Chapter VII

ON BOARD THE ALBATROSS

"When will man cease to crawl in the depths to live in the azure and quiet of the sky?"

To this question of Camille Flammarion's the answer is easy. It will be when the progress of mechanics has enabled us to solve the problem of aviation. And in a few years--as we can foresee--a more practical utilization of electricity will do much towards that solution.

In 1783, before the Montgolfier brothers had built their fire-balloon, and Charles, the physician, had devised his first aerostat, a few adventurous spirits had dreamt of the conquest of space by mechanical means. The first inventors did not think of apparatus lighter than air, for that the science of their time did not allow them to imagine. It was to contrivances heavier than air, to flying machines in imitation of the birds, that they trusted to realize aerial locomotion.

This was exactly what had been done by that madman Icarus, the son of Daedalus, whose wings, fixed together with wax, had melted as they approached the sun.

But without going back to mythological times, without dwelling on Archytas of Tarentum, we find, in the works of Dante of Perugia, of Leonardo da Vinci and Guidotti, the idea of machines made to move through the air. Two centuries and a half afterwards inventors began to multiply. In 1742 the Marquis de Bacqueville designed a system of wings, tried it over the Seine, and fell and broke his arm. In 1768 Paucton conceived the idea of an apparatus with two screws, suspensive and propulsive. In 1781 Meerwein, the architect of the Prince of Baden, built an orthopteric machine, and protested against the tendency of the aerostats which had just been invented. In 1784 Launoy and Bienvenu had maneuvered a helicopter worked by springs. In 1808 there were the attempts at flight by the Austrian Jacques Degen. In 1810 came the pamphlet by Denian of Nantes, in which the principles of "heavier than air" are laid down. From 1811 to 1840 came the inventions and researches of Derblinger, Vigual, Sarti, Dubochet, and Cagniard de Latour. In 1842 we have the Englishman Henson, with his system of inclined planes and screws worked by steam. In 1845 came Cossus and his ascensional screws. In 1847 came Camille Vert and his helicopter made of birds' wings. In 1852 came Letur with his system of guidable parachutes, whose trial cost him his life; and in the same year came Michel Loup with his plan of gliding through the air on four revolving wings. In 1853 came Béléguic and his aeroplane with the traction screws, Vaussin-Chardannes with his guidable kite, and George Cauley with his flying machines driven by gas. From 1854 to 1863 appeared Joseph Pline with several patents for aerial systems. Bréant, Carlingford, Le Bris, Du Temple, Bright, whose ascensional screws were left-handed; Smythies, Panafieu, Crosnier, &c. At length, in 1863, thanks to the efforts of Nadar, a society of "heavier than air" was founded in Paris. There the inventors could experiment with the machines, of which many were patented. Ponton d'Amécourt and his steam helicopter, La Landelle and his system of combining screws with inclined planes and parachutes, Louvrié and his aeroscape, Esterno and his mechanical bird, Groof and his apparatus with wings worked by levers. The impetus was given, inventors invented, calculators calculated all that could render aerial locomotion practicable. Bourcart, Le Bris, Kaufmann, Smyth, Stringfellow, Prigent, Danjard, Pomés and De la Pauze, Moy, Pénaud, Jobert, Haureau de Villeneuve, Achenbach, Garapon, Duchesne, Danduran, Pariesel, Dieuaide, Melkiseff, Forlanini, Bearey, Tatin, Dandrieux, Edison, some with wings or screws, others with inclined planes, imagined, created, constructed, perfected, their flying machines, ready to do their work, once there came to be applied to thereby some inventor a motor of adequate power and excessive lightness.

This list may be a little long, but that will be forgiven, for it is necessary to give the various steps in the ladder of aerial locomotion, on the top of which appeared Robur the Conqueror. Without these attempts, these experiments of his predecessors, how could the inquirer have conceived so perfect an apparatus? And though he had but contempt for those who obstinately worked away in the direction of balloons, he held in high esteem all those partisans of "heavier than air," English, American, Italian, Austrian, French--and particularly French--whose work had been perfected by him, and led him to design and then to build this flying engine known as the "Albatross," which he was guiding through the currents of the atmosphere.

"The pigeon flies!" had exclaimed one of the most persistent adepts at aviation.

"They will crowd the air as they crowd the earth!" said one of his most excited partisans.

"From the locomotive to the aeromotive!" shouted the noisiest of all, who had turned on the trumpet of publicity to awaken the Old and New Worlds.

Nothing, in fact, is better established, by experiment and calculation, than that the air is highly resistant. A circumference of only a yard in diameter in the shape of a parachute can not only impede descent in air, but can render it isochronous. That is a fact.

It is equally well known that when the speed is great the work of the weight varies in almost inverse ratio to the square of the speed, and therefore becomes almost insignificant.

It is also known that as the weight of a flying animal increases, the less is the proportional increase in the surface beaten by the wings in order to sustain it, although the motion of the wings becomes slower.

A flying machine must therefore be constructed to take advantage of these natural laws, to imitate the bird, "that admirable type of aerial locomotion," according to Dr. Marcy, of the Institute of France.

In short the contrivances likely to solve the problem are of three kinds:--

1. Helicopters or spiralifers, which are simply screws with vertical axes.

2. Ornithopters, machines which endeavour to reproduce the natural flight of birds.

3. Aeroplanes, which are merely inclined planes like kites, but towed or driven by screws.

Each of these systems has had and still has it partisans obstinately resolved to give way in not the slightest particular. However, Robur, for many reasons, had rejected the two first.

The ornithopter, or mechanical bird, offers certain advantages, no doubt. That the work and experiments of M. Renard in 1884 have sufficiently proved. But, as has been said, it is not necessary to copy Nature servilely. Locomotives are not copied from the hare, nor are ships copied from the fish. To the first we have put wheels which are not legs; to the second we have put screws which are not fins. And they do not do so badly. Besides, what is this mechanical movement in the flight of birds, whose action is so complex? Has not Doctor Marcy suspected that the feathers open during the return of the wings so as to let the air through them? And is not that rather a difficult operation for an artificial machine?

On the other hand, aeroplanes have given many good results. Screws opposing a slanting plane to the bed of air will produce an ascensional movement, and the models experimented on have shown that the disposable weight, that is to say the weight it is possible to deal with as distinct from that of the apparatus, increases with the square of the speed. Herein the aeroplane has the advantage over the aerostat even when the aerostat is furnished with the means of locomotion.

Nevertheless Robur had thought that the simpler his contrivance the better. And the screws--the Saint Helices that had been thrown in his teeth at the Weldon Institute--had sufficed for all the needs of his flying machine. One series could hold it suspended in the air, the other could drive it along under conditions that were marvelously adapted for speed and safety.

If the ornithopter--striking like the wings of a bird--raised itself by beating the air, the helicopter raised itself by striking the air obliquely, with the fins of the screw as it mounted on an inclined plane. These fins, or arms, are in reality wings, but wings disposed as a helix instead of as a paddle wheel. The helix advances in the direction of its axis. Is the axis vertical? Then it moves vertically. Is the axis horizontal? Then it moves horizontally.

The whole of Robur's flying apparatus depended on these two movements, as will be seen from the following detailed description, which can be divided under three heads--the platform, the engines of suspension and propulsion, and the machinery.

Platform.--This was a framework a hundred feet long and twelve wide, a ship's deck in fact, with a projecting prow. Beneath was a hull solidly built, enclosing the engines, stores, and provisions of all sorts, including the watertanks. Round the deck a few light uprights supported a wire trellis that did duty for bulwarks. On the deck were three houses, whose compartments were used as cabins for the crew, or as machine rooms. In the center house was the machine which drove the suspensory helices, in that forward was the machine that drove the bow screw, in that aft was the machine that drove the stern screw. In the bow were the cook's galley and the crew's quarters; in the stern were several cabins, including that of the engineer, the saloon, and above them all a glass house in which stood the helmsman, who steered the vessel by means of a powerful rudder. All these cabins were lighted by port-holes filled with toughened glass, which has ten times the resistance of ordinary glass. Beneath the hull was a system of flexible springs to ease off the concussion when it became advisable to land.

Engines of suspension and propulsion.--Above the deck rose thirty-seven vertical axes, fifteen along each side, and seven, more elevated, in the centre. The "Albatross" might be called a clipper with thirty-seven masts. But these masts instead of sails bore each two horizontal screws, not very large in spread or diameter, but driven at prodigious speed. Each of these axes had its own movement independent of the rest, and each alternate one spun round in a different direction from the others, so as to avoid any tendency to gyration. Hence the screws as they rose on the vertical column of air retained their equilibrium by their horizontal resistance. Consequently the apparatus was furnished with seventy-four suspensory screws, whose three branches were connected by a metallic circle which economized their motive force. In front and behind, mounted on horizontal axes, were two propelling screws, each with four arms. These screws were of much larger diameter than the suspensory ones, but could be worked at quite their speed. In fact, the vessel combined the systems of Cossus, La Landelle, and Ponton d'Amécourt, as perfected by Robur. But it was in the choice and application of his motive force that he could claim to be an inventor.

Machinery.--Robur had not availed himself of the vapor of water or other liquids, nor compressed air and other mechanical motion. He employed electricity, that agent which one day will be the soul of the industrial world. But he required no electro-motor to produce it. All he trusted to was piles and accumulators. What were the elements of these piles, and what were the acids he used, Robur only knew. And the construction of the accumulators was kept equally secret. Of what were their positive and negative plates? None can say. The engineer took good care--and not unreasonably--to keep his secret unpatented. One thing was unmistakable, and that was that the piles were of extraordinary strength; and the accumulators left those of Faure-Sellon-Volckmar very far behind in yielding currents whose ampères ran into figures up to then unknown. Thus there was obtained a power to drive the screws and communicate a suspending and propelling force in excess of all his requirements under any circumstances.

But--it is as well to repeat it--this belonged entirely to Robur. He kept it a close secret. And, if the president and secretary of the Weldon Institute did not happen to discover it, it would probably be lost to humanity.

It need not be shown that the apparatus possessed sufficient stability. Its center of gravity proved that at once. There was no danger of its making alarming angles with the horizontal, still less of its capsizing.

And now for the metal used by Robur in the construction of his aeronef--a name which can be exactly applied to the "Albatross." What was this material, so hard that the bowie-knife of Phil Evans could not scratch it, and Uncle Prudent could not explain its nature? Simply paper!

For some years this fabrication had been making considerable progress. Unsized paper, with the sheets impregnated with dextrin and starch and squeezed in hydraulic presses, will form a material as hard as steel. There are made of it pulleys, rails, and wagon-wheels, much more solid than metal wheels, and far lighter. And it was this lightness and solidity which Robur availed himself of in building his aerial locomotive. Everything--framework, hull, houses, cabins--were made of straw-paper turned hard as metal by compression, and--what was not to be despised in an apparatus flying at great heights--incombustible. The different parts of the engines and the screws were made of gelatinized fiber, which combined in sufficient degree flexibility with resistance. This material could be used in every form. It was insoluble in most gases and liquids, acids or essences, to say nothing of its insulating properties, and it proved most valuable in the electric machinery of the "Albatross."

Robur, his mate Tom Turner, an engineer and two assistants, two steersman and a cook--eight men all told--formed the crew of the aeronef, and proved ample for all the maneuvers required in aerial navigation. There were arms of the chase and of war; fishing appliances; electric lights; instruments of observation, compasses, and sextants for checking the course, thermometers for studying the temperature, different barometers, some for estimating the heights attained, others for indicating the variations of atmospheric pressure; a storm-glass for forecasting tempests; a small library; a portable printing press; a field-piece mounted on a pivot; breech loading and throwing a three-inch shell; a supply of powder, bullets, dynamite cartridges; a cooking-stove, warmed by currents from the accumulators; a stock of preserves, meats and vegetables sufficient to last for months. Such were the outfit and stores of the aeronef--in addition to the famous trumpet.

There was besides a light india-rubber boat, insubmersible, which could carry eight men on the surface of a river, a lake, or a calm sea.

But were there any parachutes in case of accident? No. Robur did not believe in accidents of that kind. The axes of the screws were independent. The stoppage of a few would not affect the motion of the others; and if only half were working, the "Albatross" could still keep afloat in her natural element.

"And with her," said Robur to his guests--guests in spite of themselves--"I am master of the seventh part of the world, larger than Africa, Oceania, Asia, America, and Europe, this aerial Icarian sea, which millions of Icarians will one day people."