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WHEN WE TAKE TO FLYING

What, Has Been Done So Far in the Way of Aeronautics.

WILL $100,000 TEMPT AN INVENTOR?

Herr Lilienthal-Maxim-The Use of Wings-The Motors-The Screws-Ascending and Descending Centres

“I want to know,” is about what the editor of The Aeronautical Annual asks, “why anybody should be inclined to doubt the possibility of a man's flying? It is granted that we have been trying to do some soaring from the immemorial. Will you, however, look at how slow has been the development of the bicycle? Why, it has taken eighty years of careful thought and experiment before you get at the safety.” The wheel, it is true, improved very gradually. Most of the modifications were but slight. It took years before foot cranks were imagined. To-day what does the wheelman say when he is at the top of his speed? Why, “wheeling is just flying.” Where comes in the analogy between the wheel and the actual flying machine? The main point is close. Both modes of travel are riding upon the air, through in one case “a small quantity of air is carried in a bag, and in the other the air is unbagged.”

Can you, then, make a trip through the air? You can. Have the pluck and the inventive power of Otto Lilienthal of Berlin and then flight is perfectly possible. They are censorious critics who say, “Lilienthal! why he only imitates the flying squirrel.

[Abbildung: Before the Flight.]

He does some kind of a parachute business. He can't fly up-though he may fly down.” The answer of the expert in the flying business is that Lilienthal can fly up-that is, when the current of air is favorable; that what Lilienthal has so far done is only the beginning; that his machine is not yet completed, and that when the necessary improvements come-as they must in time–flying will be no longer an impossible thing.

Now fancy that, say in 1950, we have athletic contests, (that is, providing football has not killed all the collegiates yet to come.) Then we will have races in the air. How tame an insignificant then would be a foot race. “The air,” writes Herr Lilienthal, “is the freest

element; it admits of the most unfettered movement, and the motion through it affords the greatest delight not only to the person flying, but also those looking on." All you have to do is to go to a hillside with the proper slope, buckle on your wings, adjust your steering apparatus, take the necessary

[Abbildung: Fairly Well Up.]

jump, "the powerful bound," and of you are, and you may sail away for hundreds of yards.

The art of flying, so this authority informs you, requires not only physical study but an acquaintance with natural phenomena. It is not likely that heavy or fat persons could put on the Lilienthal wings and flit around. No artist ever yet has made an adipose angel. Probably it would be only a slim person who could indulge in aerial circumvolutions. If you did not know how to manage your wings you might take a header, but nevertheless, Lilienthal says, the risk is but slight. The fatigue seems to be but little. "One can fly long distances with quite simple apparatus without taxing one's strength at all, and this kind of free and sage motion through the air affords greater pleasure than any other kind of sport."

Herr Lilienthal gives the weight of his apparatus, varying as to the size, supposably in proportion to the experimentalist's avoirduposis, as ranging from thirty-three to fifty-five pounds. You must begin in a tentative way, until you are accustomed to be borne in the air, and be satisfied with short distances. Finally you will be able "to sail over inclined surfaces as far as you wish."

The two directions in which Herr Lilienthal's experiments have been chiefly made were to sail through the air with immovable wings, and, on the other hand, to attain the dynamic flight by means of flapping the wings. When the wind is light, it dies not require much practice to go long distances without danger, but when winds are strong there are certain risks to be run. On the whole, we might say that gusty March weather was not the season which Herr Lilienthal preferred. Locality, too, might make it very uncomfortable for fliers, and the neighborhood of THE NEW YORK TIMES, with its gusty corner, would be shunned by "wingers" of the future.

Studying the flight of birds, who throw themselves from elevated points into the

[Abbildung: Lilienthal Coming Down.]

air, and then make free use of their pinions, man, when he starts to fly, will have to do about the same thing. A running start is necessary. Herr Lilienthal has had built at his house, in Gros Lichterfelde, near Berlin, an artificial hill fifteen meters high. With a light wind blowing in the proper direction, he can make a flight of 200 meters. (The meter is 39.371 English inches.) The apparatus consists "of wooden frames, winglike in shape, covered with cotton twilling. The frame is selzed by the hands, the arms resting on cushions, thus supporting the body. The legs remain free for running or jumping. The steering in the air is brought about by changing the centre of gravity." The supporting surfaces are of from ten to twenty meters. Herr Lilienthal's apparatus was patented last

year, and so you may not soar without infringing on Herr Lilienthal's rights.

If Herr Lilienthal's experiments in flying are of decidedly practical interest, the long and careful studies made by Mr. Maxim in natural and artificial flight are particularly worthy attention. It must be remembered that for the work done by Mr. Maxim the Smithsonian Institution awarded him the Hodgkins Medal. Mr. Maxim by no means slights the many difflculties which are presented. He writes that up to the last few years nearly all experiments in aerial navigation have been made by men "not versed on science, and who for the most part have been ignorant of the most rudimentary laws of dynamics." In fact, aerial flight and perpetual motion were regarded in about the same light. It is due to Profs. Langley and Thurston, and to Mr. Chanute, all of the United States, that serious attention has been called to the possibilities of constructing a flying machine.

Commencing his study with apparatus of small size, Mr. Maxim reached certain results which were favorable. When discussing the subject with Prof. Langley, the Secretary of the Smithsonian Institution suggested that the experiments made had been heretofore on too small a scale, and that the

[3 kleine Abbildungen: 1. The Start of the Maxim Machine. 2. One Wheel on the Track. 3. The Ascent.]

lifting power had not been sufficiently shown. If a flying machine was to be of any practical use it ought at least to carry a man. Some mechanical adjunct as a motor would be necessary. Mr. Maxim then designed what he calls "a large machine." His idea was that its weight should be 5,000 pounds, but without men, fuel, or water; that screw thrust should be 1,500 pounds, and that the total area of the planes should be 5,000 feet. With an expenditure of 250 horse power, he expected to lift this machine and to drive it through the air at a speed of thirty-five miles an hour. The power added in this way would have made the total weight 7,000 pounds. By experiment he found that the amount of power to be used was great deal more than he had anticipated.

Studying the natural flight of birds, some of the books consulted by Mr. Maxim said that a bird was able to develop from ten to one hundred times more power for its weight than other animals. Certain authorities declare that no "greater amount of energy is exerted by a bird flying than by land animals in running or jumping." As far as the generation of power goes Mr. Maxim believes that a bird in this respect has marked advantages, but at the same time it was evident that a rabbit, when it ran, exerted in proportion to its weight as much power as an eagle. If a 100-pound animal ascends a hill 100 feet high, that would require the development of 10,000 foot-pounds.

The difference between the four-footed animal and the bird in progress is, however, another thing. The air through which the bird moves never is a fixed quantity, "because the medium in which the bird is moving is never stationary." That air "is always moving up or down," so the birds, gifted with some "delicate sense of feeling," appreciate this difference. The air then rises or falls in ascending and descending columns. It may be that over an area of ten square miles there are several such rising or falling columns. The bird feels the difference, appreciates it, and takes advantage of it. Mr. Maxim, whose powers of observation are of the keenest, had his attention called to these varying columns while

crossing the Atlantic and when steaming in the Mediterranean. This up-and-down movement of the air must be theoretically correct. Some twenty or twenty-five miles above us the temperature ought to be at absolute zero. On the earth's surface the absolute zero can be but rarely reached by the air. Then the warm air on the earth must be always rising in certain areas, while in other areas the cold air must descend. “Suppose,” writes Mr. Maxim, “that the local influence which causes the up-and-down motion of the air should be sufficiently great to causes it to rise at the rate of two miles an hour, and that the wind at the same time is blowing at the rate of ten miles an hour, the motion of the air would then be the resultant of these two velocities.” The motion of the wind would be blowing up an incline of one in five. Take a bird which adjusts its wings properly; then “it could advance six miles by falling through one mile of air,” or it would be able “to rise as relates to the earth, while in reality falling as relates to the surrounding air.”

The conclusion Mr. Maxim arrives at, so far as concerns these columns of air, are that they may be separated by even distances of only 500 feet; that the centres of greatest action are not “in spots, but in lines, which may be approximately straight, but generally abound in simlosetics,” and, lastly, that the bird seeks out these ascending or descending columns of air. Mr. Maxim also thinks that there is great steadiness in the higher currents of air, and that the nearer the currents are to the earth the more violent or eccentric they are.

It is in his mechanical consideration of artificial flight that Mr. Maxim is singularly instructive. Starting with the carbon combustion, as developing energy, the bird from its food makes from ten to fifteen times as much power for the carbon consumed as may be developed by the best steam engine, but if petroleum were used in the steam engine the latter would have at “least twenty times as many thermal units per pound as the ordinary food of birds.” He does not believe that by mechanical means we can imitate the mo-

[Abbildung: The Hargrove Kite.]

tion of a bird's wings, or that we should use these wings as a model in constructing an artificial flying machine.

All artificial machines which are made for terrestrial or aquatic motion, as locomatives or steamers, must be immensely strong, and fairly heavy, and when the flying machine is built, its weight and strength will have to exceed that of the bird.

Innumerable were the experiments made with screw propellers unattached to any aerial machine so that Mr. Maxim could get at some satisfactory data. Finally he became satisfied that there was much power developed by an advantageous form of screw. That was shown by the theoretical formula. These are his words: “My experiments have, however shown that with a speed of forty miles an hour and screw slip of eighteen miles an hour, a well-made screw propeller is 13.1 times as efficient as early experimenters had supposed and attempted to prove by elaborate formula.” The motor was the all-important subject. The gas engine was fairly heavy and impracticable. The oil engine, using petroleum, which could develop one horse power to every one and a half pounds of petroleum, Mr. Maxim believes will answer his purpose. The recent success of the

petroleum engine for land carriages shows that Mr. Maxim was correct in his views. Studying the electrical motor, he was satisfied that it was too heavy for his special purpose, because to develop one horse power the weight of storage battery would be 150 pounds. He is, then, of the opinion that so far "we cannot look to electricity with any hope of finding a motor which is suitable for the purpose of aerial navigation."

Briefly explained, Mr. Maxim's aerial machine is a large platform, about 8 feet wide and 40 feet long. Each side is formed of very strong trusses of steel tubes, braced in every direction, with steel wire. The covering is of balloon material. There are two screws of 17 feet 10 inches in diameter. He thinks that he can increase their diameter to 24 feet. There are fore and aft horizontal rudders. It is in steering such an apparatus that the difficulty lies. It is the motion of the screws or propellers driven by the light steam engine which moves the machine.

It is the start which is everything. Imitative of the bird, and how it launches itself by a jump into space, Mr. Maxim lifted his apparatus by means of a railroad track. This track was 1,800 feet long. It took about 500 feet of the track to get up the necessary speed. About 1,000 feet the sufficed to make the apparatus, which ran on wheels, leave the track and mount, the propellers being at work.

In order to get the all-important start, Mr. Maxim has tried an air blast, but is as yet uncertain as to the results. As to the lifting by means of motion, on the railroad track, the machine rose visibly, but then there was mishap caused by the bending of an axle, but it was conclusively shown that Mr. Maxim was working in the right direction.

When his improved machine is constructed, the principle being the same, the power of the engine will be diminished some fifty horse, and less pressure will be used. Instead of mounting the machine on four wheels, only three will be used, with three rails. The track, instead of being on a straight line, will be oval. It is at least satisfactory to know that Lord Kelvin believes that Mr. Maxim's experiments have proved that "conditions were from twenty to fifty times as favorable to the aerial navigator as had heretofore been shown by accepted formulae, and that the whole mathematical question would require revision."

Last December Mr. Lodge introduced a bill, which was read twice and referred to the Comittee on Inter-State Commerce. The purport of the bill was that the Secretary of the Treasury was to pay $100,000 to anybody who at any time prior to 1901 should construct an apparatus "within or near the City of Washington which would demonstrate to a committee appointed by the Secretary of War the practicability of safely navigating the air at a speed not less than thirty miles an hour, and capable of carrying passengers and freight weighing a total of at least 400 pounds." Another section of the bill was to authorize the payment of $25,000 to any one who would demonstrate to a committee "the practicability of safely navigating the air in free flight toward any desired point of the compass for a distance of one mile or more in a descending line, the point of alighting to be not more than 66 feet lower than the point of starting." No use was to be made of the buoyant power of any gas lighter than air. The hill still awaits Senatorial approval. If heretofore aerial navigation has been, scientifically, at least, "a neglected science," should this bill pass, unquestionably many men of talent will devote themselves to the matter.

The pioneer of aeronautical science is the kite. You may learn the A B C of it in kite

flying. There you acquire first principles. You learn what is an aeroplane. We are far beyond the Chinese or the Malay kite, having invented certain flying machines of our own, and the Hargrave kite seems to be in the lead. This kite has been flown in a wind which was blowing from thirty to thirty-five miles an hour. Mr. Lamson has a modified kite which he has raised to a height of 6,000 feet. In making a kite it is advisable to use black muslin; otherwise at a great elevation you cannot see it.

In one of the late magazines an English engineering officer proposed using a kite with a man perched somewhere on it, so that he might overlook an enemy. It would take a very brave man to undertake a business of that kind.

Those devoting their time and their money to aeronautical science are to some extent purists, and such words or expressions as “Daedalus,” “Icarus,” and “Nation's Airy Navies,” and particularly that offensive headline, “Pilots of the Purple Twilight,” are tabooed. If it then should ever happen that a man who has given expression to “Pilots of the Purple Twilight” mounts with the reader in a balloon, consider him as ballast only, and to be pitched overboard if there is no bag of sand convenient.