NATURAL AND ARTIFICIAL FLIGHT.

BY E. WILSON.

The present writer's experience in experiments with aeroplanes has demonstrated to his satisfaction that glides with fixed passive surfaces of sufficient area (175 square feet) according to Lilienthal, Pilcher, and Chamber's dimensions, are an admirable means of courting sudden death. Aeroplane fixed surfaces present such an enormous "sail area," and the wind is so notoriously capricious, that to endeavor to reduce flight to perfection, as in the eagle, condor, albatross, and other "gliders," is to attempt the impossible. Why? For the simple reason that we are attempting an advanced stage of progress before we have attained elementary flight, i. e., initial extended flights at will. As a forcible illustration of the vagaries and force of the wind, the writer recently, at the top of the Watkin tower, Wembly Park, 160 feet high, in carrying an artificial wing ten feet long by four feet wide, was thrown sprawling on the platform by an unexpected gust.

Shall man ever reproduce, by his method, "the way of an eagle in the air"? Decidedly, provided he departs from his present tendency toward the aeroplane, and constructs his dynamic aerial ship more on practical lines and in accordance with natural laws as embodied in the bird, bat, and insect. Artificial flight resolves itself into reproducing Nature and her principles by man's method and ingenuity. We have abundant testimony by Pettigrew's researches that the artificially-constructed wing becomes in action a powerful propeller, sustainer, and aeroplane, increasing in efficiency with the speed at which it is driven. Screws, moreover, opposing a slanting plane, will create an ascensive movement, or horizontally, will increase the disposable weight apart from the motor and apparatus proportionately as speed increases, but will not retard descent, as in the artificial wing. Herein the wing has an inherent advantage, theoretically, over the screw, but the writer considers in practice the screw far more practical, basing this remark on his own experiments with full-sized apparatus.

Nothing is better established than that theory and practice will not agree in aerial experimentation when we come to test our apparatus. Such is the erratic behavior of the wind that it entirely upsets our calculations, besides our machines. In Fig. 1 two Pettigrew type of wings are shown (somewhat hastily put together for photographing only), to test their efficiency when actually in the air. The results were extremely disappointing, the apparatus in many trial flights, and reducing and adjustment of weights, refusing to "glide," even at its earliest trials before they began to show signs of considerable usage. Attempts were made with and against the wind, with the apparatus held perfectly horizontal (Fig. 2), but though the height of the specially erected staging is 60 feet, results, and poor results at that, could be obtained only by increasing the surface which, for flapping flight, of course, was inadmissible. The weight of the second model, Fig. 2, was approximately 250 pounds, with aeronaut and contemplated motor of 6 horse-power, being 22 feet tip to tip, with a "tail" five feet long and three feet across. In beating the air the anterior margin of the wings, being heavier and semi-rigid, created a tendency to pitch the machine forward and downward; indeed, it was recognized by the writer that the Pettigrew form of wing, as advocated, although suitable for laboratory experiments, is quite unsuitable for full-sized apparatus in the air itself, the power transferred to the front edge being wrongly applied. The last experiment with this type of wing is shown in Fig. 3, when the apparatus launched from the top of the Watkin tower, 160 feet high, while swaying in a 40-mile wind similar to a bird in strong cross currents, retained its balance perfectly, reaching *terra firma*, though but a short distance away, on a perfectly level keel. A previous trial with the weight more forward from the center caused the apparatus to plunge headlong. Sufficient experience, however, with the full-sized models, has justified the construction of two new winged apparatus on new and more advanced lines, more in accordance with Nature's plans. The first is for individual or one-man flight, for use with a gasoline engine of 6 horse-power, the wings being deeply concave with semi-rigid anterior margins, and graduating posterior edges. One pair only will be employed, each 8 feet long by 6 feet wide, with a fan-shaped tail at the rear. It is estimated at 240 reciprocating strokes per minute the machine will be propelled in an ascensional and forward flight of at least 180 feet per minute, or 3 feet per second. The second apparatus, on the same lines, has eight wings measuring 18 feet from tip to tip, flapping alternately to conserve weight and driving power. It will be tested with a gasoline motor of 50 horse-power. A third machine, nearly completed, is now on the top of the Watkin tower (Fig. 3), Wembly Park, England, and is the favorite machine of the writer. It is 70 feet long, 10 feet wide at the center, and will be elevated by thirty ascensional screws 5 feet diameter, with a fine pitch. There are four propulsive screws seven feet each in diameter, capable of revolving at high speed, driven in opposite directions. The whole machine will be driven by a gasoline engine of 100 horse-power weighing 400 pounds.

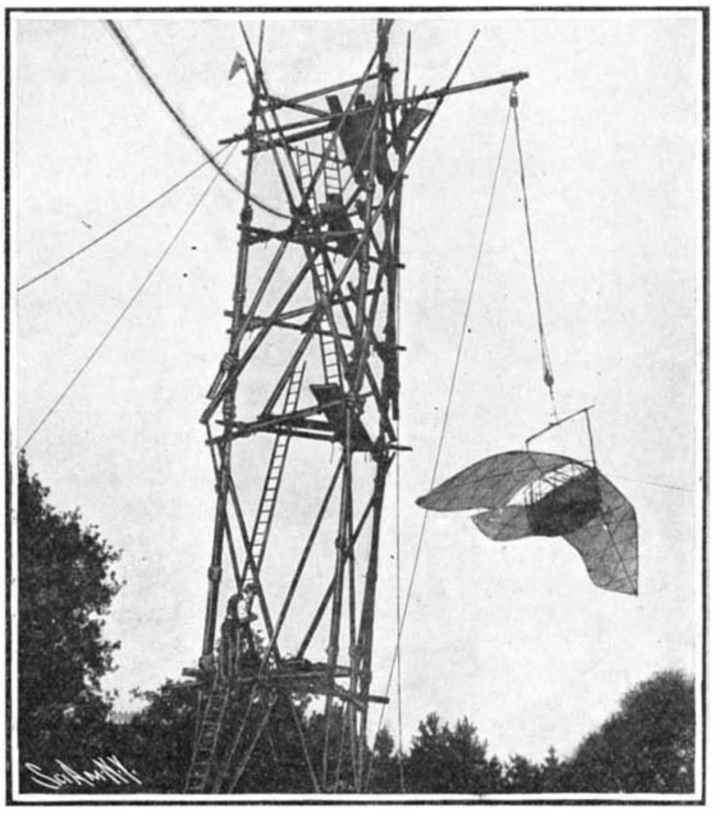

Fig. 2.—Attempts Were Made With and Against the Wind with the Apparatus Held Perfectly Horizontal.

Lippmann's Improved Method of Color Photography.

Prof. Lippmann has lately found a new method for obtaining photographs in natural colors by the use of a bichromated film, and obtains some very striking results.

In the author's well-known process, we can reproduce colors by using a transparent sensitive layer which is placed against a mercury bath during the exposure. After developing, the original colors of the object are seen by reflection. The nature of the sensitive layer is indifferent. We may use gelatino-bromide of silver, a layer of albumen, gelatine or cellulose bichromated, etc. To operate with cellulose, a solution of it is flowed upon glass. After drying it is bleached by washing in dilute hydrochloric acid and then treated with a 3 or 4 per cent bichromate solution. The dried layer is exposed in a frame adapted over a mercury bath until a trace of the image is observed in brown. It only remains to wash out the rest of the bichromate with water, when the colors appear at the same time. In this case the colors are seen only while the layer is wet. They disappear upon drying, but come back when the layer is again treated with water. This action seems to be due to the effect of light upon the hygroscopic properties of the film. The bichromated substance becomes less swelled by the water where the light has been strongest, that is, in the maxima of interference. Wetting makes the layer heterogeneous from a physical and an optical standpoint, and the effect is distributed in the mass according to a periodic law. M. Lippmann then sought to replace the water by a solid substance. Using an iodide of potassium solution, he finds that after drying the image is faintly visible. The unequal distribution is thus maintained, and we have the resulting interference effects. If now we treat the dry layer charged with iodide of potassium with a nitrate of silver solution (20 per cent) the colors become very brilliant and the effect is remarkable. No doubt the same unequal distribution is kept up with the iodide of silver which is formed in this case, but the film still remains transparent, and the iodide seems to be in the state of solution in the film. By observing the plates which are thus formed by transparence, the image appears in its complementary colors and the negatives which are thus obtained are striking. If in the future we are able to secure the same results with gelatino-bromide of silver, we could then make proofs in printing frame which would have the natural colors and obtain much better success than with bichromated films which are not very sensitive nor orthochromatic.

After the bursting of a flywheel in an American mill the superintendent designed and had constructed a large wooden flywheel 30 feet in diameter and 9 feet face. The rim is 12 inches thick, and is built up of forty-four courses of ash plank. The segments break joint, and are glued and bolted together. There are two hubs and two sets of arms, twelve in each set, and all of cast iron. The wheel weighs about 104,000 pounds, and was tested to a speed of 76 revolutions per minute, corresponding to a rim speed of 1.36 miles per minute.

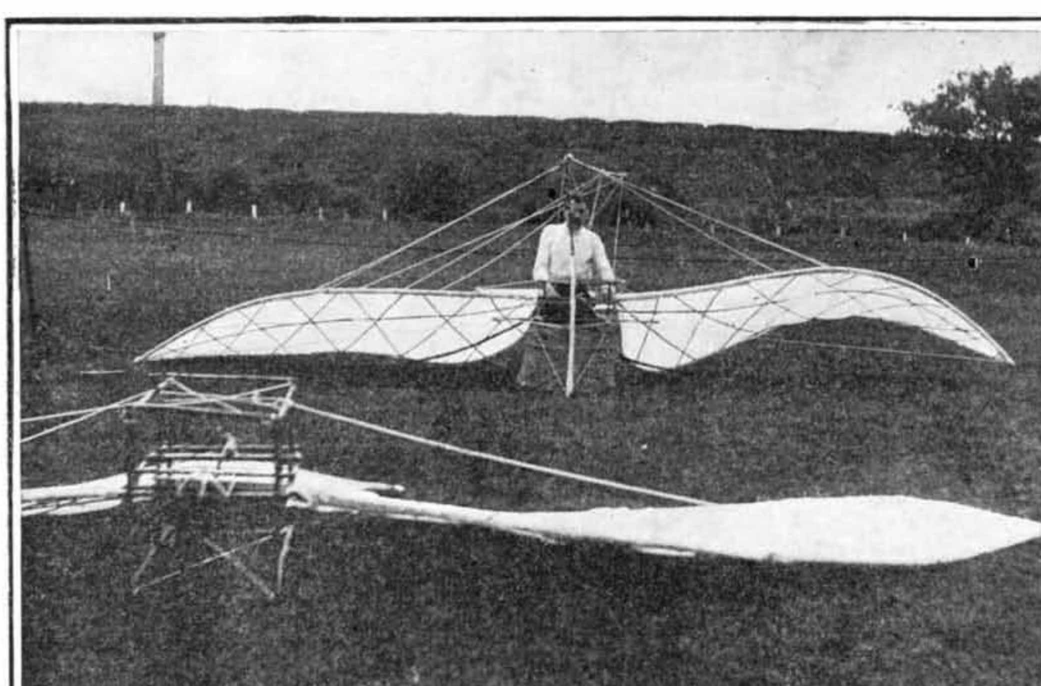

Fig. 1.—Two Pettigrew Wings.

Fig. 3.—The 160-Foot Tower from Which the Apparatus Was Launched.

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