

IMPROVEMENTS IN AEROPLANES

THE MOST EXTRAORDINARY point of aeroplane improvement during the past nine months, we are told by I. Ludlow in *The Scientific American Supplement* (New York), has been the universal adoption of nearly flat wing-surfaces. The 1911 model of the Blériot monoplane has wings that are warped but little, and those of his Gordon-Bennett racer are so flat that their curvature on the under side is barely perceptible. The experience of Blériot is typical of all. Deeply curved surfaces come into play only when an aeroplane which has small surfaces is volplaning. The theory that deep curvature is essential has been, in fact, discarded as powerful motors have come into use. There is now even a tendency to add a reverse curvature to the rear portion of the wings, just as the hull of a boat is rounded rather than square at the stern. Says Mr. Ludlow, in substance:

"The next remarkable development has been the placing of the center of thrust of the propeller in line with the leading edge of the wings. It is probable that this gives increased speed, as obviously a less proportion of air is thrown against the wings and fuselage. It is probable that this change also increases the natural stability of the monoplane, notwithstanding the fact that it raises the center of gravity. A high center of gravity has proved desirable in making turns. The best possible construction would place the hub of the propeller, the center of gravity, and the central longitudinal axis of the monoplane all on the same line.

"The rear tail has become flat and non-lifting. This has required a perfect balance of the main supporting surfaces. The tail has now acquired the function of the feathers of an arrow, viz., to give a fixt direction to the line of flight. The fault of the small rear supporting surface with its angle of incidence lay in the fact that, with increased speed, the tail had a tendency to rise in a very lively manner and to threaten to upset the longitudinal equilibrium. Blériot placed a reverse curvature on the horizontal rudder of his seventy-horse-power monoplane; but it is obvious that, in thus curing the defect, the monoplane's head resistance was increased.

"The minimum area which the rear vertical rudder can be made has been found to be about nine square feet. In most cases it should be at least twelve square feet. In making a turn the inner wing of the aeroplane is deprest and there is a definite tendency for the deprest side to drop still further, and for the aeroplane to take a course which becomes increasingly spiral until it finally overturns. Warping the wings, or using the ailerons, will not restore the balance unless the deprest wing can be speeded up by changing the direction of flight. Under these conditions a rear vertical rudder of adequate size is essential for safety. Many an aeroplane has been wrecked in flight because of its failure in this particular.

"Breguet discovered that placing two small vertical surfaces about eighteen inches square in his biplane directly under the upper surface, one each at the next to the outer upright from either end, gave good results in holding a straight course, in preventing a sliding movement toward the deprest side when making a turn, and in affording a good fulcrum against which the leverage of the rear vertical rudder might work. Alec Ogilvie used a like device in his Wright biplane in the Gordon-Bennett contest; Grahame-White has adopted this improvement on several of his biplanes, and Curtiss makes use of two diamond-shaped vertical surfaces in his front control."

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