

meet it. Now, since neither the wind nor the machine for even an instant maintains exactly the same direction and velocity, it is evident that the man who would trace the course of the centre of pressure must be very quick of mind; and he who would attempt to move his body to that spot at every change must be very active indeed. Yet this is what Herr Lilienthal attempted to do, and did do with most remarkable skill, as his 2,000 glides sufficiently attest. However, he did not escape being overturned by wind gusts several times, and finally lost his life through a breakage of his machine due to defective construction. The Pilcher machine was similar to that of Lilienthal, and, like it, seems to have been structurally weak, for on one occasion, while exhibiting the flight of his machine to several members of the Aeronautical Society of Great Britain, it suddenly collapsed and fell to the ground, causing injuries to the operator which proved sadly fatal. The method of management of this machine differed in no important respect from that of Lilienthal, the operator shifting his body to make the centres of pressure and gravity coincide. Although the fatalities which befell the designers of these machines were due to the lack of structural strength rather than to lack of control, nevertheless it had become clear to the students of the problem that a more perfect method of control must be evolved.

Early Gliders Compared.

The Chanute machines marked a great advance in both respects. In the multiple-wing machine the tips folded slightly backward under the pressure of wind gusts, so that the travel of the centre of pressure was thus largely counterbalanced. The guiding of the machine was done by a slight movement of the operator's body toward the direction in which it was desired the machine should go. The double-deck machine, built and tried at the same time, marked a very great structural advance, as it was the first in which the principles of the modern truss bridges were fully applied to flying machine construction. This machine, in addition to its greatly-improved construction and general design of parts, also differed from the machine of Lilienthal in the operation of its tail.

In the Lilienthal machine the tail, instead of being fixed in one position, was prevented by a stop from folding downward beyond a certain point, but was free to fold upward without any hindrance. In the Chanute machine the tail was at first rigid, but afterwards, at the suggestion of Mr. Herring, it was held in place by a spring that allowed it to move slightly either upward or downward with reference to its normal position, thus modifying the action of the wind gusts upon it very much to its advantage. The guiding of the machine was effected by slight movements of the operator's body, as in the multiple-wing machines. Both these machines were much more manageable than the Lilienthal type, and their structural strength, notwithstanding their extreme lightness, was such that no fatalities, or even accidents, marked the glides made with them, although winds were successfully encountered much greater in violence than any which previous experimenters had dared to attempt.

Why I took up Flight.

My own active interest in aeronautical problems dates back to the death of Lilienthal in 1896. The brief notice of his death which appeared in the telegraphic news at that time aroused a passive interest which had existed from my childhood, and led me to take down from the shelves of our home library a book on "Animal

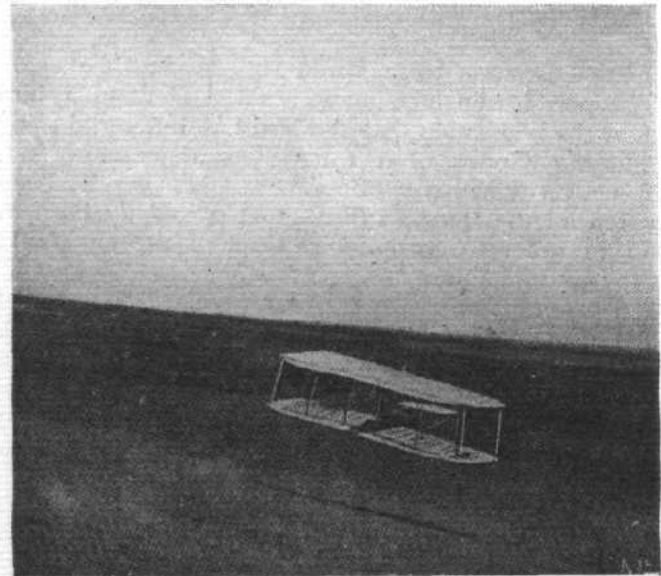
Mechanism," by Prof. Marey, which I had already read several times. From this I was led to read more modern works, and as my brother soon became equally interested with myself, we soon passed from the reading to the thinking, and finally to the working stage.

It seemed to us that the main reason why the problem had remained so long unsolved was that no one had been able to obtain any adequate practice. We figured that Lilienthal in five years of time had spent only about five hours in actual gliding through the air. The wonder was not that he had done so little, but that he had accomplished so much. It would not be considered at all safe for a bicycle rider to attempt to ride through a crowded city street after only five hours' practice, spread out in bits of ten seconds each over a period of five years; yet Lilienthal with this brief practice was remarkably successful in meeting the fluctuations and eddies of wind gusts.

The Glider Kite.

We thought that if some method could be found by which it would be possible to practise by the hour instead of by the second, there would be hope of advancing the solution of a very difficult problem. It seemed feasible to do this by building a machine which would be sustained at a speed of 18 m.p.h., and then finding a locality where winds of this velocity were common. With these conditions, a rope attached to the machine to keep it from floating backward would answer very nearly the same purpose as a propeller driven by a motor, and it would be possible to practice by the hour, and without any serious danger, as it would not be necessary to rise far from the ground, and the machine would not have any forward motion at all.

We found, according to the accepted tables of air pressures on curved surfaces, that a machine spreading 200 sq. ft. of wing surface would be sufficient for our purpose, and that places could easily be found along the Atlantic coast where winds of 16 to 25 miles were not at



A low glide on the 1901 model. Often the machine was only a few inches from the ground.

all uncommon. When the winds were low, it was our plan to glide from the tops of sandhills, and, when they were sufficiently strong, to use a rope for our motor and fly over one spot.

(To be continued.)