Le Blériot

Paolo Severin

Some time ago Giotto Mazzolini sent me a beautiful Saito 170, a radial 4-stroke engine with four cylinders. I called him the same day and he said to me: "When I saw this engine, you came to mind." Giotto is a pioneer of radio control in Italy and is just made that way. He is one of those exceptional individuals who loves to make his fellow man happy. I can't even tell you how surprised I was to receive a present so precious and welcome.

The Saito 170 is similar to the Anzani 25 HP engine mounted on the first Blériot and, by pure coincidence; I had on the wall of my garage a color three view drawing of the Blériot. I used to look at it and think of ways to build it. Not having the proper engine always seemed to prevent a project from beginning. Now, thanks to Giotto, I did not have any excuse: I was going to build a flying model of the Blériot.

Note: this article describes the prototype from which is derived my kit.
English Editing by Rusty Hupy

Picture on Left: Starting the Blériot before the Channel crossing.
Pictures at Right: Anzani engine, 25 HP and Louis Blériot with Alessandro Anzani, designer and builder of the engine. The engine for the crossing was a 3 cylinder mounted like a 'W'. Later Anzani built radial engines with 3 cylinders, like the one used on this model.

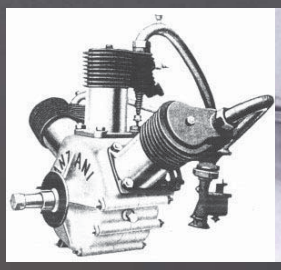
The Blériot certainly can't be defined as a nice looking aircraft. The fuselage is the least aerodynamic that you can imagine, the wing is stocky, the landing gear is very complicated, and the front view looks like the frame of a sliding door. Somebody once said it looks less like an airplane and more like a wheelchair. But, like many ugly things, it has some kind of fascination and the more you look at it, the more you are attracted to it. This is the way it happened to me.

As everybody knows, the fame of this aircraft was born on July 25, 1909, when Louis Blériot, at the crazy average speed of 62 km/h, completed the first aerial flight across the English Channel and in doing so he won the prize of 1,000£ sterling from the British newspaper Daily Mail.

The Blériot on my three view drawing was the one that Capt. Carlo Piazza was flying in Tripoli, Libya during the Italian-Turkish War of 1911-12. Naturally the production line varied a lot, and if you look at the old photographs, there is not a Blériot similar to the one before. Most likely every buyer ordered his aircraft personalized.

The major differences were the various types of engines, the tail feathers, and the rear wheel or skid. The stab/elevator configurations were:

Upper or lower camber of different values divided in three sections (the design I chose for my model). A self-stabilizing airfoil in two sections (a stab and elevator). Taube type stabilizer in one piece and controlled by warping the trailing edge. There were three primary designs of tail gear: bicycle wheel, cross skids made out of wood like a Tonet Chair, or a wooden skid mounted on springs (the one chosen for my model).



With this success the Blériot was qualified as the most reliable aircraft of the time and the orders started coming in. The plane became the preferred aircraft of many national fledgling air forces and was built under license by numerous aircraft companies. One such example is on display at the Vigna di Valle aviation museum in Bracciano, Italy and was built by the Italian company SIT of Turin, Italy.

In designing my model I followed the same design of a 1910 aircraft designer and I built it as for my feelings and personal requirements. I received a great treasure from my friend Roberto Grassi, who gave me a CD full of information and original drawings from which I made the necessary documentation.

THE FUSELAGE

This is the most difficult part, because of a very different building technique from all the other components. The structure is made of cedar wood (the original was made of ash), and comprised of four longerons 8 mm² and 8 x 5 mm oval shape vertical and horizontal cross braces (excluding the ends, that we left rectangular).

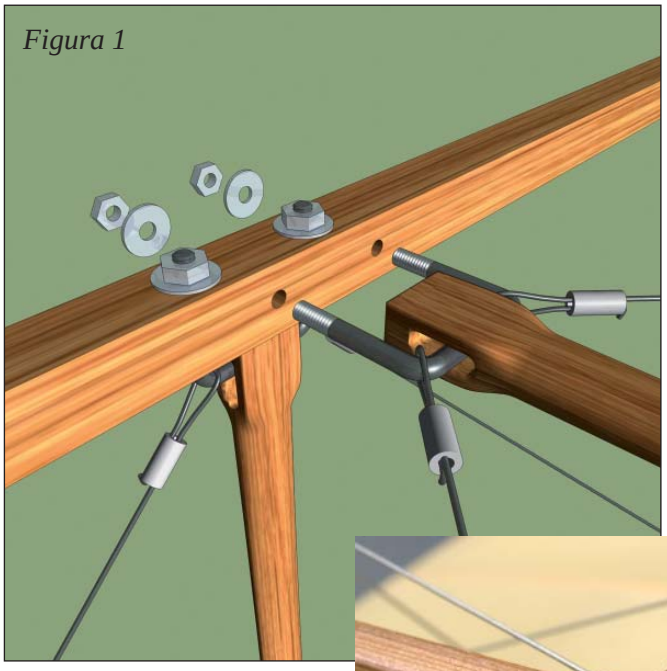
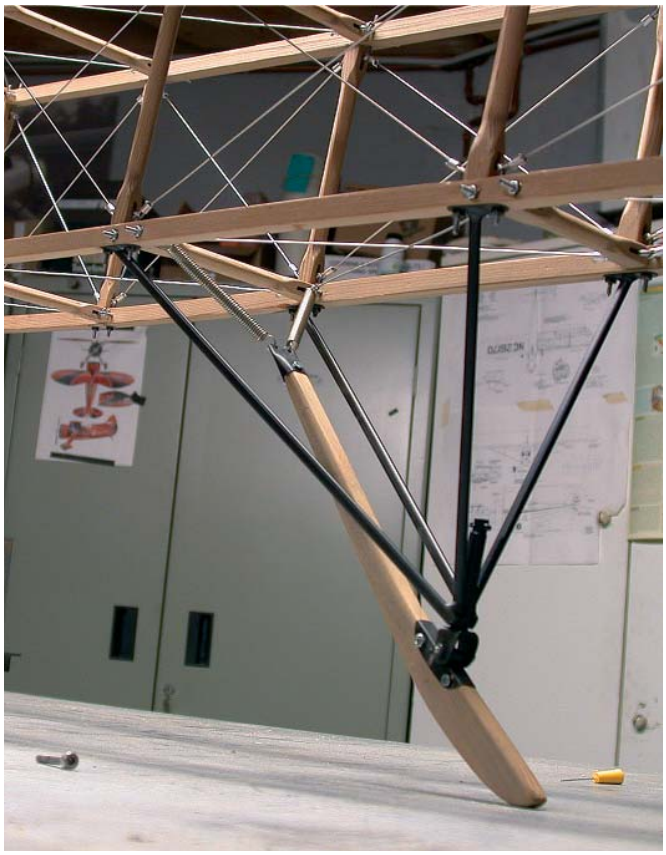


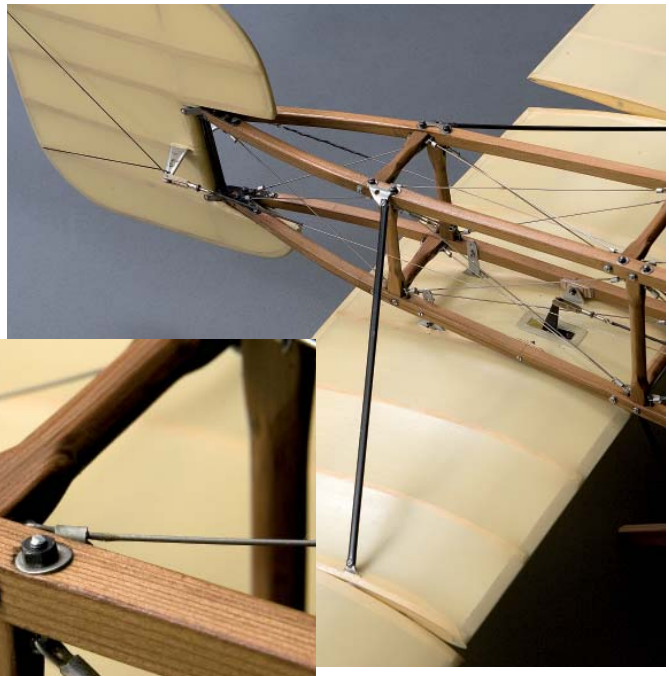
Figura 1

The fuse is kept together with .5 mm steel wire braces in tension, using U shaped fittings bent and threaded from .2 mm wire that go through slots on the rectangular ends of the vertical and horizontal cross braces and through two holes on the longerons. (Pictures above and on left)

In reality the original Blériot used turnbuckles on the cross-braces, but after checking the quantity and the availability (marine brass only, not too strong), I decided to use steel wire locked at the ends with small aluminum tubing.

After many trials, I ended up with good results. If the wires are cut the correct length, the bent fittings will keep the system tight and turnbuckles are not necessary. Accuracy is very important for the longeron slots –and- the length of the slanted cuts on the cross braces.





All the other components of the fuselage are attached at the junction where longerons and cross braces are joined. Wing cables, rear landing gear, tail assembly and main landing gear are all fastened at those intersections. *(Above)*

We must note that Mr. Blériot was an excellent engineer. His aircraft were designed as well as a modern ultralight, considering the available materials of his time; they deserve the reputation they have today.

THE MAIN LANDING GEAR

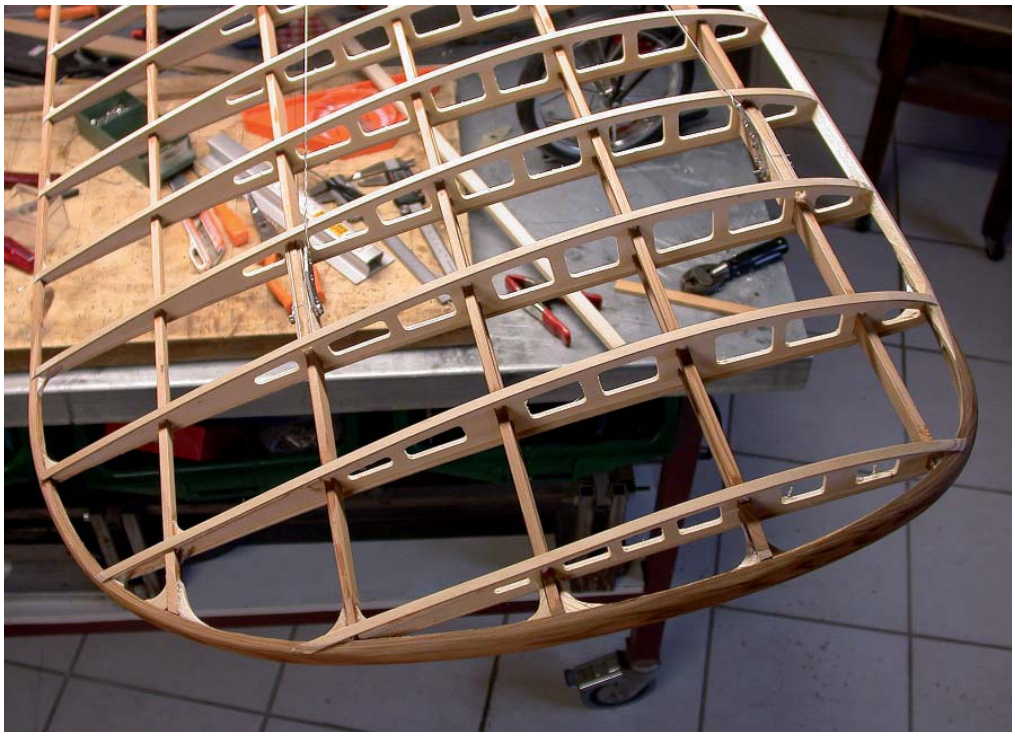
The landing gear requires as much effort to build as the fuselage. It is supported by the four fuselage longerons that extend past the engine bulkhead and the engine itself. The rectangular structure is achieved by two horizontal beams of linden wood (basswood) that reach beyond the longerons.

The top beam is connected to the bottom of the upper longerons. Two vertical posts are connected just outboard of the upper longerons and are attached at the bottom of the top beam while the lower longerons connect midway to the vertical posts. The lower horizontal beam is attached at the bottom of the vertical posts which is just above the height of the wheels. Viewed from the front, the structure looks like a Roman numeral II.

This description may sound a bit confusing

but viewing the picture of the Blériot from the front at a 45° angle is as they say ‘worth a thousand words’.

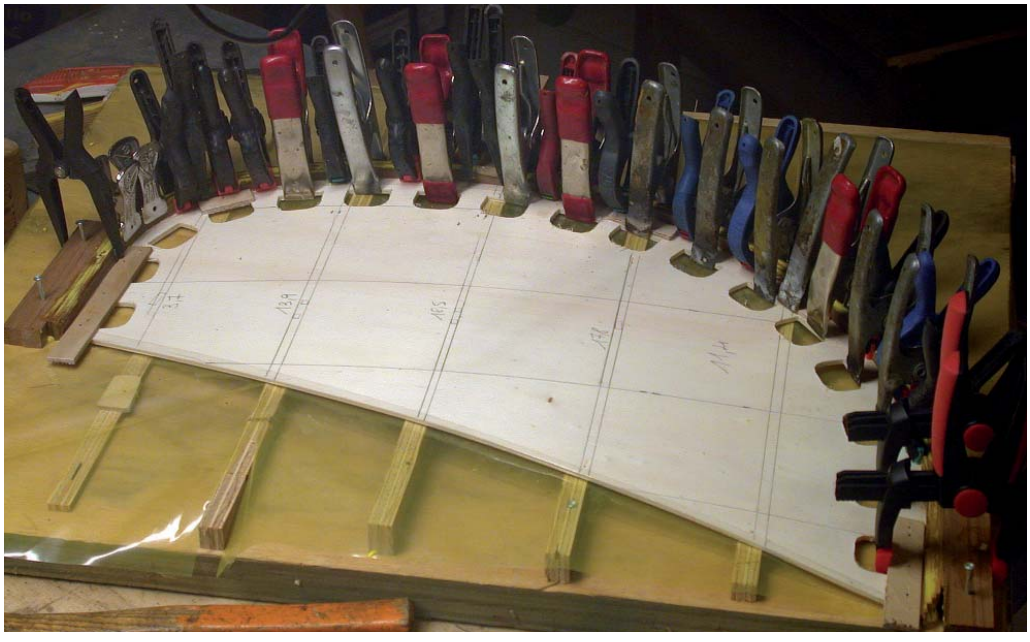
At the extreme ends of the upper and lower horizontal beams are fastened two vertical tubes on which slide the bushings of the spring suspension, the whole assembly is braced with steel wires. The wheel yokes are hinged at the base of the tubes, while the other two yokes are hinged at the bushings that ride on the tubes.

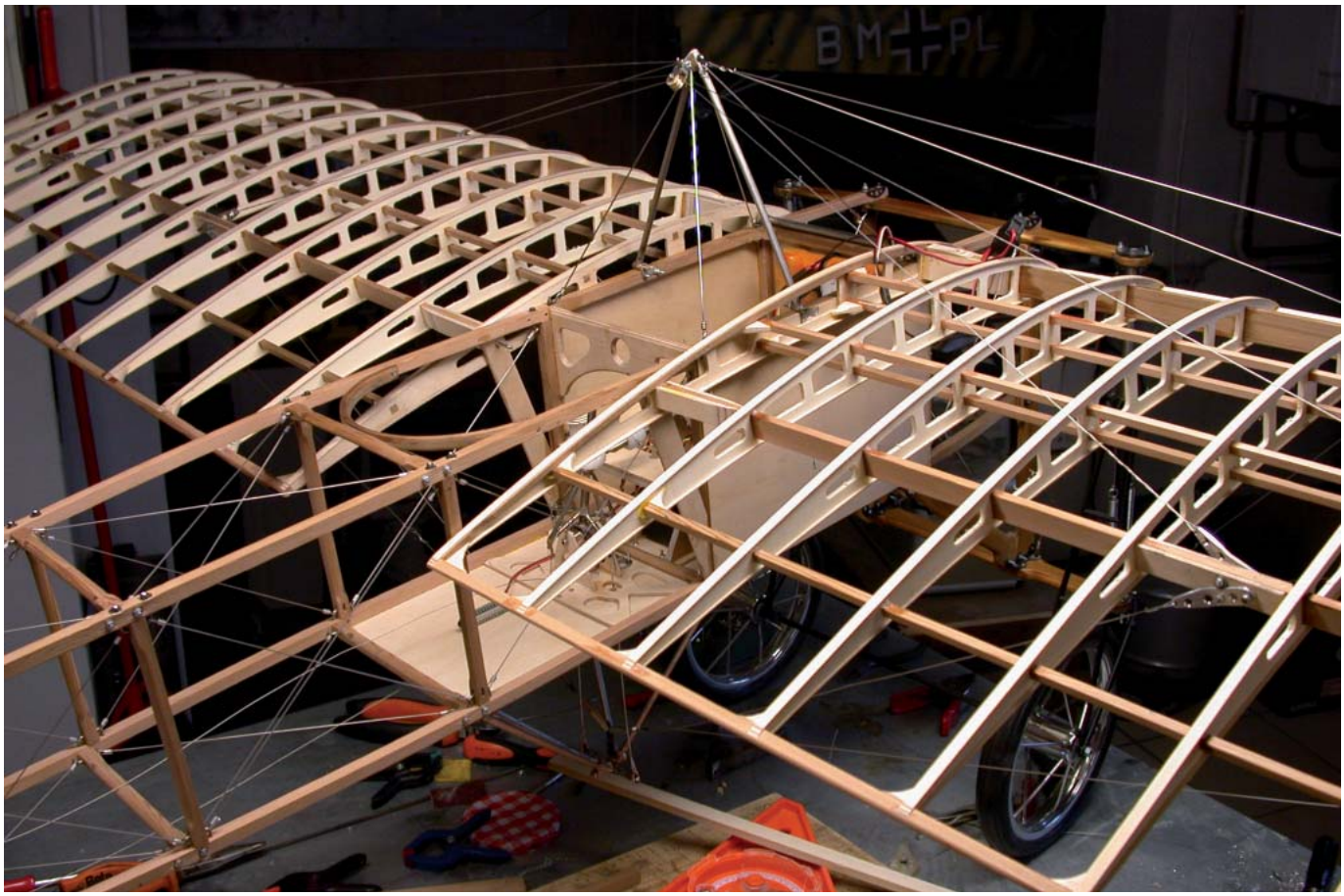


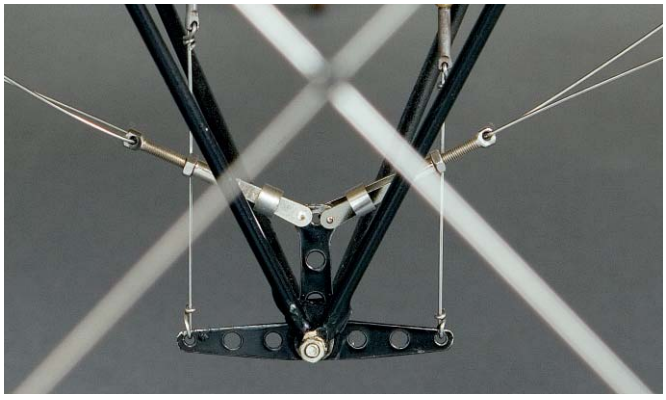
The axel joining the wheels has two universal joints that will allow the wheels to move independently. I modified the wheels by starting with two cart wheels given to me by my friend Gabriele Ottaviani who specializes in spoke wheels. The cart wheels had twelve 3 mm diameter spokes. I replaced the 12 spokes with 36 (1 mm) wire spokes by soldering them to the hub. This was done in sections so as not lose the hub centering (see the pictures below). Modifying the wheels was very time consuming and it took a whole weekend.

THE WING

The wing structure is very similar to the full size aircraft and is relatively simple. It is designed with two main spars and five secondary spars (stringers) all made out of cedar. The ribs are cut with a Step4 router and are made out of 3 mm poplar plywood. The root ribs at the fuselage are made out of 3 mm birch plywood. The leading edges are made out of obeche wood and the wing tips (above photo) are made from 2 mm cedar laminated using a ply-





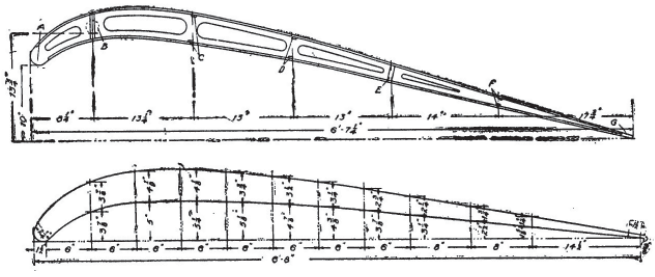


wood pattern that I had to shim in order to achieve the correct double curvature: leading edge to trailing edge (horizontal) and airfoil (vertical). [Picture below] The capstrips are made with 8 mm birch plywood.

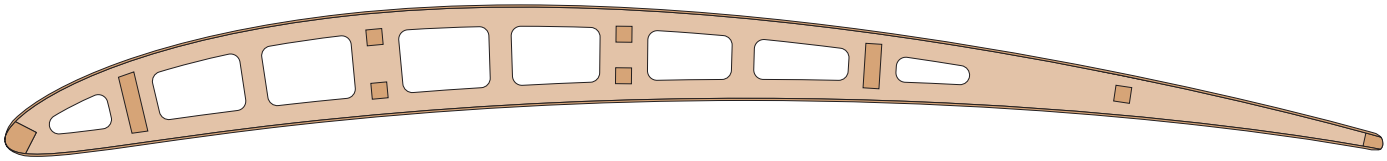
The whole structure, although very strong, will deform easily to allow the wing to warp.

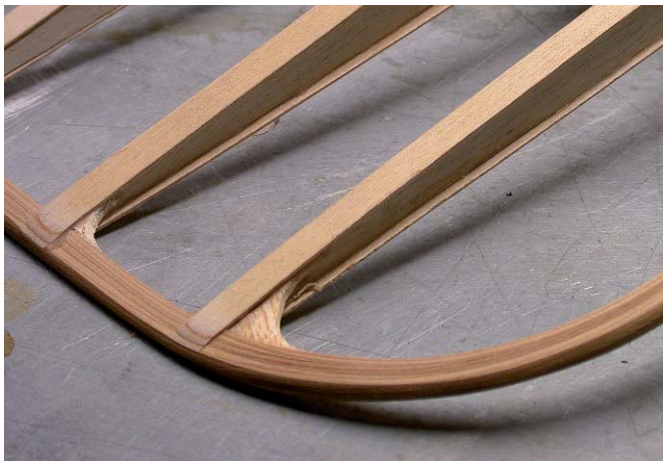
The full size Blériot did not use ailerons to provide the necessary control about the roll axis, but had wings that could be warped in opposite direction in order to roll. An ingenious system of steel wires, levers, and sheave blocks were used to achieve the wing warp.

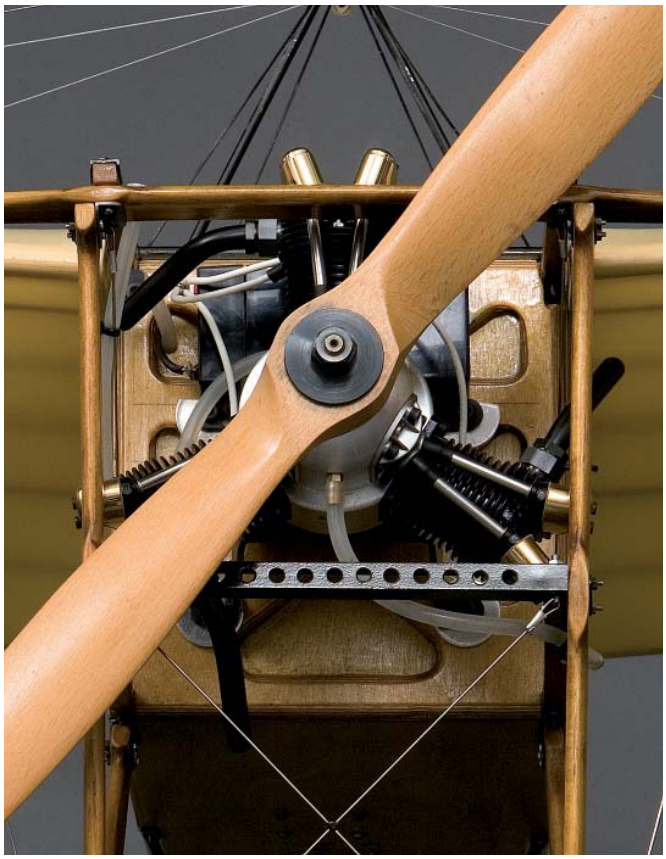
Note - how the rear spar cables are going from the pulleys on the upper tower to the wing top (see picture above) and to the tower-pulley balancer, located below the wing (picture above, on the right).



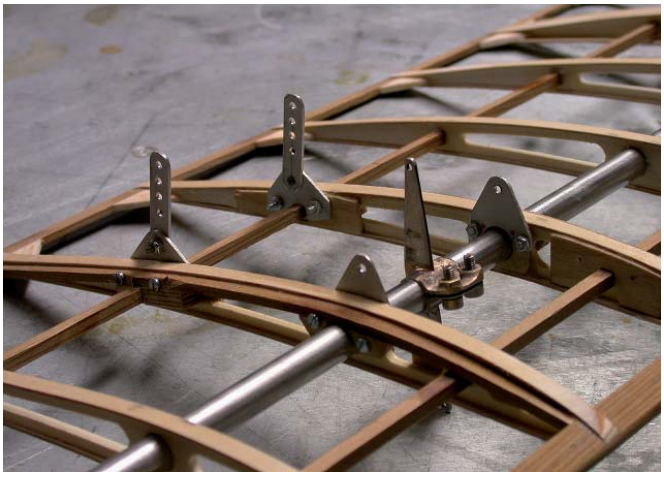
The wings on my model are kept in position by two pins inserted at







least 2 cm in to the main longerons.
The forward wing spar is fixed, braced by two cables fastened to the tower-pulley mounted above the front of the fuselage and at the landing gear base.
This system accomplishes a sufficient warp to the wing: at the wing tip, the trailing edge has a vertical travel of 12 cm. I used an airfoil design with a higher upper-camber and lower under-camber that I had on my computer, but I do not know the name of it. However I successfully used the same airfoil on an Albatros and I think that it is an airfoil for a free-flight model.
The original airfoil (above drawing) used on the full size Blériot, in my opinion, was not trustworthy.



THE TAIL ASSEMBLY

The rudder and fin are combined as one unit, fully moveable and hinged using a 6 mm tube that connects to the fuselage. It is operated using a pull-pull cable system. The outside frame is made using laminated cedar (picture above).
The horizontal tail is also in one piece, elevator and stabilizer together, but divided in three sections and of a similar structure as the wing. The center part (stab) is fixed and the outside sections (elevators) are moveable using a pull-pull system. Two stainless steel tubes 9 x 8.5 mm (one inside the other) which go through the center fixed portion and is used as a torsion bar and spar at the same time (picture below).

THE MOTOR

As I already said before, the engine is a beautiful Saito 170 four-stroke with three cylinders. When I started it for the first time, I was sure that it would not run, but when I disengaged the starter I realized that the engine was turning. It

was so quiet and had an idle so low that it did not appear to be running. I bolted the engine directly to the firewall and the distance from the propeller to the wall appeared to be perfect. Above the engine mount there was space for a glow plug battery. Using a micro-switch, the battery is on only when the engine is at idle. I have been using this method for many years and it is very convenient and safe. It allows you to adjust the weight in the front of a model without adding lead while allowing the engine to idle trouble free. A very important step is not to forget about leaving the battery on. In order to disconnect it, I got used to leaving the throttle stick in the up position.

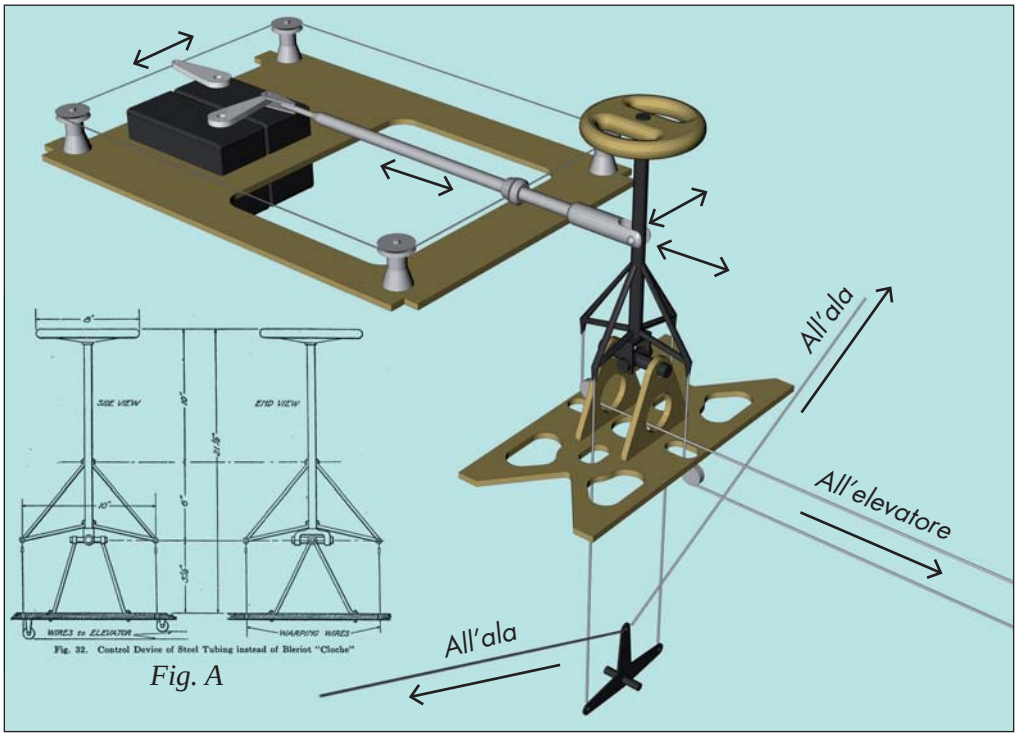
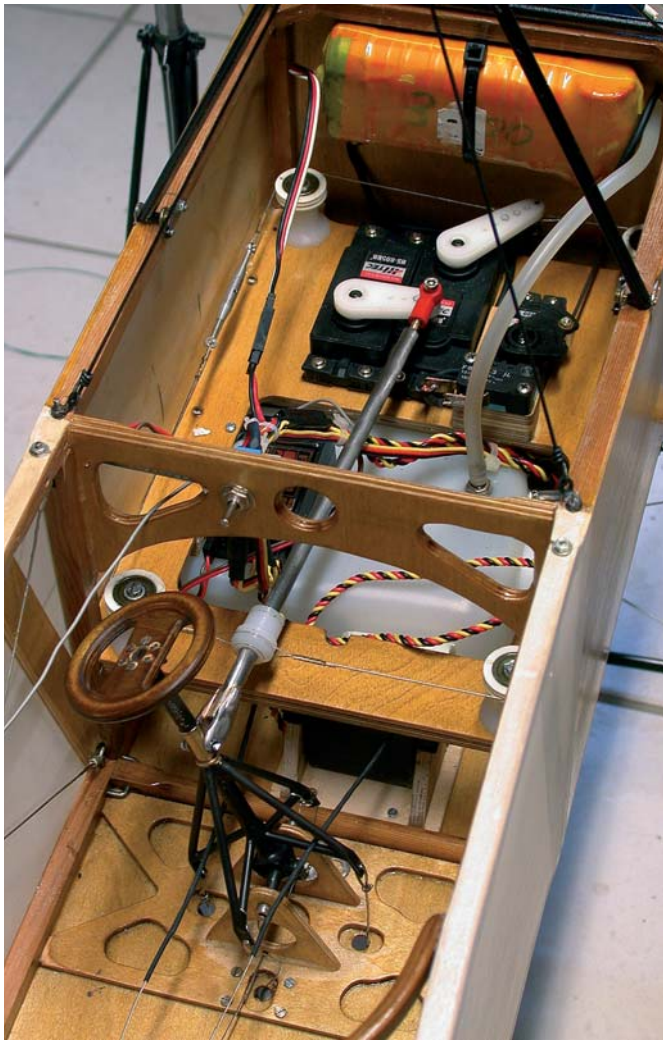
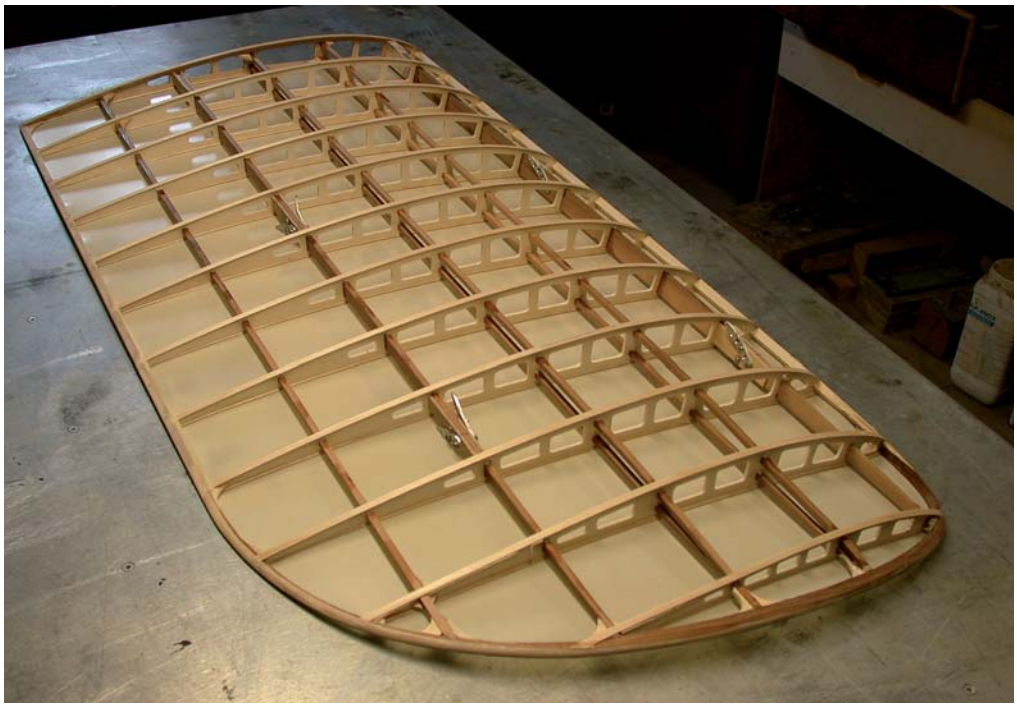


Fig. A

CONTROLS

Obviously, the most labor intense portion of the controls is the wing warp system. After thinking a lot and after a very thorough study of the old drawings, my conclusion was that the simplest and most functional system was exactly the one used on the original full-size aircraft (this happens quite often). The only difference was that on the full-size plane, the control bar was moved by the pilot, but in my model, I had to use servos.





Because the Blériot does not have a nose, I had to locate the heavy equipment as far forward as possible. Therefore I designed a system that in the end, happened to work perfectly. I used a steel rod connected to the elevator servo, to activate the control stick. This rod goes through a nylon bushing and is moved very slowly using a cable and pulley system controlled by the aileron servo. The servos are the powerful Hitec 24 kg.cm torque and are mounted on the firewall.

The control bar is built as per the original drawing and consists of a tube pyramid that moves about two axes: forward and back, and right and left from the base of which are attached the cables that operate the elevator and the balancer for the wing warp.

COVERING AND FINISHING

My first attempt at covering the wing, I used Dacron® 50 g/m^2, but I did not anticipate how once taut on the structure, how ridged the wing would be. On the Blériot the wing must warp easily.

The warping system that I had successfully built before covering would only produce half of the required travel. I tried to add another servo thus doubling the torque, but the results were the same, the wing was too rigid. Therefore I made a drastic decision about covering the wing again using a different material. This time I would use Solartex® which in my experience, I found was more flexible.

I called my hobby store and was assured that they had the two rolls of Solartex® in the Antique White color that I needed. But, to my surprise, they gave me a material called Oratex®. I did not know this material, but the dealer reassured me that it was identical to the Solartex®.

I'm sure he advised me in good faith but I doubt he ever made an actual comparison. Nevertheless the Oratex® turned out to be an excellent material that is easily installed. It is strong and rigid and I would not hesitate to use it with any other aircraft, but not with a Blériot or a Fokker Eindecker, both of which use wing warping.

I had to cover the wings for a third time - and this time I used Solartex®. Everything worked perfectly. In order to have a good bond between the covering material and the undercamber, after ironing the covering on the bottom of the wing, I deposited a few drops of cyanoacrylate adhesive along the bottom of the ribs, thus bonding them to the Solartex®.

The whole model is left unpainted but is covered with two coats of fuel proof clear coat. The hardware is painted black.

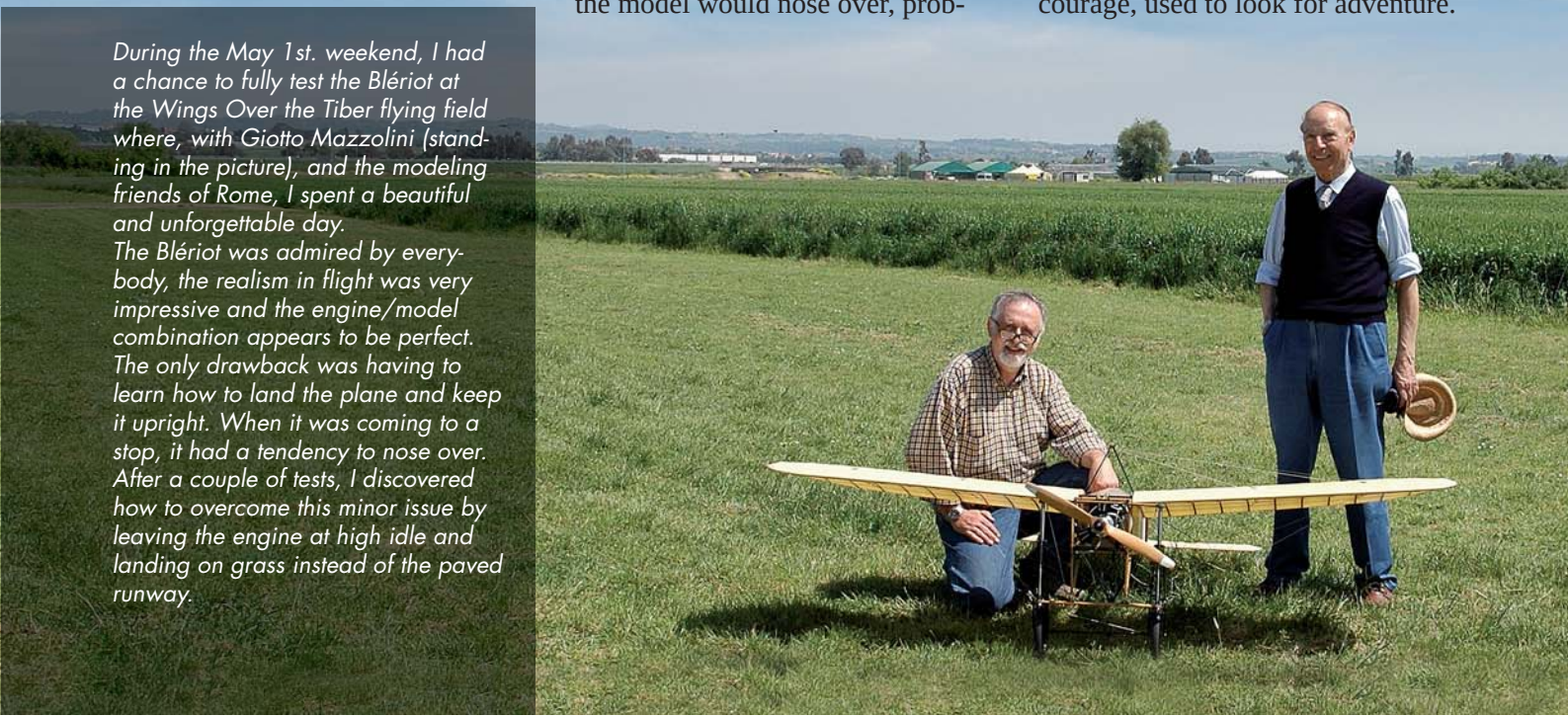
TESTING

I had promised Giotto that I would travel to Rome to test the Blériot with him. This was the least I could do to thank him for the great present of the radial engine. Unfortunately, I completed the model too soon and while I waited for the beginning of May in order to have some good weather at my disposal, the Blériot was sitting on my work bench, beautiful and tempting. Finally I could not resist anymore and at the beginning of April, with the excuse of showing it to my friends, I took it to the flying field, knowing what would happen all the while trying to convince myself it wouldn't happen.

The truth is, after starting the engine with the pretense of getting more break-in time; I tried to taxi the model on the runway. Taxiing was definitely not the best because, as soon as the throttle was cut, in order to avoid the take-off, the model would nose over, probably because of the landing gear and the balance point being too forward. At least this showed that the model was very strong.

All my friends were hoping to see it fly. They were pushing me to go faster and I quite willingly obliged and gave it full throttle. The Blériot took off stable and safe, very controllable, but maybe a little nose heavy. However, as the proverb goes, "A nose heavy model is a saved model."

After trimming the aircraft at a safe altitude and checking the flight characteristics plus the efficiency of the wing warping, I made a few low-and-slow passes. It was like watching a real full size Blériot flying in the old movie 'Those Magnificent Men in Their Flying Machines', in which men and women of great genius and courage, used to look for adventure.



During the May 1st. weekend, I had a chance to fully test the Blériot at the Wings Over the Tiber flying field where, with Giotto Mazzolini (standing in the picture), and the modeling friends of Rome, I spent a beautiful and unforgettable day.
The Blériot was admired by everybody, the realism in flight was very impressive and the engine/model combination appears to be perfect. The only drawback was having to learn how to land the plane and keep it upright. When it was coming to a stop, it had a tendency to nose over. After a couple of tests, I discovered how to overcome this minor issue by leaving the engine at high idle and landing on grass instead of the paved runway.