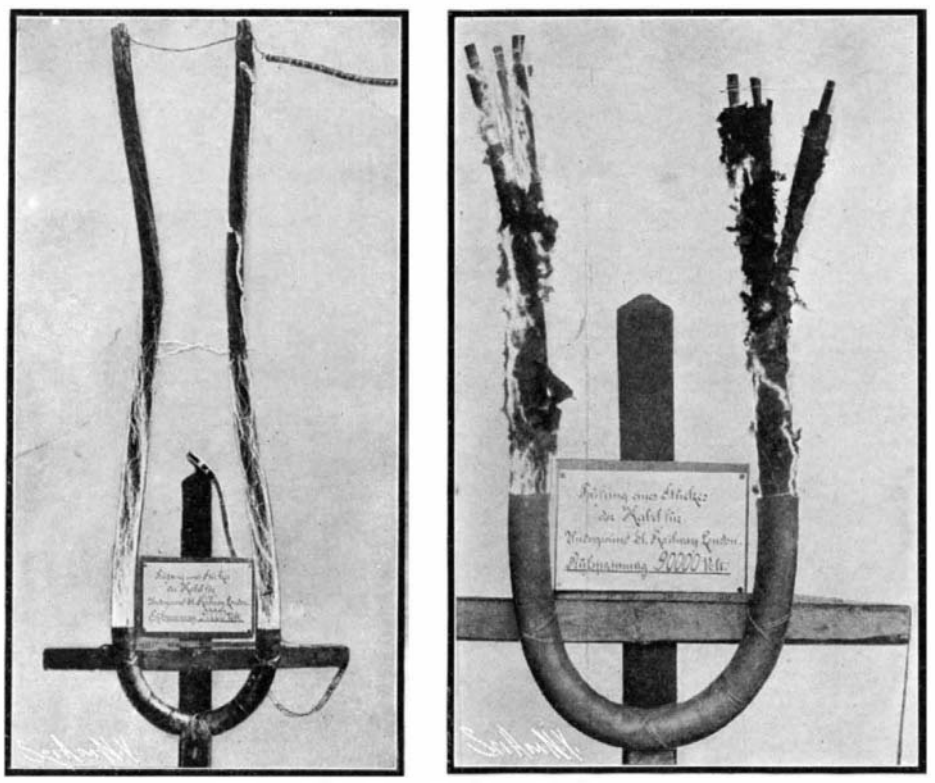
CABLES THAT WITHSTAND 90,000 VOLTS.

The distances to which the electric current is transmitted are continually increasing, and, with the distance, increases the tension of the current; but, with the tension, the insulating properties of conductors, and especially of cables, must also increase. Marked progress has been made in recent years in such insulation, and the best proof of this is the fact that some cables have recently resisted tensions of 90,000 volts. Such cables have been furnished by the Allgemeine Electricitäts Gesellschaft, of Berlin, to the Underground Railway Company of London. The cables are composed of three conductors, each having a cross section of 195 square millimeters. Each conductor is insulated by a layer of paper 11 millimeters (0.433 inch) in thickness, and the three conductors collectively are covered with a layer of paper 11 millimeters in thickness and an outer casing of lead. The diameter of the cable thus becomes 72 millimeters (2.834 inches). A cable of such length and thickness bent into a loop not exceeding five times the external diameter of the cable, should resist 33,000 volts. For testing the cables, the three conductors were placed under tension and the lead casing was grounded. The insulating material was not pierced at 90,000 volts. Some previous experiments showed that the upper layer of the insulator becomes heated so strongly and so instantaneously that the surface of the paper that covers the cores is torn, and that the tension does not pierce the insulation between the lead and the conductors. Paper is therefore an excellent insulator, but has the drawback of causing a loss of flexibility in the cable when the insulating layers have to be thick. This trouble has been remedied by adding to the material with which the paper is saturated a larger quantity of thick oil. The cable thereby becomes more flexible and the insulation still more efficient.



CABLE SUBJECTED TO 90,000 VOLTS TENSION.

THE PROGRESS OF AVIATION SINCE 1891.

Since 1891, when Lilienthal, after twenty years of calculation, experiment, and observation of soaring birds, made his first flight of 15 meters, aviators have been in possession of a method. The main difficulty is to start, as the aeroplane cannot be floated without considerable initial relative velocity. This Lilienthal acquired by running down hill against the wind. Between 1891 and 1896 he made more than two thousand flights, some of which exceeded 100 meters. If the wind freshened during the flight he was lifted, sometimes higher than his starting point, and could prolong his flight. He landed easily by raising his wings, as birds do, to check his forward motion. He omitted the motor as useless at the first stage, for he adopted the process of evolution and chose as his first model, not the intricate flight of the most adept fliers but the soaring of species like the flying-fish and the grasshopper, which are learning to fly.

Lilienthal proved that a slightly convex surface of 20 square meters, inclined from 7 deg. to 10 deg. to the wind and moving against it with a relative speed of 10 meters per second would sustain a total weight of 100 kilogrammes. He showed, too, that the problem of equilibrium is more difficult than that of motive power. The aviator, like a bicyclist or a soaring bird, is constantly engaged in regaining his lost equilibrium. Lilienthal did this by thrusting out his legs forward and laterally. In this unnatural exercise he acquired great skill which, however, did not prevent his falling to his death in 1896.*

The first of his followers, the Englishman Pilcher, used a similar apparatus, but raised it like a kite by means of a rope to which swift horses were attached. When high enough he gradually bent forward, loosed the rope and swooped down like a crow alighting in a meadow. He was killed in an attempt made in a storm in 1899.

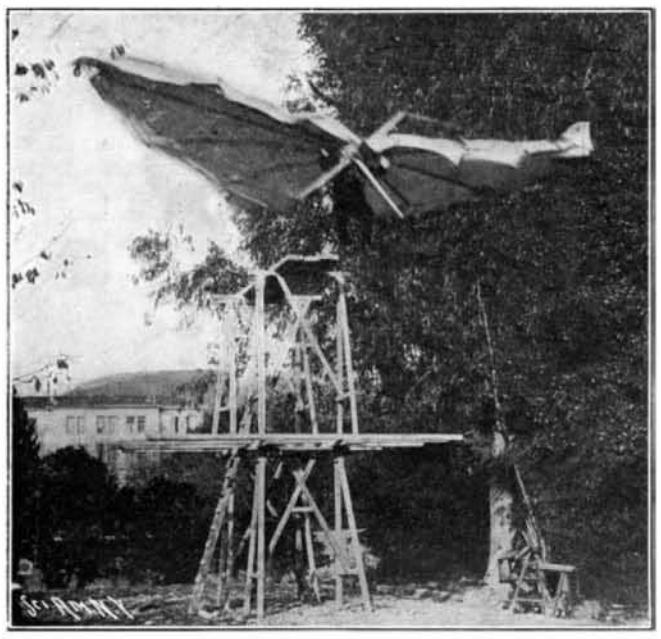
In 1896 Chanute, of Chicago, who had studied the theory of aviation and published an exhaustive history of the subject, made, with his assistants, Herring and Avery, a practical trial of the Lilienthal type of machine, but soon abandoned it on account of its instability and returned to his own plan of making equilibrium automatic by the use of several surfaces. In such an arrangement inclination forward causes increased pressure on the upper while inclination backward has a similar effect on the lower wings, the result in either case being to right the vessel. At first Chanute used five pairs of wings, but his final model contained only two parallel surfaces and resembled a Hargrave† kite moving sidewise. An elastic tail‡ favored equilibrium by increasing the moment of inertia and keeping the head to the wind.

(*Continued on page 262.*)

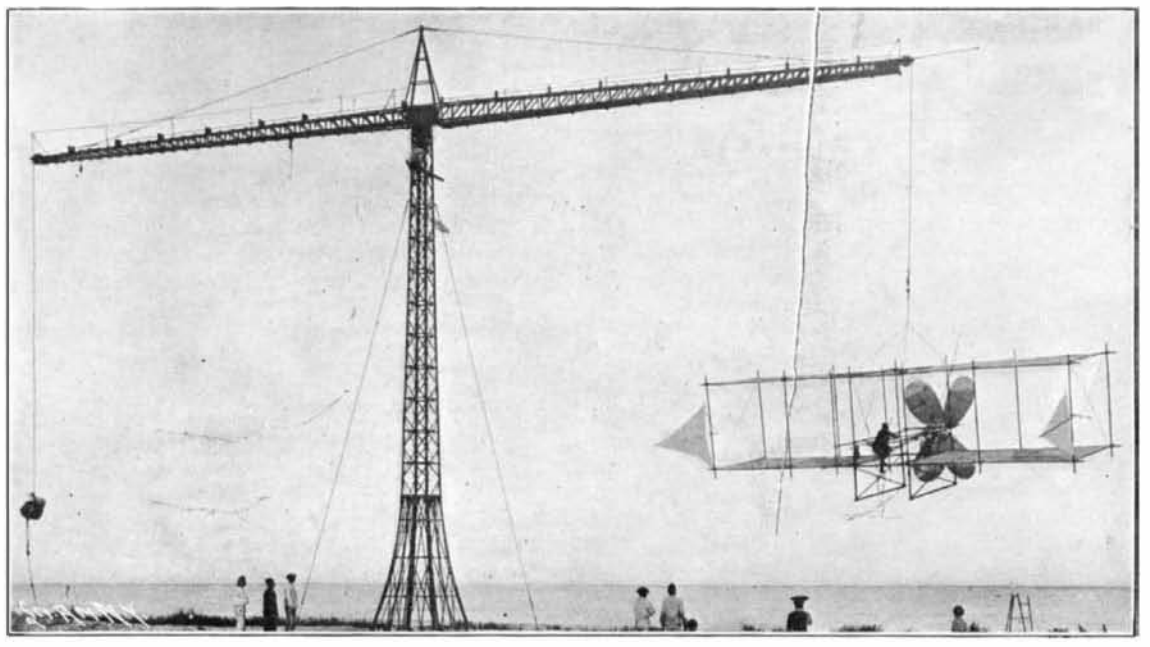
* Le Bris, a French sailor, derived from his observations of the albatross an idea identical with Lilienthal's. Adopting Pilcher's kite method of starting, he made some attempts in 1867, but poor success, accidents and lack of money forced him soon to abandon his experiments.

† L. Hargrave, of Sydney, Australia, inventor of the cellular kite and more than a score of successful aeroplane models.

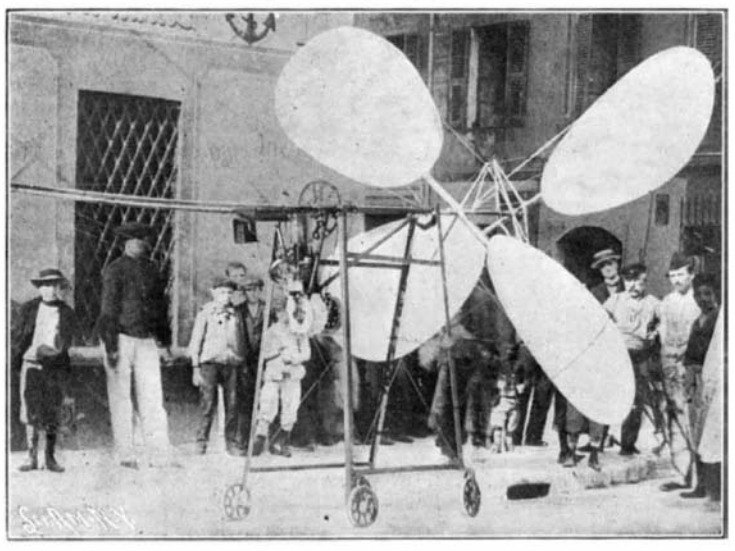
‡ Pénaud, in 1871, invented the first successful aeroplane with a flexible tail. He died in 1880 at the age of 30.



Capt. Ferber's Aeroplane No. 4.



Capt. Ferber's Aeroplane No. 6 Undergoing a Test.



The Motor and Propeller of Aeroplane No. 6, designed by Capt. Ferber.

A Flight That Ended in a Fall Because the Wind's Direction Had Not Been Considered.

THE PROGRESS OF AVIATION SINCE 1891.—CAPT. FERBER'S EXPERIMENTS.