

MONOPLANE FAILURES.

M. BLÉRIOT'S DISCOVERIES AND REPORT TO THE FRENCH GOVERNMENT, WHICH HAS CAUSED THE FRENCH WAR MINISTER TEMPORARILY TO SUSPEND THE USE OF MONOPLANES BY ARMY OFFICERS.

BELOW we give a translation of the text of what is perhaps one of the most important documents dealing with the technical side of aviation that has yet been prepared. It is the communication of M. Blériot to the French Government, which resulted in the issue by the French War Minister of that startling order to suspend the use of monoplanes in the French Army, which was only made known in the daily Press this week. That it should have been written by the pioneer designer of monoplanes and should form such a frank and lucid *exposé* of a hitherto unsuspected weakness in such machines, is the finest possible vindication of the Etablissement Blériot as a scientific concern. It would be difficult indeed to over-estimate the importance of M. Blériot's conclusions, and no reader of his argument but will extend the greater appreciation to the author in that he of all those who have tackled the problem should have been the first to present what would seem to be the true solution.

True or not, however, the fact remains that the French Army are having all their monoplanes re-trussed above the wings to resist the top loading that M. Blériot describes in his report, and it follows as a natural consequence that no designer can henceforth regard it as proper to suppose that the upper guys have only to support the dead weight of the wings. Likewise it follows that all monoplane users will proceed forthwith to have their wings re-trussed accordingly.

M. Blériot's Report.

The death of Lieut. Sevelle was not, as have been so many preceding calamities, useless to the cause of aviation. It has brought to light a new conception of the forces to which aeroplanes are subjected in flight. It has come to explain the series of mysterious accidents that have overtaken Chavez, Blanchard, Lantheaume and Ducourneau.

Up to the present no one has admitted that the wings of monoplanes can carry top-loading (*puissant travailler de haut en bas*). After Chavez's death, witnesses affirmed to having seen the wings fold down beneath the machine. No one heeded their words, regarding them as the outcome of an optical illusion; meanwhile the wings (of monoplanes) were strengthened once more. Then came Blanchard's death, followed by a second reinforcement of the wing-spars. Following upon that came the death of Lantheaume, which caused a military commission to decide that the wing spars should be strengthened yet a third time, and it was with these newly reinforced wings that Lieut. Sevelle met his death.

Alas, it was not the weakness of the wings that caused these accidents. These four deaths occurred under similar circumstances; the machines had remained for a long time in the air amid most violent *renoués*. Chavez had crossed the Alps. Blanchard had journeyed from Orleans to Paris. Lantheaume had just finished a flight of 50 kilometres, and Sevelle a flight of 2 hours 10 minutes duration. Their machines had resisted perfectly the buffeting of the wind, when suddenly, as they (the pilots) proceeded to descend by *vol's planés*, the wings, which carry very little positive loading at this time (*travailler très peu de bas en haut*), broke and doubled up.

I do not speak of Lieut. Ducourneau's accident, for that constitutes the first occasion on which the upper guys (*haubans supérieures*) were broken, and is probably due to an analogous cause.

In Lieut. Sevelle's machine the four upper guys were completely cut through.

All the-e accidents having resulted in the same conditions led to the idea that the wings must be forced from above, and had to resist pressure acting vertically in a downward direction.

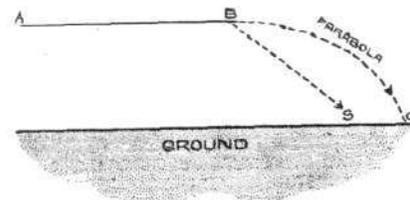
Then it was that I realised how the momentum of an aeroplane flying in a straight line, and made suddenly to descend by a *vol bique*, would reverse the loading on the wing (*faire travailler l'aile à l'envers*), and now this phenomenon cannot be doubted by any who care to analyse the problem.

A machine moving horizontally will, when the motive power is diminished, descend by a parabolic path, which will be longer in proportion to the initial speed. If, by a strong movement of the elevator, the pilot transforms the trajectory into a straight line slanting at a steeper angle towards the earth than the parabola, the machine is immediately subjected to a force from above (*pris par dessus*). In order that it (the machine) should make this descent to earth, which takes place more rapidly than that resulting from the gravitational influence of its own weight, a downward force must act upon the wings.

The diagram herewith shows that, if the pilot is moving horizontally in the direction AB, and at the point B throttles his engine without touching his elevator, he will follow a natural parabolic trajectory, BC.

If, on the contrary, at the point B he suddenly uses his elevator in order to descend in the direction BS, of which the slope is greater than its small angle of incidence (*dont l'inclinaison est plus grande que son petit angle d'attaque*), it is evident that, in order to overcome the momentum of his machine, he must apply a force on the top of the wings, and at the same time of course this will stress the upper guys.

It is then the change from the direction AB to the direction BS that causes the danger to the pilot and not the *vol piqué* itself,



which if performed slowly and progressively presents no objections.

There is no longer room for doubt that the deaths of Chavez, Blanchard, and Lantheaume were caused, not, as has been believed up to the present, by the breaking of the wings, that have withstood their trials and tests of *positive* loading successfully, but by the failure of the upper-guys, which have no strength to resist these forces coming from above.

It is therefore necessary to test monoplanes with a top loading on the wings, so as to obtain a system of upper bracing that will be of corresponding strength to the lower bracing now in use.

It is to be regretted that four deaths should have been required to pave the way to this solution, which must completely modify the design of aeroplanes.

What shall be the new factor of safety for these new forces? We estimate that, theoretically, the resistance of the upper guys may be less than the under guys.

In practice, allowing for the rare occasions on which the upper guys are stressed, we can allow, for a factor of safety of five with the lower guys, a factor of safety of three for the upper system.

This relationship of momentum and live-load on the machine also causes the factors of safety to change according to the speed of flight.

In effect, the momentum is proportional to the square of the speed; consequently, if we allow a factor of safety of 5 for a machine incapable of exceeding a speed of 100 k.p.h., it is necessary to give a f.s. four times as great, viz., 20, for the guys of a machine flying at 200 k.p.h. This explains how it is that accidents have not happened to machines that have much smaller factors of safety, but do not exceed 60 k.p.h.

In the matter of momentum, it would seem that a machine capable of 60 kilom. per hour and having a factor of safety of 3.6 will be as strong as a machine flying at 100 k.p.h. with a f.s. of 10.

Again, it is necessary to enquire if the pilot's own body can resist the sudden shocks that are the immediate outcome of those factors, and I feel certain that a man seated cannot resist a shock directed from beneath upwards of a magnitude greater than twice his own weight without being immediately upset; and it is probable that he cannot resist a vertical upward force exceeding that which will stress the wings of his machine to a factor of 5 or 6, without serious inconvenience to his internal organs.

It is, then, necessary not to fall into the error or exaggeration in respect to these factors. Their proportion must be subordinate to the physical resistance of the pilots, who withstand, by shock on their bodies, the momentum effect, which is proportional to the altitude. (This is only meant to apply to rigid machines like those in actual use.)

These new conceptions must sensibly modify the conditions of the acceptance of flying machines and will tend considerably towards safety.

(Signed) L. BLÉRIOT.

These last two paragraphs being somewhat vague in their meaning, we give below the original French:

"Il y a donc lieu de ne pas tomber dans l'exageration des co-efficients. Leur taux doit être subordonné à la résistance des pilotes qui subissent par répercussion, dans tout leur corps, des efforts d'inertie qui sont proportionnels à leur élévation. (Ceci n'est vrai bien entendu que pour les appareils rigides comme les appareils actuels.)

"Toutes ces nouvelles conceptions doivent donc modifier sensiblement les conditions de réception des appareils d'aviation et vont faire un pas considérable vers la sécurité."