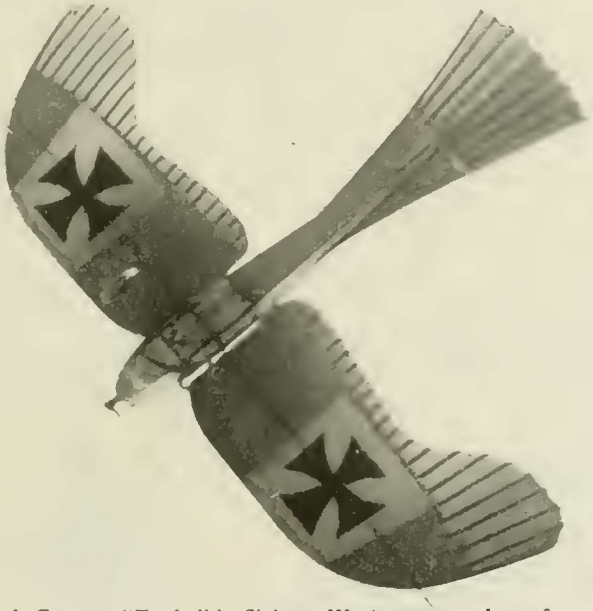
War Progress in Flying

By Carl Dienstbach

THE way aeroplanes were flown before the war seems almost ridiculous now, after men have really learned how to fly as the result of war's exigencies. The old way made them an easy prey for anti-aircraft guns and for attacking machines. When it became necessary to dart out of the range of a high-angle battery, which had suddenly revealed its presence with bursting shrapnel, or when only a quick maneuver could prevent a hostile machine from blocking the way home, the old-fashioned, steady, level flyer and slow climber proved a very death-trap.



A German "Taube" in flight. We hear less of Taubes now than we did at the beginning of the war. They were standardized machines, and the war upset all preconceived aeroplane standards

Looping-the-loop, caper-cutting, all the acrobatic performances that attend exhibition flying became normal evolutions. Only excess power for a sudden burst of speed and climbing would avail in a perilous moment.

A fast-climbing machine, which also has the virtue of exhibiting great lifting power in the thin air of high altitudes, naturally vaults into the air easily in a difficult start on rough ground. In a critical landing—when, for instance, the ground, which, from above seems invitingly smooth, turns out to be alarmingly rough—the fast-climbing machine can easily stop its swift descent and leap lightly over an obstacle. By reducing his power while the machine is flying at a steep angle, the pilot may even touch the ground at a very low speed.

Salvation Lies in High Power

A machine thus able to deal with rough ground is most stable in rough air. An aviator fears what he calls a "hole in the air"—a pocket formed by a downwardly-twisting current. Into such a hole he drops in a sickening way because his wings no longer have an upward blast to support them. He saves himself, not by trying to climb out—a useless proceeding—but by *steering downward*, thus increasing his speed and likewise the pressure beneath his wings. "To go up, one must sometimes steer up, at other times steer down," Wilbur Wright told me in his little insignificant bicycle shop in Dayton, Ohio, in 1905, in discussing the low-powered Wright machine.

Evidently the aviator needed power to combat these difficulties. This he obtained by resorting to surplus-powered and reserve-powered machines. There would seem to be no distinction between the two terms, but the difference is this: the surplus-powered machine has a motor which is more than able to make it fly and the excess power of which is constantly used for normal flight; the reserve-powered machine uses its excess only in an emergency.

In the surplus-powered aeroplane, "steering down to keep up" is not a praiseworthy maneuver. A pilot cannot possibly know how far the "hole" or local descending current extends and whether he will not plunge into the ground before he gets out of it. But with the reserve-powered machine, it is otherwise. When it steers up, it goes up—always; and what is still more important, it goes up instantly. The words "goes up" do not apply literally. They should read, "keeps up." A heavy machine cannot go up instantly on account of its inertia, but it can as instantly increase its lift as it can turn on full power and put its surfaces at a steeper angle. To steer down in order to keep up was relatively a *slow proceeding*, because even with the aid of gravity inertia cannot instantly be overcome. But with reserve power there is no need to overcome inertia, and the remedy can be applied at once.

With these explanations in mind, we understand why Europeans speak as they do of some dead officer who "lost his life because he attempted to imitate champions on high-powered machines with a weak machine."

The Germans had drawn somewhat too hasty conclusions as to the best type of a military aeroplane and had standardized it. The French simply enlisted all their current sporting types for army use, types which were inferior in long-range scouting, demanding, as it does, only reliability and sturdiness in normal flight, for which the Germans had provided at the war's beginning. But the French machines were better for aerial fighting, which has about as much to do with steady, normal flying as a free-for-all fight with walking in a procession. The new art of flying had to be learned in aerial duels, just as a boy is taught to swim by the simple process of throwing him overboard.

154

Maximum strength, minimum weight and least head-resistance are best attained by the aeroplane that has its propeller in front of a boat-body. But the propeller in front impedes observation. It also interferes with the operation of a machine-gun. Biplanes, such as this one, have been designed with the object of overcoming these military objections

This British military aeroplane is of the latest type. And yet how similar it is to the crude, early machines of 1908. There are only two striking outward signs of improvement: the streamline boat-body enclosing everything and minimizing head-resistance, and the solid inflexible appearance of the wings, due to the invention of enamels which strengthen and shrink the cloth covering and make it as smooth on both sides as Japanese lacquer

Daily encounters in the sky prove conclusively enough that flying has been as thoroughly mastered as horseback riding. In neither can any attention be paid to handling the machine. There are too many other very important matters to think about. The machine must respond to any subconscious action of its rider as obediently as a cavalry horse, so that its guidance becomes as much a matter of subconscious action as that of a warhorse. Accounts of air-duels read, in fact, as though fighting aeroplanes were under better control than cavalry horses. To place a shot at close range in these wild swoops, without being hit, can be compared only with fighting a saber-duel while jumping hurdles. The fastest French and British machines were found to be the most formidable fighters. Hence they were imitated (and fatally bettered) by the Germans and Austrians.

And Yet, the Aeroplane Is Unchanged

It is surprising how little the general appearance of the aeroplane has changed during its entire history, in spite of its marvelous development. Only the automatically stable types, distinguished by their backwardly-turned wings and upturned tips are an exception. But the aeroplane is such a simple device (and has been found best in its simplest forms) that the phenomenon is easily explained. There are only two striking outward signs of improvement: the streamline boat-body, enclosing everything and minimizing head-resistance, and the solid, inflexible appearance of the wings, due to the invention of enamels which strengthen and shrink the cloth covering and make it as smooth on both sides as Japanese lacquer.

Maximum strength, minimum weight and least head-resistance are best

Before the war, only two or three machines in an endurance contest, in which perhaps twenty aeroplanes were entered, reached their destination. But now we hear of flocks of fifteen flying from Calais to Karlsruhe on a bomb-dropping expedition and returning safely, Surely the war has taught us much about flying machine construction

attained by the aeroplane that has its propeller in front of a boat-body. Thanks to the tractor-screw the biplane has developed as much speed as the monoplane. It is even preferred, since its greater surface gives more lift in emergencies. Unobstructed vision in front is often so desirable that the propeller is sometimes placed behind the surfaces and the boat-body shortened, in spite of the increased head-resistance and decreased strength of the design with the rudders carried by poles. A beautiful solution of the problem of free vision is obtained in large passenger-carrying machines, with the long bodies of which rudders are integrally combined, two tractor-screws and two separate motors being mounted on both sides of the main body. It is then essential to enclose the motors in separate bodies. In the big German battleplanes, the motor bodies are long and carry the rudders. Even such designs waste a certain amount of power, because a catamaran has always less speed than a single boat. But multiple bodies and division of load across the span of the planes is the only method by which large aeroplanes are enabled to carry many passengers and to exhibit that strength which it has taxed all the ingenuity of the scientific engineer to obtain even in the smaller machine.

Has the Big Aeroplane Come to Stay?

Mammoth aeroplanes are at present a spectacular development, especially in America. But it would be premature to include them in a seriously critical review of the aeroplane of to-day. In the main, they have not yet justified themselves, although some of the big water machines of Curtiss, are said to be in frequent use. But there are no accounts of their performances under very critical air conditions, when their relative lack of strength would be a very serious matter, judging from the experiences of similar smaller machines. What recommended them is not economy of performance (because they carry relatively less per square foot of surface than smaller water machines) but the improved facilities offered for navigation, comfort for long trips, and the advantage that one pilot can transport many passengers. They are also required, whenever a great radius of action is demanded, which can be obtained with aeroplanes only by cutting down the passenger list and carrying more fuel instead. In a small machine, this would mean amputating the alighting gear.

The difficulty of starting and alighting with a mammoth plane is serious. The impact of the heavy mass is too much for its strength, especially for the landing wheels, which have to be made very bulky and clumsy, consequently wasting power in air-resistance. Transformed into a flying boat the mammoth machine becomes more practical, because the hull partakes of all the naval advantages that follow with increased size. Strains to which they are subject from gusts must be formidable. But no technical accounts of their behavior in the air have been published.

Air-fighting is fully as romantic as ever were the deeds of Homer's heroes or Cooper's Indians; for this is the day of personal prowess in air-fighting. We need not dwell solely on the exploits of such German supermen as Immelmann and Boelke (each with a record of at least fifteen victories). Neither superiority of numbers nor of machines cuts much of a figure if it is matched against a certain mysterious personal equation, which cannot as yet be completely analyzed. It may be safe to say that rapid, masterful marksmanship plays in it no small part. It would be indeed a rare coincidence if this ability were likewise found combined with exceptional talents (like Pégoud's) for managing an aeroplane. If that be the case it is obvious that a fighter and flyer in one person must be more formidable than the co-operation of a mere flyer and a mere fighter. We need only imagine two cavalrymen on the same horse, (assuming that they could be accommodated together as perfectly as two flyers on a machine) of whom one wields only the lance and the other manipulates the bridle. How should they communicate their respective intentions in fractions of a second?

But this holds good only in regard to small powerful racing machines which fight wasp-like at close range.