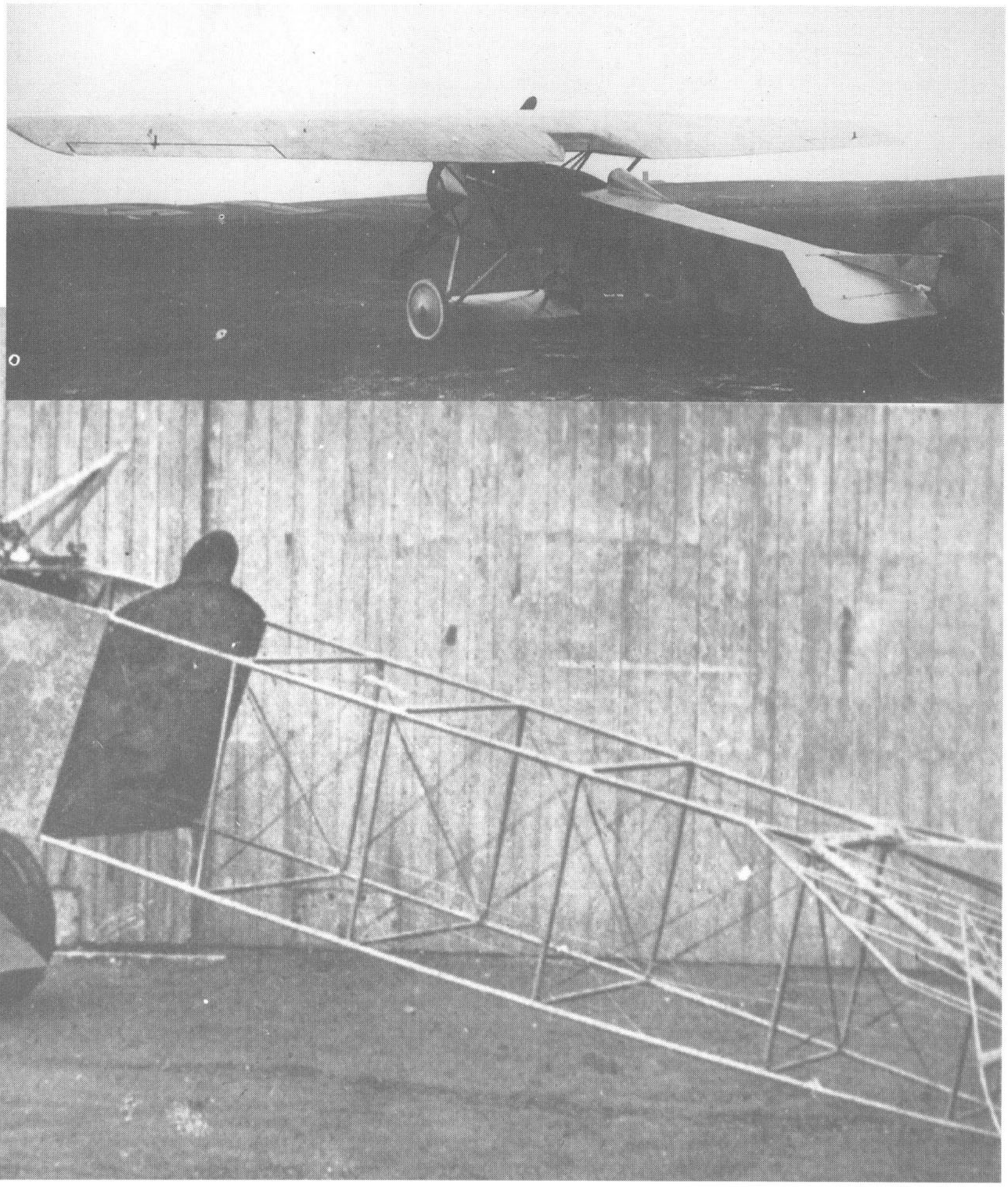


Close-up of the nose of V.37 showing its large spinner and armoured backplate. Cross and Cockade International

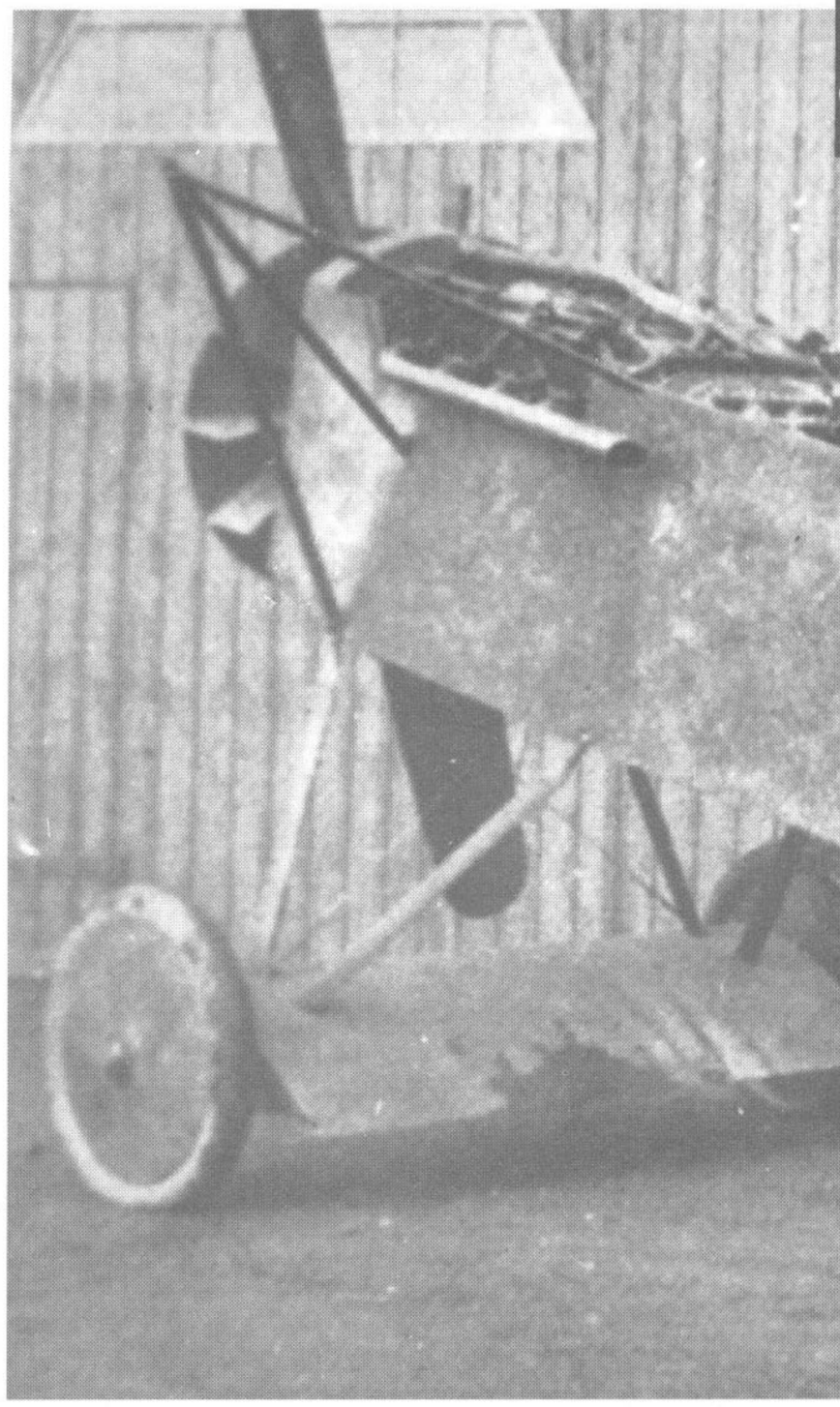
***(Below)* V.37 fuselage without its spinner fitted, showing the 2.5mm-thick spinner backplate and the side armour for the front end of the fuselage.** Harry Woodman

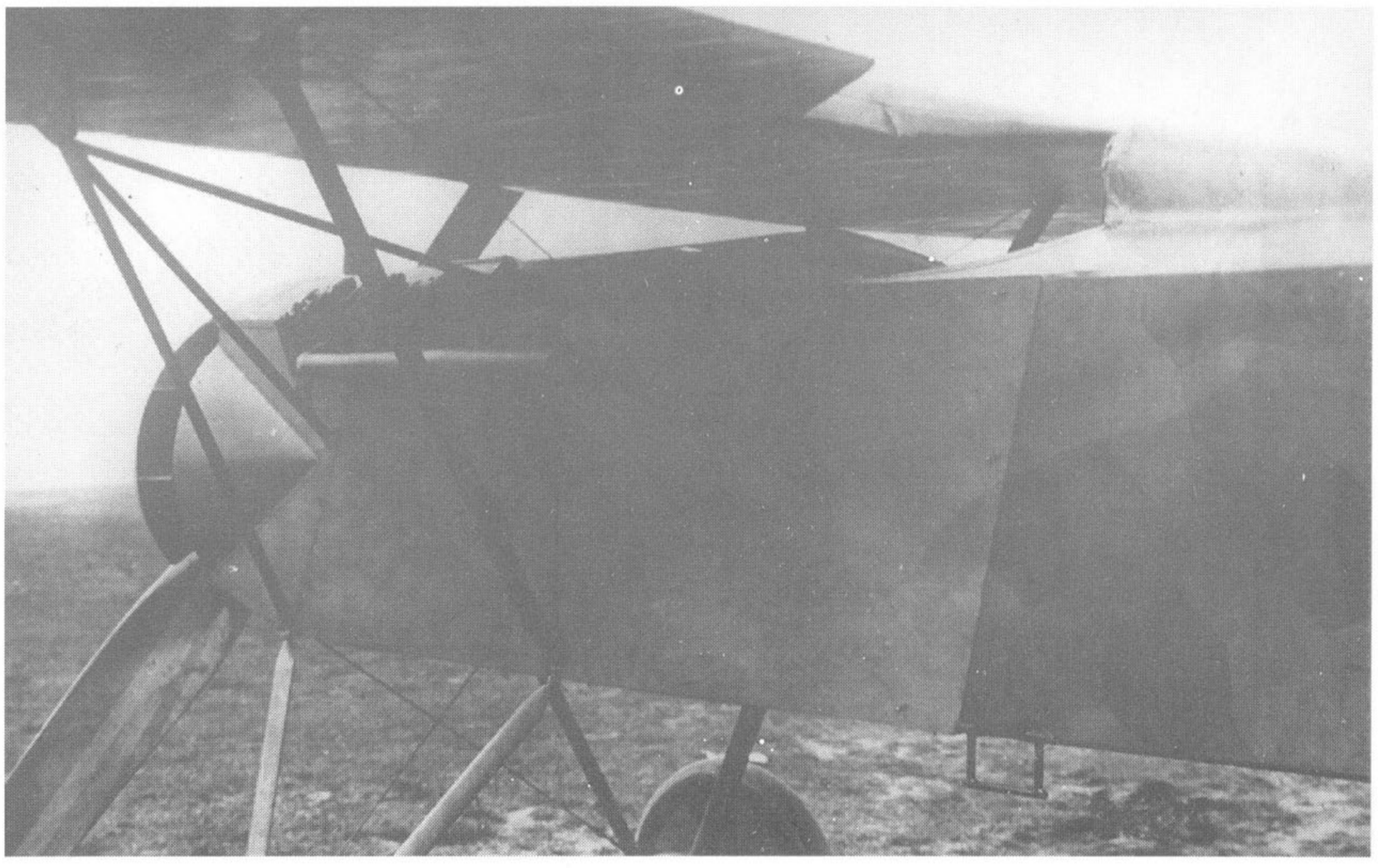


Rear three-quarter view of the V.37. Cross and Cockade International



***(Below)* Rear view of the V.37 fuselage showing the armour for the pilot's back.** Cross and Cockade International





2.5mm-thick steel armour plate behind, below and to the sides of the cockpit. So that the amount of this that was required (and the consequent weight penalty) was kept to a minimum, the pilot's cockpit was moved forward under the rear of the wing. In turn, this required that the cut-out area at the rear of the centre section be increased in size.

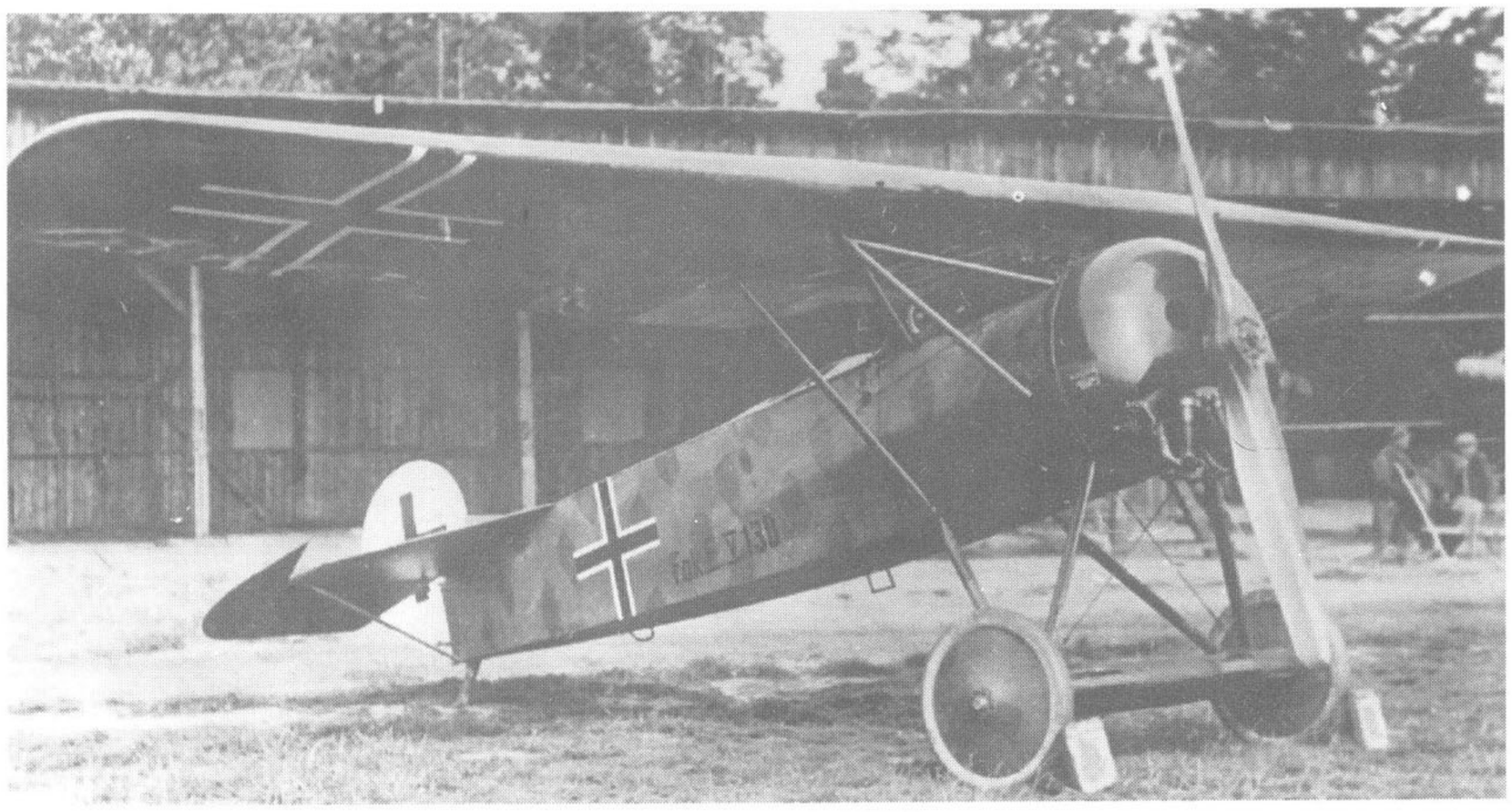
The result of this modified design was designated V.37. Its success as an aeroplane or its ability to meet the requirement is not known as it was too late for consideration by the Army, and hence not submitted for type test or structural trials.

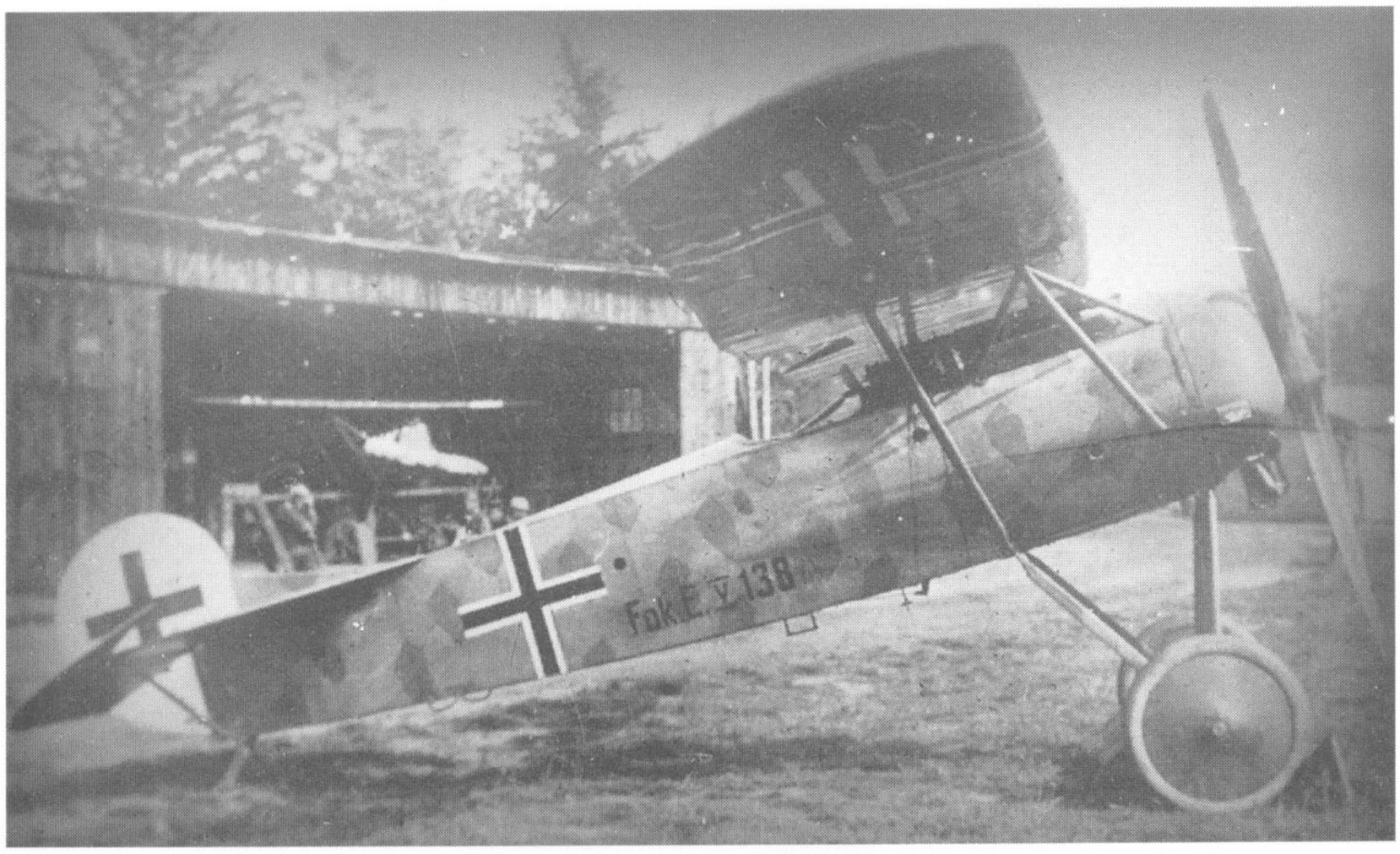
V.37. Fastenings for the side armour are clearly visible. Cross and Cockade International

The E.V/D.VIII in Service

Designated E.V, the V.26 design with its 110hp Oberursal UR.II engine was officially accepted for service with the German Army in June 1918. With the quick start given by Idflieg's early placing of orders for the E.V, the Schwerin factory was in full production by mid-June and the first three production machines were accepted on 3 July 1918.

By the beginning of August, nine new production E.Vs had passed through the supply chain and reached the front-line units. By the end of August, the number on strength at the front had risen to eighty

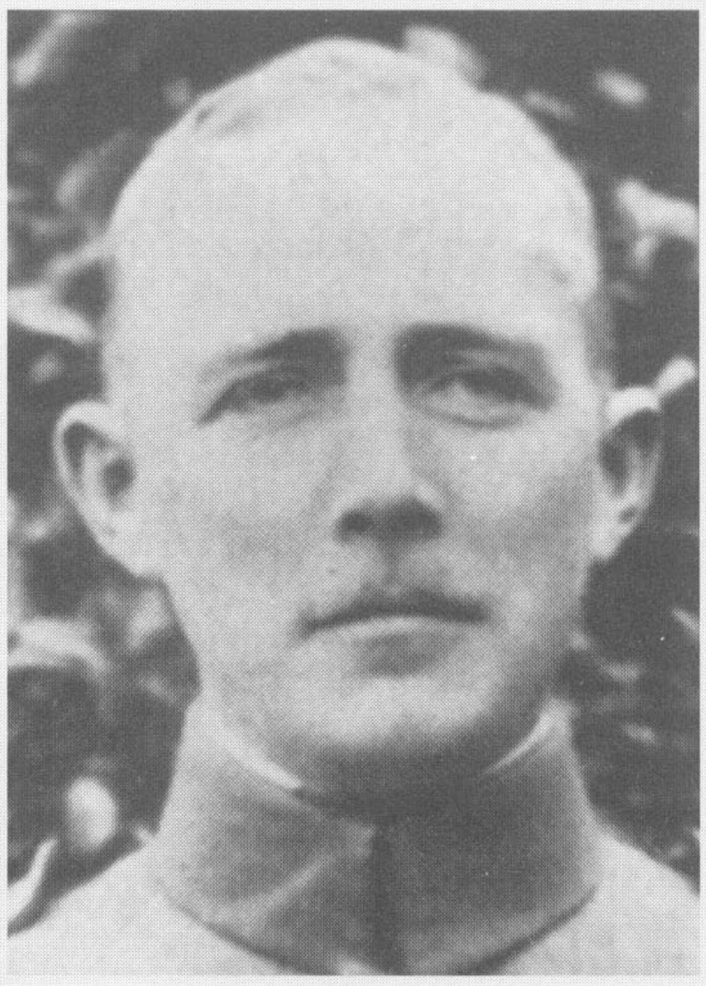




Two views of Fokker E.V 138/18 newly arrived at a Marine Feld Jasta before any unit or individual markings had been applied. Cross and Cockade International

Richard Wenzel

Ltn Richard Wenzel served with FA(A)236 and Kek Ost before transferring to Jasta 31 in the spring of 1917. He joined Jasta 11 on 27 March 1918 and transferred to Jasta 6 on 17 May 1918. He commanded Jasta 6 from 10 August to 9 September 1918. He held the Iron Cross 1st Class and the Knights Cross with Swords of the Royal Hohenzollern House Order. Between 19 April 1917 and 5 November 1918, he scored a total of twelve victories. He survived the war and died in 1957.



Leutnant Richard Wenzel.
Cross and Cockade International

machines. The first units to be equipped were Jasta 6 of JGI and Jasta 19 of JGII.

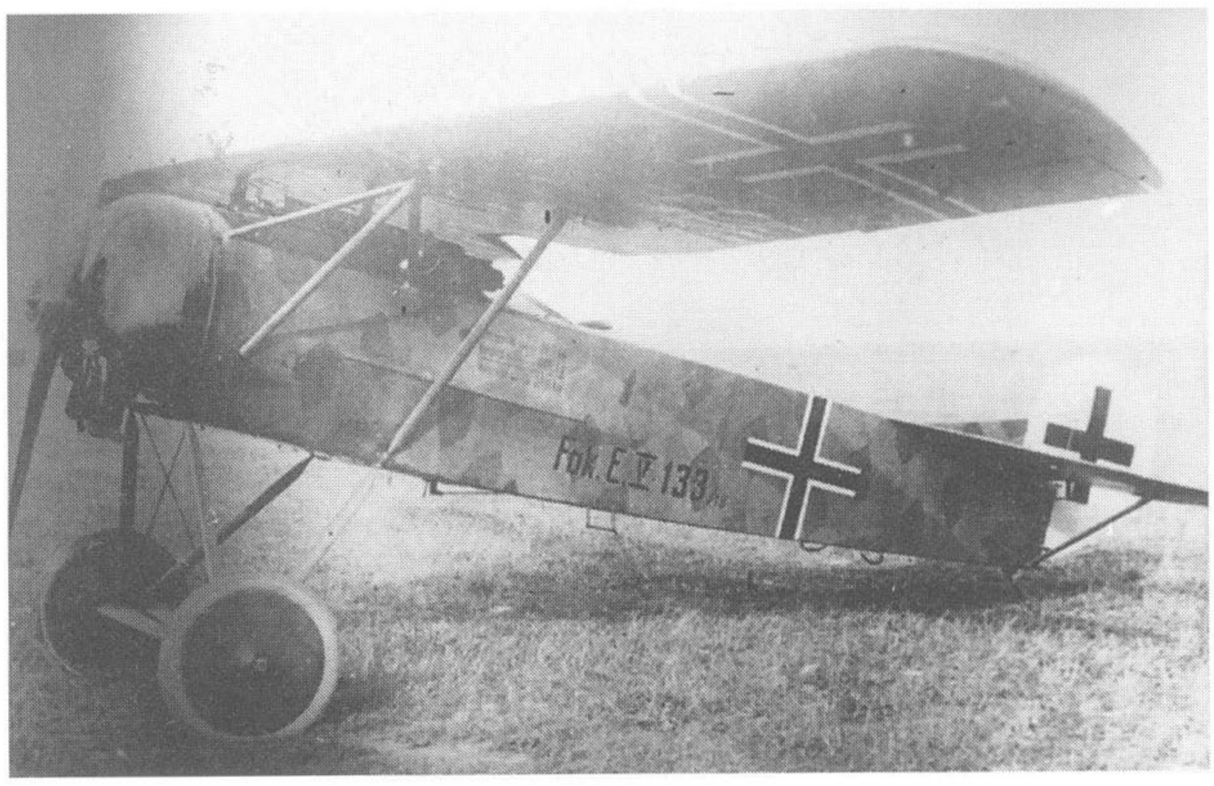
At first, the pilots were enthusiastic and one (Ltn Richard Wenzel of Jasta 6) wrote:

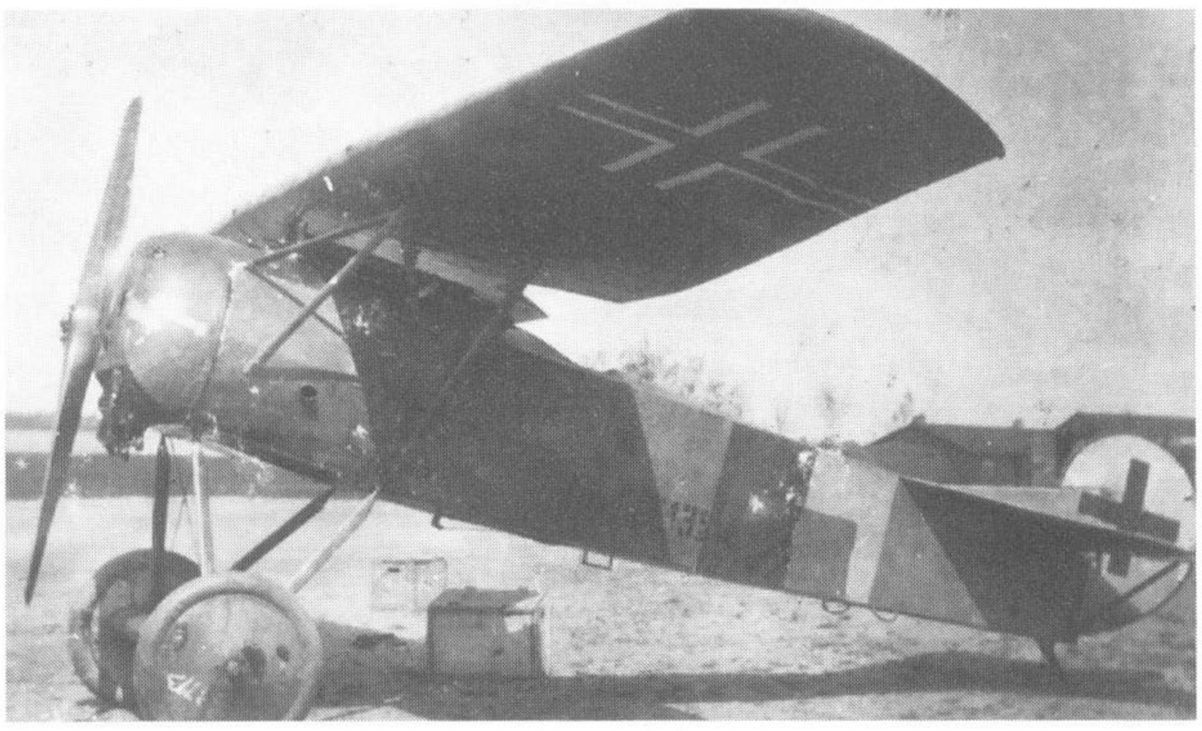
> Jasta 6 obtained the new type at the aircraft park in Clermont and we test flew the fighter. From a technical standpoint, the aircraft was superb, in spite of the fact that it had been built for the more powerful 140hp engine. It attained 1,000m in about 1½ minutes and 3,000m in eight minutes, but then performance fell off badly, a characteristic of the rotary engine. Nevertheless, with respect to rate of climb and performance,

Ltn z S Carl Kuring of III Marine Feld Jasta with his Fokker E.V, 143/18. Cross and Cockade International

(Below left) **Fokker E.V 133/18 in shiny ex-factory condition.** Cross and Cockade International

(Below) **Fokker E.V 139/18, possibly in Allied hands after the war. Replacement of fabric on the fuselage side suggests that the original cross may have been 'souvenired'.** Cross and Cockade International





(Right) **Anthony Fokker standing defiantly in front of an E.V on Jasta 19's aerodrome while twenty-four of the unit's personnel are used to demonstrate the wing's strength. This photo was taken on 23 August 1918 when Fokker attended the crash commission's report on E.V wing failures.** Cross and Cockade International

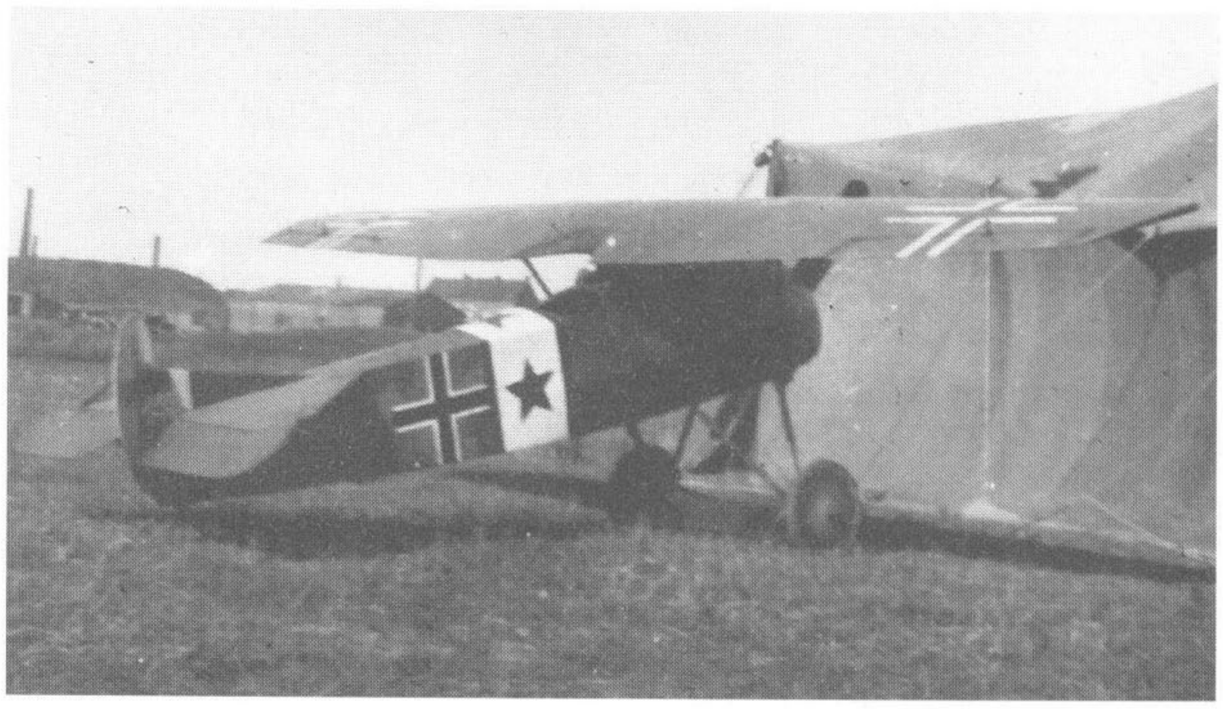
the parasol was superior to all previous types, even the (albeit much slower) triplane.

But this situation was not to last. On 16 August, E.V 107/18 lost part of its wing during a practice flight and its pilot, Ltn Ernst Riedel of Jasta 19, was killed in the resulting crash. On 19 August, 22-year-old Ltn Emil Rolff of Jasta 6, who had scored the last of his three victories in a D.VIII, was killed near Bernes when the wing of his E.V broke up shortly after take-off. Mindful of the production problems with the Fokker Dr.I the previous year, Idflieg took prompt action and grounded the E.V on 23 August, stopping production and flight testing at Schwerin at the same time. By this time a

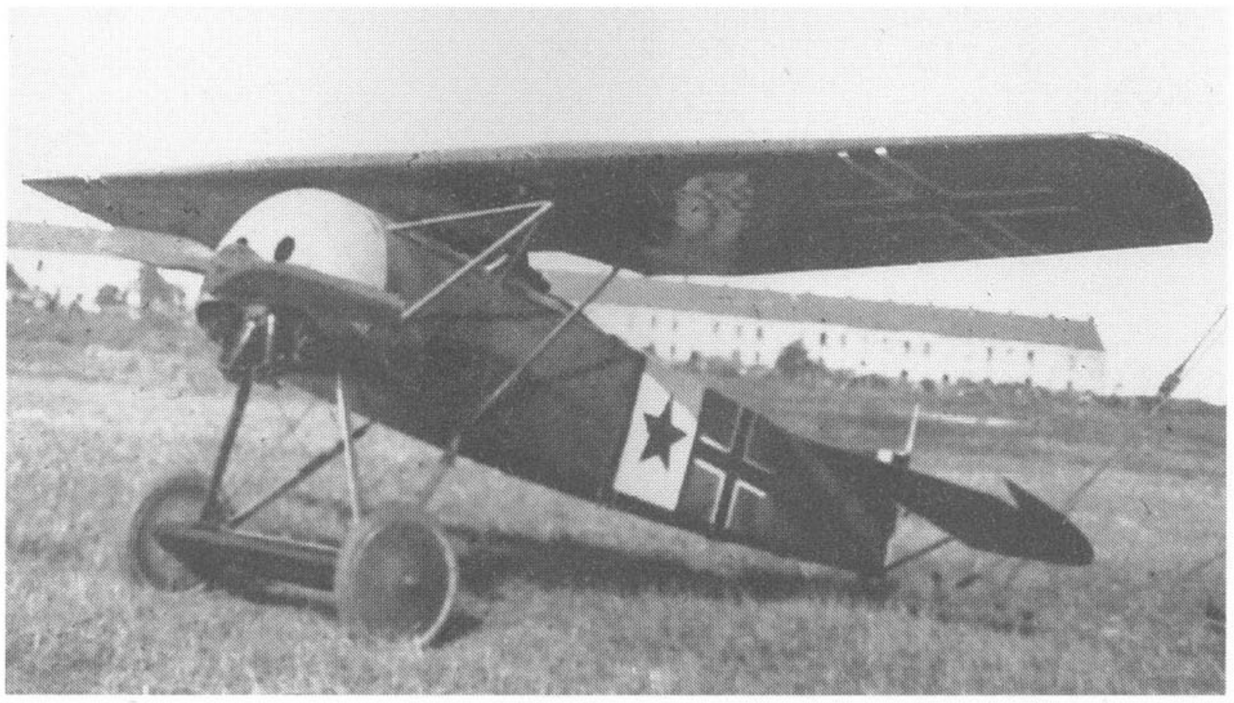
total of 139 E.Vs had been accepted. An investigating committee was formed and sent with Fokker to Bernes where the salvaged remains of a wing were available for examination. The committee was swift and thorough. Their immediate conclusion was that the wings had been twisted by high lift-loading producing increased incidence towards their tips. They recommended that, to prevent a recurrence of this, the front spar be made stiffer and the rear spar less stiff. They suggested that an external bracing cable be fitted, that greater care should be taken with the production of future wings and that a better quality varnish should be used inside and outside to provide better protection against the ingress of moisture.

While this assessment highlighted some of the problems that had caused the crashes, it needed a more thorough examination than was possible in front-line conditions to establish the real causes of the problem. To this end, the salvaged right wing from E.V 107/18, together with wings from E.V 110/18 and E.V 127/18, were sent to Adlershof where a more thorough critical examination was possible.

This succeeded in establishing the real faults and revealed that they lay mainly in Fokker's production methods and his casual regard for all aspects of quality control in material procurement and manufacture. The initial examination showed that the materials were sub-standard and that the wood used in the spars was unseasoned and of poor quality. In addition, the standard of workmanship was appallingly low and little care had been taken with assembly. The



Fokker E.V of Jasta 36 carrying unit and individual markings. George Haddow



A further view of the same E.V. Cross and Cockade International

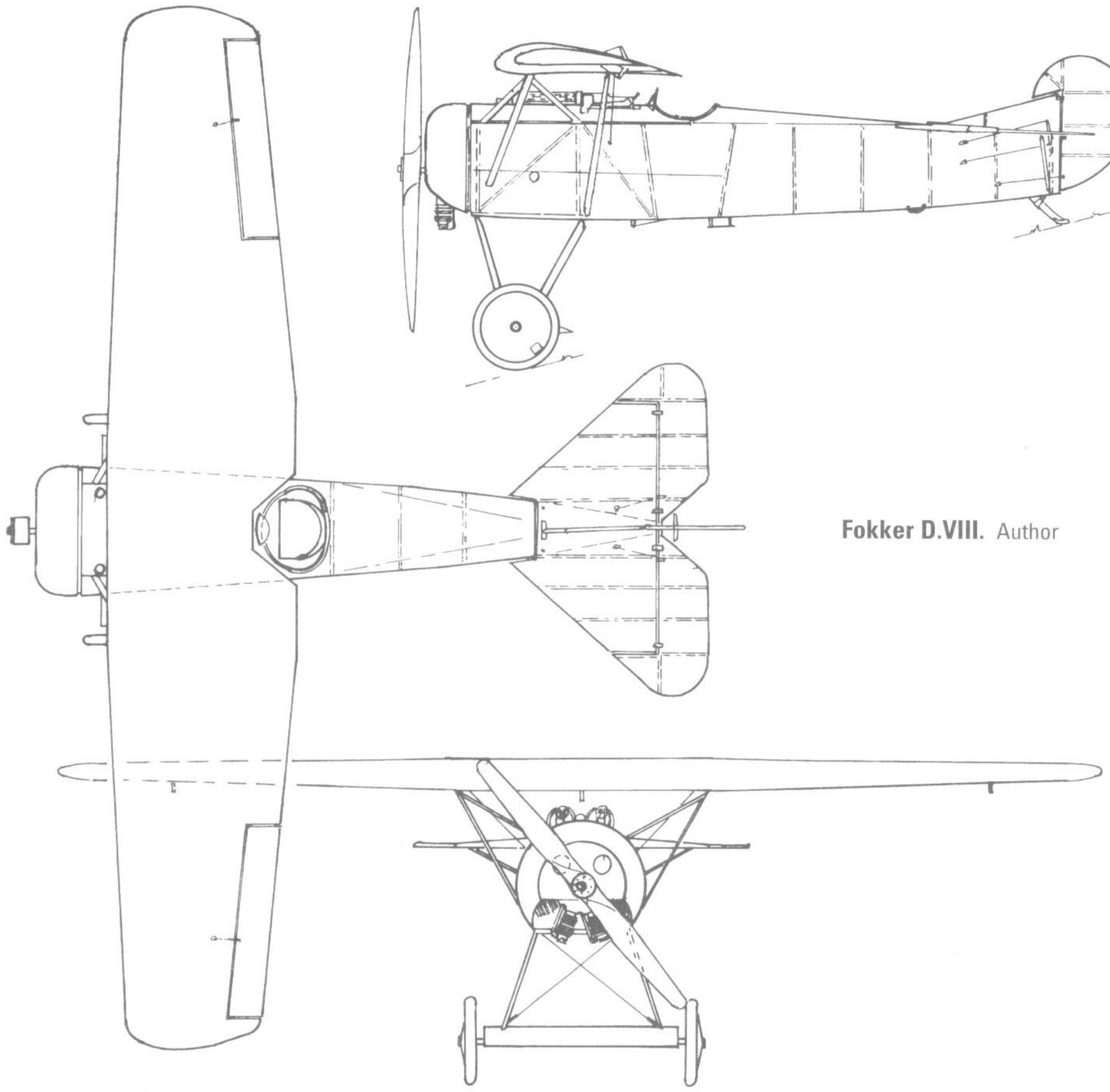
Fokker D.VIII 257/18 with what appears to be an unpainted cowling. Cross and Cockade International

outer plywood covering was of good quality but the pins used to secure it to the rib-capping strips had been carelessly driven home, in some cases missing the strips altogether, and in others merely catching the edges and splintering them. The quality of glue used was inferior and the resulting joints were inadequate. Further, the lower flanges of the front spar were found to be 7.5mm thick in contrast to the 13mm-thick flanges on the type-test machine. This may have been caused by incorrect selection of components on assembly or by poor assembly techniques. The webs had been incorrectly positioned before pinning and gluing, with the result that the top surfaces of the flanges protruded above the webs. The spar thus formed would have been over-size and needed planing down to allow assembly of the ribs. Additionally the wing of E.V 127/18 was found to contain accumulated water which had caused the casein glue used to perish and the wood to become soft.

Fokker was summoned to attend a technical meeting convened at Adlershof on 30 August 1918. This was intended to resolve the problem and those present were to witness a series of wing loading tests. Also attending and representing Fokker was his chief engineer, Friedrich W. Seekatz. Idflieg and the Flugzeugmeisterei were represented by a number of competent technical experts.

Step by step, Fokker was taken through the faults discovered and told of the inadequacies of quality control throughout his Perzina factory, where the wings had been made. It was pointed out in no uncertain terms that, through poor workmanship, the strength of production wings was not up to the standard of the wing that had been type-tested and accepted. All existing E.V aeroplanes were to continue to be grounded and their wings returned to Fokker. Fokker was required to replace these with new wings that had been manufactured properly with correct-sized materials, and no new aircraft would be accepted until the standard had been proved to have been met.

Although Fokker glibly tried to lay the blame for the failures on Idflieg's engineers who, he said, had got their test requirements wrong, he had to accept the demands made upon him. In fact, Idflieg had been preparing criminal charges against him for defrauding the German government and placing the lives of German pilots at risk. Platz had the management of production at Perzina added to his responsibilities and the first result of this was a rapid tightening up of quality control at that factory. New wings were built to the original design standard with a few minimal detail changes, and these proved to meet the requirement. Permission to re-start production was given on 24 September 1918.



Fokker D.VIII. Author

Specification – Fokker E.V/D.VIII

Engine:	110hp Oberursal UR.II
Weights:	Empty 405kg (890lb); loaded 605kg (1,330lb)
Dimensions:	Span 8.34m (27ft 4in); length 5.87m (19ft 3in); height 2.82m (9ft 3in)
Performance:	Maximum speed 200km/h (124mph) Rate of climb 1,000m (3,300ft) in 2 minutes, 4,000m (13,000ft) in 10.75 minutes
Armament:	Two LMG 08/15 machine-guns synchronized to fire through the propeller arc

A Change of Name

A change in official thinking led to the rule that all future single-seat fighter aircraft should be designated with 'D', so that the 'E'- and 'Dr'-type prefixes were no longer to be applied. So, fitted with the new production wing, the E.V became the D.VIII and continued thus until the end of the war. By 11 November 1918, although some 381 E.Vs and D.VIIIs had been accepted, only eighty-five were on front-line strength and it is probable that most of the rest were E.Vs being held in store waiting the supply of replacement wings.

The Fokker E.V/D.VIII in Service

Although some 381 Fokker E.V/D.VIIIs had been accepted by the end of the war and eighty-five were on charge in November 1918, precise details of their deployment are impossible to find. It is known that examples were on the strengths of the following units:

Jasta 1, 6, 10, 11, 19, 23, 24 and 36
Marine Feld Jagdstaffeln (MFJ) I, II and III
FEA 5 at Hanover.

Known pilots include:

Ltn Friedrich-Wilhelm Liebig – Jasta 1
Ltn Ernst Udet – Jasta 4
Ltn Richard Wenzel and Ltn dR Emil Rolff – Jasta 6
Oblt Loewenhardt – Jasta 10
Ltn Riedel – Jasta 19
Offstv Friedrich Altemeir – Jasta 24
Oblt z S Theo Osterkamp – MFJ II
Ltn z S Carl Kuring – MFJ III.

Because of its various problems, which included engine unreliability through use of synthetic lubricating oil instead of castor oil, the Fokker E.V/D.VIII was never really proven in combat. Records show that only one victory was scored by a pilot flying the type during World War One.

On 16 August 1918, Ltn dR Emil Rolff of Jasta 6 brought down Sopwith Camel D9595 of 203 Squadron RAF near Peronne. Initially posted as 'missing in action', its pilot, Sgt P. M. Fletcher, spent the rest of the war as a PoW. As related above, Rolff was killed on 19 August when the wing of his E.V collapsed during take-off.

Fokker D.VIIIe 697/18 was the first 145hp Oberursal UR.III-engined D.VIII to be accepted and took part in the third fighter competition. Inaccurate retouching of this photograph has altered the shape of the engine cowling which was in reality bulged to accept the larger diameter of the UR.III engine.
Cross and Cockade International

Theodore Osterkamp

Oblt z S Theodore Osterkamp was born in Duren in the Rhineland on 15 April 1892. He joined the Naval Flying Corps in August 1914 and spent two years as an observer operating along the Belgian coast.

He was commissioned in June 1916 and, after fighter training, posted to Marine Feld Jasta I on 14 April 1917. On 15 October 1917 he was given command of MFJ II, in which capacity he continued to the end of the war. He was shot down flying a Fokker E.V in September 1918 but survived the war with a score of thirty-two victories. He was awarded the Iron Cross 1st Class, the Knight's Cross with Swords of the Royal House of Hohenzollern Order and, on 2 September 1918, the Orden Pour le Mérite.

After the war, he took part in fighting against the Bolsheviks in the Baltic. In 1935 he joined the Luftwaffe and commanded first Jagdfliegerschule No. 1 and then JG51, with whom he scored a further six victories during the Battles of France and Britain. He commanded a number of formations and reached the rank of Leutnant General before being forced to retire on 31 December 1944 after criticizing the German High Command. He died in Baden-Baden on 2 January 1975.

Oberleutnant zur See Theodore Osterkamp.
Cross and Cockade International

(Above) **Fokker D.VIIIA 553/18. Not part of an ordinary accepted batch, it was bought by the German Government in late November 1918.** Cross and Cockade International

(Below) **Another view of D.VIIIA 553/18.** Cross and Cockade International

The only other recorded aerial victory scored by a E.V/D.VIII pilot was that by Lt Stefan Stec of 7 (Kosciusko) Squadron of the Polish Air Force, who shot down a Ukranian Nieuport on 29 April 1919.

How the E.V/D.VIII would have stood up to the harsh realities of combat and field life can only be a matter for speculation. From individual pilot's comments, it appears that, in spite of its low-powered 110hp engine, it was considered more than adequate. Replacement of this with a more powerful engine (145hp or 160hp) would certainly have enhanced its performance but may have triggered off new structural problems. It may have been considered but the war was over before it could happen. It is doubtful whether it would have continued in service much beyond the end of 1918, as the final orders placed by the German government were for quantities of Fokker D.VIIs, Siemens-Schuckert D.IVs, Pfalz D.XVs and Junkers D.Is. Also, the third series of fighter trials in October/November 1918 (*see* Chapter Eleven) would produce superior designs that would probably have replaced the D.VIII fleet.

At the end of the war, a number of E.Vs and D.VIIIs were handed over to Britain, France, Italy, Japan and the USA. Stories of the wing problems had preceded them and neither the British nor the French governments did very much with them. They discouraged their pilots from flying them and mostly allowed them to be scrapped. A number went to the USA where they were subject to an evaluation programme and continued to survive for a good few years.

An unidentified D.VIII. Cross and Cockade International

The Italian government also took a serious interest in the type and carried out their own research with the samples that were given to them and, in that capacity, they continued in service until 1925. Some late-production machines remained at Schwerin in various stages of assembly and

Ernst Udet in the cockpit of Fokker D.VIII 238/18. This unarmed machine was fitted with the experimental fuel tank fitted in its undercarriage sub-wing. Cross and Cockade International

The American View of the D.VIII

Two Fokker D.VIIIs were flown at Cook Field in the USA and the following comments made on their performance by Lt Leigh Wade.

The airplane has a tendency to turn to the right in taxiing, takes off very quickly, climbs very rapidly, and is very manoeuvrable.

It is easy to fly and the controls are sensitive. It is tail-heavy, but so light on the controls that it is not tiresome to fly.

The visibility is very good.

The machine-guns are so placed that in the event of a crash, the pilot would undoubtedly be injured by being thrown against the same.

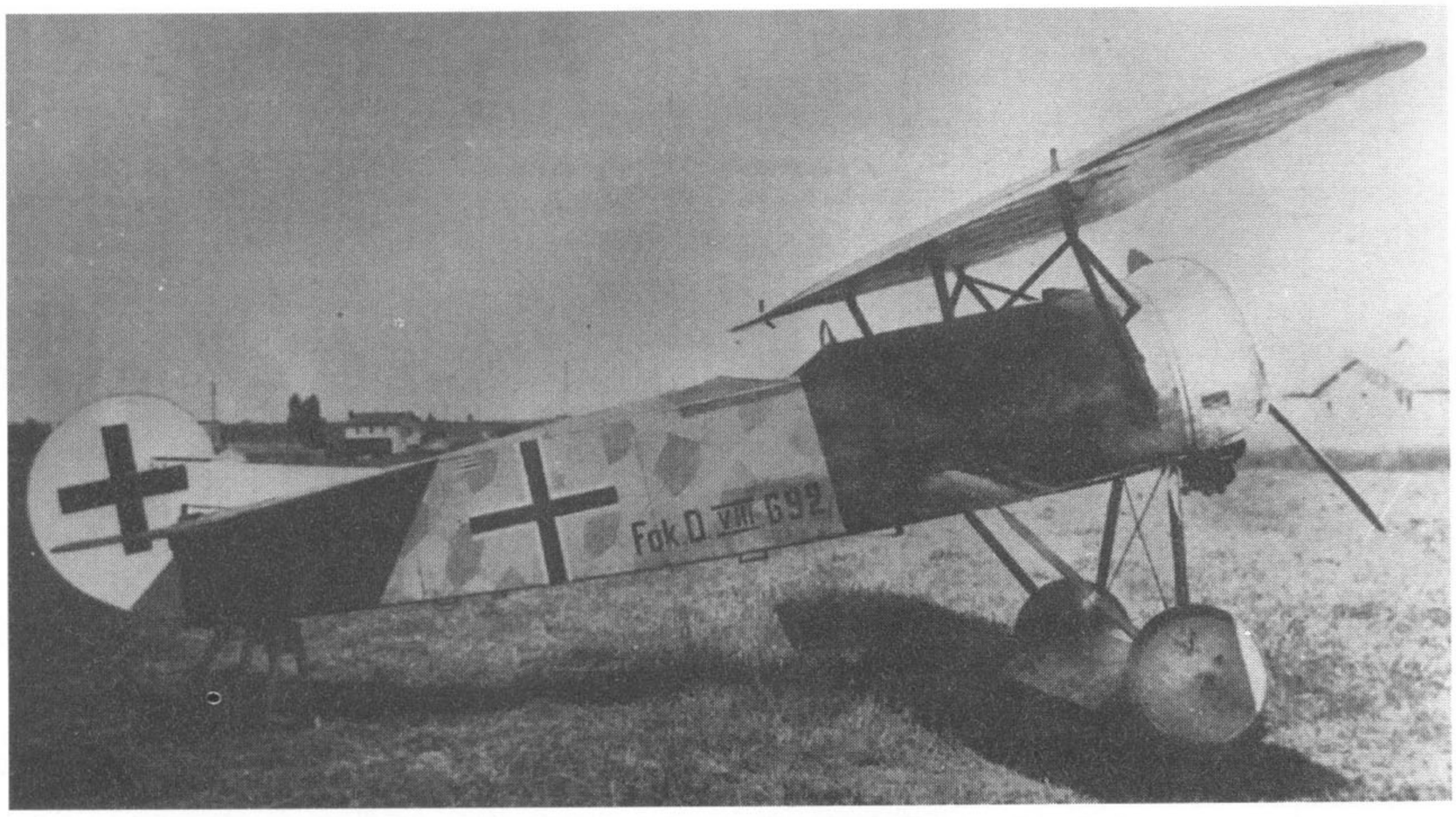
The airplane lands very slowly with a slight tendency to drop the right wing and to turn to the right on the ground

The controls for the engine are very inconveniently located, inasmuch as the throttle for the gas is on the left side of the fuselage and the throttle for the air is on the left side of the control stick.

(Above) **Personnel of Marine Feld Jasta 1 with Fokker E.V 160/18, which was delivered to the unit on 10 August 1918.** Cross and Cockade International

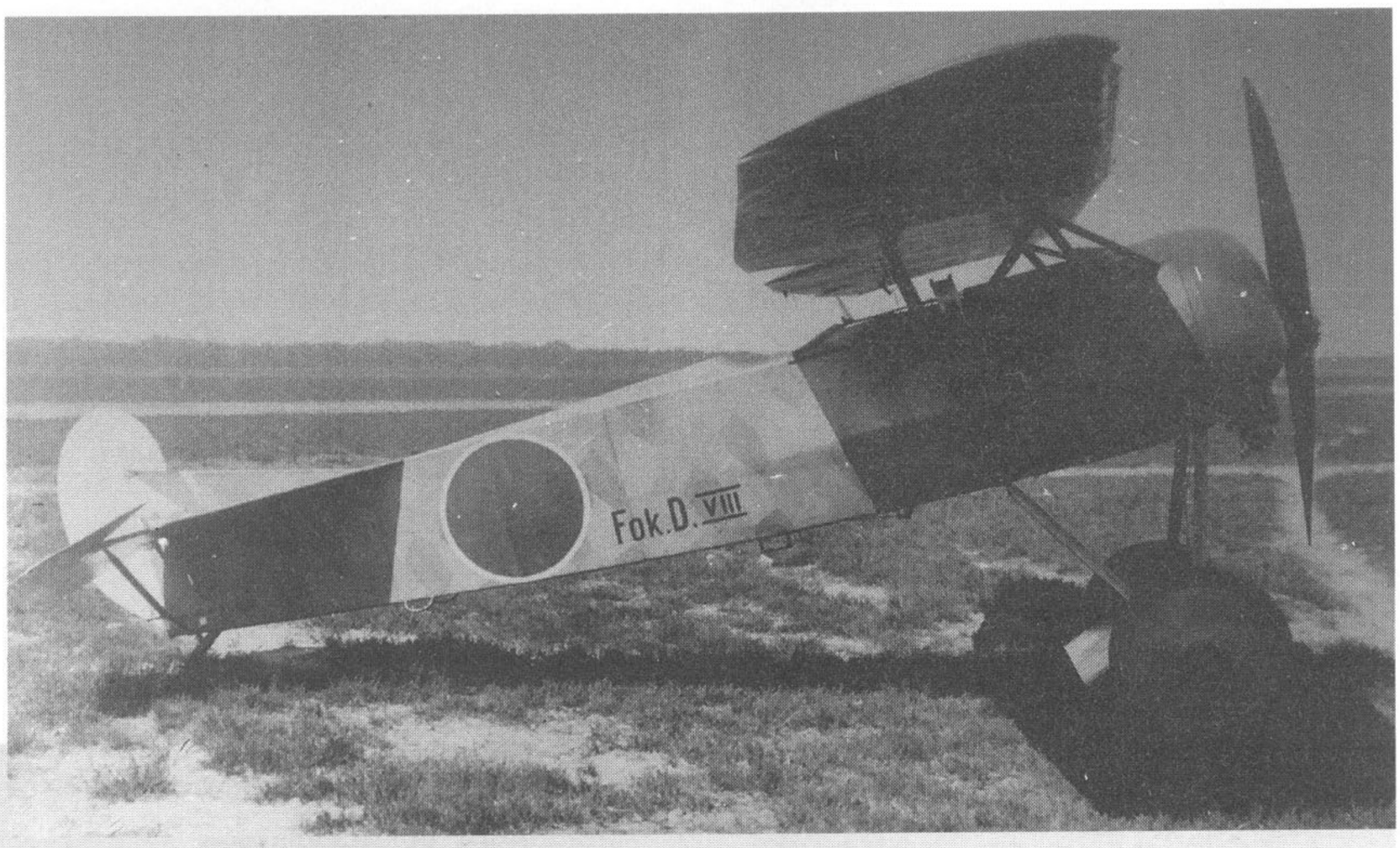
(Below) **Marine Feld Jasta pilots with an E.V. Left to right: unknown; Vzflgmstr Mayer; Vzflgmt Alexandre Zenses; Vzflgmt Karl Scharon; Vzflgmstr Hans Goerth; Flgmt Karl Engelfried; unknown.** Cross and Cockade International

D.VIII 692/18. The bulged cowling was needed to accommodate the 160hp Oberursal UR.II engine with which it was fitted. Cross and Cockade International



others were stored elsewhere in Germany. In later years attempts were made to use them for training purposes by the new German Air Force but, by then, they had deteriorated beyond use. A number found their way to Holland where they continued to provide good service until 1923, when it was considered that it was no longer practical to extend the life of their rotary engines and they were also scrapped.

Today, only part of one remains, the property of the Museo Aeronautica Caproni in Trento in northern Italy. Of this, just the fuselage structure is left although it is currently being restored. Indications are that this was either D.VIII 275/18 or 293/18. Its engine is Oberursal UR.II 3138 which was originally fitted to D.VIII 292/18. From the fasces markings on its fuselage it seems that this aircraft was in service as late as 1923.



***(Right and below)* Unarmed Fokker D.VIII 509/18 in Dutch markings. This machine was one of two sent illegally by Fokker to Holland after the Armistice in November 1918.** Cross and Cockade International

REPORT ON THE FOKKER MONOPLANE, TYPE E. 5

This aeroplane seems to have appeared on the Western Front in August, 1918. A leaflet intended to familiarise the troops with the appearance of the machine was issued by the German authorities, and is dated 7th August 1918. An earlier type, the E. 3, was found weak and was reinforced, the result being the E. 5 type.

GENERAL PARTICULARS.

Weights (from figures painted on the fuselage) : —

Weight empty	360 kg. (793.7 lbs.).
Useful load	200 kg. (441 lbs.).
Total weight	560 kg. (1234.7 lbs.).

Engine. —(Generally) 110 h.p. Oberursel.
Other rotaries which have been installed into Fokker monoplanes are: —

140 h.p. (11 cylinders) Oberursel.
160 h.p. Goero.
160 h.p. Siemens Schuckert.

Leading Particulars : —

Crew	One.
Weight per h.p. (with 110 h.p. Oberursel engine)	11.2 lbs.
Loading per sq. ft.	10.7 lbs.

Dimensions. (See scale drawing at end of report) : —

Overall span	27 ft. 7 ins.
Overall length	19 ft. 4 ins.
Overall height	8 ft. 6 ins.
Area of complete plane (with ailerons)	115.5 sq. ft.
Area of each aileron	4.5 "
Horizontal area of fuselage	38.7 "
Vertical area of fuselage	42.5 "
Area of fin	1.4 "
Area of rudder	5.1 "
Area of balance of rudder	0.5 "
Area of fixed tail planes (both sides)	17.8 "
Area of both elevators	10.0 "
Area of elevator balance (both sides)	1.0 "
Area of undercarriage plane	11.3 "

Performance. —There are no figures available from any British source, but the following are taken from a French report of German trials made at Schwerin during 1918:

Engine.	Time of Climb in Minutes.			
	To 1,000 m. (3,250 ft.)	To 4,500 m. 14,750 ft.)	To 5,000 m. (16,400 ft.)	To 6,000 m. (19,700 ft.)
110 Oberursel	–	–	18' 21"	–
140 Oberursel (11 cylinders)	–	–	13' 15"	–
160 Goero	–	–	14' 0"	21' 0"
160 Siemens Schuckert	4' 0"	11' 30"	–	–

Record climb:— To 6,000 metres in 18 minutes.

Speed at ground level, 204 km. per hour (149 m. per hour).

A representative of the British Technical Press who saw the machine flying at Amsterdam in August 1919 has stated that the "maniability" appears to be good, and that stunting can be carried out on this machine to a much greater extent than would be expected.

Wings:—

General Design.—The machine is a parasol monoplane, *i.e.*, it possesses one plane only, which is raised above the top of the fuselage. The aerodynamic design of the aeroplane is thus in striking contrast to that of the D.I. Junker monoplane, which has its single pair of planes fixed at the bottom of the fuselage.

The wing is in one piece, the shape of which is shown in the scale drawings, and entirely devoid of external bracing The angle of incidence is marked 0°, as is the case with the biplane.

There is no definite dihedral angle, but in this connection it is noticeable that the upper surface of the plane is not horizontal. On each side of the horizontal centre section there is a distinct, though

slight, drop of the upper surface towards the tips. Even then the tapering of the wings in the vertical plane is brought about chiefly by the raising of the lower surface.

The accompanying Plate shows two aerofoil sections.* The dimensions are in millimetres.

In contradistinction to established Fokker practice, the ailerons are unbalanced, but they are like those of other Fokker machines in the matter of size, being of very small area.

The various drawings and photographs show quite clearly that the single-piece plane is supported at four points. The front spar is attached in two places to a pyramid of three streamline section steel tubes welded to the fuselage framework, while the rear spar is fixed on each side to the lower longeron of the fuselage by means of a detachable streamline strut of steel.

This wing-fixing arrangement is exactly similar to that found on the D. 6 Fokker biplane, not only in general design, but also in dimensions. The D. 7 biplane has an arrangement which is similar in principle, but differs considerably in detail.

Wing Construction.—There are two spars, both of orthodox Fokker design, which pass from end to end of the wing. Only the rear one is straight in plain view; the front spar is parallel to the rear one between the strut-pyramid attachments, but from these points converges on each side towards the rear spar.

Three spar sections are shown drawn to scale. *A* is a section of the front spar at the centre section; *B* of the rear spar at the centre section; and *C* of the front spar within about a foot of the wing tip.

The wing framework is quite similar to that of the D. 7 wings, fully described in the report on that machine; but while the biplane wings were covered in fabric in the usual way, the monoplane wing has a three-ply covering throughout. The plywood is 1.5-mm thick, and of excellent quality, and is attached to the spars and ribs by thin iron-wire nails, about ½-in. long. The curved wing tip is built up of six laminations of wood which appears to be ash, strongly glued together. The wing is internally braced similar to the D. 7 wing.

Ailerons.—Each aileron is of very small chord (10 ins.) and has its leading and trailing edges parallel. The length of each is 5 ft. 3 ins., so that the area of one aileron is approximately 4.5 sq. ft.

The aileron tube carries one strap hinge of the orthodox type at its middle point, and is pivoted at each end on a pin welded into the end of the tube. This pin fits into an armoured recess which is carried in the rib left exposed by the cutting away of that portion of the wing into which the aileron fits.

The aileron covering is of 1.5 mm. 3-ply, in common with the remainder of the plane.

Fuselage.—The body of this machine is built on exactly the same lines as those of the Fokker biplane and triplane. The cowl over the rotary engine is of aluminium, and the change from circular section just behind the engine to the square section of the steel tubular frame of the fuselage is bridged over by a 3-ply skin supported on a light wooden framework of formers and stringers. The 3-ply is covered with fabric, which is glued on, and which is in one piece from front to rear.

Controls.—These are of the standard Fokker pattern. The aileron wires pass upwards from the body to pulleys in the plane, and thence through the plane to other pulleys opposite the aileron levers.

Tail.—The tail unit, including the skid, is identical in design and construction to the usual Fokker tail arrangement, and differs only from the tail described in the report on the D.7 biplane in the dimensions of the members and in the fact that the triangular vertical fin is not offset in the monoplane.

The engine mounting, together with the petrol and oil tanks, are similar to the corresponding features of the D. 6 type biplane.

The undercarriage has the familiar auxiliary plane, and the armament comprises the usual pairs of synchronised and fixed Spandau machine guns.

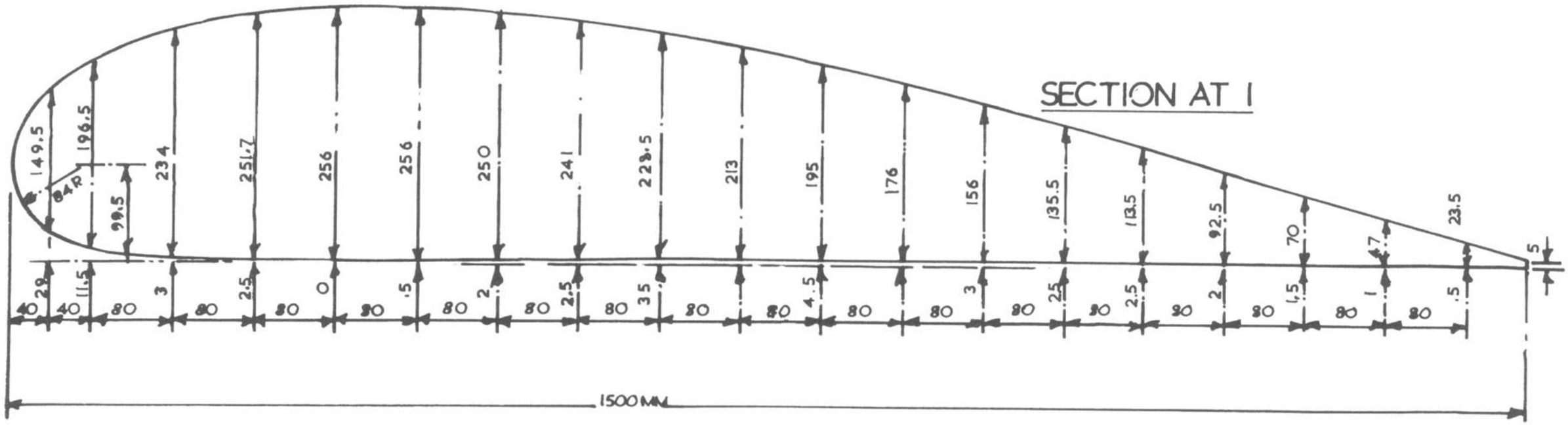
March 1920.

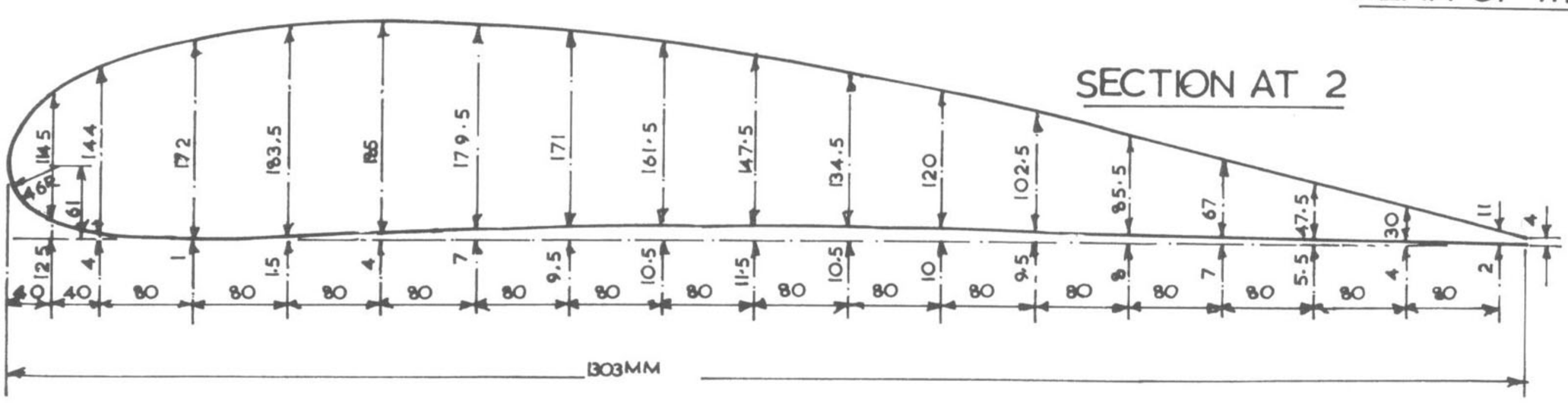
The nomenclature used, i.e. D.6, D.7 and E.5, were incorrectly used by the RAF at this time and, as we now know, should read D.VI, D.VII and E.V.

The 160hp Goero engine referred to should (probably) be the 200hp Goebel Goe.III engine.

* See *page 166 for diagram*

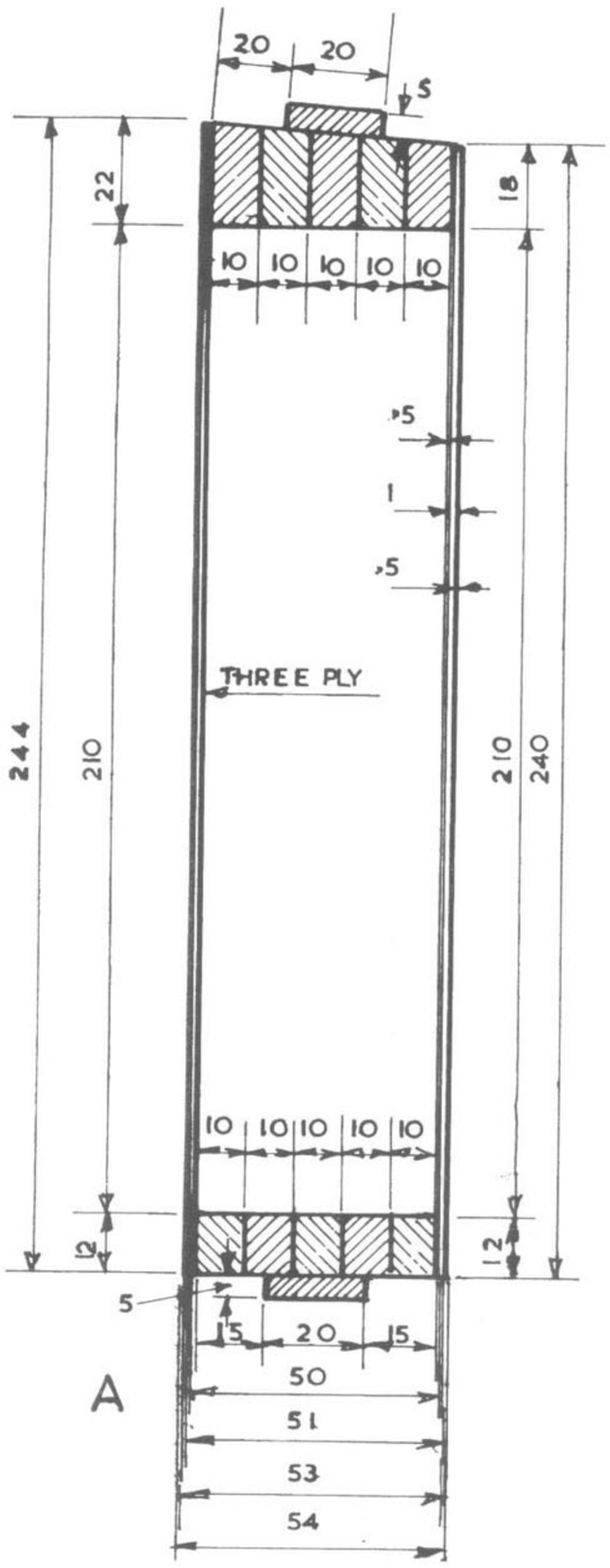
The spellings, punctuation and layout above are as in the original report which can be found in PRO file AIR1/2094/207/12/17.

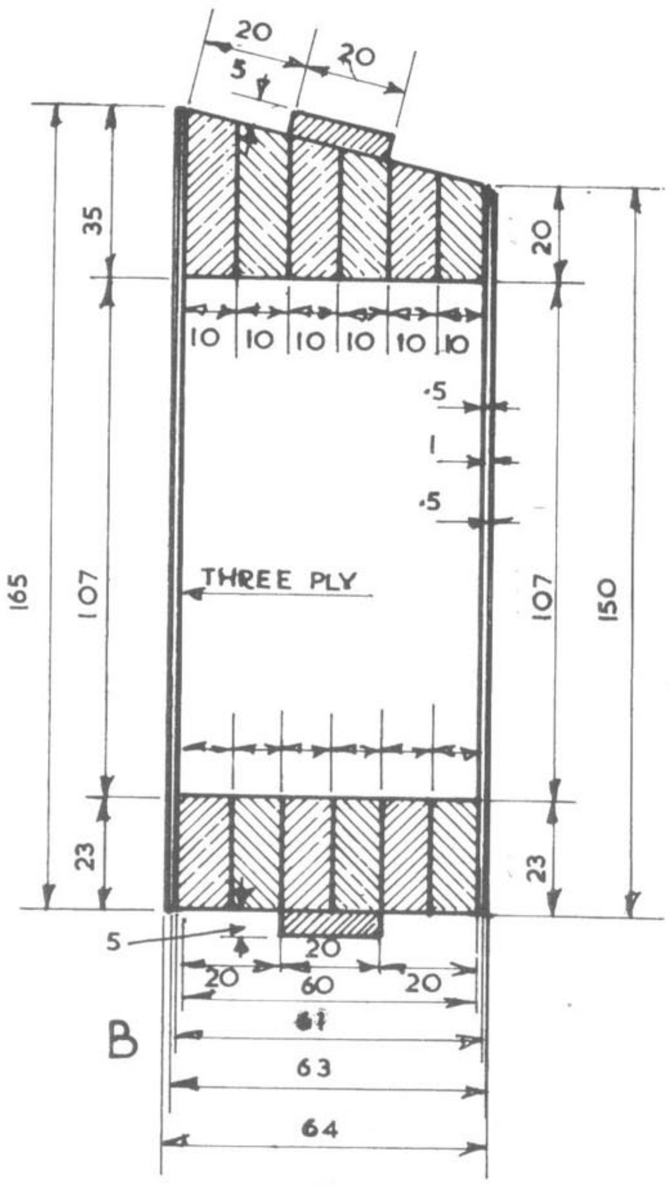


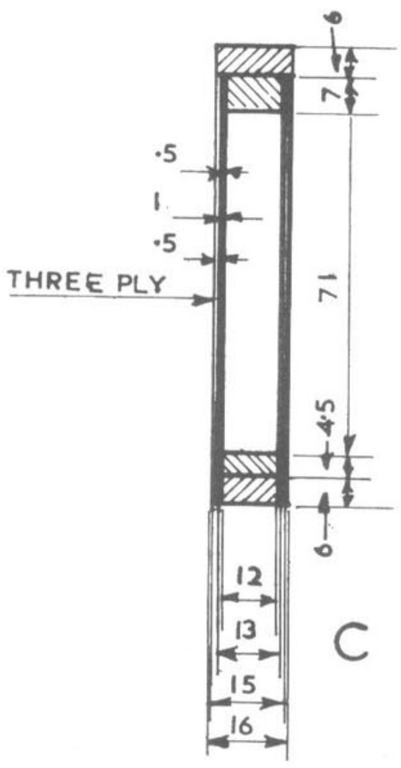


Sections and constructional details of the Fokker E.V wing from PRO file AIR1/2094/207/12/17.

dimensions in millimetres





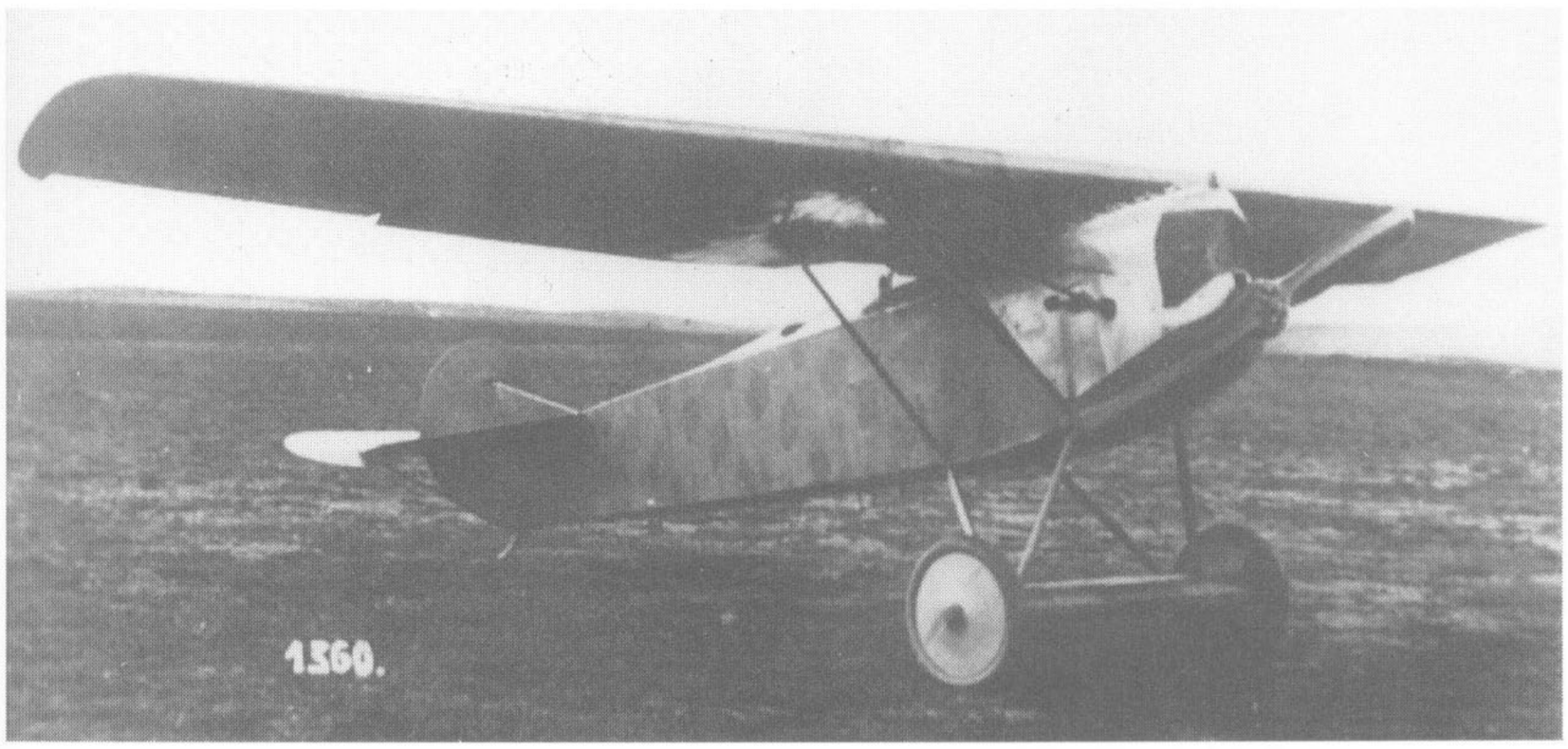


CHAPTER ELEVEN

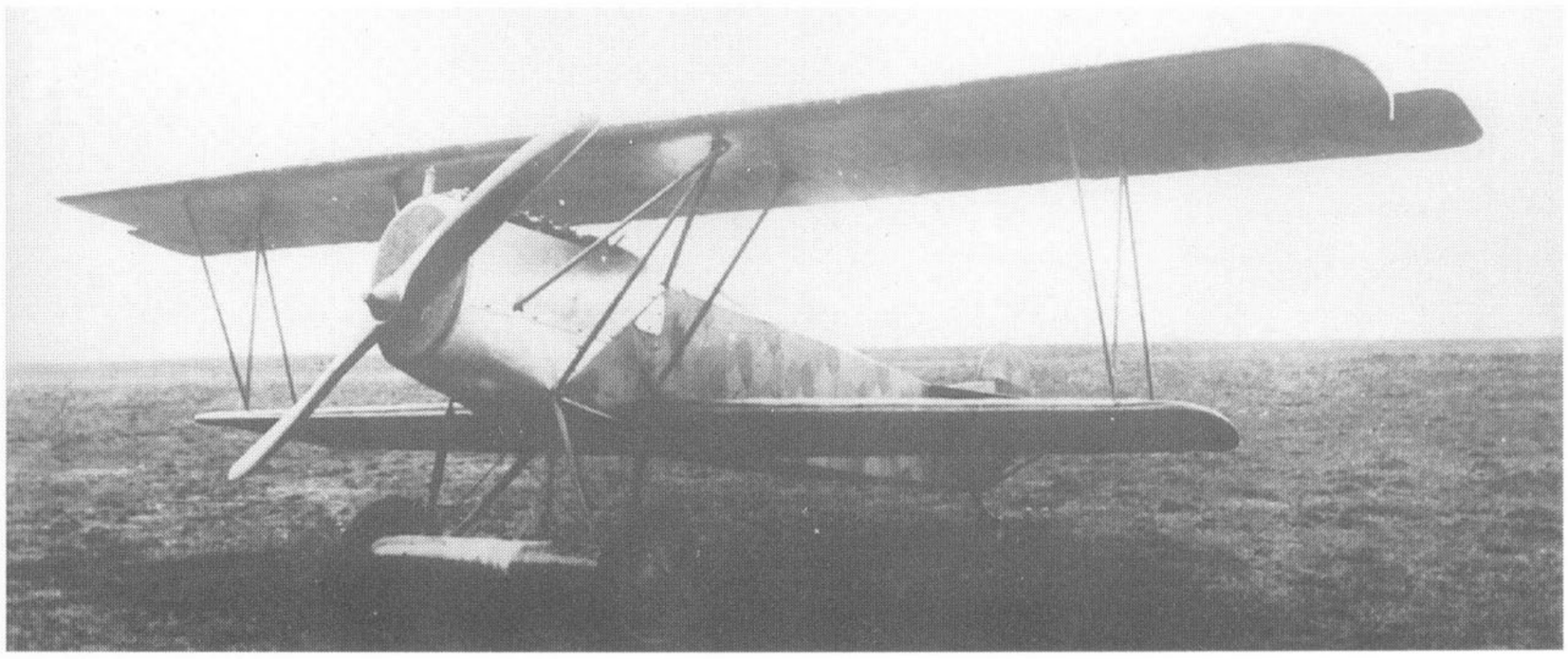
The Third Fighter Trials and the End of the War

The final fighter competition was held at Adlershof from 15–31 October 1918. It was focused mainly on aircraft fitted with the 185hp BMW IIIa engine with the intention that, in production, they would be fitted with the 240hp BMW IV that, it was planned, would be available during December 1918. It was considered that the days of rotary-engined fighters was really over, but six examples of such types were allowed into the competition. Amongst these were two Fokker D.VIIIs. One was fitted with a 160hp Siemens & Halske Sh.III engine and the other with a 145hp Oberursal UR.III. Because of running problems with the Sh.III engine and the lack of a suitable propeller, one of the machines did not appear. The Oberursal-powered machine did, but failed to achieve the results that V.26 had achieved in the second competition. It manoeuvred well, but tended to side-slip away during protracted combat curves. It also suffered wing vibrations at high speed – a warning of potential future problems.

Fokker submitted two other aircraft, V.29 and V.36, both prototypes and fitted with the 185hp BMW IIIa engine. V.29 was a parasol-winged monoplane. Structurally, it was similar to Fokker's other parasols: a fabric-covered, steel tube-structured fuselage and tail assembly with plywood-covered wooden wings. It was larger and heavier than the production D.VIII but smaller and lighter than the earlier V.27. With its car-type nose-mounted radiator it looked like a parasol version of the D.VII. It was highly manoeuvrable with excellent diving and gliding characteristics. Its take-off was good but longer than normal for the time. Its landing speed was high with a tendency to 'float'. No detail of its climbing ability remains as, during the trials, its barograph froze and no record of its performance was obtained. It came out of the trials well and was regarded as an improvement on the Fokker D.VII F.



185hp BMW IIIa-engined V.29. Cross and Cockade International

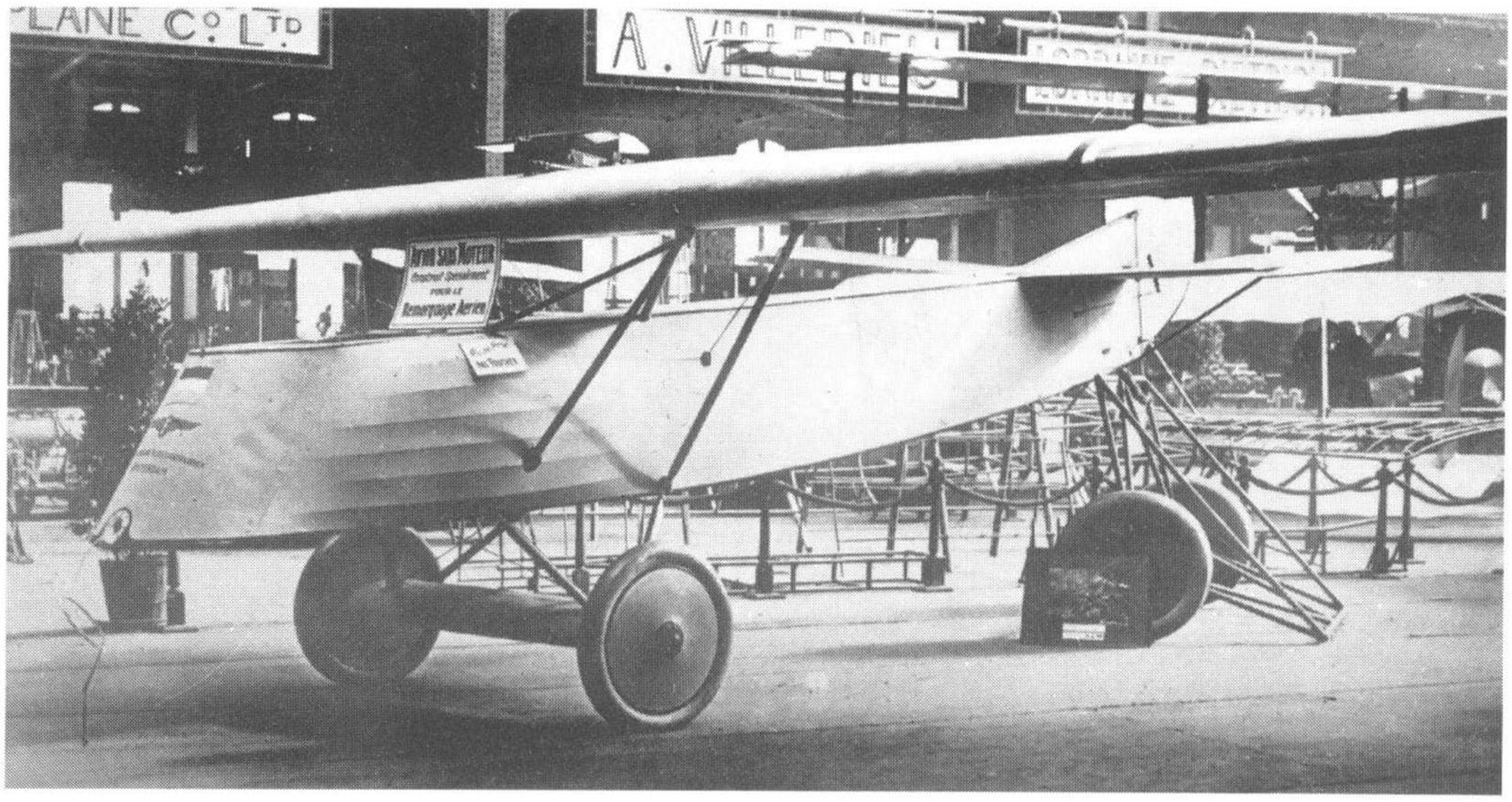


185hp BMW IIIa-engined 'wireless biplane' V.36. Cross and Cockade International

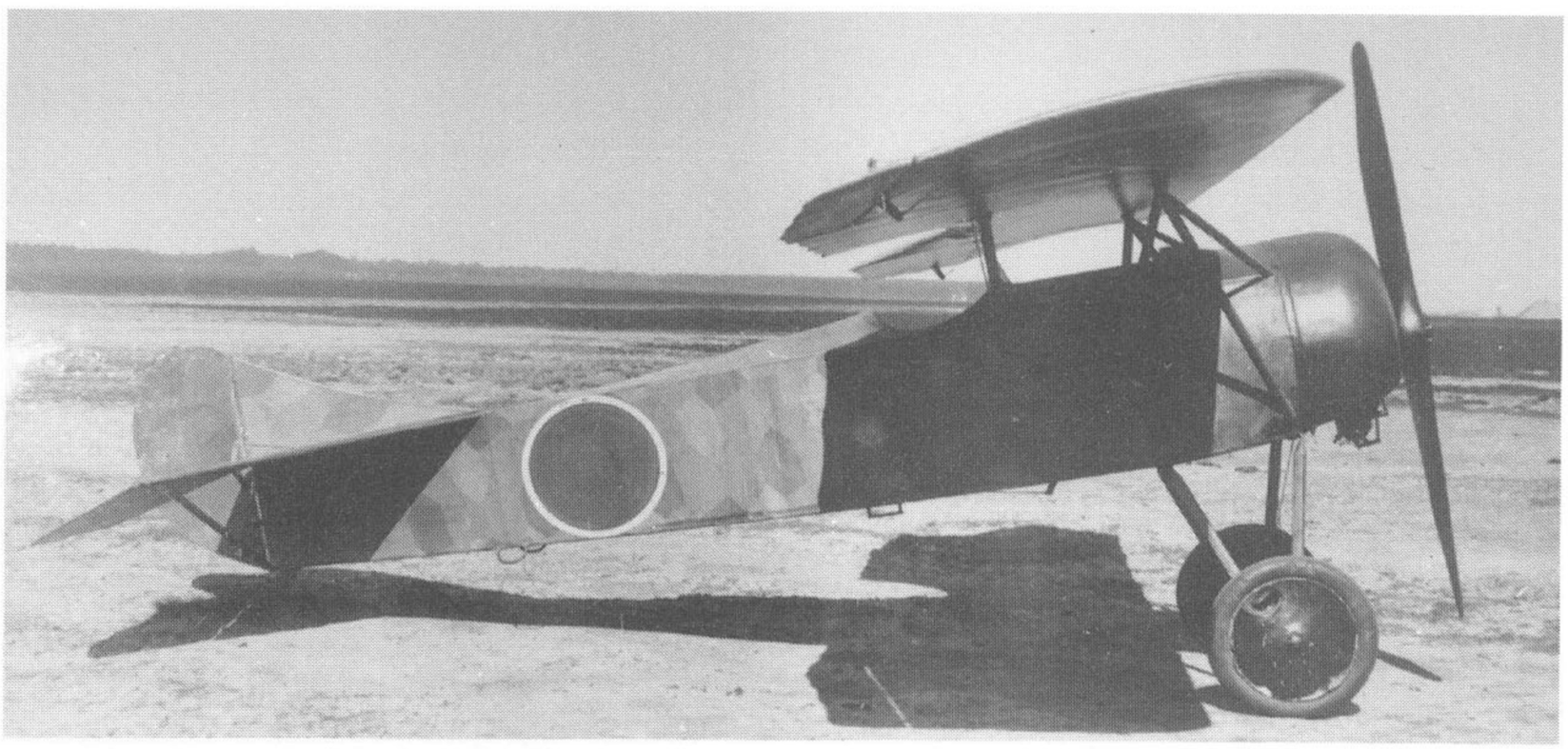
V.36, a biplane, was structurally similar to the D.VII, and the ultimate development of the V.11 concept. Instead of the D.VII's car-type radiator, its nose-mounted radiator was a neat oval shape. Its main fuel tank was carried in the undercarriage axle fairing, taking the risk of fire away from the fuselage, a feature that would have been welcomed by service pilots. Its climbing performance was better than that of the D.VII F, but in spite of this the stiffness of its controls made it unpopular to fly.

In the final assessment, the Fokker V.29 and Rumpler D.I were found to have given the best performances and, but for the Armistice, both would undoubtedly have been given production orders. As it was, the Armistice put a stop to aircraft production and almost certainly saved Fokker from another round of embarrassing problems.

Engine development had outstripped Fokker's aircraft design and the horsepower produced by the new engines was producing diving speeds beyond the structural limits of his airframes. The wing flutter experienced by the diving 145hp Oberursal UR.III-engined Fokker D.VIII was an example of this. Platz's wing design had reached its



(Above left) **Fokker V.30 glider on display at the 1921 Paris Aero Salon.** Cross and Cockade International



(Below left) **50hp or 80hp Gnome-powered V.39 (a scaled down D.VIII) in Dutch colours.** Cross and Cockade International

Aircraft Submitted for the Third Fighter Competition, 15–31 October 1918

GROUP 1 – 185HP BMW IIIA ENGINE
Fokker V.29 – cantilever parasol wing
Fokker V.36 – wire-less biplane
Pfalz D.XVf – wire-less biplane
Pfalz 'special Df' – wire-less biplane
LFG Roland D.XVII – cantilever parasol wing
Albatros D.XII – wire-braced biplane
Rumpler D.I – wire-braced biplane
Zeppelin-Lindau (Dornier) D.I – wire-braced biplane
Junkers D.I – cantilever low-winged monoplane

GROUP 2 – VARIOUS ROTARY ENGINES
Fokker D.VIII – 160hp Siemens & Halske Sh.III engine, cantilever parasol wing
Fokker D.VIII – 145hp Oberursal UR.III engine, cantilever parasol wing
Kondor E.III – 145hp Oberursal UR.III engine, cantilever parasol wing
Kondor E.IIIa – 200hp Goebel Goe.IIIa engine, cantilever parasol wing
LFG Roland D.XVI – 160hp Siemens & Halske Sh.III engine, cantilever parasol wing
Albatros D.XI – 160hp Siemens & Halske Sh.III engine, wire-less biplane
Siemens-Schuckert D.IV – 160hp Siemens & Halske Sh.III engine, in-service wire-braced biplane.

limit. It is probable that, had V.29 gone into service, a series of wing failure accidents would have resulted and Fokker could have been faced with another official inquiry. Although this time he would probably have been blameless, his production methods would have taken the blame and he may have been liable for further replacements and expenditure – if not prison.

Flying Bombs

Fokker's final wartime development was a concept that was not to see practical fruition until some twenty-five years later. A number of German companies (Siemens-Schuckert in 1914 and Junkers in 1917) had been experimenting with the practicalities of 'flying bombs'. Siemens-Schuckert 's were intended to be launched from airships and guided to their targets by means of electrical pulses down a thin control wire, in effect, a wire-guided missile, and ranges of up to 8km (5 miles) had been successfully achieved. Junkers version was intended to be towed behind an adapted 'tug' aircraft, probably the two-seater ground-attack aircraft that Junkers was also developing. This would be towed to within sight of the target, the tow slipped and, in its early development condition, the bomb would be crudely 'aimed' and then left to glide to the target. It was intended that, with further development, the bomb should be guided on to the target by a radio-control system housed either in the towing aircraft or in the front-line trenches. In conjunction with this, the army set up an experimental establishment at Döberitz to develop a suitable radio-control system.

Fokker had learned of these developments during his brief period as a director of the joint Junkers/Fokker company. Ever quick to seize an opportunity, he set Platz to design a simple glider based upon the E.V/D.VIII wing. A version of V.31 was modified to act as a tug with its tail surfaces protected from the released towing wire by a steel loop. None of the systems got beyond the experimental stage during the war, but the single example of the glider element of the experiment built by Fokker surfaced as his V.30 glider at the 1921 Paris Aero Salon.

Fokker revealed his involvement in this project during a press interview in 1919 and a number of years later read a paper to an assembly of Dutch officers in which he stressed the potential of airborne guided missiles. Neither his press release nor his paper made much apparent impact on the aviation press of the day.

Two further prototypes based upon the D.VIII design appeared immediately after the Armistice. These were V.39 and V.40, both essentially scaled-down and lightened versions of the D.VIII. V.39, the larger of the two, was fitted with a 50hp or 80hp Gnome engine and had redesigned fabric-covered wings with simplified ailerons and the familiar comma-shaped finless rudder. V.40 was much smaller and powered by a 35hp Anzani inverted-Y air-cooled engine. Both aircraft flew well and were popular with those pilots who flew them, but neither went into production.

CHAPTER TWELVE

1919 and Beyond

Undoubtedly, the war had been good for Fokker. From his penniless days as a struggling student of aviation at Zahlbach, his efforts had established him as a sound and wealthy businessman. The merit of his products had ensured that his name was internationally recognized and such was the renown gained by his D.VII design that it had received individual mention in the terms of the Armistice, the only aircraft so named.

A clause in the terms of the Armistice document calls for: 'Surrender in good condition by the German armies of the following equipment ... 2,000 aeroplanes (fighters, bombers – especially all machines of the D.VII type – and night-bombing machines).'

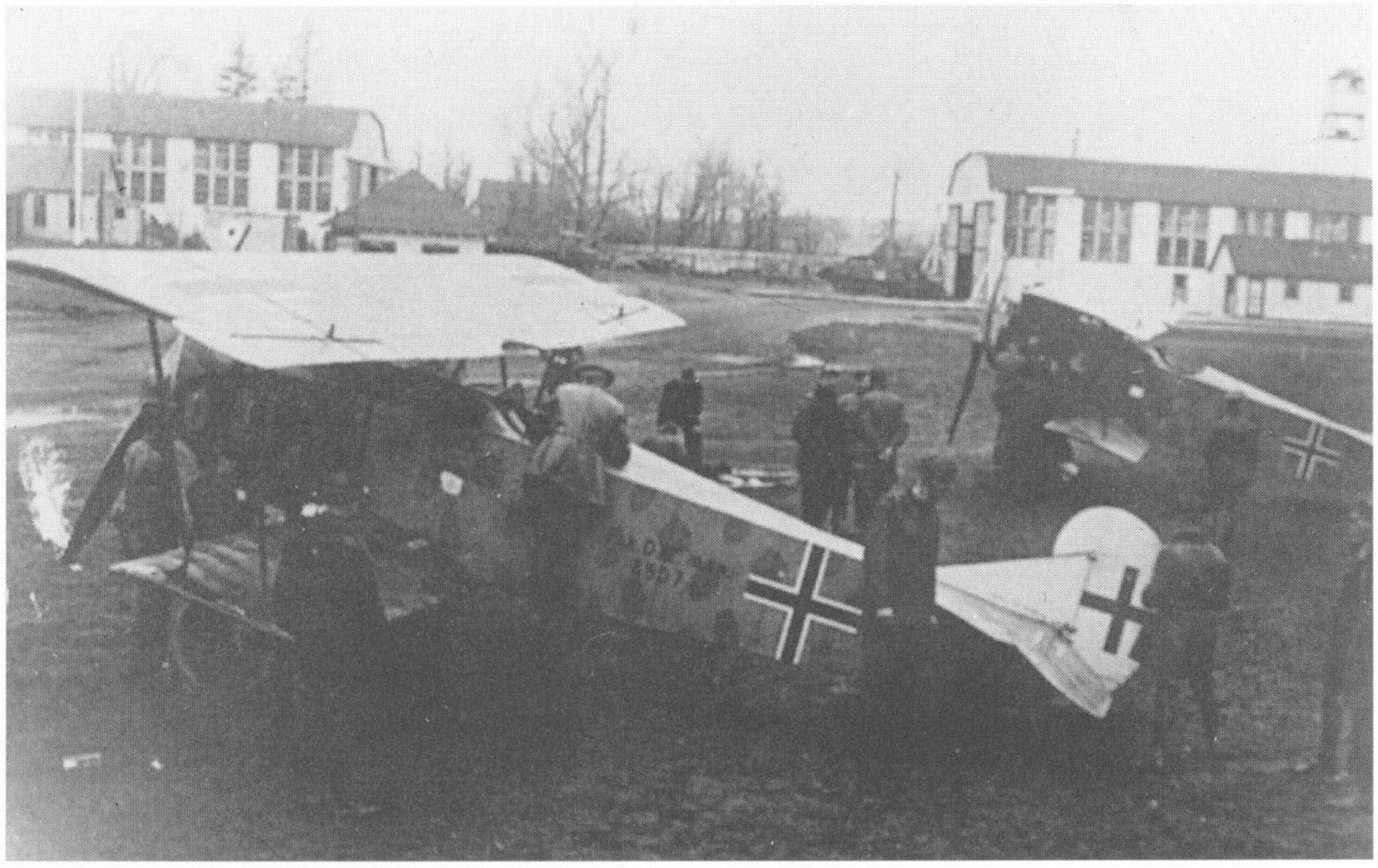
Fokker at the End of the War

Fokker had anticipated and prepared for the collapse of Germany at the end of the war, but its event still left him with problems.

First, all aircraft production throughout Germany ceased, leaving him with a number of now silent factories on his hands. Until the Armistice they had been flourishing and were well stocked with raw materials, partly finished components, engines, weapons, part-assembled airframes and a number of complete aircraft that had not yet been delivered and accepted.

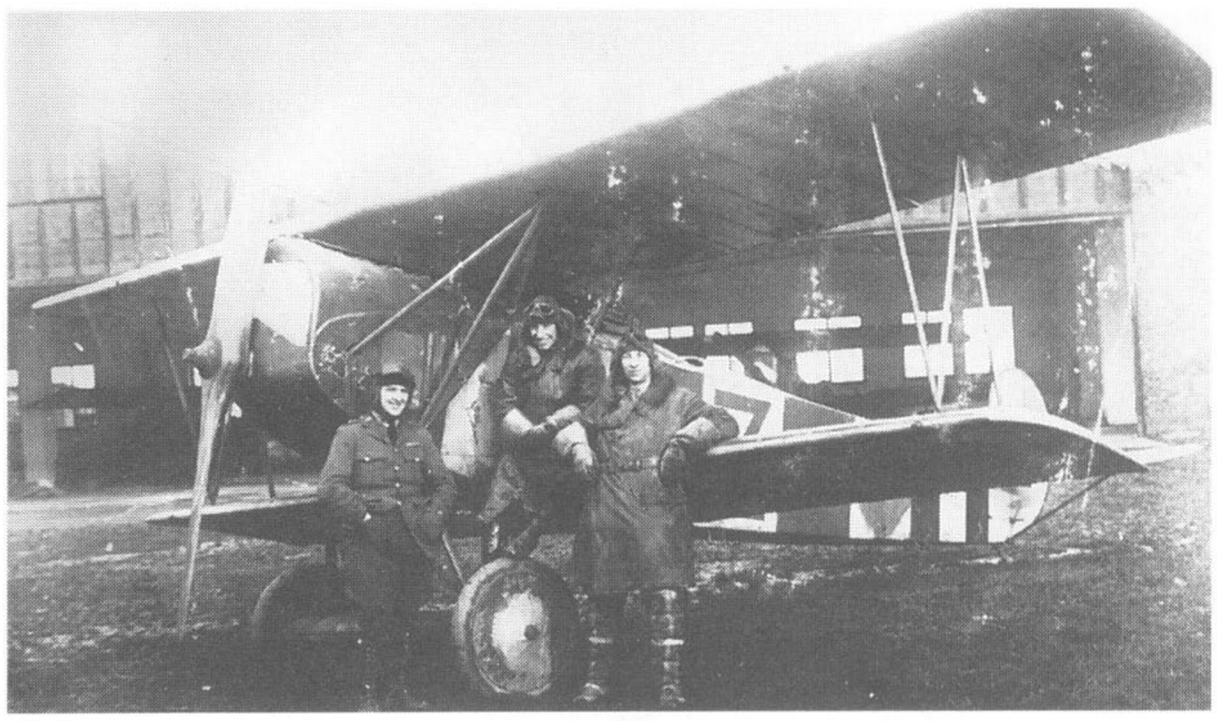
His second problem was his wealth. During the war, his factories had produced some 3,342 aircraft most of which had been accepted (and paid for) by the Army or Navy. Other factories in which he had an investment had produced engines and gun synchronizing mechanisms, all of which had brought him a sound financial return. To these must be added the returns from the licensed production of his D.VII by Albatros and Albatros (OAW). This had also brought him large sums of money, some of which he had banked in Holland but most of which remained in one form or another – cash bonds and property – in Germany.

With the end in sight, he had made plans to leave Germany and to return to Holland. His emergency escape route was by means of flight from Germany in a V.38 that had been modified to include a large fuel tank in its second cockpit and that was kept on standby in a hangar at Gorries. This dramatic plan may have worked, should his life have been in real danger, but was not practical in 'normal' circumstances. His factory



Curious RAF personnel examine a pair of Fokker D.VIIs. The machine nearest the camera is Fokker D.VII (OAW) 8507. Cross and Cockade International

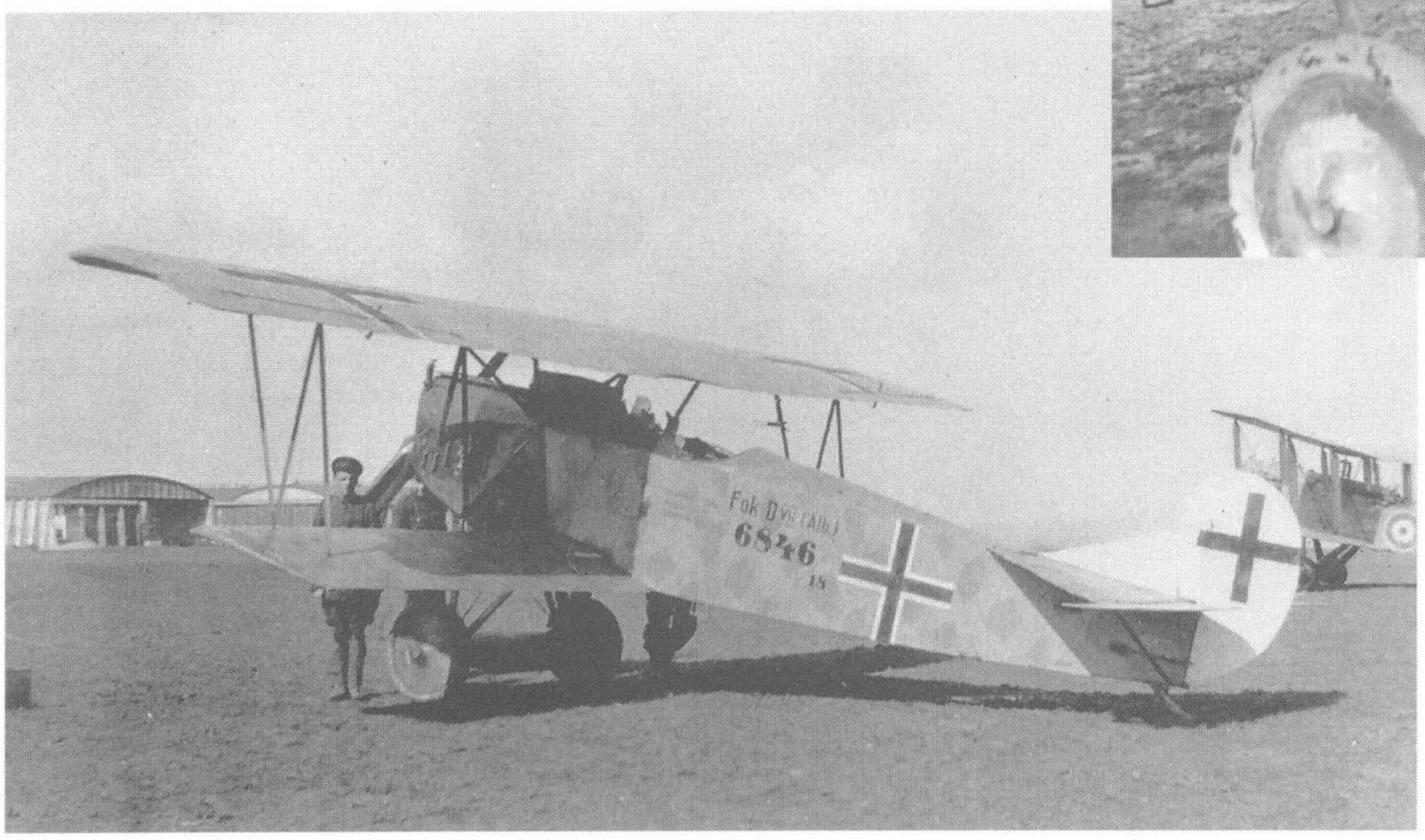
Fokker D.VII 5278/18 'Hertha' with RAF personnel after the Armistice. Cross and Cockade International



(Above) **Fokker D.VII 501/18 seen with RAF personnel at Nivelles after the Armistice. The small quick-release spinner suggests that this was fitted with a BMW engine.** Cross and Cockade International

(Above) **A pair of Fokker D.VIIs in England after the Armistice. One of them was (probably) Fokker D.VII (Alb) 6846/18.** Cross and Cockade International

(Left) **Fokker D.VII (Alb) 6846 in England after the Armistice.** Cross and Cockade International



(Below) **2/Lt James A. Royer, 9 Aero Squadron USAS, in a Fokker D.VII at Trier in January 1919.** Greg Van Wyngarden

staff, who distrusted him, had the plane under their control and he was also closely watched by the German authorities, to whom he owed a large amount of unpaid income tax.

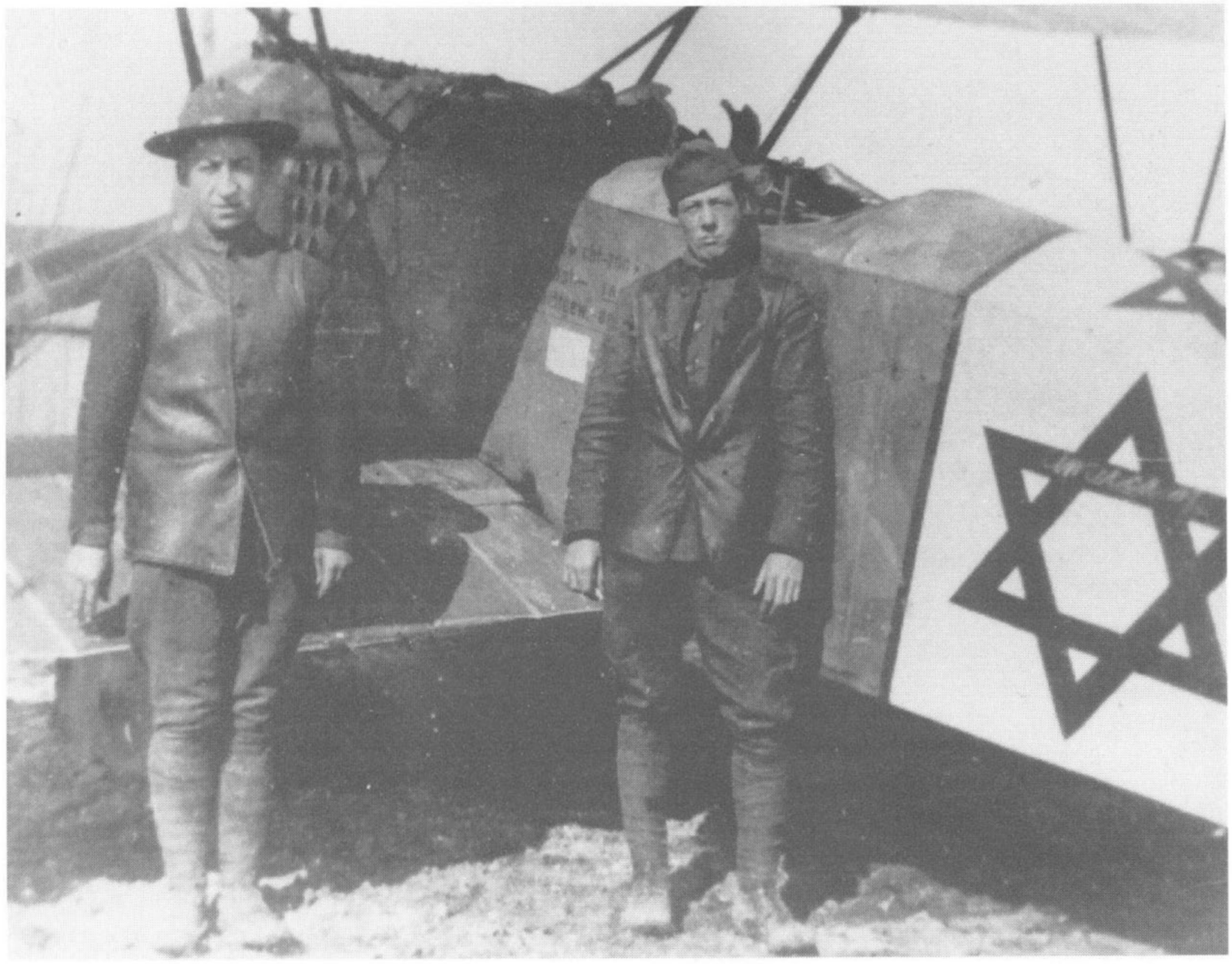
His more realistic preparations to leave Germany involved much careful manipulation of his resources. Just prior to the end of the war, he had made Herr W. Horter, his Berlin agent, deputy manager of Fokker Werke GmbH with unrestricted authority to act on his, Fokker's, behalf. He sold off a number of the properties in which he had invested during the war and made further good profits in the process. He arranged for most of the materials, components, engines, part-completed and completed aircraft to be moved out of his factories and hidden away wherever secure accommodation could be found. By this means he planned to avoid their

seizure by agents of the Allied powers or the German government.

After some negotiations with German authorities, he paid off the sum they were demanding for previous years' unpaid tax and was given a clearance certificate.

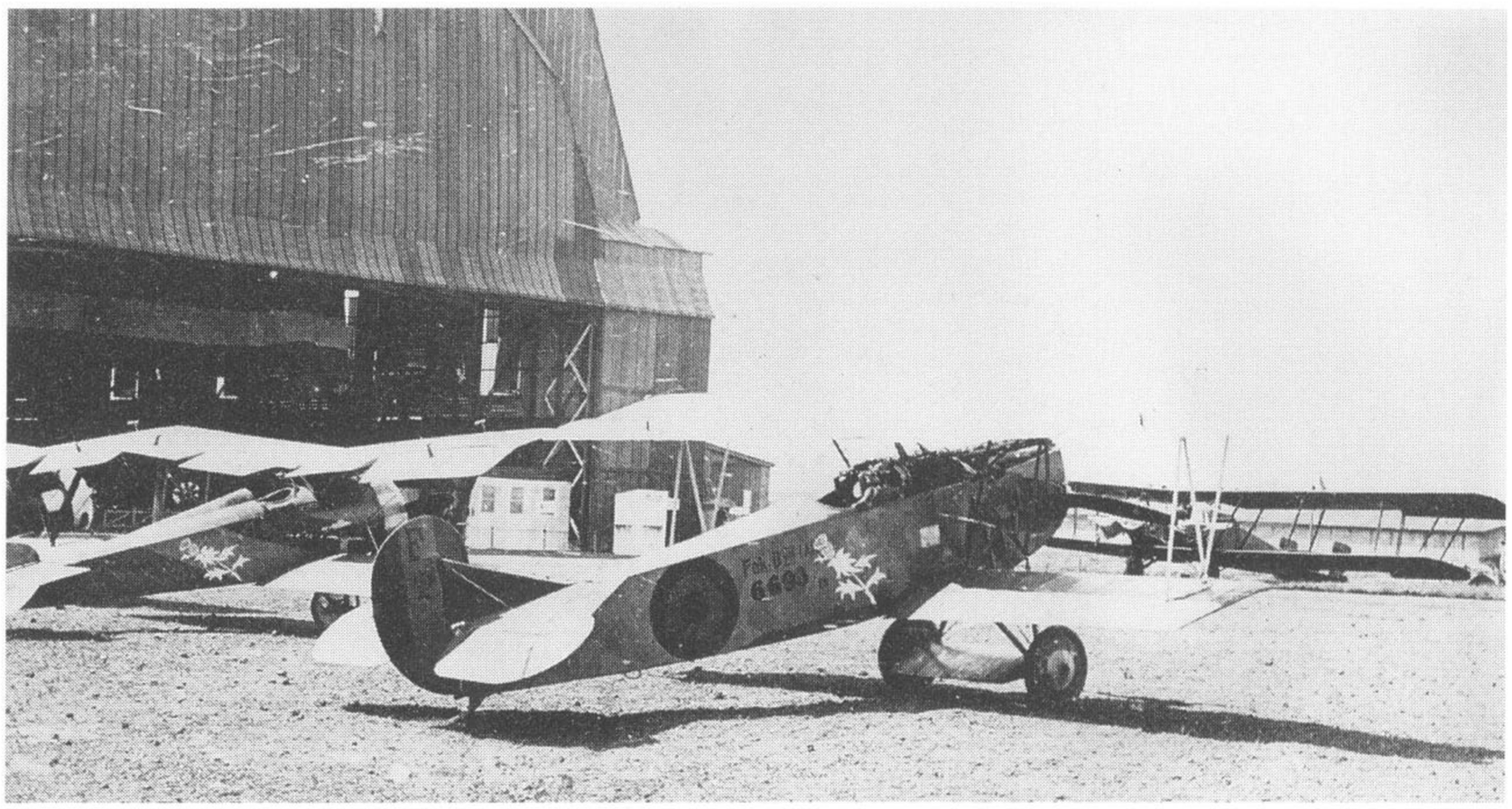
Using his contacts, he then arranged for his aircraft and stocks to be shipped from Germany to Holland. This involved the bribing of German customs authorities and may, or may not, have been carried out with the connivance of the Allied powers. All of this was moved out of Germany and into Holland by means of a number of trains each comprised of sixty or so flat cars packed with materials. By this means he transported some 220 aircraft (mostly Fokker D.VII, D.VIII and C.I), 400 engines and a vast quantity of raw materials out of Germany.

He next arranged for a large proportion (but not all) of his cash and bonds to be taken to Amsterdam in a yacht he had kept at his factory at Travemunde and which would be sailed there by a captain and crew he could trust. The remainder of his cash and bonds he arranged to be taken in an old suitcase nominally belonging to a Dutch embassy cook, and hidden in the embassy's diplomatic bag, by train from



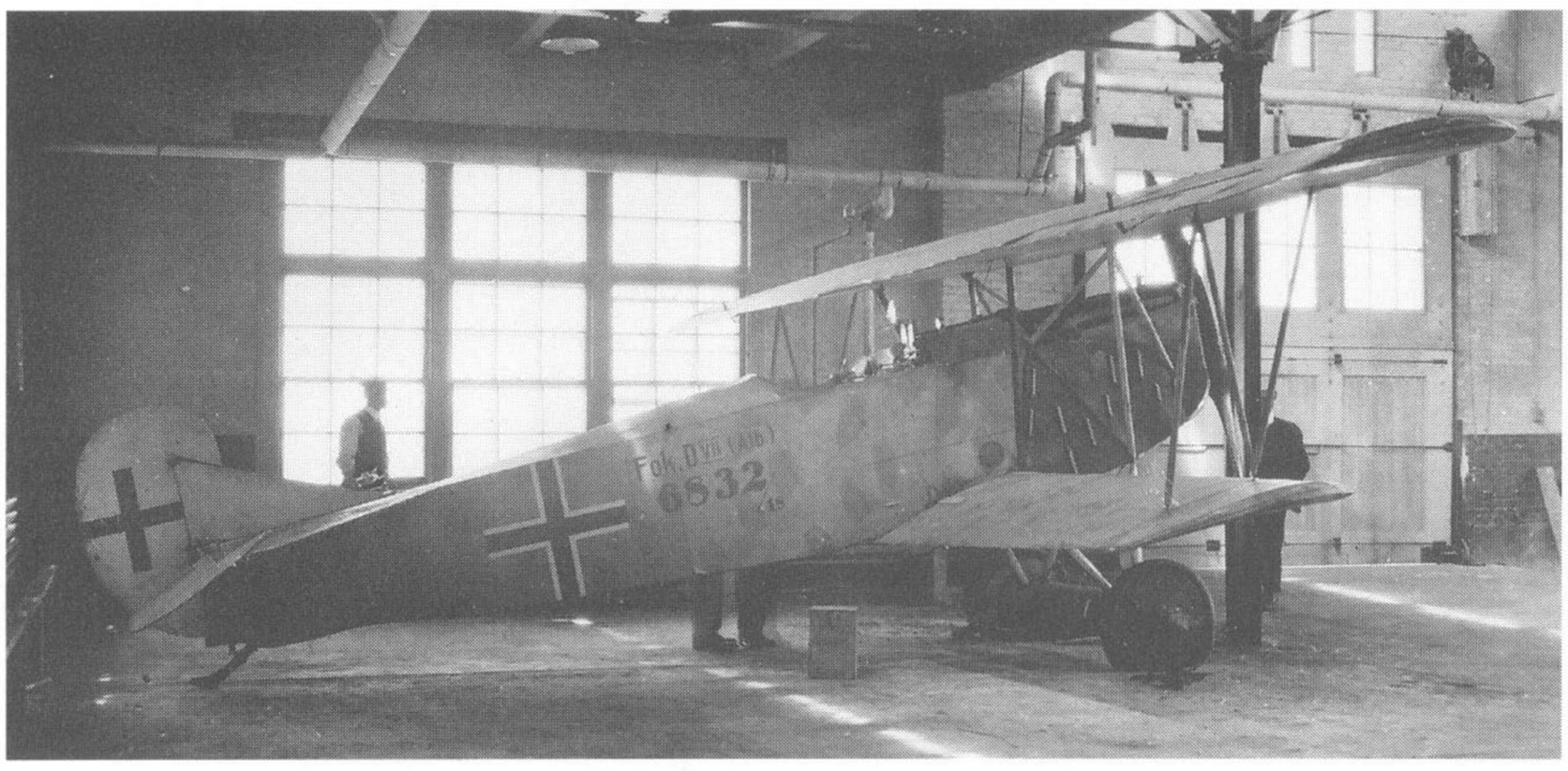
An unidentified Fokker D.VII (OAW) in American hands after the war. Greg Van Wyngarden

***(Below)* 185hp BMW IIIa-engined Fokker D.VIIF 7788/18 received by the Americans in Koblenz on 2 January 1919.** Greg Van Wyngarden



Fokker D.VII (Alb) 6693/18 in Belgian markings after the war. Cross and Cockade International

An unidentified BMW IIIa-powered Fokker D.VII in Swiss service in 1920.
Cross and Cockade International



Fokker D.VII (Alb) 6832/18 at the University of Saskatchewan, Canada in June 1920.
Cross and Cockade International

Berlin to Amsterdam. He was then free to catch the same train.

After the War

Fokker's post-war career is beyond the scope of this book but a brief synopsis of it is essential. He still had both assets and debts in Germany and he went through a complicated set of manoeuvres to gain the one and rid himself of the other. Once back in Amsterdam, he renounced the German citizenship that had been forced upon him by his need to sell his products to the German forces, and re-established his Dutch nationality. He then married Elizabeth von Morgen, the daughter of a German general who had himself been a party to some of Fokker's dubious post-war cash transactions. Having married, Fokker planned to make a three-year yachting cruise of the world by way of a honeymoon and to relax after the stressful war years.

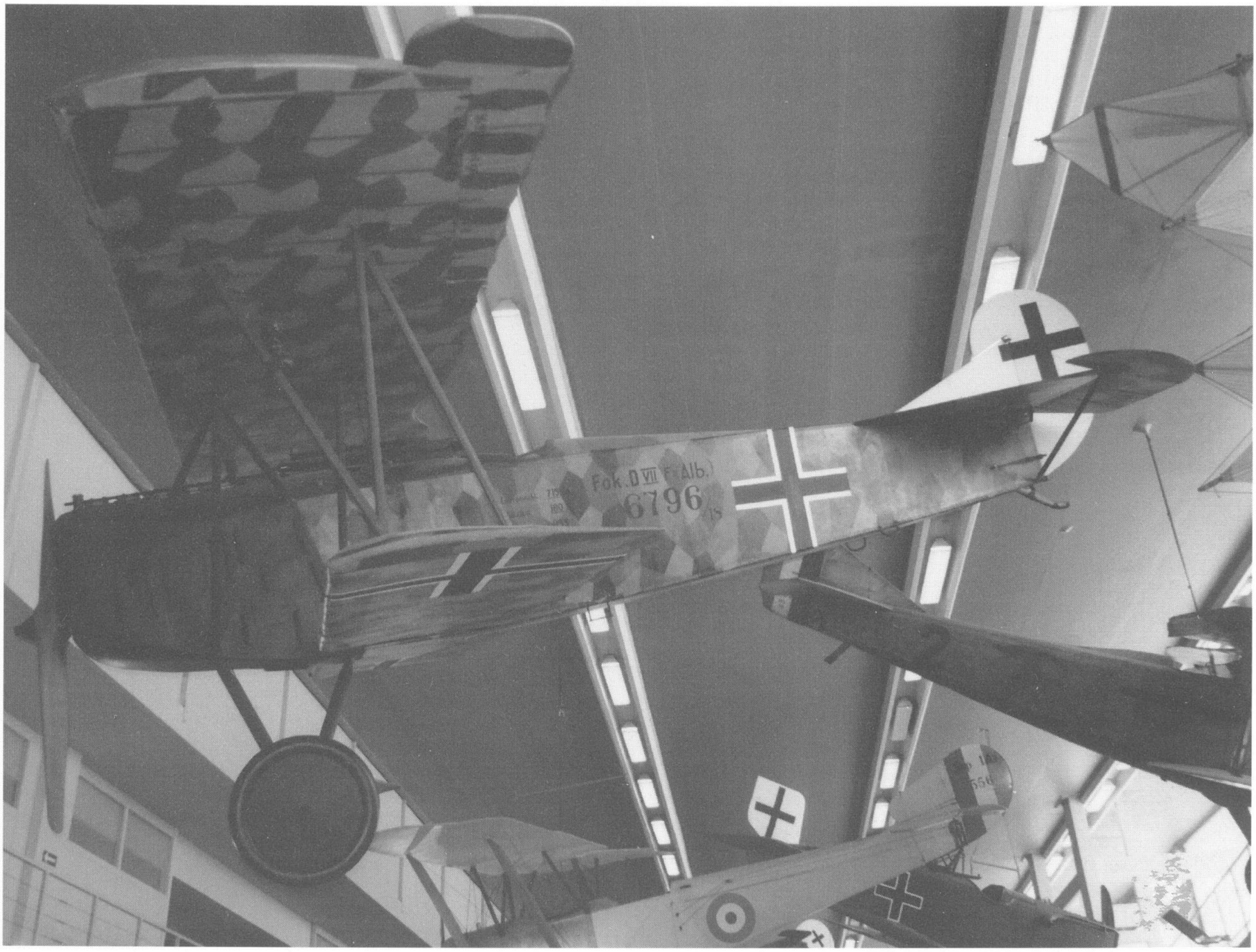
But this was not to be. His plans were overtaken by the need to store and then sell off the aircraft and material he had smuggled out of Germany and to establish himself in Holland as a Dutch aircraft manufacturer. Storage space was found in the Amsterdam Petroleumhaven and he was able to sell some of his aircraft to the Dutch government through the Spijker company at Trompenburg. Spijker had been producing Clerget engines under licence during the war and since then had been trying unsuccessfully to fulfil a contract they had from the government for the design and manufacture of aircraft. Taking over this contract, Fokker sold off twenty D.VIIs and sixty C.Is to the Government. He was also able to use the Spijker facilities to modify two of his aircraft (a D.VIII fitted with a 130hp Spijker/Clerget engine and his M.17E fitted with an 80hp Oberursal engine) for the coming ELTA (*Eerste Luchtvaart Tentoonstelling Amsterdam*) exhibition due to be held in Amsterdam in August 1919. Fokker demonstrated both at the exhibition, which aroused the enthusiasm for aviation of the Dutch public and brought his name to their attention.

On the strength of this, Fokker established a new aircraft manufacturing company, Nederlandse Vliegtuigenfabriek (NV) on 21 July 1919. Registered in Amsterdam, the company was established as being Dutch. For political reasons, Fokker's name did not appear in the title but he was listed as a director with his residence given

as Schwerin. The company's first manufacturing unit was located at Veere in Zeeland where Fokker rented buildings that had been used by the Dutch Naval Air Service during the war. The space at this facility was limited so, at the end of the ELTA exhibition, he arranged to take over the buildings that had been constructed for the exhibition. Initially these were used solely for the assembly of components that had been manufactured at Veere and Schwerin.

His factory at Schwerin, re-named the Schweriner Industrie-Werke, although still owned by Fokker at first continued to be managed by Platz. Despite the restrictions of the time, it was still producing a limited range of light prototype aircraft and a number of less profitable items. Early in 1919 it was acquired by the Unie Bank voor Nederland & Kolonien of Amsterdam, making

With the individual marking 'U10', Fokker D.VII (OAW) 4635/18 originally belonged to Ltn Heinz Freiherr von Beaulieu-Marconnay of Jasta 65. It was captured on the ground by the Americans near Verdun in September 1918 and acquired from the US War Department by the American National Air and Space Museum in 1919. It has recently been restored and is now on display in Washington. Cross and Cockade International



Fokker D.VII (Alb) 6796/18 on display in the Musée de l'Air at Le Bourget in Paris. Philip Jarrett

***(Above)* Behind the ultra-light Messerschmitt 'D887' is an unidentified Fokker V.39 in civilian use in Germany after the war.** Cross and Cockade International

***(Left)* Anthony Fokker with camera in the USA on 7 August 1922.** Stuart Leslie

it a Dutch company and thwarting any attempt by the German authorities to seize it against any further unpaid tax demands that they may have intended to make. On 29 September 1921, Platz was replaced by H. G. von Morgen, Fokker's brother-in-law, who was made the sole director of the company. Fokker had effectively severed all links with Germany.

The German government did eventually make the additional tax demands Fokker had anticipated, but by then he was firmly established as a Dutch national and all negotiations with them were carried out from the safety of Holland. To clear himself, Fokker finally agreed to meet their demands, initially to pay 5,000,000 Marks spread over five years but then, as German currency devalued, he paid off his debt in a lump sum. He was now free to visit Germany again without fear of imprisonment.

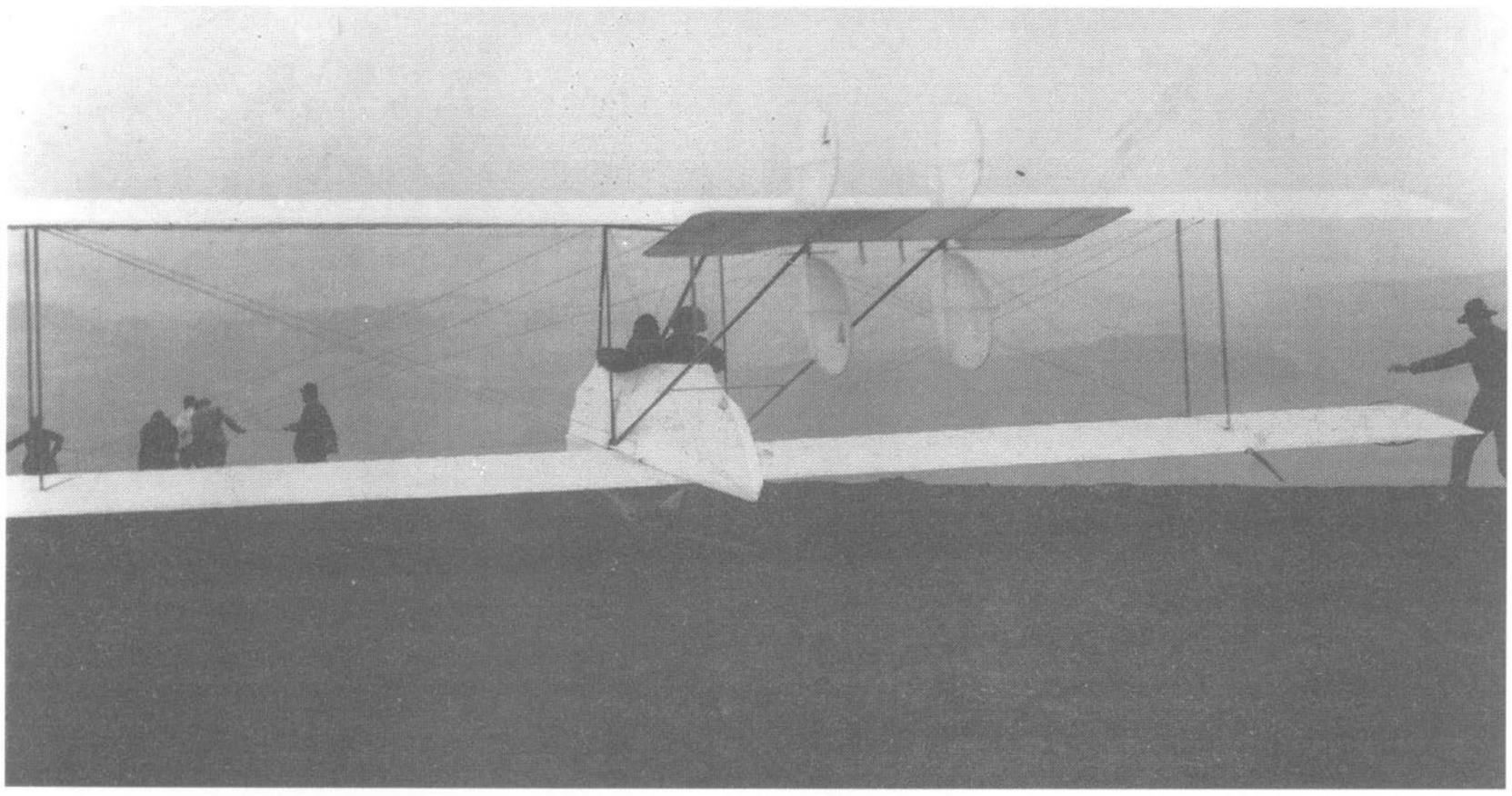
Fokker and the USA

The United States Air Service had been impressed by the samples of the D.VII and D.VIII that it had received at the end of the war and sent officers to Holland to negotiate for the purchase of new types. Encouraged by this, Fokker paid a number of visits to the USA and eventually established the Atlantic Aircraft Company, a subsidiary of his Dutch-based company, in New Jersey. In the long term, this enabled him to build aircraft in the USA, thus getting around American prejudice against the purchase of foreign aircraft for the US forces and national airlines.

With the growth of his interests in the USA, Fokker spent more and more time in that country. He finally gave up residence in Holland in 1925 and established his main home in the USA. Even so, he still made many visits to Holland and his Dutch factories.

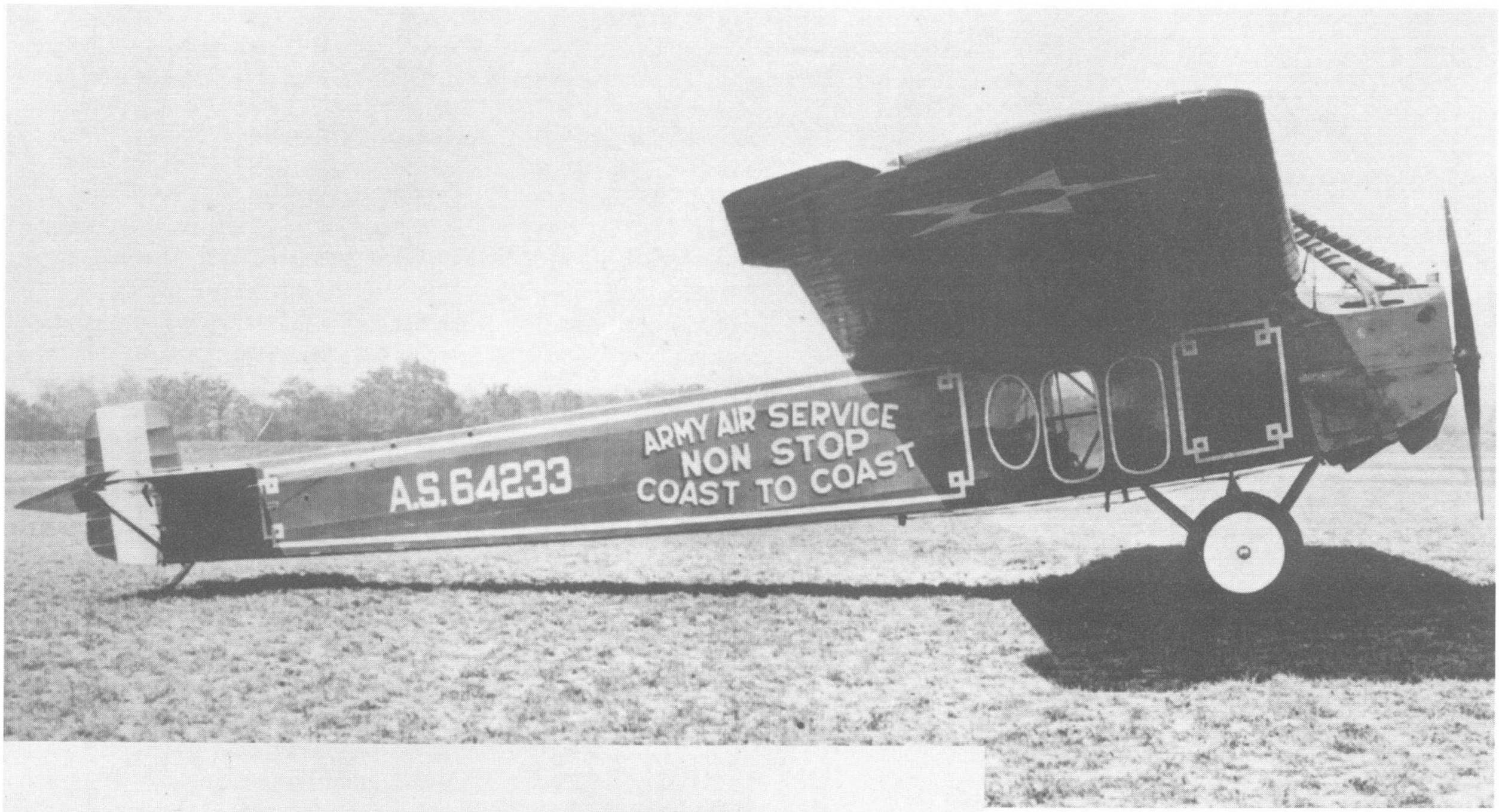
Having been replaced at Schwerin, Platz moved to Amsterdam and took over production management and continued with the design of new machines. Most of the staff from Schwerin moved with him and were joined by others who had left the company earlier. Platz stayed with Fokker for a further eleven years, producing some forty more successful aircraft before leaving in March 1931. By then aircraft had become complex structures and it was no longer possible for a single person to be responsible for every aspect. Design was now the prerogative of a highly skilled, professionally qualified team.

***(Right)* Fokker's FG.2 two-seat glider during the Rhône Gliding Competition of 1922.** Cross and Cockade International



***(Below)* The Fokker F.IV (US Army designation T-2) in which John A. Macready and Oakley G. Kelly were the first to cross the North American Continent from coast to coast, on 2–3 May 1922.** Cross and Cockade International

***(Bottom)* The Fokker C.IV floatplane in which Argentinian Major Zanni flew from Amsterdam to Tokyo in 1924.** Cross and Cockade International



Fokker's companies flourished and he remained a well-known figure in the world aviation scene. He died on 23 December 1939 in the Murray Hill Hospital in New York after an operation on his nose went sadly wrong. His funeral service was a simple one conducted in his American home, which was crowded with flowers sent by his worldwide friends and colleagues. He was cremated and his ashes taken on the SS *Volendam* back to Holland, where they were finally laid to rest in the family vault at Driehuizen-Westerveld, just north of his former home town, Haarlem.

Engines

At the beginning of World War One, two types of engine were available to aircraft designers. These were air-cooled 'rotary' engines and water-cooled 'in-line' engines.

The more powerful of the two was the in-line engine, six-cylinder versions of this being capable of developing 160–240hp. They were generally well proven, sturdy and reliable, and also had the advantage that they were well balanced and so had no effect as such on the control of an aircraft. They did, however, have the disadvantage that they were large and heavy both in their basic construction and also because they required water pumps, radiators, pipework and a coolant fluid.

Less powerful, but considerably lighter, was the rotary engine – a breed that reached its peak during the war and then disappeared from general use in the 1920s. The rotary engine had its cylinders radially displaced around its crankcase and, when the engine was running, it rotated about its stationary crankshaft. The engine was cooled by the passage of air over the finned cylinders, both through the forward motion of the aircraft and through the engine's rotation. In addition to its lightness, in its simplest form the rotary was also compact.

Rotary engines also had their disadvantages. At first, the main of these was their general messiness. They relied upon a fuel/oil mixture for lubrication, the unburned oil from which was discharged with the engine's exhaust into the slipstream – and then over the fuselage and the pilot's face. The effects of this were normally reduced by fitting a circular or horseshoe-shaped cowling to contain the excess lubricating oil and direct it into the slipstream on the underside of the aircraft. The disadvantage of these cowlings was that they reduced the cooling effect of the slipstream, leading to engine overheating, particularly in the summer months. A further disadvantage of rotary engines, from the German point of view, at least, was the difficulty of obtaining the castor oil necessary for lubricating them – *see* the box on page 108.

Another disadvantage was the effect of the rotating mass of the engine on the control of the aircraft. This ensured that the aircraft had a tendency to turn in the direction of rotation and made it difficult to turn it in the opposite direction. Experienced pilots turned this into an advantage, by using it to make rapid turns in combat. In less experienced hands it caused problems and, in some cases, fatalities. It also caused problems when moving an aircraft under its own power on the ground. Use of the blip switch and the sudden revving up of an engine would cause the appropriate wing to dip and, if the surge of power was sudden and excessive, contact the ground.

At the beginning of the war, Germany relied upon the production of in-line engines from the well-established German companies of Mercedes, Benz, Argus and Daimler and, to a lesser extent, upon a stock of imported French Gnome and Le Rhône rotary engines. As the war progressed, and the import of engines became 'difficult', German manufacturers reverse-engineered French engines and began their own production of the type: the early Oberursal series of engines were copies of Le Rhône types with minor alterations. The other main manufacturers of this type of engine were Siemens & Halske and Goebel. At the beginning of the war, the output from the more common rotary engines was around 80hp but, with demand for more powerful engines, this increased to the 110hp of the Oberursal UR.II, the 145hp of the UR.III, the 140hp of the Goebel Goe.III, the 160hp of the Siemens & Halske Sh.III and even (for limited periods) the 200hp of the Goebel Goe.IIIa.

As more horsepower was needed for heavier and faster warplanes, all engines tended to get bigger with larger cylinders and, in some cases, more of them. The main effect that this had on in-line engines was that they tended to become longer and that larger radiators and more cooling fluids were needed. This added to the weight of the system but the effect was relatively slight and easily accommodated. With rotary engines however, the effect was more serious. More and larger cylinders made for an increase in the centrifugal forces generated and, as the demand for power continued, the rotary engine became impractical. Some attempt was made to cancel out these forces by the use of 'counter-rotating' cylinders on later German engines such as the Siemens & Halske Sh.III, but the war ended before these could really be considered reliable.

Engines Available

In-line (water-cooled)
Austro-Daimler – 200hp
Austro-Daimler – 225hp
Austro-Daimler – 240hp

Benz Bz.IIIb – 195hp
Benz Bz.IVu – 240hp (high compression)

BMW IIIa – 185hp

Mercedes D.II – 120hp
Mercedes D.III – 160hp
Mercedes D.IIIa – 175hp
Mercedes D.IIIau – 200hp (high compression)

Rotary (air-cooled)
Oberursal UR.I – 100hp (9-cylinder)
Oberursal UR.II – 110hp (9-cylinder)
Oberursal UR.III – 145hp (14-cylinder)
Siemens & Halske Sh.III – 160hp (11-cylinder)
Siemens & Halske Sh.IIIa – 200hp (for limited duration at altitude) (11-cylinder)

Goebel Goe.II – 100hp (7-cylinder)
Goebel Goe.III – 200hp (9-cylinder)

In addition to those engines built by Oberursal and Siemens & Halske, the Rhemag Rhenania Motoren Fabrik factory built both Oberursal and Siemens & Halske engines – usually achieving a high standard of quality.

Development of the German Fighter Arm 1914–1918

At the outbreak of war in August 1914, the German Army saw its aviation arm as an extension of its cavalry, for use in a reconnaissance role. For this purpose it was equipped mainly with two-seater aircraft attached to corps and army headquarters and deployed to satisfy those headquarters' requirements. In the early days of the fighting, whilst the situation was fluid, the small number of aircraft available were dispersed over a wide area and seldom came into contact with similarly employed Allied aircraft. When the situation hardened into trench warfare, aerial activity naturally became concentrated near the front lines and the role of the aircraft was expanded to include artillery co-operation. As a consequence, contact with the enemy air forces increased and a need for aircraft capable of both attack and defence became apparent.

The Allied forces had been experimenting with light machine-guns (Lewis and Hotchkiss) fitted to their aeroplanes and so were able to take offensive action to protect their own reconnaissance and artillery co-operation aircraft. The Germans, initially lacking a machine-gun suitable for use from an aircraft defended themselves with pistols or, later, multi-shot carbines. When a machine-gun, the Parabellum LMG 14, became available to them, it instigated a new class of reconnaissance aeroplane. In this, the observer was located in the rear cockpit and able to use his machine-gun from a circular mounting ring. A machine of this type could fly with an unarmed machine and provide it with protection from attack by Allied aircraft. The Germans also used heavier multi-engined aircraft with a gunner seated in its nose in this role. Both types of aircraft were deployed with unarmed machines in the Feldflieger Abteilungen and flown by whichever pilot was available at the time.

The advent of the light, agile, monoplane with a fixed, forward-firing machine-gun meant that greatly improved protection could be provided for reconnaissance machines. At first, single examples were added to the strengths of the Feldflieger Abteilungen and again flown by any pilot who was available when required. The numbers of these single-seat aircraft in service increased but they were still scattered amongst the Feldflieger Abteilungen and flown by any available pilot. This situation changed as it became obvious that the temperaments of some pilots suited them to this type of combat flying and they began to be used exclusively to fly the new monoplanes. Because of their mutual interest, pilots from different units began to talk to each other and compare notes on tactics and other relevant matters. Later, ad hoc combinations of a number of these pilots would officially join forces for particular operations. The next step was for the two-seater units to 'lose' their single-seaters and for these to be grouped together as single-seater units. At first, the function of these remained the protection of the observation aircraft, but this role was soon expanded to include the denial of airspace to Allied aircraft. The Kampfeinsitzer-Kommando (Kek) had arrived.

Initially, these were not permanent groupings and both the pilots and aeroplanes remained on the strength of their original Feldflieger Abteilung, answering both to that unit and to their parent corps and army headquarters. The impracticality of this was finally recognized and the Keks became autonomous units commanded by a nominated senior pilot and responsible to their local army headquarters. As the usefulness of these units was recognized, their numbers increased and, finally, they were spread both along the Western Front and in front of important industrial targets. Their monoplanes became obsolescent and were gradually replaced by a new generation of light single-seat biplanes, still armed with a single forward-firing machine-gun.

The First Jastas

The situation changed again on 10 August 1916 when the strength of Kek Nord was augmented by the addition of pilots from Armee Flug Park 1 and further pilots from Feldflieger Abteilungen within the 1st Army's area. The resulting unit was designated as Jagdstaffel (literally 'hunting squadron') 1, this usually being abbreviated to Jasta 1.

To meet the pressure of Allied aerial activity, it soon became necessary to increase the number of these fighter units and, by the end of October 1916, there were some twenty-four such units on the Western Front. To these was added Jasta 25 on the Eastern Front and two units formed from naval single-seater pilots, Marine Feld Jagdstaffel (MFJ) I and II. By the end of 1916, a further three Jastas had been formed at the front and nine additional Jastas at Flieger Ersatz Abteilungen in Germany.

At first, because of the speed of the expansion of the fighter force, the equipment of the units contained a motley assortment of the remaining Fokker and Pfalz monoplanes together with newer first-generation Fokker, Halberstadt, Roland and Albatros biplanes. Also, the expansion stretched German manpower resources to the extent that the new units were seldom able to meet their establishment of twelve aircraft and pilots. To resolve this situation German policy was changed so that it was no longer essential for a pilot to hold a pilot's licence (requiring a number of war flights as a two-seater pilot) to be accepted for training as a single-seater pilot. A new single-seater fighter pilot training school (Jagdstaffelschule 1) was set up at Valenciennes to give new, and other, pilots training in formation flying and combat requirements. From this, the first of the 'direct entry' pilots started to arrive at the front. Also, production of the new biplane fighters got into its stride and it became possible for each unit to be (largely) equipped with a single type of aeroplane – highly desirable from the maintenance and spares viewpoint.

Birth of the Jagdgeschwadern

By late 1916, intensified Allied air activity in the Ypres-Roulers-Menin area held by the German IV Armee had drawn an increased number of Jagdsteffeln into play. Originally these had been controlled by the Armee Ober Kommando (AOK), but it was soon recognized that more effective control could be maintained by

allocating units to the Gruppenkommandos – the Army Group Headquarters in whose area their support was needed. From this, the natural progression was to group numbers of individual Jagdstaffeln together under a single commander. This commander was originally an administrator and seldom lead the unit in the air. At first this grouping was temporary and compositions of groups and the identity of the commander varied as was deemed appropriate as needs arose. In the long term such a situation could not be satisfactory and the need for a coherent unit with an established complement and a single responsible leader became recognized.

On 24 June 1917 the first such unit was formed. This was Jagdgeschwader I (JGI) and command of it was given to Manfred von Richthofen, formerly commander of Jagdstaffel 11. JGI comprised Jastas 4, 6, 10 and 11. For ease of maintenance each Jasta was to be equipped with twenty aircraft of the same type with additional numbers of like machines to be held in a central reserve to form a replacement pool. JGI was attached to the II Armee.

Jasta 11 received the first production triplanes and was mainly equipped with this type by early January 1918; Jasta 6 received a number of triplanes shortly afterwards. Both units retained some Albatros D.Vs and continued to use them in parallel with their triplanes until into February of that year. At this time, Jasta 4 and 10 continued with their Albatros D.Vs and Pfalz D.IIIs. Jasta 4 was finally re-equipped with triplanes in late April 1918. Jasta 10 continued to operate with its Albatros and Pfalz types but occasionally had triplanes from the other elements of JGI attached to it for specific operations.

The lack of availability of additional suitable leaders (regular officers with the right military background and combat experience) delayed the formation of any further such units until the pressure of the proposed German offensive in March 1918 made this essential. As a result, JGII was formed on 2 February 1918 and JGIII on 21 February 1918.

Jagdgeschwader II, originally assigned to the German VII Armee, was made up of Jastas 12, 13, 15 and 19. (It had originally been intended that Jasta 14 would be part of JGII but when command of it was given to Hptmn Adolf von Tutschek he asked for it to be replaced by his old unit, Jasta 12.) Jasta 15 had received Dr.I 115/17 in October 1917 but the investigation of Gontermann's accident and the subsequent delays to production caused by the need for rectification of the faults discovered meant that no further triplanes were received by any of the units until January 1918. Provision of triplanes for the Jasta began early in January 1918, and by March all had some on strength. Only Jasta 12 was ever fully equipped with triplanes. Even so, a well-known photograph of Jasta 12 on its aerodrome at Toulis shows it with a mixed complement of ten Albatros D.Vs plus some eight triplanes. When von Tutschek was killed in combat on 15 March 1918 command of JGII passed to Hptmn Rudolf Berthold who was recovering from wounds. By manipulation of Jasta numbers, Berthold was allowed to bring his old unit, Jasta 18, into JGII where it assumed the title Jasta 15. Jasta 15 personnel moved out to become Jasta 18 and left the few triplanes that they had received behind them. Jasta 13 had a few triplanes on strength at one time but they were phased out as replacements became available. Jasta 19 received a number of triplanes and continued to operate them as its main equipment well into the summer of 1918. JGII moved from VII Armee to be part of XVIII Armee during the German offensive of March 1918.

Jagdgeschwader III was formed in the IV Armee area and was originally commanded by Oblt Bruno Loerzer. Its original units were Jasta 2 (Boelke) and Jasta 36. These were later joined by Jastas 26 and 27, all being based in the Courtrai area. Jasta Boelke, Jasta 26 and Jasta 36 had full complements of triplanes, but while Jasta 27 had a few triplanes on strength, its complement was mostly made up from Albatros D.Vs.

It was originally intended that all three Jagdgeschwadern were to be equipped with the Fokker Dr.I which, at the time, was thought to be the best single-seat fighter available. The need for 100 to equip each Jagdgeschwader plus a small number for a replacement pool dictated a total number for the triplane requirement. Although the best machine available in the winter of 1917–18, it was recognized that it was in fact a stopgap and that better machines would be available by the spring and summer of 1918. Thus the total order for the Dr.I was restricted to 320 machines. Jastas 5, 7, 14, 32b and 34b also had Dr.Is on their strength at some time during 1918; as related above, Jasta 14 should have been a part of Jagdgeschwader II and so had a large complement of the type.

The USA declared war on Germany on 6 April 1917 and the threat of the additional resources that would shortly become available to the Allies on the Western Front put even more pressure on German resources and the *Amerikaprogramm* was formulated to help cope with this problem. Part of this recognized the urgent need for a rapid increase in the fighter force, and on 23 June 1917 a plan to increase the numbers of Jagdstaffeln by 100 per cent by March 1918 was implemented. This again stretched German resources in both manpower and material, and was slow in fulfilment. By 11 November 1918, the number of Jagdstaffeln on the Western Front stood at ninety but most of them were under strength. Not only had many of the more experienced pilots had been killed either in combat or in flying accidents, but the skilled labour needed to support them in the field had been stretched to cover the expansion. Finally, shortages of materials – fuel, lubricants, tyres and replacement aircraft – had begun to bite hard on the Air Service's ability to fight.

Weapon Development

From the early days of the war, airmen from both sides carried weapons into the air and used them against opposing fliers. Initially these were pistols or carbines, but soon the British and French were experimenting with the use of light machine-guns carried on improvised mountings. However, the aircraft of the day had been designed with reconnaissance, not aggressive combat, in mind and so their construction and layout did not readily lend themselves to it. Use of a weapon of any sort was restricted by the structure of the aeroplane from which it was being used and the possibility of causing self-inflicted damage to that machine – particularly in the excitement of an engagement.

In a pusher-type aeroplane, with the engine and propeller behind the pilot, it was possible to mount a machine-gun and to fire it forwards in the direction of flight, but existing machines of this type were both slow and cumbersome and did not lend themselves to aggressive behaviour. Further, it was not for some time that the advantages of having the weapon fixed to fire forward in the line of flight were fully appreciated and early machine-gun-equipped pushers were usually fitted with guns on flexible mountings.

Tractor aircraft, with their engine and propeller in front of the pilot, were faster and generally more agile but could only be fitted with a forward-firing gun as long as it was located so that it could not damage the aircraft's structure or propeller when it was fired. This was overcome by having guns above the upper wings of aircraft, or mounted on the fuselage side and angled so that they could fire forward or rearwards in an oblique manner. In both cases, accurate aim from an aeroplane on the move was difficult, if not impossible.

The ideal solution was to mount the gun in front of the pilot so that it fired in the direction of flight and could be aimed by pointing the entire aircraft at the target. But to do so either meant protecting the propeller blades from the bullets or interrupting the firing of the gun to avoid them. A number of keen minds were at work on this problem and a patent for an interrupter gear had been granted to Franz Schneider, a Swiss engineer working in Berlin; Schneider's gear had been fitted to a B-series Albatros as early as December 1914. Schneider's patent, DRP No. 276396, raised in 1913 whilst he was Technical Manager of the German LVG company, described a mechanism that would enable a machine-gun to fire through the arc swept by a revolving propeller. It achieved this by use of a cam driven by the engine crankshaft, a cam follower and pushrod, and a bell crank system, that caused another pushrod to act upon the weapon's trigger and prevent it from being operated when a propeller blade was in front of the gun's muzzle. The system was original and ingenious but had serious practical limitations. With an engine turning a two-bladed propeller at 1,200rpm, a blade would pass the muzzle forty times per second. The maximum rate of fire of the gun to be used was 600 rounds per minute – 10 rounds per second – so that it would be stopped from firing at a rate four times its own cyclic rate, and so be unlikely to be able to fire at all.

Raymond Saulnier had applied for a patent based on a cam-operated system. Saulnier's system followed Schneider's but modified it by taking his drive from the oil pump of a rotary engine and, by this means, caused a mechanism to press the machine-gun's trigger and thus fire it. This system suffered from the quality of the ammunition available at the time: misfires caused the timing to be upset and damage to the propeller blades resulted.

Being unreliable in operation, neither Schneider's nor Saulnier's systems found favour. However, Saulnier had devised another, simpler device. This took the form of wedge-shaped steel deflector plates fastened to the propeller blades in line with the machine-gun muzzle. These were intended to deflect any bullets that were fired whilst the blades were in line with the gun and which would otherwise have damaged them. The system was shown to the pre-war pilot Roland Garros who had been commissioned into the French Aviation Militaire and who was flying Morane Saulnier Type L scouts. With the aid of a mechanic friend, Jules Hue, he improved Saulnier's design and carried out trials with a redundant aircraft fuselage. Whilst his initial attempts lacked strength, his final version proved successful and, on 1 April 1915, he intercepted and shot down a German Albatros reconnaissance machine whom he took unawares. Further similar victories followed on 15 April and again on the 16th. Garros's successes ended there. Later that day, whilst flying low over German positions, a bullet pierced his fuel line and he was forced to land. He set his machine on fire but the damage was insufficient to hide its secret from the Germans, who carried out test firings with the device. German ammunition, being steel-jacketed and harder than the copper-coated rounds used by the French, shattered the deflectors and propeller blades, but concern that the Allies were gaining a technical advantage forced the Germans to concentrate their minds and resources on the solution of the problem. The resulting approach by Idflieg officials to German industry brought Fokker onto the scene.

Enter Fokker and Lübbe

In 1914, Fokker had engaged the services of Heinrich Lübbe, a talented technician with a keen mind. Lübbe had started work as a watchmaker and had later turned to mechanical engineering. In 1909 he had visited Paris and met the leading French aviators of the day, and from this developed an enthusiasm for everything aeronautical. Flying training with Rumpler in Berlin in 1911 led to his gaining German pilot's licence number 134. Flying an Etrich-Rumpler *Taube*, he had taken part in the first official promotion of air mail in Germany in 1912. In 1913 he had exported a Rumpler machine to Argentina where he made a record-breaking flight. Returning to Germany he performed successfully at national flying exhibitions. Lübbe's official job with the Fokker organization was as a flight instructor, but his mechanical expertise was employed on research into weapon systems and he had spent much time in the consideration of a system suitable for use with Fokker's M.5 monoplanes. Aware of Schneider's patent and its problems, Lübbe had chosen a different approach. Where Schneider had sought to time the position of the propeller through the movement of the crankshaft and had tied the firing sequence to it, Lübbe's mechanism blocked the firing sequence and stopped the gun from firing when the blades were aligned with the muzzle.

Familiar with both Schneider and Saulnier's systems, Lübbe used them as a basis for his own design. This incorporated a large cam plate

fitted to the crankshaft of an Oberursal (rotary) engine. Through a cam follower, this operated a pushrod which was in turn linked, through a bell crank lever, to another pushrod which operated through further linkages to the trigger of the gun, stopping it from firing when a propeller blade was in front of its muzzle. Because of the nature of the rotary engine, with its crankshaft rotating at the same rate as the propeller, it was possible to predict the precise location of the propeller blades at any given moment, allowing a high degree of accuracy to be achieved. To provide fine-tuning of the system, Lübbe fitted a thin, large-diameter, wooden disc in front of the propeller so that the impact point of the rounds fired could be seen and compensating adjustments made to the linkages, ensuring that the blades would be missed by all future rounds: an accurate method that continued in use until the 1930s. Until May 1915, however, Lübbe lacked access to a machine-gun suitable for mounting on an aeroplane.

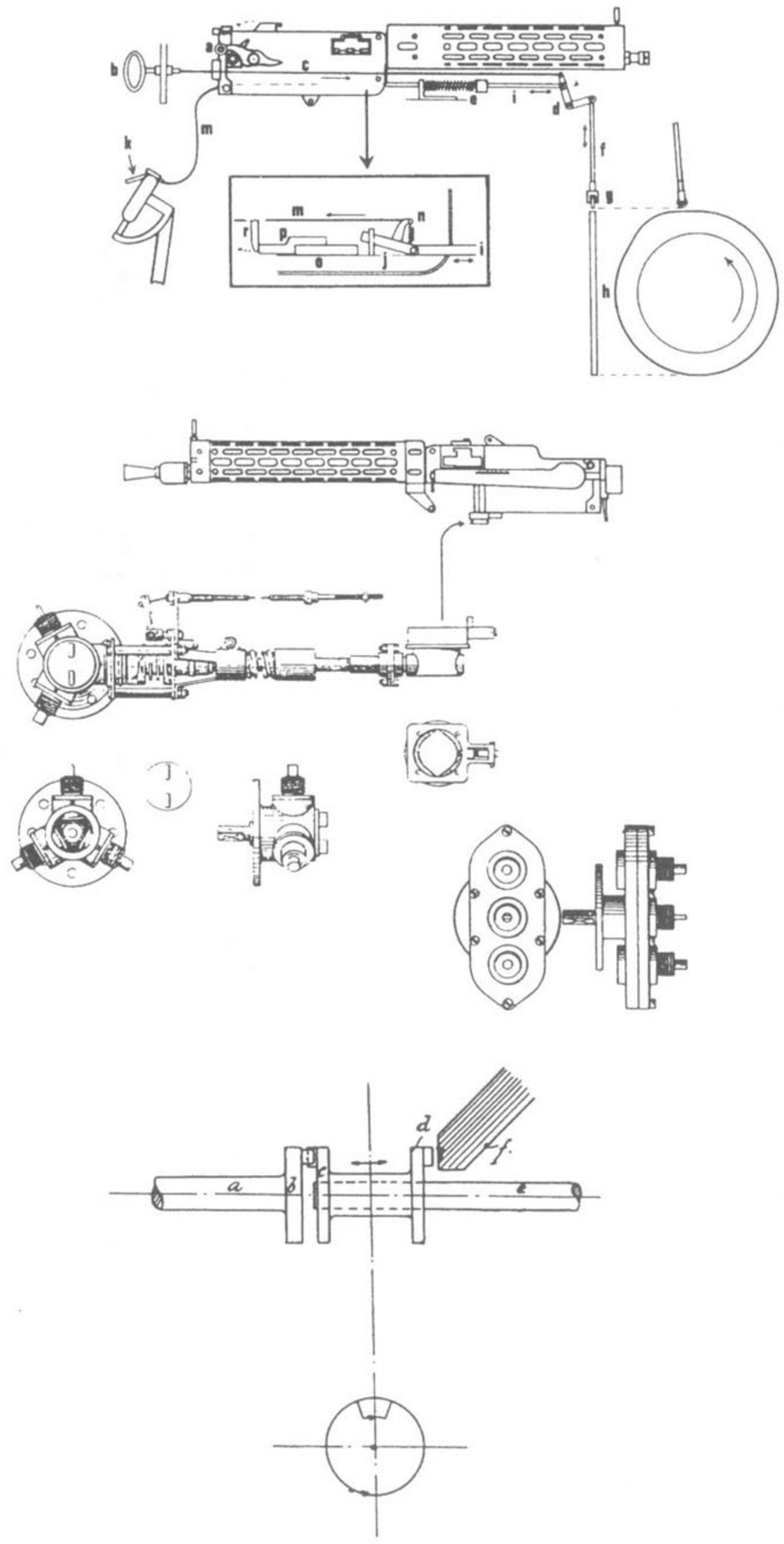
The System is Made to Work

Two German manufacturers were producing aircraft of a type similar to the Morane-Saulnier monoplanes: Pfalz Flugzeug-Werke who, before the war, had been producing the Morane-Saulnier Type H shoulder-wing and Type L parasol monoplanes under licence; and Fokker Aeroplanbau who, as related in Chapter Two, were producing a monoplane based on the Morane-Saulnier design, though with a steel-tubing rather than wooden construction. In May 1915, both were invited by Idflieg to Döberitz to inspect the system from Garros's machine and invited to tender proposals for the design and construction of a device to allow a machine-gun to be fired through the propeller of such a machine. Concealing the fact that Lübbe had already been working on such a mechanism at his factory, Fokker offered to produce a working model in very short time, provided that he was supplied with a machine-gun suitable for the purpose, which was agreed. Fokker later said that he took the gun home on the train after the meeting, but it is more likely that a new Parabellum MG.14 was sent to him at Schwerin together with any necessary tools and spares, and that it was accompanied by an NCO instructor experienced in its use. It is also probable that Lübbe's mechanism already existed in hardware form and simply needed modification and adjustment to enable it to be matched to the machine-gun. Whatever the reality of the situation, the gun and Lübbe's mechanism were fitted to an M.5K monoplane and Fokker towed the modified aircraft by car to Stenay where he proceeded to demonstrate it to assembled Idflieg officials. Initially, it was fired in a static mode, but this failed to convince the Idflieg staff of its ability to sustain long bursts of fire or even work at all in the air. So Fokker took the M.5K into the air, climbed to 300m and dived to attack a ground target – actually a stack of discarded aeroplane wings – with a long burst of fire. Ricocheting bullets and stones proved the point. Further demonstrations, with the aeroplane being flown by service pilots (in this case Ltns Wintgens and Buttlar), drove the lesson further home and Fokker received an order for supply of thirty sets to be fitted to M.5 machines and delivered within two months. Fitted with synchronized machine-guns, the M.5 became the M.5MG, which in turn became the E.I (an armed monoplane) in military service. Of later models, the M.14 became the E.II and the M.14V the E.III and, ultimately, the E.IV.

The water-cooled Parabellum MG.14 used in the original trial was later replaced by a more suitable weapon, the air-cooled LMG.08, that could fire 600 rounds per minute. This was manufactured at the Royal Rifle Factory at Spandau and continued in use until April 1916. From May 1916, all fixed guns fitted to German aeroplanes were of the improved LMG.08/15 type that was not only lighter but could fire up to 800 rounds per minute, though this rate of fire was considerably reduced when the original type of synchronizing mechanism was fitted. Improvements to the system eventually doubled the rate of fire achievable. Though not relevant to this book, it is of interest to note that LMG.08 guns continued to be used where a free gun was required by an observer or gunner in two-seat aircraft.

Early models of the LMG.08 were prone to occasional blockages that could de-synchronize the system and, initially, propeller blades were sometimes damaged by strikes from bullets. On 1 October 1915, Oswald Boelke shot through his propeller and was fortunate in being able to make a successful forced landing. On 31 May 1916 Max Immelmann did the same and the resulting engine vibrations caused its mounts to fail and left Immelmann to wrestle an all but uncontrollable machine to the ground. It is probable that a similar fault occurred again on 18 June, though this time Immelmann was unlucky and his machine, an E.III, broke up in the air and he was killed in the resulting crash. (At the time, Immelmann's death was credited by the British to the crew of an F.E.2b of 25 Squadron with whom he was in combat when he fell.) The weapon system was subject to a continual programme of modification and improvement, and eventually came to be reliable in service.

The success of Fokker's 'gun synchronizing gear' gave him cause to celebrate, but also to worry. He had achieved a practical solution to the problem but appreciated that, should he not be able to meet the demand for the supply of sufficient mechanisms to meet anticipated requirements, the German government would turn elsewhere for manufacturing capacity and he would lose both his technical lead and the profits it should bring. His solution was simple: he set up a factory dedicated to the manufacture of gun-synchronizing equipment. This, the Flugzeug-Waffen-Fabrik GmbH (Aircraft Weapons Factory Ltd) was situated in Berlin-Reinickendorf-Ost, a site chosen for its proximity to the Royal Rifle Factory at Spandau. The factory and production were managed by Lübbe and went into production in December 1916. With further development undertaken it went on to produce an improved range of synchronizing mechanisms suitable to equip all of the German aeroplane types requiring them.



***(Top)* Original cam-operated interrupter system with an LMG 08 machine-gun.**
***(Middle)* Later pressure-operated interrupter system with an LMG 08/15 machine-gun.**
(Bottom) Drawings for Heinrich Lübbe's patent in Fokker's name.
Jorg Armin Kranzhoff

APPENDIX IV

Correspondence with the British Military Attaché in Berlin *c.*1912 Regarding the Fokker Monoplane

The following letters and reports were found in file WO32/18985 at the Public Record Office at Kew, London. They are reproduced in full and without any alterations but, hopefully, without any of the typing errors of the original.

1. Memorandum to the British Military Attaché in Berlin dated 13-3-12

Military Attaché
Berlin

A certain Adolph Lindner, acting for a firm possessing the rights of a flying machine with automatic stability, states that "the trial apparatus flies daily at the aerodrome Johannisthal, and could be inspected by any delegate on behalf of the War Office".

The department concerned ask "could the M.A.Berlin be asked to verify that a flight has been made in his presence or to his knowledge in a 30 mile wind while the pilot took his hands off even for one minute".

Can you do this please, and will you say whether you know anything of this man?

Should you decide to communicate with Herr Lindner, will you kindly hand him the attached "Memo for inventors"?

A. E. Sackville-West Lieut-Colonel.
[A. E. Sackville-West] General Staff.

2. Memorandum from the Military Attaché, Berlin dated 20-3-12

Flying Machine with automatic stability.

M.O.2.(c).

Your C.12/93 of 13-3-12
I have been down to Johannisthal to investigate this matter. You do not give me much of a clue to the machine or the firm you were referring to, as no such person as Adolph Lindner has ever been heard of at Johannisthal. I have, however, practically no doubt whatever that the flying machine with automatic stability, which you refer to, is the one that is called the "Fokker=Eindecker." At all events there is only one kind of flying machine of all the many at Johannisthal which answers your description.

I have seen this machine go up in a stronger wind than 30 miles an hour and have seen the pilot take his hands off for a minute.

It is a wonderful machine and I recommend that not only be it not lost sight of, but that some further action be taken in the matter.

I have furnished you with details concerning it in my "Notes on a visit to Johannisthal", which I am sending you by this week's Foreign Office bag.

Alick Russell
Lieutenant-Colonel
General Staff

3. Notes on a visit to Johannisthal dated 20-3-12

M.O.2.(c).

I proceeded to Johannisthal in company with Captain Watson, the Naval Attaché, on Monday last the 18th instant in order to obtain information on a number of points concerning which we had been asked questions, and also with a view to noting any special matters of interest in the domain of aerial navigation which might be observed at this flying ground.

I submit below some of the points I noticed:-

I. Aeroplanes.

1) The Fokker Monoplane. After a number of enquiries as to an aeroplane with automatic stability, which had been referred to in M.O.2.(c)'s memorandum No. C.12/93 of 13-3-12, we made the acquaintance of a young Dutchman, named Fokker, who is the inventor and constructor of the machine I was in search of.

This young man appears to be endowed in a somewhat remarkable degree with the qualities which go to make not only a skilful and daring aviator, but also a most successful constructor. His machine is called the "Fokker-Eindecker". He had 3 of these machines in his shed at Johannisthal and 6 others are, I understand, in course of construction.

I do not know whether he has means of his own or not, but I have heard the name of one man (Graf Montgelas,) who is said to assist in financing the Fokker aeroplane.

A thirty-five to forty mile wind was blowing, not evenly, but in a gusty and treacherous fashion. No other aviator dared to fly; the day was decided to be much too bad. This young man, however, insisted on going up to show us the remarkable stability of his machine.

I desired him not to do so, if it was at all unsafe, but he scouted the idea of danger and maintained that he had often flown on worse days.

He then gave us a most remarkable display, flying with the wind and across the wind and against the wind, turning with consummate ease and certainty. For a long time, quite a minute, he held his hands up and waved. In fact the conditions referred to in the above memorandum appear to me to be amply fulfilled.

There seem to be some quite unusual quality in this aeroplane, which during its flight made it again and again recover it's equilibrium, yielding and accommodating itself to the wind.

I attach a description of the Fokker aeroplane which furnishes a quantity of details that need not, therefore be repeated in this memorandum.

I might, however, mention that this machine is taken to pieces and put together again with astonishing ease and speed. This is naturally a great advantage in a military aeroplane and most convenient for transport purposes.

The extraordinary steadiness in the air appears to be chiefly due to the manner in which the machine is constructed, the way the wings are set and the situation of the centre of gravity due to the special position of the engines.

Fokker is engaged at the present time, besides other work, in constructing an aeroplane for the Prussian Military Authorities, fulfilling the conditions required in Germany for a military flying machine. To use his own words, the German officers, who have been to see his aeroplane have been "kolossal imponiert"* and I must admit that I am not surprised. *[*very impressive]*

I strongly urge that the machines made by this young man not only be not lost sight of, but that some further action be taken in the matter. We have arranged to go down to Johannisthal shortly to witness further flights with the Fokker aeroplane and I hope also soon to be able to send you some photographs of the same.

2.) The Etrich Rumpler Taube. We are in touch with the firm making these aeroplanes, but the day was considered too bad for any flights to be undertaken. The defects of this monoplane seem to be that it is difficult to dismantle, the parts being so much covered up, and it is, therefore, not easy to transport. It is a slow machine but a sure one.

We hope to witness some flying with this aeroplane at an early date and shall then be able to form a better judgement of its powers and limitations.

3.) The "Luftverkehrsgesellschaft" was observed to be making an aeroplane for the military authorities, fitted with a new type of engine, which was placed rather lower than the engines usually are. The cylinders of the engine were made of a new metal called "chrome-nickel-steel" and there were no exhaust tubes, only holes in the cylinders for the gas to escape by.

We also noted a new form of flat engine for aeroplanes, made by a Swiss firm ("Werkzeugmaschinenfabrik Oerlikon") which was laid out flat rather like a spatchcocked chicken, thus enabling the pilot to watch every part of his engine at the same time. The cylinders of this engine were also made of "chrome-nickel-steel".

I attach an illustration of this engine, which I have taken from an advertisement sheet of the "Deutche Luftfahrer Zeitschrift" No.6. 1912. (See 'B'.)

4.) Jealousy among aeroplane constructors. There are some 20 or 30 aeroplane constructors at Johannisthal, each of whom has his own sheds and workshops.

The jealousy among these competing firms is very noticeable and somewhat amusing, and no constructor will allow any good to be said of any type of machine but his own. It is, therefore, rather difficult to obtain unprejudiced information.

II.Airships.

5.) Parseval. The newest Parseval airship, which Captain Watson and I have already reported on, and which has just been ordered and is in the course of construction for the Prussian Military Authorities, is to contain two machine-guns, a search light, arrangements for alighting on water and a wireless telegraph installation.

The Military Authorities are so secretive about the wireless installation that they intend to place this on the car themselves, and will not allow the Parseval Airship Company to have any hand in the matter.

The system used is believed to be "Telefunken". The apparatus is designed to send and receive messages over a distance of 300 kilometres.

The airship which has just been completed by this firm for the Japanese Government, will be fitted with a "Telefunken" wireless apparatus, but this will not be installed until the airship arrives in Japan,

6.) Suchard. I was able to make a more careful inspection of this airship this time than I was able to do, when I saw it on a previous occasion.

I do not think that it will ever be able to cross the Atlantic.

The car is a heavy kind of broad beamed boat, which is supposed to enable the crew to take to the water, if the gas balloon fails to carry them by aerial route across the Ocean. This boat is furnished with a single screw, which is driven by a 6-cylinder N.A.G. motor.

The balloon is made on the Parseval system and is, therefore, non-rigid. Notwithstanding the fact that the vertical steering can presumably be effected by means of the ballonets, rigid planes for vertical steering are attached by means of somewhat flimsy looking straps to the non-rigid hull of the balloon. I think that these would be torn away at once in a strong wind.

Under the hull but above the car is hung by means of a special belt a kind of passage (25 metres long), which is to serve the purpose of holding spare gas tubes and as a place where the crew can lay down and rest.

There is a tube which is designed to squirt water over the top of the balloon to keep it cool in a hot sun.

The intention is that after some trials here, this airship is to fly to Teneriffe and from thence in 5 or 6 days to reach Barbadoes. The start has been postponed until the commencement of 1913. I do not think it will ever perform the feat it is intended to, and because of this belief I do not supply more information about this airship.

If further details are required, they are to be found in a work, which has, I believe, only come out within the last few days. I refer to "Jahrbuch der Luftfahrt" by A. Vorreiter. This book is most interesting and contains a quantity of most useful information.

7.) Airship sheds at Johannisthal. New folding doors on wheels are in process of being fitted to the Zeppelin Shed. The other airship shed has only canvas doors.

The latest idea appears to be to cause airships to run out of the shed anchored to a set of rails, when a turntable just outside the entrance of the shed would enable them to be turned in whatever direction was required. This system would be less expensive and more economical of space than a revolving shed, but perhaps hardly as efficient.

NOTE. Captain Watson asks that this report may be shown to the Department concerned at the Admiralty.

Alick Russell. Lieutenant-Colonel
[Alick Russell] Military Attaché

Confidential

P.S.

Bristol aeroplanes. I have heard from a reliable source that the Prussian Military Authorities are much impressed with the performances of the British "Bristol" aeroplanes and have been making tests out here with one of these machines.

They apparently intend to buy one or more "Bristol" aeroplanes and to cause a German branch of this company to be formed out here for the purpose of manufacturing this type of flying machine.

Alick Russell.

Lieutenant-Colonel.
General Staff.

British Embassy.
Berlin.
20. March. 1912.

The Fokker Aeroplane Works.

Berlin - Johannisthal.

The Fokker Monoplane.

Design. It is constructed in accordance with statical principles, the correctness of theory being ascertained - in every case - by practice.

The construction of all the parts is as simple as possible, the application of welding and soldering being reduced to a minimum. The machine is, therefore, extraordinarily light, and easily repaired.

First class materials only have been used in manufacture.

Special Characteristics.

Stability. The machine has no warping (Verwindung) or auxiliary planes or suchlike contrivances, but the special position of the wings combined with the high centre of gravity affords automatic stability, which at once corrects any disturbance of equilibrium, and makes it possible to negotiate very sharp turns - the normal horizontal position being quickly resumed, as soon as pressure on the steering gear is relaxed.

The vertical steering gear is easy to work and powerful in action. It can be left alone, in gliding or turning, for a long time.

A special feature is the automatic assumption of 'gliding' flight, on stopping the motor.

It is impossible to 'glide' backwards, as (owing to the distribution of weight) the machine can never assume too great an angle of ascent, with regard to the thrust of the propeller.

The stability is, therefore, entirely automatic.

The machine can travel 15 metres per second in medium wind, and can carry a passenger even in squally weather - without any special attention being paid to stability. Even in really strong wind, a slight correction of the lateral steering gear will suffice.

Landing and brakes.

The machine requires only a short 'run', owing to the strong brakes consisting of a slide-bar (Schleif-stange) with rake (Kratzer) and spring supports on the hind end of the chassis, with spring tail.

The machine can rise almost in situ, by its own motor power.

Ascent. With 50 H.P. without passenger, the machine rises 3 metres per second (with 22 square metres plane surface), and develops a speed of 90 kilometres per hour, carrying a useful load of 150 kg., exclusive of the pilot.

The weight of machine empty, without motor but with full equipment (cooler, tanks, carriage work, etc.) is 250 kg., i.e., the specially strong type of machine for military purposes.

Stripping and Transport.

The wings can be detached in a few minutes by unfastening 3 attachments in each case. The tail is similarly detached from 3 attachments. The parts are then folded close to the frame, and are ready for transport on a motor lorry. Both tail and wings can be enclosed (for long distance transport) each in a case of 5 x 1 metre*. For rail transport all that is required is a waterproof covering for the body and tail - forming a package some 4½ metres long - and a small case for the propeller, materials, wings, and spare parts.

*5:1 metre

Flying is easily learnt, in a few hours, with this machine, owing to its stability. Instructional machines are provided with double steering gear, and are capable of carrying a passenger.

Principal parts of the Fokker Machine.

Starting carriage consists of 4 steel tube struts, attached by means of aluminium shoes to the main chassis bearers, and extending to the runners. On these a strong steel tube axle is affixed with rubber springs; on which there are two strong wheels. The whole carriage is very strongly built, and all parts are easily exchanged.

The body (Rumpf) is short, and consists of two wooden carriers upon which the motor, steering gear, and seat are fixed, as well as the carriage work.

The Tail consists of a steel tube frame upon which material is stretched.

The ribs are formed of bamboo rods lying in 'pockets'.

The horizontal rudders are in a vertical steel tube frame and are readily removable.

The wings are covered with a single layer of strong 'continental' or Metzeler aeroplane material, - sewed and strengthened with leather. Each wing is a folding steel-tube frame-work upon which the material (stretched upon Tonkin tubes) is attached.

Each rib consists of a bent piece of steel tube with a Tonkin tube lying in a 'pocket' of the stuff. The whole arrangement is as simple as possible and admits of rapid handling and repair.

Steering is by means of a hand lever (for vertical steering), and a pedal for horizontal steering.

The latter, if desired, could be replaced by a steering wheel on the hand lever used for vertical steering.

Carriage work is of aluminium and is torpedo-shaped. Two leather seats are provided. Two easily removable bonnets cover the motor (to some extent) in front, similar to the arrangements in a motor car.

The carriage work protects the pilot and passenger from cold and dirt, increases the speed, and improves the appearance of the machine.

The seats are adjustable and afford free views in all directions.

Measurements. Total width of span ... 11 metres
length " ... 8 "
height " ... 2.8 "

The normal bearing surface is 22 square metres. Larger planes supplied, if desired.

Fuel reservoirs are in the carriage work, and carry enough for 2 hours (normal).

Price: Fokker Monoplane Military Type:
With 70 H.P. Argus Motor .. £1,400(28,000 Mks.)
" 100 H.P. " " .. £1,500(30,000 Mks.)

Translated by
Major H.H. Dowding.

M.O.2.c.
War Office.
4.4.12

Known Fokker Production Quantities

Fokker E.I–E.IV Monoplanes

ORDER DATE	QUANTITY	TYPE	SERIAL NUMBERS
May 1915	85	E.I/E.II	1–85/15
Aug 1915	36	E.II/E.III	86–121/15
Sep 1915	6	E.IV	122–127/15
Oct 1915	36	E.III	400–435/15
Nov 1915	6	E.IV	436–441/15
Nov 1915	36	E.III	601–636/15
Dec 1915	6	E.IV	637–642/15
Feb 1916	30	E.IV	160–189/16
Feb 1916	60	E.III	190–249/16
Mar 1916	4	E.I	326–329/16
Apr 1916	20	E.IV	cancelled
Apr 1916	60	E.III	330–389/16
May 1916	12	E.I	688–699/16
n/k	12	E.III	627–638/16

Fokker D.I–D.IV Biplanes

ORDER DATE	QUANTITY	TYPE	SERIAL NUMBERS
May 1916	80	D.I	D.140–219/16
Oct 1916	10	D.I	D.1900–1909/16
Jul 1916	12	D.II	D.220–231/16
Jul 1916	60	D.II	D.522–581/16
Jul 1916	4	D.II	D.1000–1003/16
Aug 1916	80	D.II	D.1500–1579/16
Oct 1916	25	D.II	D.2380–2404/16
Jul 1916	30	D.III	D.350–379/16
Jul 1916	20	D.III	D.1004–1023/16
Jul 1916	200	D.III	Cancelled
Aug 1916	60	D.III	D.1580–1639/16
Nov 1916	100	D.III	D.2930–3029/16
Oct 1916	40	D.IV	D.1640–1679/16
1917	4	D.IV	D.5850–5853/17 (for Sweden)

Fokker Dr.I Triplane

ORDER DATE	QUANTITY
Jul 1917	3
Jul 1917	20
Sep 1917	100
Nov 1917	200

Fokker Dr.I Triplane

SERIAL NUMBERS	FACTORY NUMBERS
Dr.I 100/17	1830
F.I 101	1697
F.I 1012–103/17	1729–1730
Dr.I 104–119/17	1772–1787
Dr.I 121–140/17	1832–1851
Dr.I 141–170/17	1853–1882
Dr.I 171–200/17	1889–1918
Dr.I 201–220/17	1920–1939
Dr.I 400–429/17	1984–2013
Dr.I 430–459/17	2055–2084
Dr.I 460–489/17	2086–2115
Dr.I 490–549/17	2158–2217
Dr.I 550–597/17	2220–2267
Dr.I 598/17	2269(?)
Dr.I 599/17	1919

Fokker D.VI Biplane

QUANTITY	SERIAL NUMBERS	FACTORY NUMBERS
59	D.1631–1689/18	2613–2671

Fokker D.VII Biplane

ORDER DATE	QUANTITY	MANUFACTURER
Feb 1918	300	Fokker
Feb 1918	400	Albatros & OAW
Mar 1918	200	Albatros & OAW
Jun 1918	100	Fokker
Jun 1918	200	Albatros & OAW
Jul 1918	200	Fokker
Jul 1918	300	Albatros & OAW
Aug 1918	300	Albatros & OAW
Aug 1918	300	Albatros & OAW
Sep 1918	200	Fokker
Oct 1918	200	Fokker
Oct 1918	300	Albatros & OAW
Nov 1918	200	Albatros & OAW

Fokker D.VII Biplane

MANUFACTURER	SERIAL NUMBER
Fokker	227–526/18
Albatros	527–926/18
OAW	2000–2199/18
OAW	4000–4199/18
Fokker	4250–4449/18
OAW	4450–4649/18
Fokker	5050–5149/18
Albatros	5200–5599/18
OAW	6300–6649/18
Albatros	6650–6899/18
Fokker	7604–7805/18 (includes two experimental aircraft)
OAW	8300–8649/18
Albatros	10050–10100/18
Fokker	10347–10399/18

Fokker E.V/D.VIII Acceptances

NUMBER ORDERED	NUMBER DELIVERED		ENGINE	SERIAL NUMBERS		DATE
	E.V	*D.VIII*				
10	10		UR.II	100 to 109/18	2741 to 2750	3 Jul 1918
200	129	62	UR.II	110 to 309/18	2751 to 2950	3 Jul 1918
65		62	UR.II	500 to 564/18	3255 to 3319	24 Oct 1918
60		26	UR.III	670 to 729/18	2672 to 2731	8 Oct 1918

Fokker E.V/D.VIII

DATE	NUMBER
Jul 1918	59 E.V (includes sample sent to Austria-Hungary for testing)
Aug 1918	80 E.V (last E.V accepted on 23 August)
Sep 1918	None – wait approval and supply of modified wings
Oct 1918	61 D.VIII (acceptance began on 8 Oct)
Nov 1918	36 D.VIII
	53 D.VIII purchased after 28 Nov by German Government
TOTAL	**289 out of 335 ordered.**

Fokker Aircraft Captured by the British Army and Allocated 'G' Numbers

The allocation of 'G' numbers to aircraft captured by the British Army started in November 1916. Before that there appears to have been no formal listing. 'G' numbers continued from November 1916 until the formation of the RAF in April 1918, after which captured aircraft were listed by brigades (Bde). I have found reference to only two Fokker aircraft captured before the G listing commenced.

Fokker ?
Date captured: 4 November 1915
Comments: Brought down near Gentelles by Lt H.L. Taylor & Lt H.I.E. Lane of 52 Sqn RAF

Fokker E.III
Fokker E.III 210/16
Factory number: 509
Date captured: 8 April 1916
Pilot: ?
Comments: Pilot lost his way and landed on a British aerodrome

Fokker Dr.I (eight aircraft)
British number: G72
Fokker F.I 103/17
Factory number: 1730
Pilot: Ltn Werner Voss, Jasta 10 (killed)
Date captured: 23 September 1917
Comments: Brought down by Lt A. Rhys-Davids of 56 Sqn RFC. Was in open for a long time before being 'salved'. No useful remains
PRO File: AIR1/1061/204/5/1578

British number: G125
Fokker Dr.I 144/17
Factory number: 1856
Pilot: Ltn Eberhard von Stapenhörst, Jasta 11 (PoW)
Date captured: 13 January 1917
Comments: Brought down by ground fire. Salved very nearly intact and subject of extensive report. Brought back to the UK and exhibited in London
PRO File: AIR1/1061/204/5/1578

British number: G158
Fokker Dr.I 147/17
Factory number: 1859
Pilot: Ltn Ludwig Keseling, Jasta 11 (PoW)
Date captured: 22 March 1918
Comments: Brought down by anti-aircraft fire

British number: G163
Fokker Dr.I 419/17
Factory number: 2003
Pilot: Ltn Walter Gottsch, Jasta 19 (killed)
Comments: Brought down by Lt W. Hughes & Lt F.C. Peacock of 10 Sqn RAF; complete wreck

British number: G/2Bde/10
Fokker Dr.I 203/17
Factory number:
Pilot: Ltn Richard Plange, Jasta 36 (killed)

British number: G/2Bde/15
Fokker Dr.I 583/17
Factory number: 2258
Pilot: Flg Gunther Preis, Jasta 14 (PoW)
Comments: Brought down by nine pilots of 1 Sqn RAF near Dickiebusch
PRO report: AIR1/1061/204/1578

British number: G/5Bde/2
Fokker Dr.I 425/17
Factory number: 2009
Pilot: Rittmeister Manfred von Richthofen, JGI (killed)
Comments: Brought down near Corbie by person (or persons) unknown

British number: G/5Bde/8
Fokker Dr.I 546/17
Factory number: 2214
Pilot: Ltn Fedor Hubner, Jasta 4 (PoW)
Comments: Brought down near Corbie by Capt S.T. Edwards of 209 Sqn RAF. Pilot was equipped with a parachute

Fokker D.VII (nineteen aircraft)
British number: G/1Bde/16
Fokker D.VII
Factory number:
Pilot: Ltn Friedrich Kresse, Jasta 7 (killed)
Comments: Brought down near Houplines by 209 Sqn RAF

British number: G/1Bde/17
Fokker D.VII (Alb) 5301/18
Factory number: 5900
Pilot: Vfw Belz, Jasta 1 (PoW)
Comments: Brought down by 54 Sqn RAF near Tilloy

British number: G/2Bde/14
Fokker D.VII 368/18
Factory number: 2455
Pilot: Ltn Hans Schultz, Jasta 18 (PoW)
Comments: Brought down by Lt C.H.R. Lagesse of 29 Sqn RAF

British number: G/2Bde/22
Fokker D.VII
Factory number:
Pilot: Ltn Hans Popp, Jasta 77b (killed)
Comments: Brought down by Lt Caldwell, 7 Sqn RAF

British number: G/2Bde/27
Fokker D.VII 4043/17
Factory number:
Date captured: 9 October 1918
Pilot: Ltn Adolf Auer, Jasta 40 (PoW)
Comments: Brought down by Lt F.O. Soden of 41 Sqn RAF

British number: G/2Bde/28
Fokker D.VII
Factory number:
Date captured: 28 October 1918
Pilot: Offstv Alfred Jaeschke, Jasta 30 (PoW)
Comments: Brought down near Tournai

British number: G/2Bde/31
Fokker D.VII
Factory number:
Date captured: 14 October 1918
Pilot: ?
Comments: Brought down by Capt Lagesse of 29 Sqn RAF south of Ingelmunster; complete wreck

British number: G/2Bde/32
Fokker D.VII
Factory number:
Date captured: 14 October 1918
Pilot:?
Comments: Complete wreck

British number: G/2Bde/33
Fokker D.VII
Factory number:
Date captured: 16 October 1918
Comments:?

British number: G/3Bde/12
Fokker D.VII 2184/18
Factory number: said to be 1713, but this is probably a 'wing' number
Date captured: August 1918
Pilot: Vfw Anton Bernhorster, Jasta 61 (killed)
Comments: Brought down by 3 Sqn RAF

British number: G/3Bde/13
Fokker D.VIIF 4284/18
Factory number: 2985
Date captured: 23 August 1918
Pilot: Flg Leonhard Karmann, Jasta 79 (killed)
Comments: Brought down by Lts Pithey & Rhodes in a 12 Sqn R.E.8 near St Martin-sur-Cojeul

British number: G/3Bde/17
Fokker D.VII
Factory number:
Date captured: 5 September 1918
Pilot: Ltn Joachim von Winterfeld, Jasta 4 (killed)
Comments: Brought down in flames by Capt F.I. Lord of 79 Sqn RAF

British number: G/3Bde/19
Fokker D.VII(OAW) 4503/18
Factory number: 74503 (cannot be correct as should be in range 3044 to 3144)
Date captured: 4 September 1918
Pilot: Flg Otto Wagner, Jasta 79 (PoW)
Comments: Brought down by Lt Hughes, 3 Sqn RAF

British number: G/5Bde/17
Fokker D.VII 382/18
Factory number: 2469
Date captured: 17 June 1918
Pilot: Ltn Kurt Wusthoff, Jasta 15 (PoW)
Comments: Brought down intact by Capt I.D.R. Macdonald, G.O. Johnson & Lt H.D. Barton of 24 Sqn RAF
PRO File AIR1/1714/204/123/124

British number: G/5Bde/20
Fokker D.VII(Alb) 817/18
Factory number :
Date captured: 12 August 1918
Pilot: Offstv F. Blumenthal, Jasta 53 (PoW)
Comments: 'Nickchen IV'. Brought down by Capt R.M. Foster of 209 Sqn RAF

British number: G/5Bde/24
Fokker D.VII
Factory number:
Date captured:
Pilot: Gefr J. Janizewski
Comments: Brought down by Capt F.R. McCall of 41 Sqn RAF; burnt

British number: G/5Bde/26
Fokker D.VII
Factory number:
Date captured: 10 September 1918
Pilot:
Comments: To UK

British number: G/10Bde/5
Fokker D.VII
Factory number:
Date captured: 16 September 1918
Pilot: Gefr Kurt Brand, Jasta 51 (killed)
Comments: Complete wreck

Glossary

German

Abteilung	Unit, detachment or section
Armee Flug Park	Army Aviation Supply Depot
Armee Ober Kommando (AOK)	Army Headquarters
Doppledecker	Biplane
Dreidecker	Triplane
Deutsche Luftschiffe Verband	German Aeronautical Association
Eindecker	Monoplane
Einstielig	Single-bay (biplane)
Feldflieger Abteilung (FA)	Field Aviation Unit
Feldwebel (Fw)	Sergeant
Flieger (Flg)	Private
Flieger Abteilung (Artillerie) (FAA)	Artillery Co-operation Aviation Unit
Flieger Ersatz Abteilung (FEA)	Aviation Replacement Unit
Flugmeisterei	Aircraft Technical Department
Flugspende	German national movement for aeronautics
Gefreiter (Gefr)	Lance Corporal
Generalleutnant	Lieutenant-General
Gesellschaft mit beschränkter Haftung (GmbH)	German equivalent of British limited liability company
Hauptmann (Hptmn)	Captain
Inspection der Fliegertruppen (Idflieg)	Inspectorate of Military Aviation
Jagdstaffel (Jasta)	Fighter section or fighter unit
Jagdgeschwader (JG)	Permanent grouping of *Jagdstaffeln* under an individual commander. Usually four *Staffeln* with twenty aircraft of (ideally) the same type
Jastaschule	Air fighting school
Kampfeinsitzer Kommando (Kek)	Single-seater fighter unit
Kampfflugzeug	Fighting aeroplane
Kampfgeschwader	Fighting squadron
Kampfstaffel	Fighting section or squadron
Leicht Maschinen Gewehr (LMG)	Light machine-gun
Leutnant (Ltn)	2nd Lieutenant
Leutnant zur See (Ltn z S)	Naval Lieutenant
Marine Feld Jagdstaffel	Naval land-based fighter unit
Oberleutnant (Oblt)	Lieutenant
Oberleutnant zur See (Oblt z S)	Naval Lieutenant
Oberstleutnant	Lieutenant-Colonel
Offizierstellvertreter (Offstv)	Acting officer
Ritter	Knight
Rittmeister	Cavalry Captain
Spinne	Spider
Staffelführer	Leader of a *Staffel*
Taube	Dove
Unteroffizier	Corporal
Versuchmaschine (V)	Experimental aircraft
Vizefeldwebel (Vfw)	Sergeant-Major
Zweistielig	Two-bay (biplane)

Austro-Hungarian

Fliegerarsenal (Flars)	A civilian bureaucratic organization responsible for obtaining and testing equipment – engines, aircraft and weapons – for the *Luftfahtruppen*
Fliegeretappenpark (Flep)	Flying 'parks' responsible for supply of new aircraft to the *Fliks* and for some repairs
Fliegerersatzkompanie (Flek)	Training units responsible for supplying the *Fliks* with men
Fliegerkompanie (Flik)	Front-line aviation fighting unit
Kaiserliche und königliche Luftfahrtruppen (kuk LFT or LFT)	The Imperial and Royal Aviation Troops
Komando kuk LFT	The supreme command of the LFT

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Fokker Aircraft of World War One tells the story of one of that conflict's most famous aircraft companies. From the Fokker *Spinne* of 1912, through to the Fokker D.VIII of 1918, and taking in such famous types as the *Eindecker*, D.VII and Dr.I triplane in between, Paul Leaman describes the aircraft as well as the men who flew and designed them. He also covers the quality problems that plagued the company and the use of the aircraft in combat.

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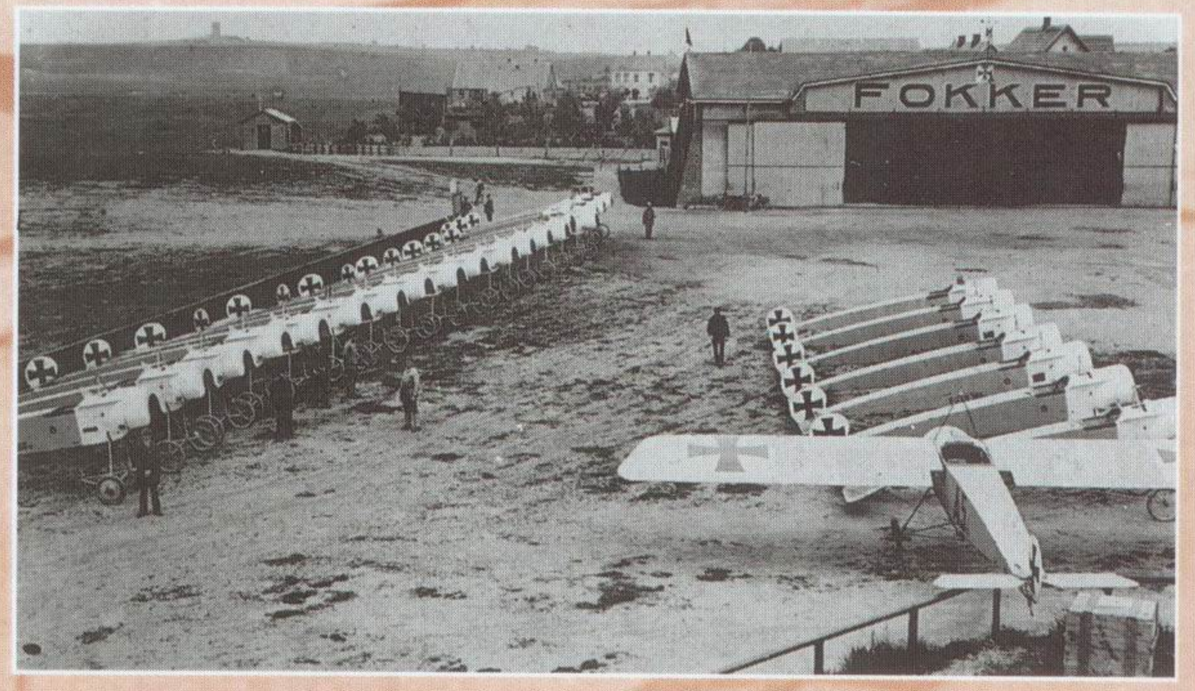

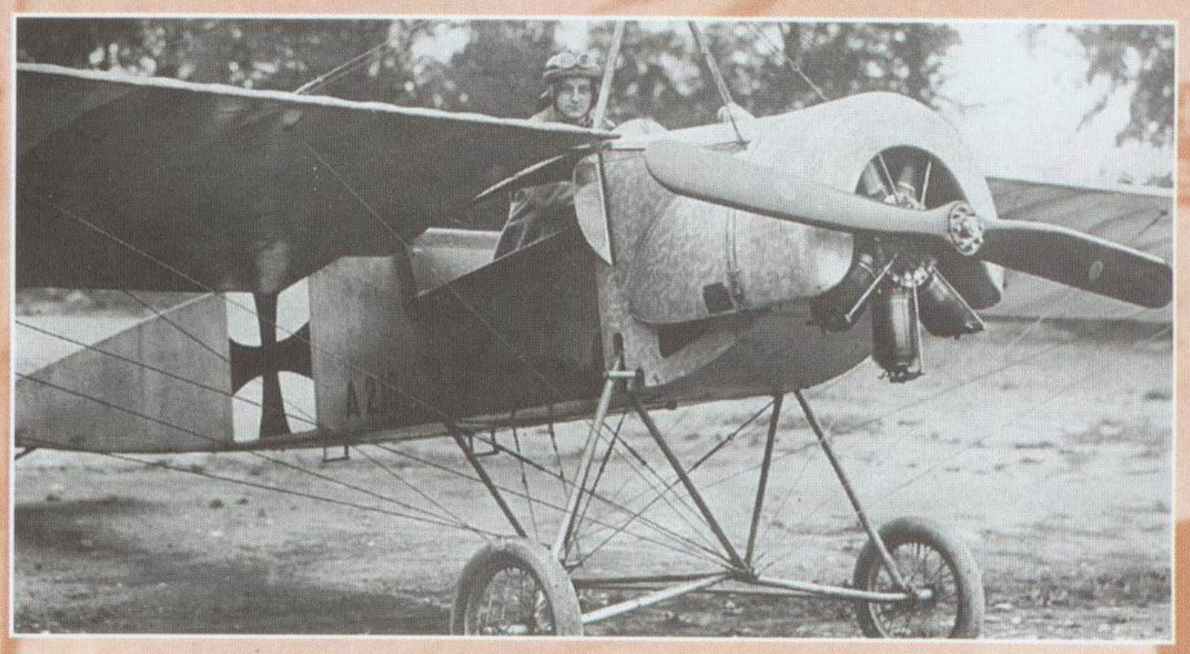

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