THE AEROPLANE PAST PRESENT AND FUTURE

CLAUDE GRAHAME-WHITE
& HARRY HARPER

THE AEROPLANE

C. Grahame-White

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PAST, PRESENT, AND FUTURE,

BY

CLAUDE GRAHAME-WHITE
(Winner of the Gordon-Bennett International Aviation Cup, 1910)

AND

HARRY HARPER

WITH NINETY-THREE ILLUSTRATIONS

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PREFACE

The policy in preparing this book has been simple—to give information likely to be useful and interesting, and to induce experts to write sections upon subjects, regarding which they are the best authorities.

Only one who follows events attentively from day to day, can now realise the extraordinary rapid strides which aviation is making.

This book—and notably such features of it as the list of the world's airmen, and the records of the chief flights made—may, we hope, bear testimony to the astonishing growth of flying, and particularly to the energy and enthusiasm of those engaged in its development.

For placing at our disposal a magnificent set of photographs, we wish to thank most heartily the proprietors of the *Daily Mirror*. Permission to reproduce four of the most remarkable photographs ever obtained, those illustrating the fatal accident to Laffont and Pola at Issy-les-Moulineaux, was very courteously granted us by the Gaumont Co., Ltd., Sherwood Street, Piccadilly Circus, W. For photos of the Paulhan biplane, we are indebted to the Topical Press Agency, Ltd.

CLAUDE GRAHAME-WHITE.
HARRY HARPER.

CONTENTS

LIST OF ILLUSTRATIONS

PICTURES ILLUSTRATING ACCIDENTS

PICTURES ILLUSTRATING INTERESTING INCIDENTS

TWILIGHT PHOTOGRAPHS

PICTURES OF PERSONALITIES

PHOTOGRAPHS OF GENERAL INTEREST

THE AEROPLANE

SECTION I

THE PIONEERS OF FLIGHT

BY MR C. G. GRUNHOLD

In this section, Mr Grunhold, a prominent member of the Aero Clubs of France and England, seeks to make interesting the story of the past. An earnest student of the beginnings of flight in France, he had the unique experience of actually witnessing himself the first historical flights of Santos Dumont, Wilbur Wright, and Henry Farman, and also the gliding experiments of the late Captain Ferber.

I

I COUNT myself a fortunate individual indeed—in these amazing modern days of aeroplane progress—that I can throw my mind back and remember having seen, in all their wonder, those first, brief flights of such early masters, and pioneers of aviation, as Santos Dumont, Wilbur Wright, and Henry Farman—to say nothing of the extraordinary interesting gliding experiments of the late Captain Ferber, who did so much to further flying in France.

Which of these first experiences of power-driven flight made the most lasting impression upon my mind? I think it was the winter evening upon which I saw Wilbur Wright make one of his first flights in France. And so I shall try and clothe the past with some reality and interest by describing what I saw.

First of all, in order to make this reference complete, I will be historical for a moment. Wilbur and Orville Wright started their first aeroplane experiments at Killdevil Hill, near Kittyhawk, North Carolina, where they lived in Spartan-like simplicity, housed in a tent or wooden shed, cut off from the rest of the world—inspired, absorbed, and determined to solve the great problem of flight.

Their early experiments were made with an aeroplane constructed by Chanute. It consisted of two planes only, and the first addition which the Wrights made to M. Chanute's primitive construction was a forerudder, for the purpose of regulating the rise and fall of the machine.

After frequent experiments of this nature, they added a vertical rudder, and with this addition they succeeded in describing a turn of a quarter of a circle in 1902.

All these experiments, which were of a gliding nature, were accomplished by starting from the top of a dune, the operator lying at full length, face downwards on the under plane of his machine. They succeeded, during these experiments, in flying 600 feet. The two great lessons that they learned during their trials, were the difficulty of retaining their equilibrium in the air, and the inexactitude of existing tables dealing with the pressure of the air.

Their first flight with an aeroplane, driven by a motor took place on December 17th, 1903, when they succeeded in flying 260 metres in one second less than the minute, against a wind, driving their machine at the rate of 32 kilometres an hour. They used an aeroplane driven by a 16-h.p. motor, and having a surface of 48 square metres. After these experiments, the movements of the Wrights were for a time wrapped in mystery.

They once again came out of their shell at about the end of 1905 when, in a letter to Captain Ferber, who was acting on behalf of the French Government, they expressed their ability to construct machines capable of carrying more than one person, and stated their readiness to undertake trial flights over a distance of at least 40 kilometres.

After experimenting at Dayton, Ohio, and elsewhere, and perfecting their biplane, Messrs Wright entered into commercial relations with the Lazare Weiler Syndicate, at the head of which was Mr Hart O. Berg.

We now find Wilbur Wright on this side of the "herring pond." His early experiments commenced on the racecourse at Hunaudrieres, near Le Mans. But let us follow him to the Camp d'Auvours, the artillery range near Le Mans, where the greatest of his early achievements took place, and where I gained my personal knowledge of the first "man-bird."

Before I actually describe what I saw of Wilbur

Wright's flying, the appended little table, showing their progress in the art, may be interesting :—

Year	Best Flight
1903	59 secs.
1904	5 mins. 17 secs.
1905	38 mins. 13 secs.

One day in December, 1908, at the Aero Club of France, I assisted in welcoming Colonel Massy, and a deputation of Britishers interested in aeronautics, amongst whom were Alec Ogilvie and T. P. Searight.

The rumour was circulated that Wilbur Wright would make a flight on December 16th; so it was decided that a pilgrimage should be made to the Camp d'Auvours. I crossed over to the other side of the Champs Elysees, and called on Mr Hart O. Berg, who most courteously gave me all the requisite information regarding Wilbur Wright's proposed flight.

Colonel Massy, the leader of the little British contingent, decided that we should leave for Le Mans by an early train to be in good time for the flights, which were expected to take place about 10 o'clock in the morning. It *was* early—5.55 a.m. from the Gare de Montparnasse, to be precise.

Travelling by a slow train in France is not enjoyable. The journey, which should have lasted about three hours, took nearly seven. We experienced the extreme annoyance of being shunted into a siding to allow a train to pass us which had left Paris three hours and a half later than our own. But the truth of the old saying, "A merry heart goes all the way," was proved by the state of good humour in which we were kept by Colonel Massy, who possesses, together with the qualities of a soldier, and sportsman, all the charm of the cheery and ready-witted Irishman.

Champagne, at last! The town, I mean, not the wine. Here we found the motor-cars for which we had wired overnight, waiting to take us to the flying ground. Here, upon our arrival, we learned that Wilbur Wright most probably would not fly, as, through the neglect of someone, alcohol had been poured into his tank in mistake for petrol.

Messages reached Mr Wright, however, that a party of Britishers had travelled down specially from Paris to see him fly; so, with the generous instinct of the sportsman, which is one of the principal charactertistics of this truly exceptional man, he decided that we should not go back disappointed. He ordered his tank to be emptied of its undesirable contents; and we were told that Mr Wright, who was lunching at the moment, would make a flight during the afternoon.

I learned afterwards that it had been his intention to make an attempt for the altitude prize that morning; so, had it not been for the mistake above mentioned, I should have been deprived, through the delay of our train, of witnessing the most impressive and fascinating experience of my life.

By this time the tank was empty. We readily followed our guide over to Wright's hangar. It was a simple shed, built of boards, one corner partitioned off like a loose box, furnished only by a truckle-bed in the corner, a bicycle, two chairs, and a common little deal table.

When I asked, afterwards, why Wilbur Wright slept there, under conditions minus all the comforts of modern life, I was told that he had to keep an eye on his beloved aeroplane. I believe that his affection for his aeroplane resembled that of a parent for his child.

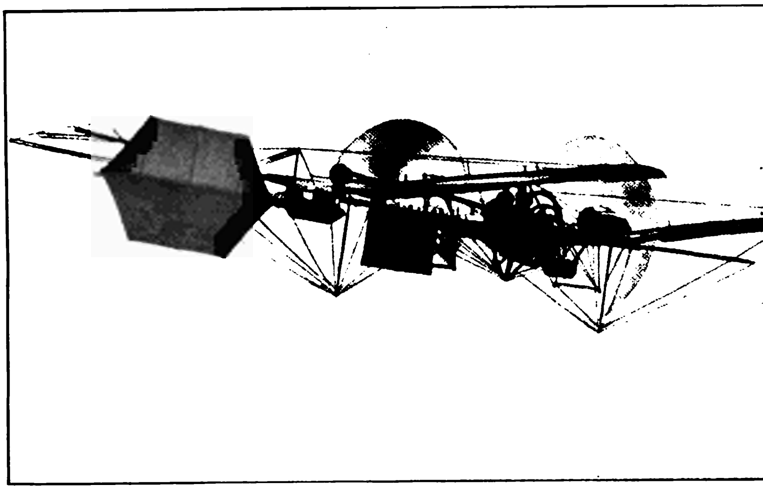
Afterwards, we strolled across to where the aeroplane rested on the rail, and examined Wright's great inanimate bird, the achievements of which have been sung in the four quarters of the globe.

I think that what struck me most was the apparently simple mechanism, the crudeness of the materials employed in its construction, and the rough-and-ready way in which they had been put together.

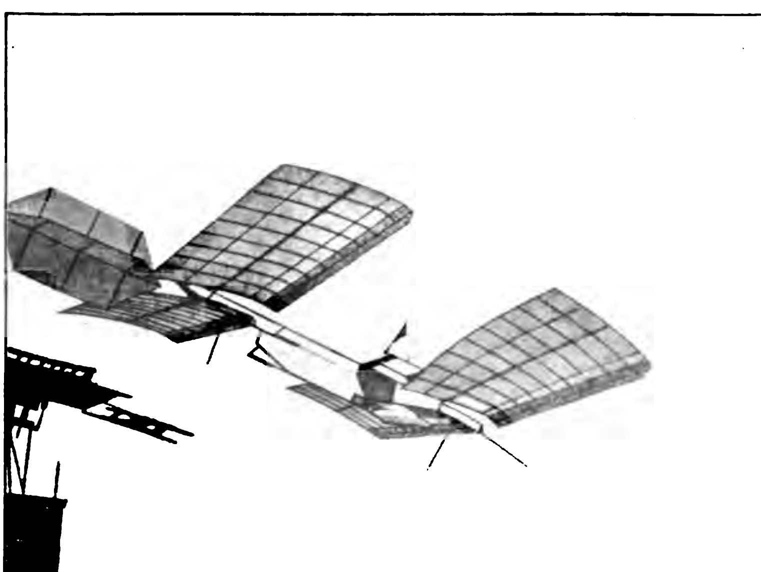
I had always taken it as a *sine qua non* that the surfaces of the plane should be absolutely airproof to ensure resistance, but that this idea was a fallacy was proved by a rent in the under plane, large enough to put your hand through; and, here and there, the loops employed to attach the canvas of the planes to the framework were missing.

In fact, in one place, a portion of the canvas was attached by what looked suspiciously like a bootlace. I mention these facts about the appearance of the greatest mechanical contrivance of the age to show that Wilbur Wright was above the considerations of the showman—and this is a proof of true greatness in an inventor.

Presently someone remarked, "*Voila qu'il vient!*" and a minute or two after we were joined by the great man himself, with his gaunt form, weather-beaten face, and piercing, hawk-like eyes.



PROFESSOR LANGLEY'S FIRST MONOPLANE.



PROFESSOR LANGLEY LAUNCHING ONE OF HIS MODEL AEROPLANES FROM A HOUSE-BOAT.

Everybody has read descriptions of Mr Wright's modesty, and so forth, and I need not, therefore, dilate upon it. I will content myself with repeating an utterance of his, which is an excellent indication of his character: "The only birds that talk are parrots, and they are not birds of high flight."

I was greatly struck with the extreme caution exercised by Wilbur Wright to insure every part of his machinery being in working order. For instance, before mounting the seat, he personally inspected the vulnerable points of his aeroplane. Then, being already seated, I heard him inquire of one of his mechanicians—"Is that tap shut off? Are you sure that tap is shut off?"

And then, to make assurance doubly sure, he dismounted and personally satisfied himself that the tap *was* shut off. I mention this as a proof of his thoroughness, and that Wilbur Wright was a man who took no unnecessary risks.

He again mounted to the pilot's seat, taking hold of the levers working the rudders. The motor was set in motion, the two propellers, revolving in opposite directions, were started. He called out the word "Go!"

The lever of the starting derrick was pulled, the weight dropped, and the aeroplane glided forward, rapidly gaining momentum from the action of the propellers. The pilot, having reached the end of the rail, detached the runner, raised the elevator, and the aeroplane buzzed into the air.

The first flight I saw him make, he flew round the ground at a height of about from 25 to 30 metres, rising, falling and turning at will, and returning to earth with the greatest ease. Whereupon, we all gathered round him and expressed our congratulations, to which I believe he was utterly indifferent—only he was too good-natured to show it.

On the second flight, which I witnessed, a successful start was made, and the aeroplane gradually rose to a height of 70 metres, gazed on with ever-increasing admiration by the enthusiastic crowd.

The scenic conditions under which this flight was made left a most delightful impression in my mind. It was past 4 o'clock; a darkening veil was falling on the wintry landscape, which one of our companions, the Tika of Kapurthala, said reminded him of an Indian jungle scene.

The rays of the setting sun tinged the western sky with shafts of purple, red, and gold. The outline of the great man-eagle, circling round above our heads, stood out black against the sky.

Suddenly he soared to an altitude of 300 feet, and poised for a moment; then, like a hawk, he swooped down to a level of about 200 feet. Again he soared; then, amidst the enthusiastic applause of the spectators, he glided gracefully to earth.

II

I will now relate my experience of seeing M. Santos Dumont fly at Bagatelle.

This Brazilian millionaire, after showing great enterprise and daring with balloons and dirigibles, turned his attention to the heavier-than-air principle.

His first attempt at flight was with a biplane glider. His method for gaining momentum was by means of a motor boat, which he used on the river Seine. The machine was fitted with floaters. He soon abandoned this amphibious construction, however, for a power-driven machine.

In 1906, with his first attempt at mechanical flight, he once more showed his preference for the gas-bag, by attaching the aeroplane to his No. 14 balloon, with the idea of helping the flying machine to make a start. The balloon, far from being of assistance, however, was but an encumbrance, and was soon dispensed with by M. Dumont.

At a lecture on air-currents, given by my friend and mentor, M. Marcel Deprez, of the French Academy, in October, 1906, the rumour was circulated that Santos Dumont was to make an attempt to gain the "Archdeacon Cup" within the coming week.

So, on the afternoon of the memorable 23rd of October, we hied us down to Bagatelle, where we found the aviation committee of the Aero Club de France. The little crowd was in high expectancy.

The distance to be flown was 25 metres. We waited for an hour or so, inspecting, but chiefly criticising, the great box kite—with all humility, none the less. I must admit that I was one of the croakers, for the general flimsiness of the construction suggested to me that it would be at the mercy of the slightest ground current.

We began to look at our watches; the cold, damp air of an autumn evening was beginning to roll up from the Seine. Suddenly a shout went up.

Santos Dumont, who had just before mounted the machine, started the 50-h.p. motor.

The aeroplane ran for a few yards along the ground. Then, suddenly, it rose; steadily it flew, for about 40 or 50 metres, and continued on a level keel for another 10 metres.

As it advanced, however, the aeroplane became less stable, and after flying 60 metres it rocked visibly. Santos cut off his ignition at once, and his descent was distinctly abrupt. But what did a broken elevating plane and a couple of wheels matter in such an hour of victory?

A power-driven machine had flown, and Santos Dumont had flown it. As for myself, my feelings of penitence, for having only the minute before adversely criticised his construction, did not prevent me from cheering my loudest, and wringing the great little man's hand in heartiest congratulation.

That this success exceeded the expectations of even his most fervent followers, was proved by the fact that the aviation committee were so taken by surprise that they failed to check the whole distance of the flight; and he was only credited with 25 metres, the bare distance specified to capture the Archdeacon Cup.

Santos Dumont's triumph was most popular, for he held the sympathy of all who knew him. The appended table summarises his achievements at this time :—

October 23rd, 1906.—At Bagatelle, he flew for 80 yards. His machine weighed 600 lbs. The motor weighed only 130 lbs. Machine ran on cycle wheels.

November 12th, 1906.—Flew 160 yards in 5½ secs. Then made two or three short flights of 40 and 50 yards. Followed this up by creating a "world's record" flight of 230 yards in 21 1-5 secs., at a speed of 25 miles per hour.

His aeroplane work since those days, notably with the tiny "Demoiselle" monoplane, is well known.

III

One name should be written in letters of gold when the complete history of aviation comes to be written—that of the late Captain Ferber, of the French Artillery, who gave up his life for the art he loved.

How well I remember, on the dunes of Berck-sur-Mer, about Easter-time, in 1904, watching, with a curious eye, the gallant Captain Ferber, with M. Voisin, and another whose name I cannot recall, dragging their gliders, which appeared to me to be high box-kites, to the top of a hillock from which, with a push-off, they would glide into space.

After soaring for about 20 metres, more or less, the would-be flyers came down, as a rule, with a bump, often to be picked up thoroughly shaken and occasionally bruised—but never dismayed!

Captain Ferber was first inspired by reading of the exploits of Lilienthal, in 1898. He came to the conclusion that if the German engineer had not perfected mechanical flight, he had at least hit on an excellent method by which man could learn to float in the air. Ferber once made the statement to me that, in his opinion, the possibility of man flying dates from the day in 1891, when Lilienthal soared fifteen or sixteen metres.

Captain Ferber started his flying career with gliding, *á la* Lilienthal. His first glider weighed 30 kilos, having a plane surface of 25 metres. It was tested at the Chateau de Rue, in Switzerland, in 1899. Number 2 was about a third smaller in size.

Before attempting to glide with this, he sent it up as a kite, and discovered that, although possessing certain stability, its shape offered too much resistance to the air—thus impeding progress. It absolutely turned turtle during experiments at Fontainebleau.

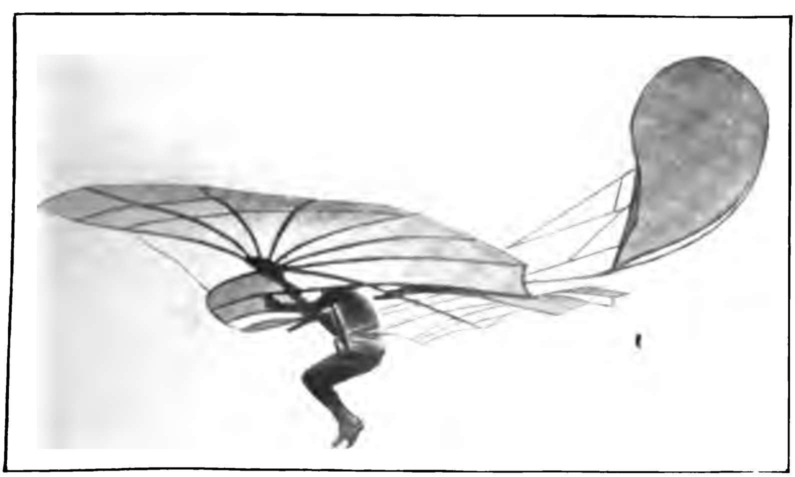
With his No. 4 machine, Ferber conceived a new means of launching the air-craft. On December 7th, 1901, he jumped off a platform, erected on a scaffold, five metres high, the end of the platform acting as a spring-board. He covered a distance of 15 metres in the air, and affected an easy and comfortable landing.

This little experiment lasted only two seconds, but it sufficed to demonstrate that the time was just double that which a man's body would have taken to descend to the ground, if precipitated into space without any sustaining appliance whatever.

I suppose the most elaborate paraphernalia ever devised for launching air-craft was the starting-tower, on the cross-tree principle, erected by Ferber.

The aeroplane was suspended from one arm; a heavy weight being suspended from the other. Then the motor was started, the propellers set in

ADER'S "AVION."



LILIEUTHAL'S "GLIDER" IN FULL FLIGHT.

motion, and the aeroplane circled round, the high cross-beam, to which it remained attached, pivoting on the top of the column.

That Ferber was justified in advising his Government to offer £24,000, to secure the Wright invention for the French Army, recent events have proved. His interest in aviation, from a military standpoint, shows how far-sighted the French authorities have ever been in this direction.

Striking the war note brings to my mind one of the many pleasant evenings we, of the Aero Club de France, spent under the hospitable roof of the French Automobile Club in the Place de la Concorde.

On that particular evening, I was sitting next to Captain Ferber. That great student of bird flight, Professor Richer, having returned from South America, full of bird theories, was demonstrating to us how instinct enables a bird to rectify an inequality in its plane-surface, or steering apparatus, caused by the mutilation of a wing, or tail.

I remember a "V," a "U," then a "W" shaped wedge was cut out of a pigeon's wing, and a further notch was taken out of the fan tail. The bird was then released. He flopped, in a lopsided manner, for a few yards, and then came down. But, on the second or third attempt, he had learnt to equalise his defective plane-surface, and flew perfectly from one end of the room to the other.

At this result, Ferber enthusiastically proclaimed that, from the experiment, we had learned the valuable lesson that even if an aeroplane had its planes shattered in warfare, providing the pilot had not been hit, and the mechanism remained intact, the machine could easily be righted by automatic stability.

IV

And now as to some of the other great pioneers with whom I have been brought into contact.

Who among us who experienced the "thrill," will ever forget our visits to Issy-les-Moulineaux to see Mr Henry Farman achieve his first flights upon the big Voisin biplane?

It was after a series of brief and wavering straight flights that Mr Farman amazed the then small world of aviation by making a half-circular flight, returning to his starting-point. The enthusiasm, at this flight, was tremendous.

The appended table gives a good idea of Farman's wonderful progress :—

October 14th, 1907.—Flew 311 yards, beating Santos Dumont's record of 230 yards.

October 27th, 1907.—Flew 843 yards at an average speed of 30 miles per hour. This flight was done in two stages. First stage :—383 yards in 27 secs. Second stage :—440 yards in 31½ secs.

January 11th, 1908.—Flew 1 mile 20 yards in 1 min. 55 secs.

January 13th, 1908.—Flew 1,093 yards at average speed of 34 miles per hour in 1 min. 28 secs. By this flight, Farman won the Deutsch-Archdeacon prize of £2,000, also *Daily Mail* £100 for a half-mile circular flight.

It must be remembered that Britishers got a little of their own back in this triumph. Although Mr Farman is a born Frenchman, his father was an

Englishman. Like the late M. Delagrange, he started in the realms of art, but preferred the brush to the chisel.

As a cyclist, he became champion of France. With his steady nerve and great power of endurance, he afterwards became one of France's leading racing automobilists. As he had succeeded in cycling and motoring, to take up aviation was a natural sequence.

Mr Farman will go down to history, I think, as the winner of the first serial point-to-point contest, having succeeded in flying on his biplane, driven by a 50-h.p. motor, from Chalons to Rheims, a distance of 28 kilometres, in 27 minutes, without a hitch. This, in those days, was an amazing feat.

My first meeting with the late M. Leon Delagrange—another martyr to aviation—some time during 1903 or 1904, was in the realm of art, at the studio of my old friend Vital Cornu, the sculptor, under whom Delagrange had been studying. The master deplored the fact that a pupil of such great promise had abandoned art for the new science of flight.

The sports of Delagrange's boyhood were yachting and bicycling, and in time, of course, he went in for motor-cars. It was in 1905 that he commissioned Voisin to construct his first aeroplane.

His first flights took place at Issy-les-Moulineaux, and on April 11th of 1908, with his Voisin-constructed biplane, he captured the Archdeacon Cup, remaining 9 minutes and 15 seconds in the air. This was regarded as a wonderful duration record. Compare it with modern times, when men remain 8 hours in the air!

When news came of M. Bleriot's wonderful cross-Channel flight, on July 25th, 1909, I well remembered the early experiments, in France, of this wonderfully persevering pioneer of aviation.

M. Bleriot commenced his aerostatic experiments as early as 1900. In those early days, he had the time-honoured intention of achieving flight by means of a mechanical bird with flapping wings. The one defect that marred the success of Bleriot No. 1, was simply that the "bird" would not fly.

Quite undismayed, M. Bleriot's third attempt was with a construction formed of two elliptical cells, mounted on floats, and driven by two 24-h.p. Antoinette motors. He experimented with this apparatus on the Lake of Enghien, but it was not successful.

Then he began to turn his attention to monoplanes. One of his first achievements was a flight at Buc, of a kilometre and a half, at a height of 45 feet.

After this, he moved forward, with a series of improved machines, until he produced the simple apparatus upon which he flew the Channel, and established himself, at a bound, as one of the world's most famous airmen.

V

Everyone who studies the very earliest beginnings of flight must appreciate the enormously important pioneer work achieved by those men who first made gliding flights with aeroplanes unequipped with any power plant, but otherwise thoroughly under control.

A pioneer of undying fame, in this field of experiment, was Otto Lilienthal, a Berlin engineer. His theory of flight may be summed up in his own words: "To conceive a flying machine is nothing; to construct one is little; to fly is everything." He also said: "Man must serve an apprenticeship to the birds."

His experiments, begun in 1871, were made by means of wings similar to those of a bird, attached to his body. The frame of the machine was made of osier, covered with glazed calico.

Lilienthal's seat was swung below the wings, at such a distance that his head was above the wing level, whilst his shoulders were absolutely on a line with it. His method of launching himself was to jump from a little tower, in the face of the wind, regulating his centre of gravity by instinctive movements of his body and legs.

His longest *vol plane* was 300 metres. Altogether, he accomplished over 900 glides. He abandoned the monoplane type of glider in favour of a biplane, on which this gallant pioneer of flight eventually met his untimely end, breaking his back after a fall of 80 metres, in 1896.

Lilienthal's most ardent disciple, in the art of gliding, was Percy Sinclair Pilcher, an English engineer. His glider was constructed on the lines of the former, but his manner of departure was quite different. He harnessed horses, attached a cord to them, the end of which he held. The horses started off with a gallop, and he went up like a kite. When he was sufficiently high in the air, he gradually brought his body to the front, and let go of the cord; and the kite, having become an aeroplane, traversed the air, having the appearance of a crow about to alight.

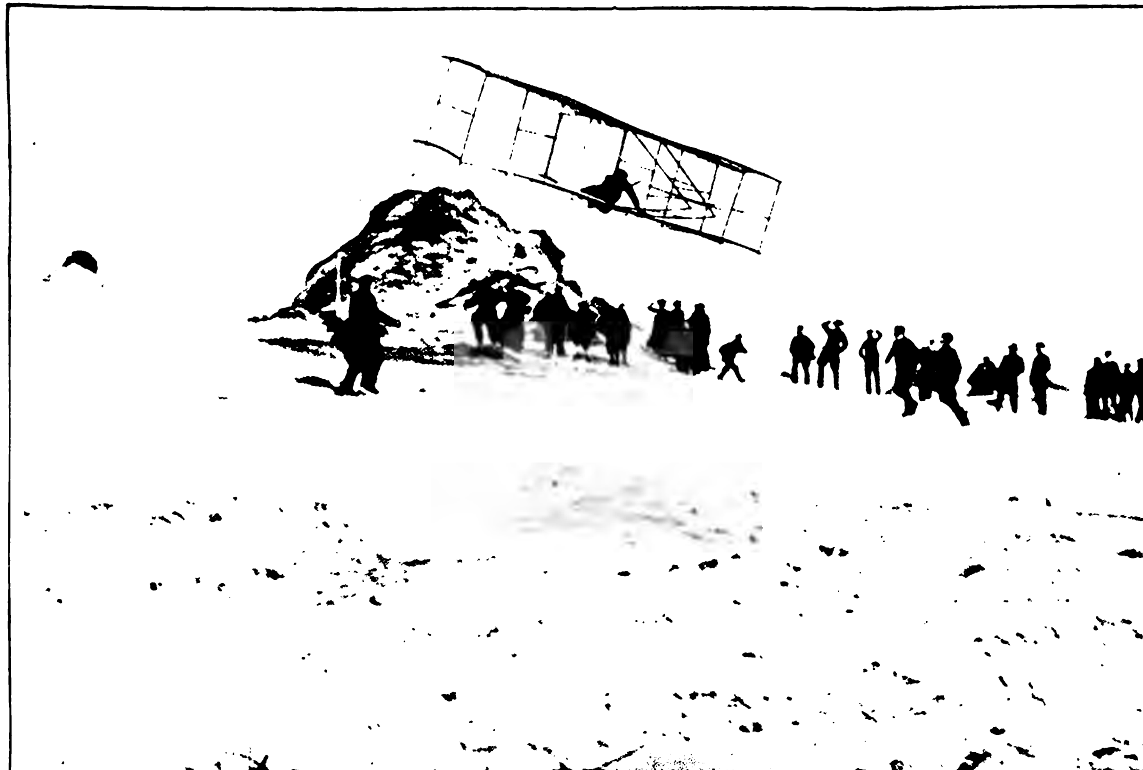
Pilcher, in his ever-readiness to demonstrate in the interest of flight, made two attempts to rise, on September 30th, 1899, in a misty rain, and unfavourable air conditions. At the second attempt, the tail of his glider buckled up, and Pilcher was thrown to the ground. He died the next day, without having recovered consciousness.

Another great pioneer of gliding was Octave Chanute, who was the aeronautical mentor of the brothers Wright. He was born in Paris, in 1831, but settled in America, and became a student of Lilienthal.

His early experiments were carried out about 30 miles from Chicago, on the sand dunes which line the shores of the Michigan, and his practical experiments of flight, according to his own admission, taught him more in three weeks, than in twenty years spent in scientific calculations and constructing models.

M. Chanute, having already passed the age of 60 at the period of which I speak, the practical experiments with his machines were carried out by his assistants, Herring and Avery. One of Chanute's biplane gliders was fitted with a stern rudder; another, a more complicated model, had five pairs of wings.

He invented, also, a system of articulated wings, working on a pivot.



CAPTAIN FERBER'S FIRST GLIDES AT BERCK-SUR-MER, 1904.

VI

The student of airmanship, after only a brief investigation of this subject, is led to wonder why men did not fly long before the first power-driven flights were actually achieved.

Excellent machines were designed, in fact, many years before aeroplane flight was possible. All that inventors lacked was the motive power given to modern experimenters—the light, powerful, and yet wonderfully reliable petrol motor!

These early pioneers had to fumble along with weighty, inefficient power-plants supplied by compressed air and steam; hence they could not do more than establish the fact, in brief experiments, that their machines had stability and control.

Take the case of Sir George Cayley, for example. Foremost among the very early inventors of flying craft, it was in 1809 that this scientist explained the details of his wonderful conception in a lecture given at the Institute of Civil Engineers. It is significant to note, in view of modern knowledge, how fully this design embraced all the parts and qualities of an aeroplane as we know it to-day, and to a great extent anticipated the Bleriot monoplane.

In 1842 the first practical model of an aeroplane, on Cayley's design, was constructed by Henson, an English experimenter.

But the weight of the steam engine by which this model was to have been driven, was out of all proportion to its lifting power. Had a suitable motive power been at hand, flight could have been achieved as long ago as this.

Of all the early French inventors, the man who produced the first machine with the most perfect mechanism was Clement Ader. The best example of this machine is exhibited at the Institute of Arts and Sciences in Paris, as the classical example of an early type heavier-than-air machine.

In appearance Ader's machine somewhat resembled a bat. The wings were dome-shaped, and the under carriage, in which the aviator sat, had what appeared to be a wind screen surmounted by a roof stretched around it. A series of cells above the wings were intended to act on the principle of a box-kite, for the purpose of .increasing the suspensory power and stability. Two four-bladed propellers worked on either side of the machine.

To Ader belongs the honour of having constructed the first machine that actually flew. It was at Satory, in 1896, that this machine covered a distance of 300 metres in the air.

As an example of the financial support that the French Government gave to aerial navigation, even in those early days, Ader received, from the Ministers of War, a grant of £20,000.

In America, quite rightly, the name of Professor Langley is greatly honoured as a pioneer of aviation. This American scientist studied the heavier-than-air principle with extraordinary thoroughness. In 1896, he produced a model aeroplane, weighing a quarter of a hundredweight. It flew for nearly a mile. The driving power was steam.

In connection with aviation, as with most progressive movements, the American War Office showed their great faith—like the French—in the possibilities of mechanical flight, by subsidising Langley to the extent of £10,000.

Unfortunately, his further trials, with man-carrying machines, did not meet with such success as his tests with models. A large aeroplane, designed with great care, proved unstable; and his experiments were abandoned.

No reference to pioneer work in America is complete without mention of Professor Montgomery, who, after commencing the study of aeronautics in 1884-5, gave astonishing public exhibitions with a glider in 1905. In this machine, on various occasions, specially trained aeronauts ascended to heights of 4,000 feet, attached to balloons, and then cut themselves free.

The perfect control which they had over the gliders, which were in the form of a tandem monoplane, with a tail, was the admiration and wonder of all who saw the tests. Twenty-minute flights were, occasionally, achieved before reaching the ground. Unfortunately, one of the aeronauts, Maloney, was killed in a flight through the tail of a glider having been damaged by a rope, without his noticing it, at the launch of the balloon.

Great importance attached to the early experiments of Sir Hiram Maxim which, in 1894, culminated in the construction of a very ambitious steam-driven aeroplane, constructed to run on rails, and with a set of overhead rails to prevent its rising beyond a certain height. The machine had 3,875 feet of surface, and weighed, altogether, more than 3 tons.

At several tests, it actually "lifted" unmistakably, demonstrating the practicability of the inventor's theories; but the machine was eventually wrecked, without any very conclusive results having been attained, owing to the breaking of the upper, or checking rail.

For ease in reference, and also for the sake of brevity, I have grouped together below, under various dates, the work of some others of the very early pioneers.

1848.—Stringfellow and Henson designed an aeroplane, steam-driven, on the lines suggested by Sir George Cayley, that greatly resembled present-day Antoinette monoplane.

1856.—Le Bris, of the French Navy, constructed a successful gliding machine, which was towed by horses.

1862.—Ponton Avrecourt constructed the first helicopter on record—a steam-driven model.

1862.—Phillips studied the dipping front edge on the bird's wing, and made models.

1872.—Penaud invented a model aeroplane driven by india-rubber springs.

1878.—Enrico, another inventor, produced a helicopter model, with a steam motor, which weighed in all about 6 lbs., and flew 30 metres.

1879.—Victor Tatin built a model aeroplane, driven by compressed air. The little model, exhibited at Chalais-Mendon, rose by its own power, and successfully circled a miniature aerodrome, its course being kept within bounds by a cord which was attached to it.

1885.—Laurence Hargrave, of New South Wales, carried out experiments with box-kites and gliders, which he continued until the year 1893. He achieved many flights with power-driven models. He constructed steam-engines, for aeroplanes, weighing 10 lbs. per h.p. In 1898, he invented the box-kite.

1896.—Chanute began work with gliding machines in America.

1898.—Captain Ferber began experimental work in France.

The appended table shows the progress achieved, in the way of flights, by the early experimenters with gliders, models, and full-sized machines :—

Year.	*Experimenter.*	*Maximum Flight.*	*Motive Power.*
1885-9 ...	Hargrave ...	800 feet	Com. Air
1893 ...	Phillips ...	400 feet	Steam
1894 ...	Maxim ...	200 feet	Steam
1905 ...	Lilienthal ...	1,200 feet	Gravity
1896 ...	Pilcher ...	800 feet	Gravity
1896 ...	Chanute ...	200 feet	Gravity
1897 ...	Ader ...	500 feet	Steam

All these painstaking pioneers played their part in the development of the aeroplane; each added something to the storehouse of knowledge. But each one was handicapped, as I have said, by the lack of a really suitable motive power.

SECTION II

AEROPLANE FLIGHTS AND RECORDS

In this Section, grouped concisely under their various headings—such as cross-country, altitude, and over-sea flying—are set forth the principal feats achieved with the aeroplane. Heading each section, will be found a table revealing progress at a glance.

—C.G.W.—H.H.

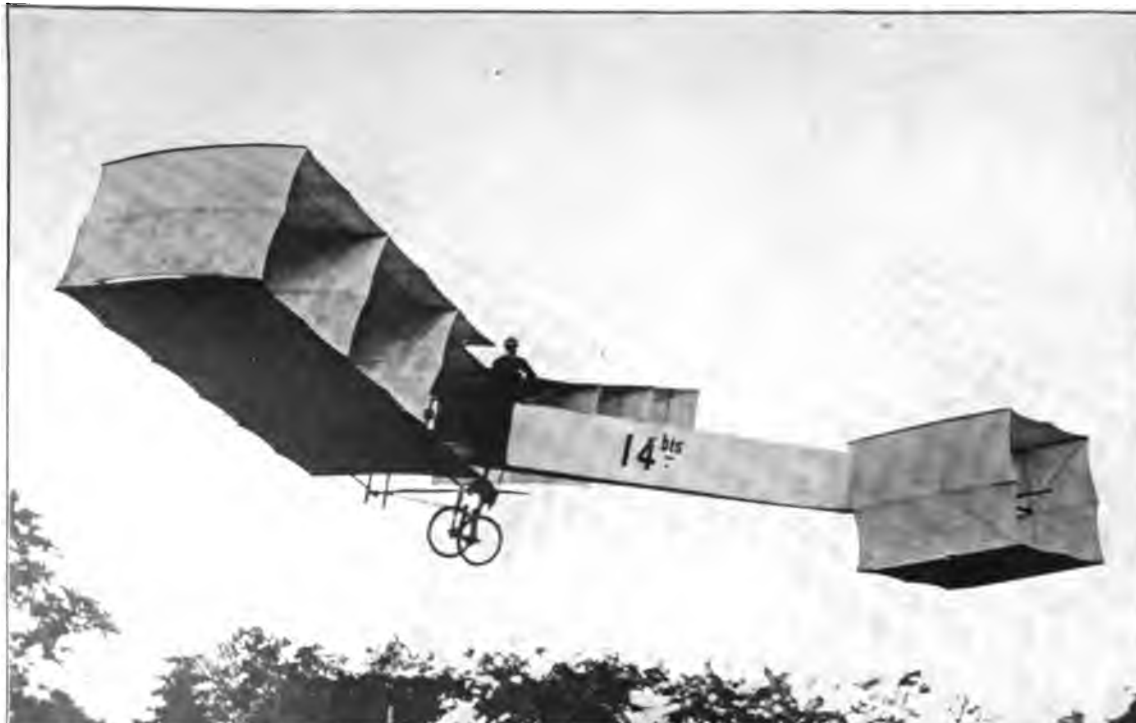
I

CROSS-COUNTRY FLYING.

PROGRESS AT A GLANCE.

Year	*Airman*	*Non-stop Flights*
1909 ...	... Bleriot ...	... 27 miles
1909 ...	... Farman ...	... 42 miles
1910 ...	... Sopwith ...	... 169 miles
Year	*Airman*	*Flights with Stops*
1910 ...	... Bellenger, Capt. ...	200 miles
1911 ...	... Bellenger, Capt. ...	450 miles
Year	*Airman (with passenger)*	*Non-Stop Flights*
1909 ...	... Bleriot	1,000 yards
1910 ...	... Camerman, Lieut.	145 miles
Year	*Airman (with passenger)*	*Flight with Stops*
1910 ...	... Wynmalen	... 380 miles

Nothing has illustrated the progress of the aeroplane more than the growth in the number



M. SANTOS DUMONT'S FIRST FLIGHT AT BAGATELLE, 1906.

and the importance of cross-country flights. In the early days of aeroplaning, before they were confident in their motors, their machines, and in their own skill, airmen were content to fly around aerodromes, close to the ground.

But, as soon as motors were improved, machines were made more practical, and pilots gained confidence by flying at heights of 1,000 feet and more, a regular series of cross-country flights were instituted, culminating to-day in aerial journeys across country of many hours' duration, carried out at heights of 2,000 and 3,000 feet, and at speeds superior to those of express trains.

Skill in the manipulation of his machine, and confidence in the strength and practicability of that machine, and also in the reliability of his motor, are all indicated by a pilot's cross-country flying.

Below are set forth the most notable cross-country flights which have been achieved, up to date, by airmen flying alone. Passenger flights will be dealt with later. The table is appended:

CROSS-COUNTRY FLIGHTS (AIRMEN ONLY).

Airman	Time—Distance—Details	Date
Bellenger, Capt.	Paris — Pau. 3 stops. Vincennes — Pontleroy; Pontleroy—Poitiers; Poitiers—Croix-d'Hins; Croix d'Hins—Pau. 450 miles. Actual flying time 7 h. 16 m.	Feb. 1st and 2nd 1911
Bellenger, Capt.	Vincennes—Chalons; Chalons — Vincennes. 200 miles.	Sept 29th, 1910
Sopwith, T.	Eastchurch—Thirimont, Belgium. 169 miles 3 hrs. 40 mins.	Dec. 18th, 1910

CROSS-COUNTRY FLIGHTS.—(AIRMEN ONLY)—*Contd*

Airman	Time—Distance—Details	Date
Bielovucie . .	Paris—Bordeaux. 1st stage: Issy—Orleans, 78 miles; 2nd stage: Orleans — Chaterlarault-Augouleme, 197 miles; 3rd stage: Augouleme — Bordeaux, 75 miles. Total distance, 350 miles. Actual time in air, 7½ hours. Flight lasted 3 days.	August 1st, 2nd and 3rd, 1910
Paulhan . .	Buc — Chartres; Chartres — Buc; Buc—Chartres; Chartres—Buc. 200 miles. 4 stops.	August 11th, 1910
Paulhan . .	London — Manchester. 183 miles. 1 stop. 4 hrs. 12 mins.	April 27th-28th, 1910
Grahame-White, C.	London—Rugby; Rugby—Lichfield. 113 miles. 1 stop.	April 21st, 1910
Grahame-White, C.	London—Roade; Roade — Polesworth, 117 miles. 1 stop.	April, 27th-28th, 1910
Brookins, W. .	Chicago—Springfield. 2 stops. 187 miles.	Sept. 30th, 1910
Hamilton . .	New York—Philadelphia —New York. 160 miles. 2 stops. Time, 3 hrs. 28 mins.	June 13th, 1910
Curtiss, Glen. H.	Albany—New York. 150 miles. 1 stop. 2 hrs. 50 mins.	May 29th, 1910

All the cross-country flights set forth above were, as stated, achieved by an airman flying alone. In the list given below the most notable flights made by airmen when carrying passengers across country are tabulated.

This table reveals in a striking way the growing practicability of the aeroplane, seeing that it is now possible for a flyer to take up a passenger with him and embark upon a pleasant aerial "tour" across country. The table is appended :—

CROSS-COUNTRY FLIGHTS (WITH PASSENGERS).

Airman	Time—Distance—Details	Date
Wynmalen, H. .	Paris—Brussels—Paris, 850 miles. 7 stops. Actual time flying about 5 hours.	Oct. 16-17th, 1910
Renaux, E. . .	Buc — Puy de Dome Mountain, Clermont Ferrand. 231 miles. 1 stop.	March 7th, 1911
Weymann, C. .	Buc—Clermont Ferrand. 231 miles. 3 stops.	Sept. 7th, 1910
Camerman, Lieut.	Chalons — Monsigny — Troyes—Chalons. 145 miles. Time of flight 4 hours.	Dec. 21st, 1910
Maillois, Lieut. .	Etampes — Blois — Etampes. 127 miles. Non-stop. 3 hrs. 15 mins.	Nov. 26th, 1910
Menard, Lieut. .	Chalons — Satory. 125 miles in 2 hrs. 5 mins. Non-stop.	Feb. 1st, 1711
Fequant, Lieut. .	Mourmelon—Vincennes. 100 miles. Non-stop. 2 hrs. 30 mins.	June 9th, 1910
Moisant, J. B. .	Paris — Amiens. 100 miles. Non-stop. 1 hr. 45 min.	Aug. 16th, 1910
Graham Gilmour.	Brooklands — Hampton Court. 45 miles. 1 hr. 15 mins.	Sept. 13th, 1910
Paulhan . .	Los Angeles — 22 miles inland. 33 min.	Jan. 19th, 1910
Moisant, J. B. .	Calais—Tilmanstone. 27 miles across English Channel. 38 mins.	Aug. 17th, 1910

CROSS-COUNTRY FLIGHTS (WITH PASSENGERS).
(*Continued*)

AIRMAN	TIME—DISTANCE—DETAILS	DATE
Dutrieu, Mlle .	Blankenberghe—Bruges —Blankenberghe. 20 miles.	Sept. 2nd, 1910
Weymann . .	Mourmelon—Rheims—Mourmelon. With 2 passengers. 37½ miles.	Jan. 17th, 1911
Weymann . .	Mourmelon — Rheims. With 3 passengers. 19 miles in 27 mins.	——
Sommer . .	Douzy—Romilly. With 6 passengers.	Jan. 26th, 1911

The third section into which cross-country flying falls concerns the flights which have been made in a series of stages—aerial tours, in fact. They are dealt with in the table which is appended :—

CROSS-COUNTRY FLIGHTS (IN STAGES).
"*Matin.*" *Circuit d'Est.*

1st STAGE. AUG. 7th, 1910. ISSY-LES-MOULINEAUX—TROYES. 84½ MILES.

Leblanc .	1 hour 32 min. 20 sec.
Aubrun .	1 hour 37 min. 35 sec.
Lindpainter .	2 hours 25 sec.
Legagneux .	3 hours 50 min. 35 sec.

2nd STAGE. AUG. 9th, 1910. TROYES—NANCY. 103 miles.

Leblanc .	2 hours 19 min 11 sec.	3 hours 52 min. 9 sec.
Aubrun .	2 hours 27 min. 40 sec.	4 hours 5 min. 15 sec.
Legagneux .	5 hours 31 min. 26 sec.	9 hours 31 min. 1 sec.

3rd STAGE. AUG. 11th, 1910. NANCY-MEZIERES—CHARLEVILLE. 100 MILES.

Leblanc .	2 hours 6 min. 20 sec.	5 hours 28 min. 29 sec.
Aubrun .	3 hours 41 min. 27 sec.	7 hours 47 min. 42 sec.

CROSS-COUNTRY FLIGHTS (IN STAGES).—(*Continued*)
"*Matin*" *Circuit d'Est*

4th STAGE. AUG. 13th, 1910. CHARLEVILLE—MEZIERES—DOUAI. 84½ MILES.

Aubrun .	2 hours 20 min.	10 hours 6 min. 50 sec.
Leblanc .	3 hours 3 min.	9 hours 1 min. 36 sec.

5th STAGE. AUG. 15th, 1910. DOUAI—AMIENS. 50 MILES.

Leblanc .	1 hour 8 min.	10 hours 14 min. 54 sec.
Aubrun . .	1 hour 25 min.	11 hours 36 min. 6 sec.

6th STAGE. AUG. 17th, 1910. AMIENS—ISSY-LES-MOULINEAUX. 75 MILES.

Leblanc .	1 hour 23 min. 28 sec.	12 hours 8 min. 22 sec.
Aubrun .	2 hours 3 min.	13 hours 28 min. 11 sec.

TOTAL DISTANCE FLOWN: 497 MILES.

BIELOVUCIE'S PARIS—BORDEAUX FLIGHT.

1st Stage.	Issy-les-Moulineaux—Orleans.	78 miles, Aug. 1, 1910
2nd Stage.	Orleans—Augouleme . .	197 miles, Aug. 2, 1910
3rd Stage.	Augouleme—Bordeaux .	75 miles, Aug. 3, 1910

TOTAL DISTANCE FLOWN: 350 MILES. TIME, ABOUT 7½ HOURS.

MAURICE FARMAN'S PARIS—BORDEAUX FLIGHT.

1st Stage.	Buc—Chartres.	53 min.	42 miles, Dec. 9, 1909
2nd Stage.	Chartres—Orleans.	50 min.	42 miles, Dec. 31, 1909

HENRY FARMAN AND L. PAULHAN'S COMBINED JOURNEY.

H. Farman.	Etampes—Chevilly. 50 miles.	April 17th, 1910
L. Paulhan.	Chevilly—Arcis-sur-Aube. 110 miles	April 18th, 1910
L. Paulhan.	Arcis-sur-Aube—Chalons. 40 miles	April 18th, 1910

TOTAL DISTANCE FLOWN—ABOUT 200 MILES IN ABOUT 5 HOURS.

So great is the importance of cross-country flying, in the development of the aeroplane, that the majority of prizes are now being given for feats in the nature of aerial tours across country.

Such flights tend to produce a type of machine which is speedy, but at the same time reliable, and with a thoroughly efficient landing chassis, capable of making safe descents on fairly rough ground when necessary.

II

DURATION AND DISTANCE

PROGRESS IN DISTANCE FLOWN—AT A GLANCE!

Date	*Airman*	*Distance Flown*
1905	Wright Bros. ...	24 miles
1906	Santos Dumont ...	235 yards
1907	Farman, H. ...	1,093 yards
1908	Wright, W. ...	95 miles
1909	Farman, H. ...	150 miles
1910	Tabuteau ...	365 miles

In this section it is sought to show, concisely, how aeroplane flights have grown in duration from minutes to hours, and, in distance, from yards to miles.

Whereas the table which started this section showed the progress made in the distance of flights, that set forth below indicates how airmen have increased the length of time they have been able to remain in the air.

HENRY FARMAN MAKING ONE OF HIS FIRST FLIGHTS AT ISSY-LES-MOULINEAUX, 1907.

The table is appended :—

Year		*Airman*		*Time in the Air*
1905	...	Wright O.	...	38 m. 13 secs.
1906	...	Santos Dumont	...	21 1-5 secs.
1907	...	Farman, H.	...	1 m. 30 secs.
1908	...	Wright, W.	...	2 h. 20 m. 23½ secs.
1909	...	Farman, H.	...	4 h. 17 m. 53 secs.
1910	...	Tabuteau	...	8 h. 35 m.

As completing our reference to the aeroplane feats of duration and distance, a detailed table is appended of the principal flights which have been made :—

Airman	Time	Distance		Place	Date
Tabuteau	8h. 35m.	365 miles		Buc	Dec. 30, 1910
Farman, H.	8h. 23m.	288¾ ,,		Etampes	Dec. 18, 1910
Farman, H.	7h.	291¼ ,,		Etampes	Dec. 31, 1910
Pierre-Marie	6h. 9m.	333 ,,		Buc	Dec. 31, 1910
Tabuteau	6h. 1m.	290 ,,		Etampes	Oct. 28, 1910
Legagneux	5h. 59m.	322 ,,		Pau	Dec. 21, 1910
Renan	5h. 5m.	223¾ ,,		Buc	Dec. 31, 1910
Olieslagers	5h. 3m.	245 ,,		Rheims	July 10, 1910
Breguet	5h. 3m.	242½ ,,		Douai	Dec. 31, 1910
Cody, S. F.	4h. 47m.	189 ,,		Laffan's Plain	Dec. 31, 1910
Labouchere	4h. 37m.	212½ ,,		Rheims	July 9, 1910
Sopwith	4h. 34m.	174 ,,		Brooklands	Dec. 31, 1910
Farman, H.	4h. 22m.	150 ,,		Chalons	Nov. 3, 1909
Ogilvie	3h. 54m.	147½ ,,		Camber, near Rye	Dec. 28, 1910
Sopwith	3h. 12m.	140 ,,		Brooklands	Nov. 26, 1910
Cattaneo	3h. 11m.	144 ,,		Lanark	Aug. 10, 1910
Welsh	3h. 5m. 40s.	—		St Louis	Oct. 11, 1910
Farman, H.	3h. 4m.	112 ,,		Rheims	Aug. 27, 1909
Kinet, D.	2h. 51m.	—	(flew with passenger)	Mourmelon	May 15, 1910
Cody, S. F.	2h. 50m.	115 ,,		Laffan's Plain	Dec. 22, 1910
Paulhan	2h. 49m.	96 ,,		Brooklands	Nov. 1, 1909
Farman, H.	2h. 45m.	100 ,,		Mourmelon	Dec. 31, 1909
Rougier	2h. 41m.	87 ,,		Berlin	Oct. 1, 1909
Jennin, M.	2h. 38m.	—		Berlin	May 13, 1910
Olieslagers	2h. 35m. 18s.	125 ,,		Rheims	July 8, 1910
Dutrieu, Mlle	2h. 35m.	105 ,,		Etampes	Dec. 21, 1910
Grahame-White	2h. 34m. 56s.	90½ ,,		Bournemouth	July 11, 1910
Delagrange	2h. 32m.	125 ,,		Juvisy	Dec. 30, 1909
Cody, S. F.	2h. 30m.	100 ,,		Laffan's Plain	Nov. 4, 1910
Sommer	2h. 27m.	—		Chalons	Aug. 7, 1909

Englehardt	2h. 21m.	—	,,		Berlin	May 13, 1910
Christiaens	2h. 20m.	84	,,		Bournemouth	July 11, 1910
Wright, W.	2h. 20m.	93	,,		Le Mans	Dec. 31, 1908
Kinet, D.	2h. 19m.	102	,,	(flight with passenger)	Mourmelon	April 8, 1910
Latham	2h. 13m.	96½	,,		Rheims	Aug. 26, 1909
Sommer	2h. 10m.	—	,,		Bouy	Aug. 4, 1909
Aubrun	2h. 9m.	84	,,	(flight with passenger)	Rheims	July 9, 1910
Wachter	2h.	—	,,		Mourmelon	May 15, 1910
Olieslagers	1h. 54m. 54s.	96¾	,,		Rheims	July 8, 1910
Wright, W.	1h. 54m.	95	,,		Le Mans	Dec. 18, 1908
Lambert, Count	1h. 54m.	72½	,,		Rheims	Aug. 26, 1909
Englehardt	1h. 53m.	80	,,		Berlin	Nov. 5, 1909
Sommer	1h. 50m.	—	,,		Chalons	July 19, 1909
Herveu, Mlle	1h. 50m.	62¼	,,		Pau	Dec. 31, 1910
Wright, O.	1h. 35m.	—	,,	(with passenger)	Berlin	Sept. 19, 1909
Paulhan	1h. 32m.	—	,,		Dunkerque	Aug. 7, 1909
Farman	1h. 32m.	47	,,		Blackpool	Oct. 20, 1909
Lesseps, Count	1h. 30m.	—	,,		Issy	Dec. 16, 1909
Latham	1h. 24m. 58s.	62½	,,		Rheims	July 5, 1910
Farman	1h. 23m.	—	,,		Chalons	July 19, 1909
Wright, O.	1h. 21m.	—	,,		Fort Meyer	July 20, 1909
LeBlanc	1h. 19m. 12s.	62½	,,		Rheims	July 5, 1910
Farman	1h. 12m.	50	,,	(with 2 passengers)	Mourmelon	March 5, 1910
Wright, O.	1h. 15m.	—	,,	(with passenger)	Fort Meyer	July 17, 1909
Laurens	1h. 16m.	62½	,,	(with passenger)	Buc	Dec. 21, 1910
Farman	1h. 7m.	—	,,	(with lady passenger)	Chalons	Nov. 2, 1909
Latham	1h. 7m.	—	,,		Chalons	June 5, 1909
Singer	1h. 5m.	41	,,		Chalons	Dec. 21, 1909
Tissandier	1h. 2m.	—	,,		Pau	May 20, 1909
Curtiss	50m.	40	,,		Brescia	Sept. 11, 1909
Farman	16m.	14	,,	(with 2 passengers)	Mourmelon	March 4, 1910

A flight of twelve hours has now become only a question of equipping a machine with tanks for sufficient fuel and oil, and arranging the sustaining surfaces to bear the extra weight.

A prominent manufacturer expresses the opinion that, were a prize sufficiently valuable offered for a flight of 24 hours, this would be effected without difficulty, a large machine being built capable of carrying two pilots and the necessary fuel. By this means the two airmen would be able to take turns in driving.

III

SPEED-FLYING

PROGRESS AT A GLANCE

Date	*Airman*	*Miles per hour*
1903	Wright Bros.	30
1904	Wright Bros.	34
1905	Wright Bros.	38
1906	Santos Dumont	25
1907	Farman, H.	30
1908	Wright, W.	39
1909	Delagrange	49.9
1910	Leblanc	67.5

The importance of speed in the development of flying lies in the power which speed gives to an airman in combating a wind.

For this reason, all practical aviators are striving to increase the speed of their machines. But many difficulties lie in the way of big increases of speed.

Constructionally, machines must be made stronger. It is imperative, also, that problems arising through machines descending at high rates of speed should be solved.

A monoplane flying at 65 or 70 miles an hour lands at a speed which makes a descent on anything save a perfectly smooth aerodrome a very "tricky," and, occasionally, a dangerous operation.

To take full advantage of high speed while in the air, and at the same time to be able to effect a landing on any reasonable surface, it is hoped that 1911 may see the development of a machine with more than one speed.

Already, designers are busy with experimental machines of this type. It is hoped to achieve the desired result either by altering the angle of the planes of a machine while in flight, or by enlarging and reducing the plane surfaces at will. Rendering both systems difficult of achievement are many constructional problems.

The ideal which one famous constructor has laid down is a soaring and landing speed of 25 miles an hour, and a maximum flying speed of 100 miles an hour.

The table appended shows how the speed of machines has gradually crept up :—

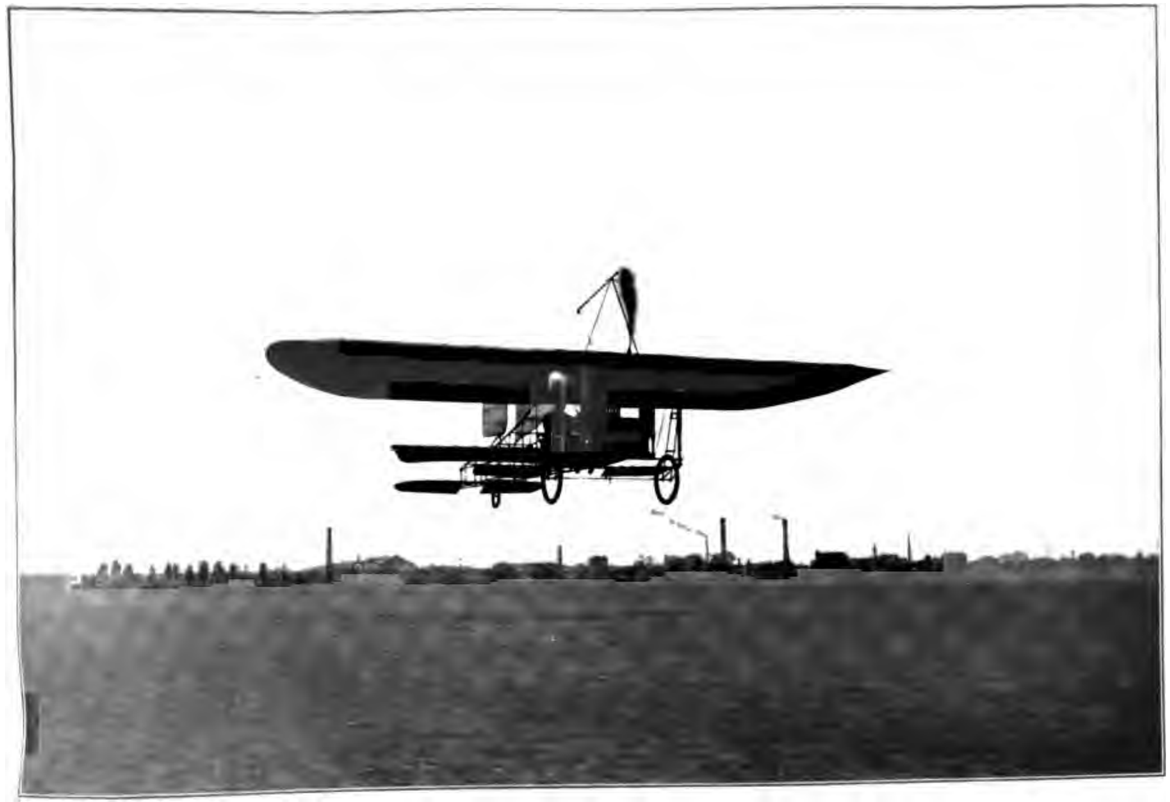
Aeroplane.	*Average Speed.*
Early type biplane with 50 h.p. engine ...	30-35 m.p.h.
Improved type biplane with 50 h.p. engine	35-40 m.p.h.
Early type monoplane with 25-30 h.p. engine	40-45 m.p.h.
Improved type monoplane with 50 h.p. engine	50-55 m.p.h.
Racing type biplane with 80-100 h.p. engine	55-60 m.p.h.
Racing type monoplane with 100 h.p. engine	65-70 m.p.h.

Another table, which is set forth below, gives the speed records made during 1910, and officially passed by the International Aeronautical Federation. They include flights made by aviators alone, and also flights undertaken with passengers :—

SPEED RECORDS OF 1910

AVIATOR (FLYING ALONE).

Kilo-metres	*Miles*	*Airman*	*Time*	*Place*	*Date*
1	5/8	Radley	47 2/5 secs.	Lanark	Aug. 13, 1910
5	3 1/8	Leblanc	2 m. 44 78/100 s.	Belmont Park	Oct. 29, 1910
10	6 1/4	Leblanc	5 m. 30 92/100 s.	Belmont Park	Oct. 29, 1910
20	12 1/2	Leblanc	11 m. 4 78/100 s.	Belmont Park	Oct. 29, 1910
30	18 3/4	Leblanc	16 m. 38 31/100 s.	Belmont Park	Oct. 29, 1910
40	25	Leblanc	22 m. 12 58/100 s.	Belmont Park	Oct. 29, 1910
50	31 1/4	Leblanc	27 m. 48 70/100 s.	Belmont Park	Oct, 29, 1910
60	37 1/2	Morane	39 m. 32 3/5 s.	Bordeaux	Sept. 18, 1910
70	43 1/4	Morane	46 m. 19 1/5 s.	Bordeaux	Sept. 18, 1910
80	50	Morane	53 m. 5 s.	Bordeaux	Sept. 18, 1910
90	56 1/4	Morane	59 m. 52 2/5 s.	Bordeaux	Sept. 18, 1910
100	62 1/2	Grahame-White	1 h. 0 m. 47 73/100 s.	Belmont Park	Oct. 29, 1910
150	93 3/4	Aubrun	1 h. 43 m. 19 3/5 s.	Bordeaux	Sept. 9, 1910
200	125	Aubrun	2 h. 18 m. 39 3/5 s.	Bordeaux	Sept. 9, 1910
250	156 1/4	Pierre-Marie	3 h. 4 m. 28 1/5 s.	Buc	Dec. 31, 1910
300	187 1/2	Pierre-Marie	3 h. 40 m. 55 2/5 s.	Buc	Dec. 31, 1910
350	218 3/4	Pierre-Marie	4 h. 17 m. 26 1/5 s.	Buc	Dec. 31, 1910
400	250	Pierre-Marie	4 h. 54 m. 6 4/5 s.	Buc	Dec. 31, 1910
450	281 1/4	Pierre-Marie	5 h. 30 m. 35 3/5 s.	Buc	Dec. 31, 1910
500	312 1/2	Pierre-Marie	6 h. 7 m. 7 4/5 s.	Buc	Dec. 31, 1910



MR. GRAHAME-WHITE'S FIRST FLIGHT—MADE AT ISSY-LES-MOULINEAUX UPON A TWO-SEATED BLERIOT.

AVIATOR (WITH 1 PASSENGER).

Kilo-metres	*Miles*	*Airman*	*Time*	*Place*	*Date*
10	6¼	Laurens	7 m. 31 1/5 s.	Buc	Dec. 21, 1910
20	12½	Laurens	15 m. 14 2/5 s.	Buc	Dec. 21, 1910
30	18¾	Laurens	22 m. 56 2/5 s.	Buc	Dec. 21, 1910
40	25	Vidart	29 m. 40 s.	Mourmelon	Dec. 31, 1910
50	31¼	Laurens	38 m. 19 2/5 s.	Buc	Dec. 21, 1910
100	62½	Laurens	1 h. 16 m. 51 s.	Buc	Dec. 21, 1910

AVIATOR (WITH 2 PASSENGERS).

10	6¼	Mamet	10 m. 18 4/5 s.	Rheims	July 3, 1910
20	12½	Mamet	21 m. 14 s.	Rheims	July 3, 1910
30	18¾	Mamet	31 m. 53 1/5 s.	Rheims	July 3, 1910
40	25	Mamet	42 m. 32 3/5 s.	Rheims	July 3, 1910
50	31¼	Mamet	52 m. 56 1/5 s.	Rheims	July 3, 1910

Developments in the matter of speed will, in the immediate future, be watched with considerable interest. One of the fastest flights ever recorded was that made by Mr James Radley, at the Lanark aviation meeting in 1910. On a Bleriot monoplane, engined with a Gnome, he flew a measured mile at a speed of slightly more than 75 miles an hour. But his speed was increased by a following wind of 8 or 10 miles an hour.

The Bleriot monoplane, as now fitted with a 100-h.p. Gnome motor, is said to have achieved a speed of between 75 and 80 miles an hour when flying over a straight course. Its recorded speed, when circling a course, and thus losing ground at the turns, has naturally been appreciably less than this.

Many eminent authorities are found to declare that, during 1911, a speed through the air of 100 miles an hour will be achieved.

IV

HIGH-FLYING

PROGRESS AT A GLANCE

Year	*Airman*	*Height*
1906	Santos Dumont	3 feet
1907	Farman	8 feet
1908	Wright, W.	400 feet
1909	Latham	1,640 feet
1910	Legagneux	10,746 feet

All prophecies have been at fault in the matter of the heights attained by aeroplanes.

At the Rheims meeting, in 1909, aviators were creeping cautiously to a height of 500 feet, to the wonder and awe of the spectators. Then it was predicted, with confidence, that 1,000 feet was the greatest altitude that would be attainable.

This was soon reached, and passed, however. Whereupon, more than one practical authority declared that 5,000 feet would be absolutely the limit.

But this, too, was proved to be a grievous underestimate of what could be done, as will be seen from the table (p. 40), which sets forth the principal altitude flights which have been made.

That the best performance on this table will be easily eclipsed, is now generally conceded. In view of the feats that have been achieved, it is predicted that, during the year 1911, an airman will reach an altitude of close upon 20,000 feet.

V

PASSENGER-CARRYING

PROGRESS AT A GLANCE

Date	*Airman*	*Passengers*	*Time in Air*
1908	Wright, W.	1	1h. 9m. 45s.
1909	Wright, O.	1	1h. 35m. 47s.
1909	Bleriot	2	Short flight.
1910	Camerman, Lieutenant	1	4h.
1910	Farman, H.	2	1h. 12m.
1910	Farman, H.	3	1h. 20m.
1910	Farman, H.	4	12½ miles
1910	Breguet	5	5 minutes
1911	Sommer	6	Short flight.
1911	Lemartin	7	5 minutes
1911	Breguet	11	2 miles
1911	Sommer	12	6 miles

As will be seen from the table above, it has been possible, since 1908, to increase the passenger-

ALTITUDE RECORDS

HEIGHT	AIRMAN	MACHINE	PLACE	DATE
11,476 feet	Hoxsey (unofficial)	Wright, B.	Los Angeles	Dec. 26, 1910
10,746 „	Legagneux	Bleriot, M.	Pau	Dec. 9, 1910
9,714 „	Johnstone	Wright, B.	Philadelphia	Nov. 23, 1910
9,450 „	Drexel	Bleriot, M.	Belmont Park	Oct. 31, 1910
9,174 „	Wynmalen	Farman, B.	Mourmelon	Oct. 1, 1910
8,790 „	Chavez	Bleriot, M.	Issy	Sept. 9, 1910
8,469 „	Morane	Bleriot, M.	Havre	Sept. 2, 1910
6,691 „	Morane	Bleriot, M.	Havre	Aug. 29, 1910
6,600 „	Drexel	Bleriot, M.	Lanark	Aug. 11, 1910
5,850 „	Chavez	Bleriot, M.	Blackpool	Aug. 3, 1910
5,500 „	Tyck	Farman, B.	Brussels	Aug. 1, 1910
4,658 „	Latham	Antoinette, M.	Rheims	July 7, 1910
4,503 „	Brookins	Wright, B.	Indianapolis	July 16, 1910
4,490 „	Olieslagers	Bleriot, M.	Brussels	July 30, 1910
4,164 „	Paulhan	Farman, B.	Los Angeles	Jan. 12, 1910

carrying accommodation of aeroplanes from one passenger to twelve.

Further developments, in passenger-carrying, are expected during 1911, when "air-cars," carrying four and six occupants as their regular equipment, will be introduced.

This will open the field for what Mr Henry Farman advocates as the most effective way to develop the popular uses of aeroplanes—the organisation of aerial tours through countries.

Below are set forth some of the most notable achievements which have been recorded in passenger-carrying :—

FLIGHTS WITH PASSENGERS

Airman	*Date*	*No. of Pass.*	*Time and Distance*	
Sommer	Mar. 25, 1911	12		6 miles
Breguet	Mar. 23, 1911	11		2 miles
Lemartin	Feb. 2, 1911	7	5 mins.	
Sommer	Jan. 26, 1911	6	Short Cross-c'ntry Flight	
Breguet	Aug. 29, 1910	5	5 mins.	Short Flight
Farman	Jan. 19, 1911	5		
Sommer	April 20, 1910	4	5 mins.	
Farman, H.	Nov. 10, 1910	4		12½ miles
Farman, H.	Aug. 2, 1910	3	1h. 4m.	
Farman, H.	Mar. 5, 1910	2	1h. 12m.	50 miles
Mamet	July 9, 1910	2	1h. 20m.	47 miles
Farman, H.	Mar. 4, 1910	2	16 mins.	14 miles
Bleriot	June 12, 1909	2		1,000 yards
Kinet, D.	May 15, 1910	1	2h. 51m.	
Kinet, N.	April 8, 1910	1	2h. 19m.	102 miles
Aubrun	July 9, 1910	1	2h. 9m.	84 miles
Wright, O.	Sept. 19, 1909	1	1h. 35m.	
Farman, M.	May 21, 1910	1		50 miles
Wright, O.	July 27, 1909	1	1h. 12m.	
Farman, H.	Nov. 2, 1909	1	1h. 7m.	
Dutrieu, Mlle	Sept. 2, 1910	1		20 miles
Laurens, M.	Dec. 21, 1910	1	1h. 16m.	62½ miles

With even the present-type engines of 100 h.p., and with special machines and propellers, the lifting capacity of an aeroplane could, it is generally agreed, be increased to a regular complement of a dozen passengers.

VI

OVER-SEA FLYING

PROGRESS AT A GLANCE

		Over-Sea Flight
1909	Bleriot	21 miles
1910	The late Hon. C. S. Rolls	44 miles
1910	R. Loraine	52 miles
1911	McCurdy	95 miles
1911	Bague, Lieut.	130 miles

From the day when, on his small, low-powered monoplane, M. Bleriot astonished the world by his flight from France to England, across the English Channel, the over-sea flights achieved have revealed, very strikingly, the progress of aeroplaning.

No greater indication of an airman's confidence in his machine can be given than his attempting, with it, a long flight over sea.

Set forth (p. 43) are the chief feats which have been performed in over-sea flying.

Much attention is now being paid to the possibility of launching aeroplanes from ships, for naval purposes, and also of machines rising from, and descending upon, the surface of the water. That both feats are possible has already been demonstrated by the American airmen, Mr Eugene Ely and Mr Glenn H. Curtiss.

OVER-SEA FLIGHTS.

Airman	*Machine*	*Details*	*Date*
Bleriot	Bleriot (M.)	Calais-Dover. 21 miles.	July 25th, 1909
Lesseps, Count de	Bleriot (M.)	Calais-Dover. 21 miles	May 23rd, 1910
Rolls, Hon. C. S.	Wright (B.)	Dover-Calais; Calais-Dover. 44 miles	June 5th, 1910
Moisant, J. B.	Bleriot (M.)	Calais-Dover. 21 miles	August 17th, 1910
Sopwith, T.	Howard-Wright (B.)	Dover-Calais. 21 miles	December 18th, 1910
Grace, C.	Short (B.)	Dover-Calais. 21 miles	December 22nd, 1910
Rolls, Hon. C. S.	Wright (B.)	Nice-Cap Ferrat. 32 miles	April 23rd, 1910
Van der Born	Farman (B.)	Nice-Cap Ferrat. 32 miles	April 22nd, 1910
Loraine, R.	Farman (B.)	Holyhead-Howth Head (Ireland). 52 miles	September 11th, 1910
Curtiss, G.	Curtiss (B.)	Cedar Point-Euclid Beach; Euclid Beach-Cedar Point. 60 miles each way across Lake Erie.	August 31st and September 1st, 1910
McCurdy, J. A. D.	Curtiss (B.)	Key West to 10 miles off Havana. 95 miles across sea. Fell in water.	January 30th, 1911
Curtiss, G.	Curtiss (B.)	Ascended off water and alighted on same again off San Francisco.	January, 28th, 1911
Bague, Lieutenant	Bleriot (M.)	From Nice, across Gulf of Genoa, to Gorgona Island, near Leghorn. 130 miles.	March 5th, 1911

SECTION III

THE WORLD'S AIRMEN

As illustrating the wonderful progress that flight has made, a list is here presented, alphabetically arranged, of the principal aviators in the world, with the aeroplanes they pilot and, where possible, details of their achievements. The list comprises more than 700 names. —C.G.W.—H.H.

THE most conclusive way to illustrate the progress that is being made in flying is to enumerate the pilots who have, so far, learned to fly.

In this section is printed a list of airmen. It is made up to the beginning of March, 1911.

The method of preparing it has been to obtain, from all possible sources, the names of aviators, with the machines they pilot, and, where possible, details of any meritorious flights which they have made.

Such a list cannot pretend to be complete. At the flying schools which have now grown up in such numbers, fresh pupils are learning to fly every day. Many men, also, who have learned to fly, have never been mentioned in any way, nor have any of their feats been chronicled.

However, the mere preparation of such a list as

[*Daily Mirror*.

M. BLERIOT'S START FROM LES BARAQUES, NEAR CALAIS, FOR HIS FAMOUS CROSS-CHANNEL FLIGHT—JULY 25TH, 1909.

this, incomplete though it may be, is an instructive work. It shows us, in as effective a way as is possible, what the progress of flying has been.

It was only at the beginning of 1908—three short years ago—that the world's flying men numbered four. Now, in the list which is printed below, a reader will find the names of over 700 pilots. Taking into consideration the pupils who are learning to fly at the schools, and the number of airmen, in various countries, about whom it is difficult to obtain information, there is no doubt that the world's pilots, at the moment, far exceed 1,000.

It has been estimated, as a matter of fact, that the total number of aviators in the world is not far short of 3,000. But research work, in this field, makes it clear that such an estimate is rather too ambitious. It would have been possible to augment appreciably the list printed below had airmen been included, without mention of the machines they pilot. But, in each case in this list, the pilot's aeroplane has been set forth.

In quite a number of cases the aviator's name, together with the machine he flies, is the only information that it is possible to give. In many cases, after he has learned to fly, an airman makes no performances that are chronicled. For this reason, even keen students of flying are only familiar with a comparatively few names of pilots.

The airmen who are enumerated in this list fly altogether 729 machines. In an appreciable number of cases, one flyer handles several machines.

It is interesting to note, in studying the aeroplanes that are flown, how biplanes and monoplanes are to be compared numerically. The figures reveal :—

Biplanes, 361.
Monoplanes, 302.

It will thus be seen that the biplane is still the more popular flying machine, despite the very large number of monoplanes that are now being built, and flown.

Another analysis that suggests itself is to classify the flyers of the various types of biplanes. In doing this, it is speedily seen that the biplane built by Mr Henry Farman is easily the most-used machine. Appended is a table showing the principal biplanes flown by the airmen in our list :—

Farman, H.	135
Viosin	59
Wright	39
Sommer	36
Bristol	16
Farman, M.	14
Aviatik	14
Curtiss	13

The preponderance of the Henry Farman machine is, it will be seen, quite overwhelming.

Turning to the question of monoplanes, one finds that the Blèriot machine completely outnumbers all others, as will be seen in the list of monoplanes set forth below, as principally flown by the pilots in our list :—

Bleriot	158
Antoinette	47
Hanriot	21
Demoiselle	10
Tellier	10
Koechlin	8
Valkyrie	7
Gyp	5
Nieuport	5
Etrich	5
Morane	4
R. E. P.	4

It is a striking fact that the Blériot machine should thus so greatly outnumber all other makes of machines. This machine, it will be remembered, came into prominence first owing to M. Bleriot's memorable flight across the English Channel on July 25th, 1909.

Since then, by fitting a Gnome engine to this monoplane, it has been rendered an exceptionally fast machine, and also one with which a pilot can "climb" very rapidly. Thus it has been found that the Bleriot machine has, at the many flying meetings that have been held, secured the majority of prizes for speed and high flying.

In every country, almost, monoplanes of original design have been built—original, that is to say, in some of their details. But, in a general way, these machines all bear a strong family resemblance to either the Blériot or the Antoinette monoplane. The latter machine, extremely beautiful in design, and a wonderful machine for flying in a wind, comes, it will be seen, second on the list.

Apart from the machines of known types which figure in the tables already given, some of the airmen who are tabulated in the list below fly machines of an original form, generally designed by their pilots. Of such machines there are 66.

Another very interesting table is possible if the nationality of the pilots is tabulated. If this is done, France, as might be expected, takes premier place. But it is gratifying, also, to note that British aviators come second on the list—a conclusive proof of the fact that, even if the general public in England is still somewhat apathetic, there are many men who are keen enough to take up aviation.

Appended is a list of the six nationalities which provide the majority of the pilots :—

French	387
British	128
German	46
Italian	38
Russian	37
American	31

The awakening of interest as regards aviation, in Japan, is indicated by the fact that four Japanese airmen are shown, in the list below, to have learned to fly. Apart from building a number of machines in Japan, the Japanese military authorities have decided to send officers to Europe to learn to fly machines of the accepted types.

In the list of pilots, seven French airwomen find a place. They are :—Mlle Dutrieu, Mlle Hervue, Mlle Marvingt, Mlle Aboukaia, Mme Niel, Mme Franck, and Mme Laroche.

Appended is the list of pilots, alphabetically arranged. One final remark is necessary concerning it. The large number of military flyers is an important feature of it, an indication of the interest that is now being taken in flying by the Governments of Europe :—

A

ABOUKAIA, Mlle.—Mlle Aboukaia was one of the first women in France to take up aviation. She began experiments with a Demoiselle monoplane, soon after M. Santos Dumont had introduced this machine. Subsequently, going to Chalons, she learned to fly upon an Antoinette monoplane.

ACQUAVIVA, Lieut.—This officer was one of the early military pilots in France. He learned upon a Bleriot monoplane, and has made a number of good flights. His pilot-aviator certificate was granted to him on May 2nd, 1910.

ADORJAN, M.—The designer and builder of the Adorjan monoplane, which has been satisfactorily tested.

AIGUILLON, Lieut. R. DE.—A French military pilot. The machine he learned to fly was the Gyp monoplane. Lieut. Aiguillon's certificate was granted on December 7th, 1910.

AITKEN, A.—The pilot of a Bleriot monoplane.

ALBERTI, Dr.—Flies a Bleriot monoplane.

ALGRIN, RENE.—A French airman. Gained his certificate on October 4th, 1910. Flies a Wright biplane.

ALIGRO, M.—Flies a Breguet biplane, an interesting machine which has come very much to the front in France, particularly for military purposes.

ALLARD, M.—Flies one of the new type of Voisin biplane, lighter and faster than the first machines built by the Voisin firm.

AMAN, G.—Has been experimenting at Issy recently with an Etrich monoplane, a machine with which remarkably good results have been attained.

AMERIGO, Herr.—This German airman, piloting an Aviatik biplane, flew for 3 hours 19 minutes at Mulhausen on December 11th, 1910, carrying a passenger. He is a world's record holder for passenger-carrying.

ANDERSON, Mr.—Learned to fly upon a Sommer biplane.

ANDRE, CLAUDE.—A French airman. Pilots a Farman biplane. His certificate was granted on Aug. 29th, 1910.

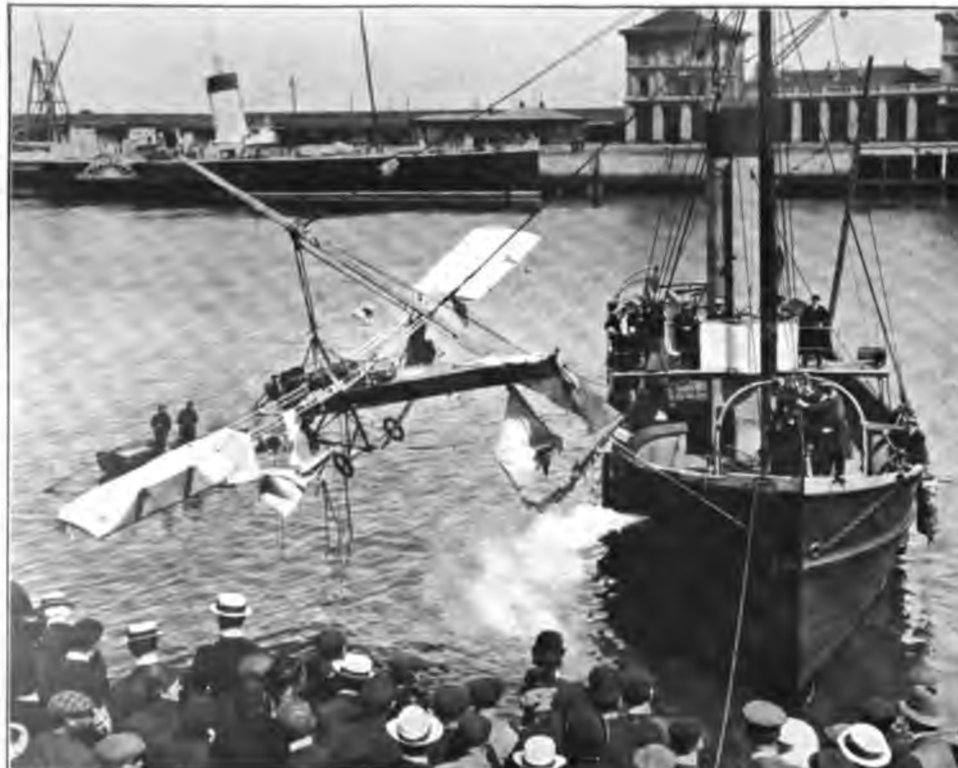
ANZANI, M.—The builder of the motor which was fitted to the monoplane upon which M. Bleriot flew across the English Channel on July 25th, 1909. Recently, while testing new motors, M. Anzani has been making flights with a Bleriot monoplane at Issy.

ARCHER, ERNEST.—An English pilot, who learned to fly a Bleriot monoplane at Mourmelon, being given his certificate on Aug. 9th, 1910.

ASTLEY, H. D. J.—After experimental work with monoplanes, Mr Astley, who is a British pilot, learned to fly a Sommer biplane at Brooklands. Has made a number of good flights, having attained an altitude of 1,500 feet. Now flying Bleriot two-seater. A keen motorist.

AUBRUN, E.—A very well-known French flyer. Learning to fly a Bleriot monoplane, he gained the distinction of coming in second in the great Circuit d'Est organised by the French daily paper *Le Matin*. The holder of the 150 kilometre speed record. M. Aubrun is now experimenting with a Morane monoplane. His certificate was granted on Jan. 6th, 1910.

AUDEMARS, E.—One of the most successful pilots of the Demoiselle monoplane. At the Bournemouth aviation meeting, 1910, he flew exceedingly well. Now he has transferred his attention to a Tellier monoplane. M. Audemars, who is a Swiss pilot, won his certificate on June 10th, 1910.



[*Daily Mirror.*

MR. LATHAM'S MONOPLANE, AS IT WAS RESCUED FROM THE ENGLISH CHANNEL AFTER HIS FIRST UNSUCCESSFUL CROSS-CHANNEL FLIGHT, JULY 19TH, 1909.

B

Bablot, M.—One of the very early pilots in France of the Wright biplane.

Bachand, M.—Learned to fly upon a Bleriot monoplane at Pau.

Bachot, A.—A French aviator. Learned to fly upon a Bleriot monoplane. Was granted his certificate on Oct. 19th, 1910.

Baeder, F. de.—A very successful French airman, having piloted in turn a Voisin, Farman, and Breguet biplane. Has made a great number of flights. While testing a Voisin biplane, he fitted to it a Wolseley British-built engine, and secured excellent results.

Bague, Lieut.—French military aeroplanist. Pilots a Bleriot monoplane. Certificate was issued on Dec. 23rd, 1910. On March 5th, 1911, flew 130 miles oversea, from Nice across Gulf of Genoa to Gorgona Island, near Leghorn.

Baillod, L.—A French airman. The pilot of a Hanriot monoplane. Obtained his certificate on Oct. 4th, 1910.

Balbi, Count.—At Cameri, Italy, has been making flights on a monoplane which resembles both a Bleriot and an Antoinette.

Baldwin, Mr.—Canadian aviator. Is the pilot of a Baddeck biplane, with which he has made many flights. Flying over ice, has effected trips of 40 miles and more, and has carried a number of passengers.

Balensi, Capt. A.—A French military pilot. Flies a Farman biplane. Gained his certificate on Aug. 9th, 1910.

Balsan, J. H.—A French pilot. Flies a Bleriot monoplane. His certificate was acquired on Jan. 6th, 1910.

Banks, R. C.—An Englishman. Learned to fly a Wright biplane. Visiting Australia, he had a bad fall on March 1st, 1910.

Baratoux, Marcel.—A French pilot. Flies a Wright biplane. Has done a great amount of passenger carrying. Was given his certificate on April 10th, 1910.

Barber, H.—One of the most earnest British experimenters. Has designed and built a British machine of entirely original type. This machine, which is known as the Valkyrie, combines the good features of both the biplane and the monoplane. It is driven by a Green, British-built engine, and has, at the Hendon aerodrome, made a great number of flights. Mr Barber has now opened a regular flying school, with a number of British pupils.

Barbier.—Pilots a Bleriot monoplane.

Barbotte, E.—A Frenchman. Flies a Bleriot monoplane. His certificate was granted to him on Oct. 19th, 1910.

Barillon, Pierre.—The designer and builder of the Barillon aeroplane. A Frenchman. Gained his certificate on Dec. 7th, 1910.

Barnes, G. N.—An Englishman who was well known as a racing motor-cyclist before he became an aviator, winning many prizes both in France and England. He first built a monoplane of his own design, and flew with it near London, being one of the first successful constructors in England. Afterwards, he learned to fly upon a Humber monoplane and appeared at several of the English aviation meetings. At Folkestone, giving a display in the summer of 1910, Mr Barnes had the misfortune to fall and injure his head severely.

Barnwell, H.—A British flyer who has built, in Scotland, a monoplane of his own design. In 1910, making a first flight, he met with an accident, smashing his machine. In the beginning of 1911, however, he was able to make several good flights.

Barra, F.—The pilot of a Maurice Farman biplane. A Frenchman. Secured his certificate on Aug. 9th, 1910.

Barrier, Rene.—A French pilot. Flying a Bleriot monoplane, he won prizes at the Belmont Park aviation meeting in October, 1910. His certificate was granted on May 2nd, 1910.

Barrington-Kennett, Lieut. B.W.—A British military pilot. Mı Barrington-Kennett was formerly a pupil at the Beaulieu flying school. Subsequently, he took his certificate at Hendon on a Bleriot monoplane.

Basset, Paul.—The pilot of a Farman biplane. A Frenchman. Took his certificate on July 19th, 1910.

Bathiat, H. H.—A French aeroplanist. Learned to fly upon a Hanriot monoplane at Rheims, gaining his certificate on Oct. 4th, 1910.

Bathiat, Leon.—The pilot of a Breguet biplane. Secured his certificate on July 21st, 1910. A Frenchman. Is experimenting with a Sommer monoplane.

Baugnies, Lieut. J. E.—French military airman. Learned to fly upon a Sommer monoplane. Took his certificate on Aug. 29th, 1910.

Bayale, Auguste.—A French flyer. Pilots a Farman biplane. His certificate was given him on Nov. 8th, 1910.

Beard, Peirre.—A juvenile aviator. Gained his certificate on Sep. 15th, 1910.

Beattie, Mr.—Experimented with a Roe triplane at Brooklands.

Beaud, E.—A very well-known French pilot. Gained his certificate on July 19th, 1910. Flies a Farman biplane, with which he made a number of excellent flights at the Burton-on-Trent aviation meeting in 1910. Instructed Mlle Dutrieu in the art of flying.

Beck, Lieut.—An American military pilot. Learned to fly upon a Wright biplane.

Becue, M.—A French aviator. Learned to fly at

Etampes, upon a Tellier monoplane, gaining his certificate on Oct. 19th, 1910. Has made a number of flights.

BEHREND, Herr.—German airman. Won a 7,000 marks prize offered by Dr Lanz.

BELL, Mr.—English pilot. Has experimented with a Roe triplane at Brooklands.

BELLENGER, Capt. G.—One of the most famous of French military airmen. He gained his certificate on a Bleriot monoplane on April 5th, 1910. Capt. Bellenger has made a great number of cross-country flights, demonstrating the value of the aeroplane for reconnoitring work. On Feb. 1st and 2nd, 1911, Capt. Bellenger flew from Paris to Pau, a distance of 450 miles, which he traversed with only three stops. His actual flying time was 7 hours 16 minutes. He has also made a number of flights, carrying officers with him for observation purposes.

BELLER, A.—A French flyer. Learned to handle a Antoinette monoplane. Was given his certificate in November, 1910.

BELLOT, A.—A Frenchman. Learned to fly at Pau upon a Bleriot monoplane, being given his certificate on Dec. 7th, 1910.

BENDAL, Mr.—Experimented at Brooklands with a Bristol biplane.

BENSON, Mr.—Pupil at the school inaugurated at Hendon by Mr H. Barber, inventor of the Valkyrie monoplane.

BERDA, Lieut.—Military airman. Pilots a Farman biplane.

BERGONIE, Lieut.—French military airman. Flies a Sommer biplane. His certificate was issued in January, 1911.

BERIN, A.—Learned to fly upon a Farman biplane.

BERNETTI, M.—Has made a number of experiments with a machine of his own construction.

BIALOVUCIE, M.—Flies a Sanchez-Besa biplane, a machine with which successful results have been obtained.

BIANCHI, M.—Learned to fly upon a Voisin biplane at Cameri, in Italy. Afterwards, became instructor of a flying school started in Switzerland.

BIARD, Capt. G.—Is one of the French military airmen, of whom France will soon possess a hundred. Pilots a Farman biplane, having taken his certificate on October. 19th, 1910.

BIBESCO, Prince G.—A Roumanian airman. Learned to fly upon a Bleriot monoplane. Took his certificate of proficiency on Jan. 6th, 1910.

BIELOVUCIE, J.—A Peruvian airman, who has made a great number of cross-country flights. Flies a Voisin and a Farman biplane. His certificate was awarded to him on June 10th, 1910. His chief cross-country flight was an aerial journey from Paris to Bordeaux, a distance of 370 miles. This he performed with three stops in seven hours, flying his Voisin biplane. In Peru, has made cross-sea flights.

BIER, Lieut.—Military pilot. Flies a Montgolfier monoplane.

BILL, H.—Is the chief pilot of the Farman flying school at Etampes. Is a Frenchman, being given his certificate on Aug. 29th, 1910.

BILLING, E.—An English airman. Has rebuilt an old-type Voisin biplane, and has made it like a Farman machine. Has made flights at Brooklands.

BINDA, Lieut. L.—French military flyer. Pilots a Maurice Farman biplane. Took his certificate on Oct. 4th, 1910.

BLACKBURN, Mr.—Is the designer and builder of the Blackburn monoplane, with which successful tests have been made.

BLANCHET, G.—The pilot of a Farman biplane. Is a Frenchman. Was granted his certificate on Oct. 4th, 1910.

BLANCK, M. GUY.—Learned to fly upon a Bleriot monoplane at Pau.

BLERIOT, LOUIS.—M. Bleriot, one of the world's most famous airmen, has the distinction of holding Certificate No. 1 of the French Aero Club. After a great many most painstaking experiments, begun in 1900, M. Bleriot gained undying fame by being the first man to fly from France to England. He made the memorable aerial cross-sea journey on July 25th, 1909, winning a prize of £1,000 offered by the *Daily Mail*. Previously, on July 13th, 1909, he had made a cross-country flight of 25 miles. Afterwards, owing to the rush that there was to acquire machines of this type, he opened a flying school at Pau, where he taught a large number of pupils to fly. He took a prominent part in the first Rheims meeting of 1909. His most important step, afterwards, was to fit his monoplanes with 50-h.p. Gnome motors, which made them so speedy and powerful that they won practically all the height and speed contests offered at the various aviation meetings. After constructing a monoplane to carry two people, M. Bleriot has now tested satisfactorily, a monoplane to lift four people into the air. Upon this machine, as many as eight passengers, in addition to the aviator, have been carried.

BLONDEAU, G.—Pilots a Farman biplane. Flew at the Lanark aviation meeting, 1910. Afterwards, entered into partnership with Mrs Maurice Hewlett, opening a flying school at Brooklands. Has taught many pupils, including Lieut. Snowden-Smith, and has undertaken passenger work. His certificate was granted on June 10th, 1910.

BOARD, Captain A. G.—Pupil of Bleriot school at Hendon. Flew for his certificate on Nov. 29th, 1910.

BOBBA, A.—French airman. Pilots a Gyp monoplane. Gained his certificate on Dec. 7th, 1910.

[*Daily Mirror*.

MR LATHAM'S START FROM SANGATTE FOR HIS SECOND CROSS-CHANNEL FLIGHT, JULY 27TH, 1909.

BOILLOT, M.—Pilots a Hanriot monoplane. After one lesson flew for twenty minutes. On the following day was able to obtain his certificate. A well-known motor driver.

BOISE, COUNT DE C.—French airman. Gained his certificate on a Bleriot monoplane, on Nov. 8th, 1910.

BOLVIN, A.—Flies a Hanriot monoplane. Is a Frenchman. His certificate was granted on Oct. 4th, 1910.

BONNIER, G. R.—Flies both a Demoiselle monoplane and a Farman biplane. Is a Frenchman. Was given his certificate on July 19th, 1910.

BORGUIS, M.—Learnt to fly a Bleriot monoplane at Pau.

BORN, VAN DER.—A Belgian flier of a Farman biplane, whose certificate was given him on May 8th, 1910. Has made many flights at aviation meetings, notably at Nice in 1910.

BOTHEY, M.—Flies in Belgium, a monoplane of original design.

BOURNIQUE, PIERRE MARIE.—Flies an R.E.P. monoplane, fitted with an R.E.P. engine. Competing for the Michelin Cup, 1910, he flew for 6 hours 30 minutes, covering 330 miles. During this flight, he set up world's records for speed from 156 to 312 miles. Is an Alsatian.

BOUSQUET, Lieut. P.—French military airman. Pilots a Farman biplane. Took his certificate on Nov. 23rd, 1910.

BOUVIER, ANDRE.—A French flyer. Learned to handle a Sommer biplane. His certificate was granted on June 21st, 1910. Afterwards, he piloted a Goupy biplane.

BOUWENS, B. G.—English airman. Learned to fly at the Bleriot school at Hendon, securing his certificate on Dec. 28th, 1910.

BOYER, L.—The pilot of an Antoinette monoplane. Gained his certificate on Nov. 23rd, 1910. Is a Frenchman.

BOYLE, Hon. ALAN.—Began to fly in the spring of 1910, learning upon an Avis British-built monoplane at

Brooklands. Was the first airman to make a cross-country journey in England on a monoplane. Flew at the Wolverhampton flying meeting in 1910. At the Bournemouth International meeting, he had the misfortune to make a descent in a clover field, with the result that the skids of his machine were caught by the clover, and the monoplane was overturned. Mr Boyle sustained very serious injuries to his head. At the end of February, 1911, he had, fortunately, almost completely recovered.

Bradshaw, Mr.—Pilots a British-built Star monoplane, which resembles an Antoinette. After carrying out a number of tests at the Dunstall Park aerodrome, he brought his machine to Brooklands.

Bregi, Henri.—Acquired his certificate on Dec. 21st, 1909. Is chief pilot of the Voisin flying school. In January, 1911, carried out successful tests with a new Voisin biplane, which flies tail first.

Breguet, Louis.—One of the most original French designers. Carried out experiments prior to the meeting at Rheims in 1909. Here, although his machine attracted interest, he was not successful. Since then he has improved his machine greatly. It has, on account of its portability, found acceptance with the French military authorities. He has taken up six passengers.

Bresson, G.—Gained his certificate on Nov. 8th, 1910, flying an Antoinette monoplane. Is a Frenchman.

Briancon, L.—Learned to fly upon a Breguet biplane. Is a Frenchman. Secured his certificate on Nov. 8th, 1910.

Brookins, Walter.—One of the most prominent American airmen. First flying upon the early type Wright biplane, he has since piloted the new "Baby" Wright, a faster machine than its predecessor. At the Belmont Park meeting, October, 1910, he had an accident with a "Baby" Wright. The machine was destroyed, but he was only slightly hurt. Mr Brookins has made a speciality of high flights. On Sept. 30th, 1910, he flew from Chicago to Springfield, 187 miles, with two stops. At

Indianapolis, on July 16th, 1910, he rose 4,503 feet high.

BRUNHUBER, SIMON.—A German airman. Has made many flights at the Johannisthal aerodrome, near Berlin, upon an Albatross aeroplane. Has carried four passengers.

BUNAU-VARILLA, E.—One of the early French fliers. Learned to pilot a Voisin biplane. Was one of the competitors at the Rheims meeting, 1909. Was a prize-winner here.

BURDIN, M.—The pilot of a Fabre hydro-aeroplane.

BURGEAT, Captain M.—A French military airman. Learned to fly upon an Antoinette monoplane, gaining his certificate on April 5th, 1910.

BURKE, Captain C. J.—One of the first British military airmen. Learned to fly in France. Took over the first Farman military-type biplane purchased by the War Office, at the end of 1910. At Farnborough, subsequently, when testing the machine, had an accident which completely wrecked the biplane. Acquired his certificate on Oct. 4th, 1910.

BUSSON, G.—Was given his certificate on June 21st, 1910. Is a Frenchman. Pilots a Bleriot monoplane.

BYASSON, Lieut. L.—One of the first officers in the French Navy to take up aviation. Flies a Maurice Farman biplane. Took his certificate on Aug. 9th, 1910. Has made a number of cross-country flights.

C.

CACHAT, Lieut.—The pilot of a Farman biplane.

CAGLIANO, NINO.—Italian airman. Secured his certificate at Cameri, Italy, flying a Hanriot monoplane.

CAGNO.—Has made a number of flights near Pordenone, Italy.

CAILLE, ALBERT.—French pilot. Learned to fly upon a Farman biplane, securing his certificate on Aug. 29th, 1910. Afterwards, undertook the first tests of the military biplane designed by M. Paulhan. The British Government has acquired a machine of this type.

CALDERARA, Lieut.—The first Italian military airman. Pilots a Wright biplane. Has made many flights. Recently reported to have given up aviation.

CAMERMAN, Lieut.—French military aviator. Has made many cross-country flights. His certificate was given him on March 8th, 1910. Lieut. Camerman flew for 232 kilometres on Dec. 18th, 1910, carrying a passenger, and covering the distance in 4 hours 2½ minutes. By this, he won the Lazareweiler cross-country prize of £1,000.

CAMES, G.—Flies a Bleriot monoplane, gaining his certificate on Oct. 8th, 1910.

CAMMELL, Lieut.—British military airman. Learned to fly on Salisbury Plain. Is now piloting a Bristol biplane.

CAMPBELL, Mr.—Flies a Voisin biplane.

CAMPO-SCIPIO, M. DE.—A Russian airman. Learned to fly a Hanriot monoplane, gaining his certificate on Aug. 29th, 1910.

CANNONIERE, UMBERTO.—Flew for his certificate at Pordenone, using a Bleriot monoplane.

CARLISH, Mr.—The designer, builder, and pilot of the Carlish monoplane.

CARTER, H. G.—Has designed and built a biplane.

CATERS, BARON DE.—Learned to fly an early type Voisin biplane. Has visited India. Is now flying upon a Farman biplane. On Feb. 1st, 1911, gave a demonstration at Bangalore, India, before 25,000 people.

CATTANEO.—One of the first airmen to fly the Bleriot monoplane, with a 50-h.p. Gnome motor. Won many prizes in France at the meetings held in 1910. Flew at the Lanark meeting, 1910. Held the British duration record—3 hours 11 minutes, made on Aug. 10th, 1910—until beaten by Mr Cody. On Dec. 17th, 1910, won a £4,000 prize for flying across the river La Plata from Buenos Ayres to Colonia, and back again, a distance of 70 miles.

CAUDRON, R.—French airman. Pilots a Caudron biplane. Gained his certificate on July 9th, 1910. Flew at the rate of 95 kilometres an hour on Jan. 28th, 1911.

Cederstrom, Baron **Carl de**.—The first Swedish aviator. Pilots a Bleriot monoplane. Secured his certificate on May 2nd, 1910.

Cei.—First flew a Farman biplane. Now flies a Caudron biplane. Flew over Paris from Issy on Jan. 26th, 1911.

Celinsky.—Russian airman. Flies an Antoinette monoplane.

Chailley, H.—French flyer. Pilots a Voisin biplane. Was given his certificate on Aug. 9th, 1910.

Challenger, Mr.—Pilots a British-built Bristol biplane.

Chambers, C. J.—Pupil at the Valkyrie school, Hendon.

Champel, F.—Appeared at the Lanark meeting, 1910, where he flew a new type of Voisin biplane. Fell in a wood at Lanark. His machine was extricated with difficulty. He was unhurt. Obtained his certificate on July 10th, 1910. At Issy, in February, 1911, made 62 flights in one day.

Charpentier, L.—French pilot. Flies a Bleriot monoplane. Got his certificate on Nov. 8th, 1910.

Chassange, J.—Pilots a Hanriot monoplane. A Frenchman. Obtained his certificate on August 9th, 1910.

Chatain, L.—Frenchman. Flies a Sommer biplane. Was given his certificate on Oct. 19th, 1910.

Chatain, M. L.—Flies an Antoinette monoplane. Obtained his certificate on Nov. 23rd, 1910.

Chateau, E.—Chief pilot of the Tellier flying school, Etampes. A Frenchman. Obtained his certificate on July 1st, 1910.

Chaunac, Capt.—Flies a Maurice Farman biplane of the military type.

Chemet, G.—A Voisin flyer. Frenchman. Certificate is dated Aug. 9th, 1910.

Cheuret, L.—Learned to fly a Farman biplane at Etampes. Afterwards went to Cameri, Italy, starting a flying school. A Frenchman.

Cheutin, Lieut. E.—French military pilot. Flies a Maurice Farman biplane. Gained his certificate on Oct. 4th, 1910.

Chevalier, L.—Pilots a Nieuport monoplane. Was granted his certificate on Dec. 23rd, 1910. A Frenchman.

Chevreau, Lieut. R.—French military officer. Flies a Wright biplane.

Chioni, B.—Russian airman. Learned to fly an Antoinette monoplane. Secured his certificate on Oct. 4th, 1910.

Chouvasse, M.—The pilot of a Farman biplane.

Christiaens, J.—Learned to fly a Voisin biplane, afterwards piloting a racing Farman, flew at Bournemouth, 1910, where had accident while passenger carrying. Flew for 2 hours 20 minutes at Bournemouth. With his brother Armaud, is making a tour of the East Indies, taking with him two British-built Bristol biplanes.

Christiansen.—Pilots a Voisin biplane.

Ciro, Signor.—An Italian. Learned to pilot a Voisin biplane at Cameri, Italy.

Cirri, M.—Learned to fly a Voisin biplane at Cameri, Italy. Afterwards piloted a Farman. On Dec. 26th, 1910, had the misfortune to fall into the sea while flying at Genoa. Was rescued, but his aeroplane was lost.

Clavenad, P.—A Frenchman. Pilots an Antoinette monoplane. Was granted his certificate on Nov. 23rd, 1910.

Clayton, Captain.—An Englishman. Pilots a Bleriot monoplane.

Clement, M.—Pilots a Demoiselle monoplane, constructed by the Clement-Bayard firm. His certificate was granted on July 21st, 1910. Flying for his certificate he used a Clement-Bayard biplane.

Clolus, Commandant G.—French military pilot. Flies an Antoinette monoplane. Certificate is dated July 20, 1910.

Clusson, M.—Designer and builder of the Clusson monoplane.

Clutterbuck, E. C.—Pupil of the Valkyrie school, Hendon.

MR. GRAHAME-WHITE LEAVING RUGBY IN HIS FIRST LONDON-MANCHESTER FLIGHT, APRIL 21ST, 1910.

COBIANCHI.—Italian airman. Pilots a Farman biplane.

COCKBURN, G.—Bought the first biplane of present type made by Henry Farman. This was a month before the first Rheims meeting, 1909. Learned to fly before the Rheims meeting. Was the only English competitor here. Afterwards, made flights in England, notably at Salisbury Plain. At the Wolverhampton meeting, 1910, won the quick starting contest. Is still able to use the original machine upon which he learned to fly.

CODY, S. F.—An American by birth. Became, in 1909, a naturalized Englishman. First interest in aviation took the form of inventing man-lifting kites. These were adopted by the War Office, and Mr Cody became one of the chief engineers at the balloon factory, South Farnborough. Built an aeroplane more than two years ago. Was first man to fly in England. By a flight of 4 hours 47 minutes, made over Laffan's Plain on Dec. 31st, 1910, Mr Cody won the British Empire Michelin cup. He covered 187 miles 787 yards. Mr Cody's biplane has original features, one of the chief being its strength of construction.

COLLIER, H. A.—Pilots a Bleriot monoplane.

COLLIEUX, MAURICE.—The flyer of a Voisin biplane. Obtained his certificate on July 10th, 1910. A Frenchman.

COLLIN, G.—Was granted his certificate on Nov. 8th, 1910. A Frenchman. Pilots a Farman biplane.

COLMORE, G. C.—English flyer. Obtained his certificate at the Eastchurch aerodrome on July 21st, 1910. Flies a Short biplane. Flew at the Lanark International meeting, 1910.

COLOMB, H.—Flies a Farman biplane. A Frenchman. Obtained his certificate on Dec. 7th, 1910.

COLOMBO, S. B.—Flying at the Johannisthal aerodrome in June, 1910, had the misfortune to fall upon the roof of the grand-stand. Machine was badly damaged. He escaped without serious injury.

COMMEAU, Naval-Lieut. J.—French naval officer.

Learned to fly a Bleriot monoplane in December, 1910.

CONNER, Lieut. D. G.—English pilot. Flying at Salisbury Plain, gained his certificate upon a British biplane.

CONTARD, P.—Flies a Bleriot monoplane, upon which he gained his certificate on January 4th, 1911. A Frenchman.

COOK, Major R. H.—English officer. Joined flying school at Beaulieu. Obtained his certificate, flying a Bleriot monoplane, on Dec. 28th, 1910.

CORDONNIER, M.—Pilots a Hanriot monoplane. Was granted his certificate on Sept. 19th, 1910.

COTAIN, M.—Pilots the Cotain biplane.

CROCHON, M.—A Frenchman. Flies a Farman biplane, also a Train monoplane. On the latter machine, made a cross-country flight of an hour's duration in January, 1911. His certificate was issued on April 5th, 1910.

CROMIER, A.—A French aviator. Piloting an Antoinette monoplane, obtained his certificate on Jan. 4th, 1911.

CUGNET, G.—Gained his certificate on July 19th, 1910. A Frenchman. Flies a Farman biplane.

CURE, G. M.—Can fly both a Koechlin and Antoinette monoplane. Was given his certificate on Oct. 4th, 1910. A Frenchman.

CURTISS, GLENN, H.—American airman. In 1909, piloting a racing biplane of his own design, won the Gordon-Bennett race at the Rheims meeting. Since then, has built machines in America. At San Francisco, on Jan. 28th, 1911, succeeded in rising off the surface of the water with a special biplane. Holds Certificate No. 2 of the French Aero Club. On May 29th, 1910, flew 150 miles from Albany to New York, with one stop.

CUTLER, Mr.—Flies a Bleriot monoplane.

D.

DAILLENS, J.—French airman. Flies a Sommer biplane. Certificate was granted to him on July 21st, 1910.

DAROGINSKY.—Russian flyer. Learned to pilot an Antoinette monoplane.

DAVIES, E. KEITH.—Learned to fly at Brooklands. Pilots a Humber and Hanriot monoplane. Has visited India, where he was one of the first men to fly on a heavier-than-air machine.

DAWES, Capt. G.—One of the first military pilots in England. Flies a Bleriot monoplane. Gained his certificate on July 26th, 1910. Took part in the Wolverhampton meeting, 1910.

DEFRIES, COLIN.—Having learned to fly a Wright biplane, visited Australia in 1910.

DELAGE, Lieut. G.—French military pilot. Uses a Sommer biplane. Secured his certificate on Sept. 19th, 1910.

DELAMINE, M.—Pilots a Farman biplane.

DELARUE, M.—Flies a Bleriot monoplane.

DELATANG, F.—French pilot. Learned to fly a Bleriot monoplane. Gained his certificate on April 5th, 1910.

DELROUTELLE, PIERRE.—Flies a Zodiac monoplane.

DEMANEST, M.—French aviator. Piloted an Antoinette monoplane at the Rheims meeting, 1909. Recently, has designed a new monoplane.

DERNEY, L.—Frenchman. Flew for his certificate on a Farman biplane on Oct. 4th, 1910.

DEUHAUT, M.—Pilots a Demoiselle monoplane.

DEVAULX, R.—Flies a Farman biplane. A French airman. Secured his certificate on Aug. 9th, 1910.

DEVE, M.—French pilot. Flies a Farman biplane. Was granted his certificate on Oct. 4th, 1910.

DICKSON, Capt. BERTRAM.—Learned to fly in France on a Farman biplane. Was granted his certificate on April 19th, 1910. Afterwards, at French meetings at Rouen and Tours in May and June, 1910, won more than £3,000. Flew at the Bournemouth and Lanark meetings, 1910. Also flew at Leopardstown racecourse, Ireland. Gave a demonstration to the military authorities, on a Bristol biplane, during the manœuvres in the autumn of 1910. Went to Milan, where he met with a serious accident, colliding in the air with the aviator Thomas, who was flying an Antoinette monoplane. Although very seriously injured internally, Captain Dickson recovered.

DIDIER, A.—Was granted his certificate on May 17th, 1910. A Frenchman. Flies a Farman biplane.

DIMMOCK, Lieut.—Made his first flight, on a Valkyrie monoplane, at the Hendon school, after an hour's tuition.

DOITRINSKY.—Russian airman. Pilots a Bleriot monoplane.

DORNER, Herr.—Forty-seven flights were made by this German airman during November, 1910, at the Johannisthal aerodrome. The total duration of his flights was 6 hours 24 minutes 30 seconds.

DOROGUSKY, S.—Flies an Antoinette monoplane. A Russian pilot. Was granted his certificate on July 21st, 1910.

DREXEL, J. ARMSTRONG.—Was one of Mr Grahame-White's first pupils at Pau. Afterwards obtained his certificate at Beaulieu, in the New Forest, on June 21st, 1910. At Beaulieu, in conjunction with Mr W. E. McArdle, an English amateur flyer, opened a flying school, which was operated during 1910. At the Lanark meeting on Aug 11th, 1910, secured a world's record for altitude, rising 6,500 feet. Flew in the Gordon-Bennett Cup race at Belmont Park in October, 1910. At this meeting, on October 31st, 1910, rose 9,450 feet high.

DUBONNET, E.—Pilots a Tellier monoplane. On the second day after he had learned to fly, made a fifty-mile flight. Flew over Paris in his monoplane on April 23rd, 1910, starting from Juvisy. Entered for the *Daily Mail* £10,000 prize for the flight from London to Manchester, but the feat was accomplished before he could bring his monoplane to England. Was the winner of the Prix de la Nature for a 100-kilometres cross-country flight. Has now abandoned flying.

DUCROCQ, MAURICE.—Purchasing a racing Farman biplane, has made flights at Brooklands. Makes a speciality of passenger carrying, holding a British passenger-carrying record for 1910, with a flight of 1 hour 12 minutes on Dec. 31st, 1910, during which he covered 49 miles.

DUFLOT, E.—French pilot. Flies a Bleriot monoplane. His certificate was granted on Nov. 8th, 1910.

DUFOUR, E.—A Frenchman. Pilots a Bleriot monoplane. Accorded his certificate on July 10th, 1910.

DUFOUR, J.—French pilot. Flies a Voisin biplane.

DUFOUR, L.—Pilots a Farman biplane. A Frenchman. Gained his certificate on Aug. 29th, 1910.

DUHAIT, M.—Pilots a Farman biplane.

DUMONT, SANTOS.—*See Santos Dumont.*

DUNNE, Capt. J. W.—British officer. Was engaged by the War Office to carry out the first experiments that were made, in Scotland, with a Government aeroplane. Has devoted himself to the study of automatic stability. At the Aero Club flying ground, Eastchurch, Isle of Sheppey, has constructed, and flown, a biplane which he claims possesses automatic stability. Has demonstrated his ability to fly for an appreciable distance without holding the levers controlling the machine. On Dec. 20th, 1910, demonstrated to Mr Orville Wright, and Mr Griffith Brewer, representing the Aeronautical Society, that he could write notes while flying, taking both hands off levers.

DUPERRON, Capt.—French military pilot. Flies a Maurice Farman biplane. Certificate was issued to him on Aug. 29th, 1910.

DURAY, M.—Frenchman. Was a well-known racing motorist. Learned to fly a Farman biplane. Was the victim of a remarkable accident, the propeller of his machine striking him, and injuring him severely.

DUTRIEU, Mlle HELENE.—French airwoman. Began to learn to fly a Demoiselle monoplane, but afterwards transferred her attentions to the Farman biplane. Flew at the Doncaster and Burton-on-Trent meetings, 1910. In France, in 1910, won the Coupe Femina. Her longest flight, made on Dec. 21st, 1910, was one of 105 miles, during which she remained in the air for 2 hours 35 minutes.

DUVAL, E.—French aviator. Pilots a Saulnier monoplane. Certificate was granted on July 21st, 1910.

E.

EDMOND, M.—French aviator. Learned to fly a Farman biplane. Afterwards came, as an instructor, to the Salisbury flying school of the British and Colonial Aeroplane Company.

EDWARDS, Mr.—Flies a Voisin biplane.

EFIMOFF, MICHEL.—Russian airman. Learned to fly at Chalons in February, 1910. Afterwards, won many prizes. At Nice, in April, 1910, flying past Mr A. Rawlinson, the British pilot, he blew the latter into the sea with the " wash " of his propeller. Has recently been appointed instructor of the Russian military school of aviation, at a salary of £3,000 per annum.

EGERTON, Hon. MAURICE.—Learned to fly a Short-Wright biplane at Eastchurch, Isle of Sheppey, in June, 1910. Has met with two accidents, injuring his hand and leg. Recently consented to become instructor of the naval officers who are learning to fly at Eastchurch.

EHRMANN, Herr.—German aviator. Pilots a Farman biplane.

ELY, E. B.—American airman. Flies a Curtiss biplane. On January 17th, 1911, succeeded in flying across San Francisco harbour, landing on the deck of the cruiser *Pennysylvania* and returning to the shore again.

ENGLEHARDT, Capt.—German airman. One of the first

[*Daily Mirror.*

MR. GRAHAME-WHITE, WITH HIS MOTHER, SISTER, AND MR. HARRY HARPER, AT LICHFIELD, AFTER HIS FIRST LONDON-MANCHESTER FLIGHT, APRIL 21ST, 1910.

pilots, in Europe, of the Wright biplane. During November, 1910, made 81 flights at Johannisthal aerodrome.

ENGLAND, GORDON.—With a Weiss monoplane, has made experiments at Brooklands.

ENO.—Japanese pilot. Flies a Langley monoplane.

ERISTOFF, PRINCE W.—Russian aviator. Flies a Hanriot monoplane. Obtained his certificate on Nov. 8th, 1910.

EROS.—Italian pilot. Has flown across country from Turin to Salussola.

ESNAULT-PELTERIE, R.—Frenchman. Obtained certificate No. 4 of the French Aero Club. Designed, built, and flew a monoplane with which he appeared at the Rheims meeting, 1909. It was fitted, also, with an engine of his own construction. Met with success after many failures. His chief pilot, M. Pierre-Marie Bournique, has created world's records for speed.

ESTERRE, CHARLES, R.—British pilot. Flies an Antoinette monoplane. Secured his certificate on Oct. 4th, 1910.

ETEVE, Capt. A.—French military pilot of a Wright biplane. Learned to fly in July, 1910.

ETRICH, Herr.—Inventor of the Etrich monoplane, a machine which has been adopted by the German military authorities.

EULER, Herr A.—Inventor and pilot of the Euler monoplane. The longest flight made by this machine is one of 3 hours 6 minutes.

EYRING, Herr.—Flies a machine known as the Huth biplane. Won a prize of 1,000 marks offered by Dr Lanz.

F.

FABRE, M.—Designed, and flew, the Fabre monoplane. Has succeeded in rising off the water for a flight.

FACCIOLI.—Italian airman. Has made flights at Turin.

FAILLONBAZ, M.—Flies a Bleriot monoplane.

FARMAN, HENRY.—First flew, in 1907, on Voisin biplane. First flights were: Oct. 14th, 1907, 311 yds.; Oct. 27th, 1907, 843 yds.; Jan. 11th, 1908, 1 mile 20 yds. By half-circular flight of 1,093 yds., won Deutsch-Archdeacon prize of £2,000 on Jan. 13th, 1908, also *Daily Mail* £100 prize. Made first cross-country flight in France—from Chalons to Rheims, a distance of 28 kilometres. His principal subsequent flights are set forth herewith: 1 hr. 23 mins. Chalons, July 19th, 1909; 3 hrs. 4 mins. (112 miles), Rheims, Aug. 27th, 1909; 1 hr. 32 mins. (47 miles), Blackpool, Oct. 20th, 1909; 1 hr. 7 mins. (with passenger), Chalons, Nov. 2nd, 1909; 4 hrs. 22 mins. (150 miles), Chalons, Nov. 3rd, 1909, winning Michelin Cup, 1909; 2 hrs. 45 mins., Mourmelon, Dec. 31st, 1909. Flew 16 miles with two passengers, Mourmelon, Mar. 4th, 1910; flew 50 miles with two passengers, Mar. 5th, 1910; flew for 1 hr. 20 mins. with three military passengers on Aug. 2nd, 1910; flew 12½ miles with four passengers, Nov. 10th, 1910. Flew for 8 hrs. 23 mins. on Dec. 18th, 1910. Carried five passengers in February, 1911. The biplane Mr Farman builds and flies is one of the best known in the world.

FARMAN, MAURICE.—A brother of Henry Farman. Designed and constructed a biplane, which has been found particularly suitable for military purposes. With a Maurice Farman biplane M. Tabuteau won the Michelin Cup, 1910, flying 365 miles.

FARNIER, E.—Pilots a Bleriot monoplane.

FELIX JULIEN.—French airman. Pilots a Bleriot monoplane. Gained his certificate on Oct. 19th, 1910.

FENWICK, R. C.—Pilots a biplane of original construction, built by Planes, Ltd., Liverpool. Engine, and pilot, are suspended beneath the main-planes. Obtained his certificate on this machine on Nov. 29th, 1910, at Freshfield.

FEQUANT, Lieut. A.—French military pilot. Obtained his certificate, on a Farman biplane, on May 2nd, 1910.

His best flight is one of a hundred miles, non-stop, which he made, while carrying a passenger, on June 9th, 1910. Was 2 hours 30 minutes in the air. Is now flying a Nieuport monoplane.

FEQUANT, P.—French pilot. Flies a Farman biplane. Obtained his certificate on December 23rd, 1910.

FERGUSON, H. G.—Flies a Ferguson monoplane, an Irish-built machine.

FILLIPPI, M.—Pilots a Farman biplane.

FISCHER, M.—Has made a flight round the principal tower of Turin. Flies a Farman biplane.

FLESC, M.—Pilots a Voisin biplane.

FLORENCIE, J.—French flyer. Piloting a Farman biplane, gained his certificate on Aug, 29th, 1910.

FOULIS, W.—Has experimented with a Lane, British-built aeroplane.

FOURNIER, H.—Racing-motorist. Appeared at the Rheims meeting, 1909, flying a Voisin biplane.

FOYE, Mr.—Learned to fly a Bleriot monoplane at Pau.

FRANCK, Mme.—Came to Calais, soon after having learned to fly at Chalons, with the intention of crossing the Channel. Bad weather interfered with the project, however. At Newcastle, while giving a demonstration, she collided with a pole which held up some decorations. Her machine was wrecked, and she was badly injured, recovering completely, however.

FREY, Herr A.—After flying a Farman biplane, this airman is learning to pilot a Morane monoplane.

FRISBY, J. B.—Flies a Curtiss biplane in America.

FROUSSART, E.—In January, 1911, secured his certificate upon a Sommer biplane.

FULTON, Capt. J. D. B.—Began experiments with a two-seated Bleriot monoplane at Salisbury Plain. Acquired his certificate on a Farman biplane, belonging to Mr Cockburn. Captain Fulton went to France in January, 1911, and took over the Paulhan biplane which had been purchased by the War Office. Captain Fulton flew this machine at St Cyr on January 16th and 17th, 1911,

G.

Gaget, J.—Obtained his certificate on December 23rd, 1910, piloting a Farman biplane. A Frenchman.

Gallie, F.—French aviator. Flies a Bleriot monoplane, upon which he gained his certificate in December, 1910.

Garnier, L.—Flying a Bleriot monoplane gained his certificate on December 7th, 1910.

Garros, R.—Learned to fly upon a Demoiselle monoplane with which he secured his certificate on July 19th, 1910.

Gaskell, Mr.—A pupil at the Valkyrie school, Hendon.

Gasnier, Gustave.—Flies a Wright biplane.

Gasnier, Pierre.—Flies a Bleriot monoplane.

Gasnier, Rene.—Has made flights upon a Wright biplane.

Gaston.—Flies a Nieuport monoplane.

Gaunt, Mr.—Designer and pilot of a biplane on original lines.

Gaubert, E.—French aviator. Learned to fly a Bleriot monoplane at Pau.

Gaubert, Lieut. L.—French military airman. Flies a Wright biplane. Obtained his certificate on May 2nd, 1910.

Gaudart, L.—Pilots a Voisin biplane. A Frenchman. Certificate was issued on October 4th, 1910.

Gaulard, C.—Learned to fly upon an Antoinette monoplane. A Frenchman. Obtained his certificate on Nov. 3rd, 1910.

Gaver, Paul van.—French aviator. Flies an Antoinette monoplane. Learned in December, 1910.

Gavotti, Lieut.—Flies a Voisin biplane

Gaye, G.—A French flyer. On Oct. 4th, 1910, obtained his certificate on a Voisin biplane.

Gentil.—Pilots a Voisin biplane.

George, A. E.—Obtained his certificate at Eastchurch, Isle of Sheppey, on Sept. 6th, 1910. Is the constructor of the " George and Jobling " biplane.

Gerrard, F. A.—Built a monoplane which was wrecked at the London aviation ground, Acton, on Dec. 18th, 1910.

[*Daily Mirror.*

MR. GRAHAME-WHITE AND M. PAULHAN MEET AT HENDON JUST BEFORE THE LONDON-MANCHESTER FLIGHT.

GIBBS, Lieut. L. D. L. — Obtained his certificate at Mourmelon on June 7th, 1910. Pilots a racing Farman biplane. Soon after learning to fly, made a flight of over an hour's duration. At a flying engagement in Spain, Mr Gibbs had his machine burnt by an angry crowd. At the Wolverhampton meeting, 1910, Mr Gibbs had a fall which shook him severely, being blown over by the "wash" from another machine. Was engaged as an "air scout" in the Army manœuvres in the autumn of 1910, but was unable to make more than one short flight. Has since given up flying, suffering from the effects of his fall.

GIBERT, E.—A Frenchman. Flies a Bleriot monoplane. His certificate was granted on October 4th, 1910.

GIBERT, L.—Flies a Farman biplane. A Frenchman. Was given his certificate on July 10th, 1910.

GILMOUR, GRAHAM.—Learned to fly a Bleriot monoplane fitted with a J.A.P. air-cooled engine. Made flights at Brooklands and elsewhere. Took part in the Lanark and Wolverhampton meetings, 1910. Afterwards flew a Bleriot monoplane with a Gnome engine. At Brooklands, has done passenger-carrying work with a two-seated Bleriot monoplane. On Sept. 13th, 1910, made a forty-five miles cross-country flight from Brooklands, landing at Hampton Court. In February, 1911, joined the British & Colonial Aeroplane Co. as a pilot.

GIRARD, Lieut. J.—French military airman. Learned to pilot a Sommer biplane.

GIUOCCHIO.—Flies a Bleriot monoplane.

GLORIEUX, L.—French pilot. Flies a Sommer biplane. Was given his certificate on Aug. 26th, 1910.

GOBE, A.—Flies an Antoinette monoplane. A Frenchman. Gained his certificate on July 10th, 1910.

GOBRON, J.—First learned to fly a Voisin biplane. Now pilots the Gobron biplane. His certificate was issued on Oct. 7th, 1909.

GOFFIN, MARCEL.—A Frenchman. Pilots an Antoinette monoplane.

GORRISON, Herr.—Flies a Euler monoplane.

GORTCHKOFF, Lieut.—Flies a Farman biplane.

GOUENCEY, H.—Pilots a Hanriot monoplane.

GOUIN, E.—Gained his certificate on Jan. 4th, 1911. Pilots a Bleriot monoplane. A Frenchman.

GOUNOUILHOU, A.—Flies an Antoinette monoplane. Was given his certificate on Dec. 23rd, 1910.

GOURNAY, H.—French airman. Pilots a Hanriot monoplane.

GOUX, M.—French airman. Learned to fly a Hanriot monoplane at Rheims. Obtained his certificate after only one day's tuition.

GRADE, Herr.—German airman. Flies a monoplane of his own construction. Has won many prizes, notably one of 4,000 marks, offered by Dr Lanz. On Jan. 21st and 22nd, 1911, Herr Grade carried four and five passengers respectively on his monoplane.

GRAHAME-WHITE, CLAUDE.—English aviator. One of M. Bleriot's first pupils. Took delivery, as his first machine, of a two-seated Bleriot, in which the occupants sat beneath the planes. On this machine he flew at Issy-les-Moulineaux. Afterwards went to Pau and opened a flying school, which was visited by many English pupils. After learning to handle a Bleriot monoplane, went to the Farman school at Chalons and flew a Farman biplane. With a Farman biplane made two attempts to fly from London to Manchester for the *Daily Mail* £10,000 prize. On first attempt made on April 21st, 1910, covered 113 miles in two flights. Had the misfortune to have his aeroplane blown over and very badly damaged by a high wind. On second flight, with repaired machine, flew for 117 miles in two stages. His second flight on this attempt was notable for the fact that he started away from Roade, his first descending place, in darkness, in an attempt to overtake his rival, Paulhan. Flew at the Bournemouth, Wolverhampton, and Blackpool meetings, 1910. Also gave displays of flying, notably at the

Crystal Palace, Ranelagh, Brooklands, Halifax, and Newcastle. In the autumn of 1910, went to America where, besides winning prizes, he flew for, and won for England, the Gordon-Bennett Cup, covering 100 kilometres, on a 100-h.p. "Gnome-Bleriot" monoplane, in 1 hour 4 mins. 3 secs. On his return to England, inaugurated a flying school at Hendon.

GRAILLY, Lieut. DE.—French military airman. Pilots a Hanriot monoplane.

GRANDSEIGNE, M.—Frenchman. Pilots a Farman biplane.

GRANET, MARCEL.—Flies a Bleriot monoplane.

GRANIER, Lieut.—Pilots a Farman biplane.

GRELLET.—Learned to fly a Bleriot monoplane at Pau.

GREMONT.—Flies a Farman biplane.

GRENEL, MARCEL.—French airman. Flies a Bleriot monoplane. Obtained his certificate on July 21st, 1910.

GRESWELL, C. H.—Pupil of Mr Grahame-White. Learned to fly a British-built Farman biplane. Gained his certificate at Brooklands. Also flies a Bleriot monoplane. Is instructor at the Grahame-White school at Hendon.

GREZAUD, P.—Flies a Sommer biplane. A Frenchman. Was granted his certificate on Oct. 19th, 1910.

GROUNIER, JULES.—French pilot. Flies a Farman biplane. Obtained his certificate on July 19th, 1910.

GRULICH, Herr.—German airman. Has made flights at the Johannisthal aerodrome. Gained his certificate in November, 1910.

GRUNET. M.—Learned to fly a Farman biplane.

GUEE, A.—Pilots a Farman biplane. French airman. Won his certificate on Sept. 19th, 1910.

GUILLEMIU.—Farman and Wright biplanes are piloted by this airman.

GUYOT, M.—Learned to fly a Bleriot monoplane at Pau.

H.

HABLE, A.—Flies a Savary biplane. French airman, Gained his certificate on Oct. 4th, 1910.

HARNAUX, MARCEL.—Pilots a Bleriot monoplane. A Frenchman. His certificate was dated Oct. 4th, 1910.

HAMEL, M.—First flew a Bleriot monoplane. Has now transferred his attention to the Morane monoplane.

HAMILTON, C. K.—American airman. Flies a Curtiss biplane. Flew 160 miles from New York to Philadelphia on June 13th, 1910. On Feb. 12th, 1911, flew over the town of Ciudad Juarez, Mexico, while it was besieged by insurrectionists.

HAMMERSLEY, Mr.—At Etampes, learned to fly a Tellier monoplane. An American.

HAMMOND, J. J.—An Australian. After flying a Sanchez-Besa biplane, came to England and flew a Bristol biplane. Gained his certificate on Nov. 26th, 1910, at Salisbury Plain. Made cross-country flights in Australia in Jan., 1911.

HANRIOT, MARCEL.—Pilots a Hanriot monoplane, designed and built by his father, who has an aviation school at Betheny, near Rheims. Appeared at the Lanark meeting, 1910.

HANUSCHE, Herr.—Flights have been made by this pilot at the Johannisthal aerodrome.

HARDING, H. J.—Learned to fly a monoplane with a J.A.P. engine, at Amberieu. Took part in the Blackpool meeting, 1910. Obtained his certificate on Aug. 9th, 1910.

HARKNESS, Mr.—American airman. Flies an Antoinette monoplane. Has made flights with passengers.

HARMANN.—Flies a Bleriot monoplane.

HARMON, CLIFFORD.—American pilot. Has made flights in America with a Farman biplane.

HAUTEFEUILLE, Lieut.—French military airman. Pilots a Farman biplane. Obtained his certificate on Oct. 4th, 1910.

HAVILLAND, G. DE.—English experimenter who has built several biplanes. In January, 1911, his machine was acquired by the War Office. He entered Government service. His biplane, with which tests have been made over Farnborough Common, resembles a Farman and Sommer. Is fitted with a

[Daily Mirror.

PAULHAN'S MECHANICS SLEEPING UNDER HIS AEROPLANE AT LICHFIELD DURING THE LONDON-MANCHESTER FLIGHT, APRIL 27TH-28TH, 1910.

4-cylinder, horizontal engine of his own construction.

Heidenrich, Herr.—German airman. Won a prize of 1,500 marks, offered by Dr Lanz.

Heim, Herr.—One of the first German pilots of a Wright biplane.

Herbster, Maurice.—Pilots a Farman biplane. Secured his certificate on March 8th, 1910.

Hervue, Mlle J.—French airwoman. Learned to fly a Bleriot monoplane at Pau. On Dec. 31st, 1910, flying for the Coupe Femina, remained in the air for 2 hrs. 5 mins., traversing 145 kilometres. Her certificate was granted on Dec. 7th, 1910.

Hesne, Paul.—Pilots a Breguet biplane. A Frenchman. Obtained his certificate on July 21st, 1910.

Hewitt, Mr.—Flies a Bleriot monoplane.

Hieronymus, Otto.—An Austrian airman. Pilots a Laurin-Klement aeroplane. Obtained his certificate at Vienna, being the fourteenth Austrian pilot to secure one.

Hinds-Howell, Mr.—Flies a Howard-Wright biplane.

Higginbotham, Mr.—An Englishman. Has learned to pilot a Bleriot monoplane.

Hildebrandt, Capt.—German military airman. One of the early pilots of the Wright biplane.

Hilsmann, Herr.—Designer and builder of the Hilsmann monoplane.

Hino, Capt.—Japanese military officer. Pilots a Farman biplane. One of the first Japanese officers to come to Europe to fly.

Hintner, Herr.—The designer and the builder of the Hintner monoplane.

Hirst, Mr.—A pupil at the Valkyrie school, Hendon.

Hoff, Herr.—German airman. Has made flights at the Johannisthal aerodrome. Gained his certificate in November, 1910.

Holder, N. F.—Learned to fly a Humber-Bleriot monoplane at Wolverhampton.

Hornstein, Mr.—Designed and built a biplane on original lines.

HOSPITALIES, M.—Flies an Antoinette monoplane.

HOUDINI, HARRY.—Music-hall artiste. Bought a Voisin biplane, and has made flights upon it.

HOUSE, J.—Englishman. Pilots a Bleriot monoplane.

HUBBARD, G. G.—Canadian airman. Flies a Baddeck biplane.

HUBERT, CHARLES.—A pupil at the Grahame-White school at Hendon. Secured his certificate in Feb., 1911.

HUGON, E.—French pilot. Flies a Farman biplane. Certificate was issued May 9th, 1910.

HUGONI, Capt.—Commander of the French military air-corps. On Dec. 21st, 1910, flew 145 miles, as a passenger and observer, on a Farman biplane, with Lieut. Camerman. Was in the air for four hours.

HUMPHREY, Mr.—American pilot. Had the honour of taking Mr Roosevelt for a flight in October, 1910.

HUMPHREYS, Lieut.—American military pilot. Flies a Wright biplane.

HUNTER, A.—Englishman. Learned to fly a Goupy biplane at Juvisy. Has since brought a machine to England.

HUNTINGTON, Prof. A. K.—Designer of a biplane. Has made experiments at Eastchurch, Isle of Sheppey.

HYNES, Lieut. G. B.—British military airman. Gained his certificate at the Bleriot school, Hendon.

I.

ILNER, Herr.—Pilots an Etrich monoplane.

J.

JACQUES, H.—Frenchman. Flies a Vendome monoplane.

JAMBLEY, P.—Flies a Bleriot monoplane. Gained his certificate on Oct. 19th, 1910.

JEANNIN.—An Alsatian airman. Has made flights both across country and with passengers. Won a prize of 2,500 marks, offered by Dr Lanz.

JENKINS, C. F.—Has experimented with a Matchless monoplane and a Roe triplane.

JEZZI, P. G. L.—Experimenter at Eastchurch, Isle of Sheppey. Has designed and built a biplane upon which he has made flights.

JOHNSON, Mr.—Pilots an Antoinette monoplane.

JOHNSTONE, ST CROIX.—An American. Gained his certificate at the Bleriot school, Hendon, on Dec. 28th, 1910.

JOLIOT, A.—A Frenchman. Flies a Koechlin monoplane. Was granted his certificate on Aug. 29th, 1910.

JOLLY, Lieut.—A French military aviator. Pilots a Koechlin monoplane. Gained his certificate in December, 1910.

JOST, RENE.—A Frenchman. Pilots an Antoinette monoplane. Gained his certificate on Oct. 19th, 1910.

JULLEROT, H.—Flies a Farman biplane and a Bristol biplane. Took out some of these machines to India, where—early in 1911—he gave displays before officers of the Indian army. On Feb. 21st, 1911, he carried an officer for an observation flight during manœuvres at Midnapore.

JUNOD, A.—A French airman. Flies a Farman biplane. Obtained his certificate on Oct. 4th, 1910. Now flies a Bristol biplane.

K.

KABOUROFF, V.—A Russian airman. Flies a Bleriot monoplane.

KAUFFMANN, P.—Flies a Farman biplane. Secured his certificate on Aug. 29th, 1910.

KEIM, Herr.—Pilots a Wright biplane.

KIEDEL, M.—Flies a Wright biplane.

KIJMMERLING.—Pilots a Sommer biplane. In 1910 went to South Africa, and made exhibition flights with a Voisin biplane.

KIMBALL, W. R.—Flies a Wright biplane.

KOECHLIN, J.—Designer, builder, and pilot of the Koechlin monoplane.

KOLOWRAT, COUNT A.—Pilots a Farman biplane.

KOMAROFF, MICHAEL.—Russian airman. Pilots an

Antoinette monoplane. Gained his certificate on Oct. 4th, 1910.

KOOLHOVEN, F.—A Dutch pilot. Flies a Hanriot monoplane.

KOSTINE, N.—Russian airman. Flies a Farman biplane. Secured his certificate on Sept. 19th, 1910.

KOUZMINSKI, Lieut.—Russian military airman. Pilots a Bleriot monoplane.

KRASTER, M.—Flies a Bleriot monoplane.

KUHLING, P.—A French airman. Pilots a Bleriot monoplane. Gained his certificate in July, 1910.

KULLER, G. P.—A Dutch pilot. Flies an Antoinette monoplane. Flew at the Lanark meeting, 1910. While at this meeting his engine failed him, and he descended in a wood, damaging his machine, but being uninjured himself.

KULLING, M.—Pilots a Bleriot monoplane.

KUTASSY, Dr.—Pilots a Maurice Farman biplane.

L.

LABORIE, BRUNEAU DE.—French flyer. Pilots a Farman biplane. Obtained his certificate on May 2nd, 1910. Flew at the Doncaster and Burton-on-Trent meetings, 1910. At the latter met with an accident, which wrecked his machine.

LABOUCHERE, JACQUES.—Flies a Zodiac monoplane. His certificate was granted on Dec. 23rd, 1910.

LABOUCHERE, RENE.—A Frenchman. Pilots an Antoinette monoplane.

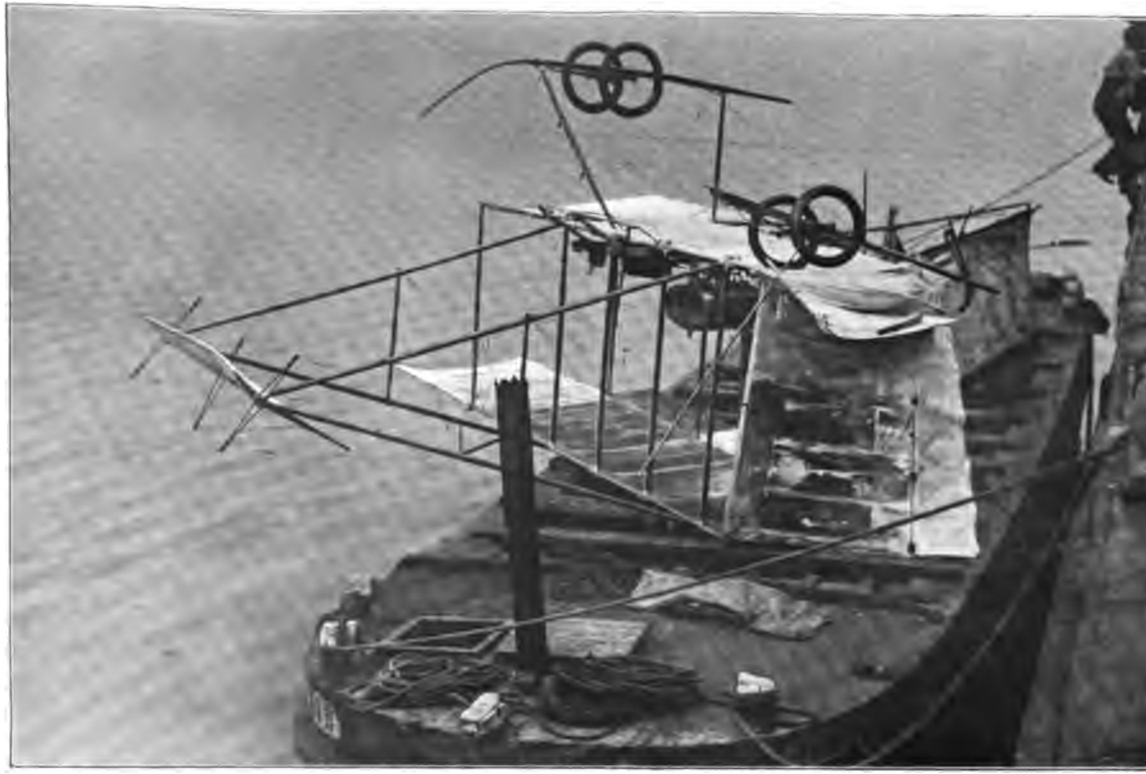
LABOURET, R.—Flies a Sommer biplane. A Frenchman. Obtained his certificate on Sept. 19th, 1910.

LACHAPELLE, DE.—Flies a Wright biplane.

LADOUGNE, E.—French aviator. Flies a Goupy biplane. Flew at Doncaster and Burton-on-Trent meetings, 1910.

LAFARGUE, H.—Flies a Hanriot monoplane. Was granted his certificate on Nov. 8th, 1910. A Frenchman.

LAFON, Naval Ensign C.—Learned to fly a Farman biplane, obtaining his certificate on Aug. 29th, 1910.



[*Daily Mirror.*

MR. ROBERT LORAINE'S FARMAN BIPLANE AS RESCUED FROM THE SEA AFTER HIS FIFTY-TWO MILE FLIGHT FROM HOLYHEAD TO A POINT OFF HOWTH HEAD, IRELAND.—SEPTEMBER 11TH, 1910.

LAHM, Lieut.—American military airman. Flies a Wright biplane.

LAITSCH, M.—Flies a Voisin biplane.

LAMBERT, COMTE DE.—One of the first pilots in France of the Wright biplane. His certificate was granted on Oct. 7th, 1909. Flew at the Rheims meeting, 1909, also at Juvisy. Flew round the Eiffel Tower on Oct. 18th, 1909.

LANE, CHARLES.—One of the early experimenters in England. Performed flights, at Brooklands, on a monoplane of his own construction.

LANGHE, A. DE.—French aviator. Flies a Voisin biplane. His certificate was granted on Aug. 29th, 1910.

LANSER, M.—Belgian pilot. Has flown from Paris to Brussels in connection with a £4,000 prize, but did not complete the return journey, a necessary part of the contest. Has done passenger carrying.

LARGIER, M.—Has made flights on a Voisin biplane.

LAROCHE, Mme RAYMONDE DE.—One of the first airwomen in France. Learned to pilot a Voisin biplane in March, 1910. Flew at the Heliopolis meeting, and afterwards at the second Rheims meeting, 1910. Here, while making a descent, met with a bad accident, being very seriously injured

LATHAM, HUBERT.—First long flight, on an Antoinette monoplane, was one of 1 hr. 7 mins., on June 5th, 1909. Attempted to win the *Daily Mail* £1,000 prize for a flight across the English Channel. In this contest was unfortunate, engine failure bringing him twice into the water, on July 19th and July 27th, 1909. At the Rheims meeting, 1909, he flew for 2 hrs. 13 mins. At the Blackpool meeting, which followed that at Rheims, he made a memorable flight in a wind, the gusts of which were estimated to reach a velocity of 40 miles an hour. At the Rheims meeting, 1910, rose 4,658 feet high. Flew unsuccessfully in the Gordon-Bennett Aviation Cup at Belmont Park in October, 1910. Has flown to house parties on his monoplane.

Laurens, E.—First flew a Maurice Farman biplane. Now pilots an R.E.P. monoplane. With this machine, carrying his wife as a passenger, he broke the hour's passenger-carrying record, covering 77½ kilometres. Has made several flights of more than an hour, while carrying passengers.

Lavine, J.—Flies a Farman biplane.

Leake, G.—Has carried out experiments with a Weiss monoplane.

Lebbedeff, W.—Russian pilot. Learned to fly a Farman biplane. His certificate was issued to him on July 10th, 1910.

Leblanc, Alfred.—Pilots a Bleriot monoplane. Holds the world's speed record for 1910 (67.5 miles an hour). Also won the Circuit d'Est contest, carried out by the *Matin*, in August, 1910, flying 497 miles in 13 hrs. 28 mins. 11 secs. Flying for the Gordon-Bennett Cup in October, 1910, M. Leblanc had bad luck, his petrol supply giving out in the last circuit, with the result that he descended awkwardly and smashed his machine.

Lecomte, H.—Learned to fly a Bleriot monoplane. His certificate was issued on Dec. 7th, 1910.

Lecrue, M.—Has made flights on a Farman biplane.

Lefrage, De.—Pilots a Voisin biplane.

Legagneux, G.—Learned to fly a Voisin biplane, afterwards piloting a Sommer biplane. Is now flying a Bleriot monoplane. At Pau, flying for the Michelin Cup, he covered 322 miles in 5 hrs. 59 mins. Holds the world's height record, having ascended at Pau on Dec. 19th, 1910, to a height of 10,764 feet.

Lemartin, T.—Instructor at the Bleriot school at Pau. Was the first man to fly the four-seated monoplane designed by M. Bleriot. With this machine he was able to carry seven passengers on Feb. 2nd, 1911.

Leprince, P.—French aviator. Has made flights on a Nieuport monoplane.

Lesire, E.—French airman. Learned to fly, on a Voisin biplane, in August, 1910.

Lesna, M.—Learned to pilot a Bleriot monoplane at Pau.

LESSEPS, COMTE JACQUES DE.—Second man to fly across the English Channel. Made flight from Calais to Dover on May 23rd, 1910.

LESSEPS, PAUL DE.—Flew on a Bleriot monoplane at the meetings held at Doncaster and Burton-on-Trent in 1910. Went to America in the autumn of 1910, and flew at the Belmont Park meeting. Here he rose to an altitude of 6,950 feet.

LETHEUX, Lieut. G.—French military officer. Pilots a military-type Farman biplane.

LETORT, M.—Learned to fly a Bleriot monoplane. A Frenchman. Secured his certificate on Aug. 9th, 1910.

LEVEL, RENE.—Pilots a Savary biplane. A Frenchman. Was granted his certificate in December, 1910.

LEWKOWICZ, L.—Russian airman. Flies a Bleriot monoplane. Secured his certificate in November, 1910.

LINDPAINTER, M.—Pilots a Sommer biplane. Has made cross-country flights. Took part in the Circuit d'Est contest in France in August, 1910, completing one stage, and then losing his way.

LIPOWSKI, H. DE.—A Russian airman. Learned to fly a Bleriot monoplane in September, 1910.

LOMBADI, M.—French flyer. Pilots a Farman biplane. Was given his certificate in October, 1910.

LONG, J. B. D.—Flies a Long monoplane.

LORAINE, ROBERT.—Well-known actor. Went to Pau to learn to fly soon after Bleriot flew across the English Channel. Afterwards, at Chalons, learned to fly a Farman biplane, buying a racing type of this machine. Appeared at several English flying meetings, making several over-sea flights, notably from Bournemouth to the Isle of Wight, and from Holyhead across the Irish Sea to a point within a hundred yards of Howth Head, Ireland. Here he fell into the sea, but was able to extricate himself from his machine and swim ashore. For this flight, 52 miles over-sea, made on Sept. 11th, 1910, he was awarded a silver medal by the Royal Aero Club. In the De Forest contest, in December, 1910, he had bad luck, two of his machines being destroyed, one by a hangar falling on it, and the other through engine failure.

LORIDAN, MARCEL.—French flyer. Learned to pilot a Farman biplane in September, 1910.

LOVELACE, Capt.—Pilots a Bleriot and Humber monoplane. Was engaged, for some time, as chief engineer of the aerial department of Messrs Humber, Limited.

LOWE, A. R.—Technical expert of the British and Colonial Aeroplane Co. Flying a Bristol biplane, he obtained his certificate at Brooklands in November, 1910.

LUCCA, Lieut. D.—French officer. Pilots a Wright biplane. Learned to fly in August, 1910.

LUDMANN, M.—French aviator. Learned to fly a Breguet biplane in October, 1910.

LUSSETI, A.—Italian pilot. Flies a Bleriot monoplane.

LUTGE, F.—Dutch flyer. At Pau, in December, 1910, learned to fly a Bleriot monoplane.

M.

MCARDLE, W. E.—British airman. Gained his certificate at Pau, flying on a Bleriot monoplane. Afterwards, in partnership with Mr Armstrong Drexel, opened a flying school at Beaulieu, in the New Forest. Created interest at the Bournemouth aviation meeting, 1910, by arriving on his monoplane, with his portmanteau strapped behind him. Mr McArdle flew at the Lanark meeting, 1910.

MCCLEAN, F. K.—One of the first experimenters in England, flying a Short-Wright biplane at Eastchurch, Isle of Sheppey. Is now piloting a Short biplane, fitted with a Gnome motor. Has recently placed two machines at the disposal of the Admiralty for naval officers to learn to fly upon.

MCCURDY.—Canadian airman. On Jan. 29th, 1911, flew 95 miles over-sea on a Curtiss biplane from Key West to a point 10 miles off the coast of Havana.

[*Daily Mirror.*

MR. COCKBURN FLYING NEAR M. BLONDEAU'S WRECKED FARMAN AT LANARK.—AUGUST, 1910.

[*Daily Mirror.*

M. AUDEMAR'S "DEMOISELLE" MONOPLANE AFTER COMING TO GRIEF IN A FIELD AT BOURNEMOUTH.—JULY, 1910.

Fell into the water, but his machine remained on the surface, being fitted with floats, and he was rescued.

MacDonald, L. F.—Gained his certificate at Brooklands on Nov. 15th, 1910, piloting a Bristol biplane.

Macfie, R.—The constructor of both biplanes and monoplanes. Has achieved flights at Brooklands with biplane driven by a Gnome motor.

Mackenthun, Lieut.—One of the first German military pilots. On Jan. 2nd, 1911, he flew, with a passenger, from Doberitz to Magdeburg on an Aviatik biplane fitted with an Argus motor. Covered the 80 miles in two hours.

Magnan, Lieut.—Pilots a Farman biplane.

Mahieu, G.—Is chief director of the Farman school at Etampes. Obtained his certificate in July, 1910.

Mahieu, Michel.—Flies a Bleriot monoplane. Secured his certificate in August, 1910.

Mailefert, Lieut.—French military pilot. Flies a Farman biplane.

Maillois, Lieut.—Military airman. Pilots a Bleriot monoplane. On Nov. 26th, 1910, made a non-stop flight of 3 hrs. 15 mins., with a passenger, covering 127 miles.

Maillos, J.—French flyer. Pilots a Wright biplane. Learned to fly in January, 1910.

Maitland, Capt. E. M.—His first experiments were made at the Doncaster aviation meeting in 1909, with a Voisin biplane. On Salisbury Plain, while testing a biplane in the summer of 1910, he met with an accident, breaking both his ankles.

Maitland, Lieut.—Lieut. Maitland has flown at Brooklands on a Howard-Wright biplane.

Maitre, Le.—Pilots a Tellier monoplane.

Makrowestsky.—Flies an Antoinette monoplane.

Malherbe, Lieut. Rene.—French military airman. Learned to fly a Bleriot monoplane at Pau.

Malynski, Count.—Russian flyer. Pilots a Farman biplane, having secured his certificate in August, 1910.

MAMET, J.—French flyer. Is the holder of the speed record, for two passengers, from 10 to 90 kilometres. Also holds record for the longest flight with two passengers. Flies a Bleriot monoplane. Flew at the Burton-on-Trent aviation meeting. 1910, making a flight from Burton-on-Trent round Lichfield Cathedral.

MANDER, LIONEL.—Pilots a Bleriot monoplane.

MARCHAL, A.—French aviator. Flies a Voisin biplane.

MARCONNET, Capt.—French military flyer. Pilots a Farman biplane. Has made cross-country reconnoitring flights.

MARIE, Capt.—Flies a Maurice Farman biplane.

MARIE, FELIX.—French aviator. Learned to fly a Bleriot monoplane in May, 1910.

MARKS, Lieut.—Has experimented with a Lane monoplane.

MARQUEZY, R.—French aviator. Flies a Farman biplane. His certificate was granted on Oct. 4th, 1910.

MARS, BUD.—Exhibition flyer with a Curtiss biplane in America.

MARTIN, J. V.—American pupil of the Grahame-White school at Hendon. Obtained his certificate, piloting a Farman biplane, on Feb. 7th, 1911.

MARTIN, X.—French aviator. Pilots a Hanriot monoplane. Obtained his certificate in August, 1910.

MARTINET, R.—French flyer. Learned to pilot a Farman biplane. A day or two after having learned to fly, he set out on a cross-country flight to Paris, and covered a distance of more than 90 miles.

MARVINGT, Mlle M.—Frenchwoman. Learned to fly an Antoinette monoplane. Her longest flight, made for the Coupe Femina, was one of over an hour's duration.

MASLENIKOF, D.—Flies a Farman biplane. Russian airman. Secured his certificate in November, 1910.

MASSON, DIDIER.—American airman. Flies a Curtiss biplane. Recently carried newspapers across country, thus acting as an àerial messenger.

MATZEVITCH-MATZEVITCH.—Russian pilot. Learned to fly a Bleriot monoplane.

MAUVIS, J.—A Sommer biplane is piloted by this French aviator.

MAXFIELD, A. B.—Flies a Maxfield monoplane.

MAYLOS, Lieut.—Military flyer. Pilots a Wright biplane.

MELLY, H. G.—A Liverpool airman. Obtained his certificate at Pau in August, 1910. Completed his training at Etampes. Has now opened a school at Freshfield, near Liverpool, teaching pupils with a Bleriot monoplane.

MENARD, Lieut. V.—A flight of 125 miles, non-stop, while carrying a passenger, was made by this French military officer on Feb. 1st, 1911. Was in the air for 2 hours 5 minutes.

METROT, R.—Learned to fly in January, 1910. French airman. Has made flights upon a Voisin biplane.

MEUNIER, M.—The pilot of a Farman biplane.

MEYER, J.—A French flyer. Went to the Antoinette school at Chalons, and learned to fly in September, 1910.

MIGNOT, R.—Is the flyer of a Voisin biplane. His certificate was obtained in May, 1910.

MILTGEAN, P.—French aviator. Learned to fly a Farman biplane in December, 1910.

MITCHELL, Mr.—Flies a Farman biplane.

MOISANT, S. J.—A brother of the late Mr J. B. Moisant. Learned to fly a Bleriot monoplane.

MOLLA, H.—Flies a Sommer biplane. A Frenchman.

MOLLA, MICHAEL.—Flies a Sommer biplane. Granted his certificate in August, 1910.

MOLLIEN, M.—French airman. Learned to fly a Bleriot monoplane at Pau.

MOLON, LEON.—Flies a Bleriot monoplane. Gained his certificate in January, 1910.

MOLON, LOUIS.—Flies a Bleriot monoplane. Gained his certificate in October, 1910.

MOLON, LUCIEN.—Pilots a Bleriot monoplane.

MONTIGNY, A. DE.—A Frenchman. Pilots a Bleriot monoplane.

MOORE-BRABAZON, J. T. C.—Flies an all-British machine. By flying a semicircular mile, on a Short biplane, he won a £1,000 prize offered by the *Daily Mail*. Has flown a variety of British-built machines at Eastchurch, Isle of Sheppey. Won the British Michelin Cup, 1909, with a flight of 19 miles in 31 minutes. His first aeroplane was an early-type Voisin.

MORANE, L.—Pilots a Bleriot monoplane, both single and double seater. At the Havre aviation meeting, Sept. 2nd, 1910, rose to a height of 8,469 feet. While flying with his brother for a long cross-country journey on Oct. 10th, 1910, the wing of the two-seater monoplane he was steering collapsed. He was severely injured. Has recently designed a new and very fast monoplane, which has been built for him by M. Saulnier, and is being piloted by M. Aubrun.

MOREL, PIERRE.—French aviator. Flies a Sommer biplane. Granted his certificate on Oct. 19th, 1910.

MORELLE, E.—Flies a Farman biplane. A Frenchman. Gained his certificate in May, 1910.

MORIN, R.—Learned to fly a Bleriot monoplane at Pau. Made cross-country flights in January, 1911.

MORISON, O. C.—At Brooklands, piloting a Gnome-Bleriot, has made flights. Flew from Brooklands to Brighton, a distance of 40 miles, on Feb. 15th, 1911, landing on beach.

MORLAT, M.—Flies a Voisin biplane.

MOROT, M.—Pilots a Farman biplane.

MORTENSEN, M.—Has been experimenting with a new monoplane—the Veheyen.

MOSER, Herr.—German airman. Pilots a Hanriot monoplane.

MOSSNER, Lieut. VON.—German military airman. Made 65 ascents at Johannisthal in November, 1910. Pilots a Wright biplane.

MOUTHIER, L.—Pilots a Bleriot monoplane. Was granted his certificate in August, 1910.

MOULINIAS, M. DE.—Flies a Demoiselle monoplane.

MUISGAN, M.—Flies a Voisin biplane.

MUMM, WALTER DE.—Has learned to fly an Antoinette monoplane. Obtained his certificate in April, 1910.

[Daily Mirror.

KULLER'S ANTOINETTE MONOPLANE, WHICH FELL INTO A WOOD AT THE LANARK MEETING, AUGUST, 1910.

N.

NABAT, DE.—Pilots a Koechlin monoplane.
NAZARRO.—Racing motor driver. Recently learned to pilot a Voisin biplane.
NEALE, J. D.—Constructor and pilot of the Neale biplane and monoplane.
NEBI, G.—Italian pilot. Flies an Antoinette monoplane. Was granted his certificate on Dec. 23rd, 1910.
NERCHEFF, M.—Croatian airman. Has given exhibitions before the military authorities at Belgrade.
NIEL, A.—French pilot. Flies a Voisin biplane. Obtained his certificate in July, 1910.
NIEL, Mme M.—A Frenchwoman. Flies a Koechlin monoplane. Was granted her certificate in September, 1910.
NIEUPORT, E.—Designer of the Nieuport biplane and monoplane. Obtained his certificate in July, 1910.
NISSOLE, PRINCE DE.—Learned to fly a Tellier monoplane at Etampes.
NIXEL, M.—Pilots a Nieuport monoplane.
NOEL, A.—Pilots a Bleriot monoplane. A Frenchman. Obtained his certificate in July, 1910.
NOGUES, MAURICE.—Pilots a Voisin biplane. Obtained his certificate on July 21st, 1910.
NOIMAND, Lieut.—French military airman. Pilots a Sommer biplane. Obtained his certificate in December, 1910.

O.

OBRE, E.—Designer and constructor of the Obre aeroplane. Obtained his certificate in July, 1910.
ODIER, M.—Pilots a Vendome monoplane.
OGILVIE, ALEC.—Experimented with a Wright biplane in 1909, making flights. On Dec. 28th, 1910, flying for the Michelin Cup, on a new type Wright biplane fitted with an N.E.C., two-stroke engine, remained in the air for 3 hrs. 55 mins., covering 139¾ miles, at Camber, near Rye. Flew for the Gordon-

Bennett Aviation Cup, 1910, gaining third place, and being presented by the Royal Aero Club with a silver medal.

OLIESLAGERS.—Belgian airman. Pilots a Bleriot monoplane. At the Rheims meeting, 1910, created a long-distance record, flying for 5 hrs. 3 mins. Covered 245 miles.

OLIVIER.—Pilots a Bleriot monoplane.

ORNS, Lieut.—Military airman. Flies a Farman biplane.

OSMONT, M.—Ex-champion cyclist. Has been appointed instructor of flying to the Spanish military school. Flies a Farman biplane. Took nine machines to Spain in February, 1911.

ORUS, MAURICE.—A Frenchman. Flies a Farman biplane. Obtained his certificate in October, 1910.

OULIANINE, SERGE.—Russian airman. Pilots a Farman biplane.

OUTHEROT, M.—Pilots a Farman biplane.

OXLEY, Mr.—An Englishman. Flies a Hanriot monoplane.

P.

PAILLETTE, MARCEL.—Frenchman. Flies a Sommer biplane. Obtained his certificate in July, 1910.

PANWELS, M.—Pilots a Voisin biplane.

PARENT, F.—Frenchman. Pilots a Poulain-Orange biplane. Gained his certificate in August, 1910.

PARIS-LECLERC, M.—Frenchman. Pilots a Farman biplane. Secured his certificate on Aug. 29th, 1910.

PARISOT, L.—Pilots a Farman biplane.

PARKINSON, Mr.—An Englishman. Pilots a Bleriot monoplane.

PARMALEE, Mr.—American airman. Flies a Wright biplane. On Jan. 23rd, 1911, flew 3 hrs. 39 mins. 49 3-5 secs. On March 3rd, on military machine, flew 116 miles with a passenger.

PASCAL, F.—Piloting a Bleriot monoplane, obtained his certificate in November, 1910. A Frenchman.

PASHLEY, Mr.—First experimented with a Lane monoplane. Then flew a Sommer biplane.

PATERSON, C. COMPTON.—Designer and builder of the Paterson biplane, a machine of the Curtiss type, upon which he gained his certificate at Freshfield, near Liverpool, on Dec. 6th, 1910. One of Mr Paterson's flights was from Freshfield to Altcar, in February, 1911, when, carrying his friend Mr King as a passenger, on a Farman biplane, he attended the Waterloo Cup by aeroplane.

PAUL, EDMOND.—Frenchman. After flying a Voisin biplane, piloted a Bleriot monoplane.

PAUL, ERNEST.—Frenchman. Flies a Voisin biplane. Gained his certificate in July, 1910.

PAULHAN, LOUIS.—First learned to fly a Voisin biplane. Flew at the Rheims meeting, 1909. After this, gave exhibition flights, visiting America, and flying at Los Angeles, where he rose over 4,500 feet. Now piloting a Farman biplane. Chief performance, in 1910, was to win the *Daily Mail* £10,000 prize for the flight from London to Manchester. This he did, with one stop, in 4 hrs. 12 mins. Distance: 183 miles. Date: April 27th and 28th, 1910. Also succeeded in winning the *Daily Mail* £1,000 prize for the greatest aggregate distance flown across country in 1910. Has recently invented, and built, a biplane, particularly designed for military use, of which the British War Office has bought a model.

PEHANOVSKY, B.—Russian airman. Flies a Bleriot monoplane. Obtained his certificate in January, 1911.

PELLOUX, M.—Flying a Savary biplane, obtained his certificate in January, 1911.

PEQUET, H.—A Frenchman. Learned to pilot a Voisin biplane, taking his certificate in July, 1910. Later, flew a Humber monoplane, visiting India in the early part of 1911.

PERIN, A.—Flies a Farman biplane. French airman. Obtained his certificate in August, 1910.

PERREYOU, E.—Flies a Bleriot monoplane. Gained his certificate in December, 1910, at Pau.

PETEERS.—Belgian airman. Was reported to have been killed on Nov. 11th, 1910, but the rumour was untrue.

PETROUVSKI, ALEX. DE.—Russian airman. Pilots a Sommer biplane. Acquired his certificate in July, 1910.

PICARD, P.—Pilots a Savary biplane.

PIFFARD, HAROLD.—After experimenting with aeroplane since 1909, has recently carried out, at Shoreham, flights with a biplane, resembling a Sommer, driven by an E.N.V. engine.

PIOTROUSKI, G.—Russian airman. Pilots a Bleriot monoplane.

PISCHOFF.—Designer, builder, and pilot of the Pischoff monoplane.

PIXTON, C. HOWARD.—Flies a Roe triplane at Brooklands.

PIZEY, Mr.—Has learned to fly a Bristol biplane on Salisbury Plain.

PIZZAGALLI.—Flies a Hanriot monoplane.

PLANCHUT, E.—Learned to fly a Bleriot monoplane at Pau in December, 1910.

POGGIOLI, Signor.—Learned to fly at the Beaulieu school.

PONZELLI.—Flies a Voisin biplane.

POPOFF, M.—Pilots a Wright biplane. Russian airman.

POST, A.—An American. Has learned to fly a Curtiss biplane.

POULAIN, G.—German airman. Has made flights at the Johannisthal aerodrome. Is an ex-champion cyclist. Has built a monoplane of original design.

POULERIGUEN, F.—French aviator. Learned to fly an Antoinette monoplane. Gained his certificate in January, 1911.

POWER, A. G.—Has experimented with an Ornis monoplane.

PREVOTEAU, M.—Pilots a Bleriot monoplane. Took part in the Doncaster aviation meeting, 1909.

PRIER, P.—French airman. Came to England to act as instructor at the Bleriot school opened at Hendon. He flies an Anzani-Bleriot and a Gnome-Bleriot. During the motor show, 1910, he flew over Olympia.

PRINCETEAU, Lieut. P.—French military airman. Learned to fly at Pau in December, 1910.

PRUSSIA, PRINCE HENRY OF.—Obtained his certificate in November, 1910, piloting an Aviatik biplane.

R.

RADLEY, JAMES.—First flew a Bleriot monoplane at Huntingdon. Flew at several English meetings. At Lanark piloted a Gnome-Bleriot. Over a mile, here, he created an unofficial speed record of 75 miles an hour. Went to America in the autumn of 1910 for a long series of flying engagements. Flew over San Francisco on Jan. 8th, 1911.

RAOULT, M.—After making cross-country flights at Pau, on a Bleriot monoplane, went to Madagascar, where he proposes to institute mail-carrying by aeroplane.

RAOUT, M.—Is learning to fly one of the new Morane monoplanes at Pau.

RAVETTO, M.—Flies a Voisin biplane.

RAWLINSON, A.—Well known as a racing motorist. Learned to fly at Chalons. Got into the air at the very first time he tried a machine. Flew his Farman biplane at several meetings in 1910. At Nice, in April, 1910, was blown into the water by the backwash from the propeller of Effimoff, the Russian airman. At Bournemouth, 1910, Mr Rawlinson had an accident, breaking his leg, and dislocating his shoulder.

RAYGORODSKY, A.—Russian pilot. Flies a Farman biplane. Obtained his certificate in August, 1910.

RAYMOND, Senator.—An American. Learned to pilot a Bleriot monoplane.

REGY.—Flies a Peugeot monoplane.

REIMBART, Lieut.—French military airman. Pilots a Sommer biplane.

REMY, H.—Flies a Farman biplane. Obtained his certificate in July, 1910.

RENAUX, E.—Pilots a Maurice Farman biplane. A Frenchman. On March 7th, 1911, flew with a passenger from Buc to the summit of the Puy de Dome mountain, Clermont-Ferrand, 231 miles. Won Michelin prize of £4,000.

RETESSI, M.—Pilots a Sommer biplane.

REYMOND, Dr.—A Frenchman. Learned to fly a Bleriot monoplane in August, 1910.

RICHARDSON, P.—Flies a Bleriot monoplane.

RICHET, R.—Flies a Voisin biplane.

RIEMSDYK, F.—Dutch pilot. Flies a Curtiss biplane.

RIGAL, V.—French aviator. Flies a Voisin biplane.

RIPPEN, Mr.—Has flown a Neale biplane at Brooklands.

RIVOLLIER, M.—Pilots a Bleriot monoplane.

ROBILLARD-COSNAC, COUNT G. DE.—Piloting an Antoinette monoplane, has made flights in the Riviera.

ROE, A. V.—One of the first practical experimenters in England. First work was done with model aeroplanes. Won the *Daily Mail* model competition with a biplane, afterwards experimenting with a full-sized machine of the same design at Brooklands. Subsequently, carried out a number of experiments with a triplane, obtaining flights when using an engine of only 9-h.p. Recently went to America, and gave demonstrations. Has now aeroplane works at Manchester, and a flying school at Brooklands

ROMANCE, F. DE.—Frenchman. Pilots a Bleriot monoplane. Gained his certificate in November, 1910.

ROSE, TRICORNET DE.—French military airman. Learned to fly Bleriot monoplane at Pau in December, 1910.

ROUGIER, H.—Well known as the driver of racing motor-cars. Learned to fly a Voisin biplane prior to the Rheims meeting of 1909. Flew at this meeting, winning prizes. Afterwards, in the south of France, carried out number of exhibition flights. Was one of the aviators who flew at the Blackpool meeting, 1909. At the Nice meeting, 1910, had the misfortune while flying to fall into the sea, sustaining severe shock. Has recently been occupied with the designing of machines.

RUCHBONNET, E.—Swiss aviator. Learned to fly an Antoinette monoplane.

RUDINEFF.—Pilots a Farman biplane.

[*Daily Mirror.*

THE HON. ALAN BOYLE'S WRECKED "AVIS" MONOPLANE AT BOURNEMOUTH.—JULY, 1910.

MR. GRAHAME-WHITE'S 100 H.P. BLERIOT MONOPLANE, OVERTURNED AFTER AN AWKWARD DESCENT AT BELMO NT PARK, U.S.A.—OCTOBER, 1910.

S.

SALLENEVE, H.—French aviator. Flies a Bleriot monoplane. His certificate was granted in May, 1910.

SALVAY, M.—Pilots a Tellier monoplane.

SAMBURG, M.—Pilots a Koechlin monoplane.

SANCHEZ-BESA, J.—Chilian airman. Invented, and pilots, the Sanchez-Besa biplane.

SANDERS, Capt.—British experimenter. Built, and flew, several biplanes. Has invented a device to give pupils a notion of the control of an aeroplane, before they actually get on a machine.

SANDS, HAYDEN.—American airman. Learned to fly an Antoinette monoplane. Has appeared at a number of meetings.

SANTONI, M.—Pilots a Tellier monoplane.

SANTOS-DUMONT, A.—A Brazilian. Has been identified with the flying movement from its inception. After first experiments with dirigible balloons, he earned distinction by effecting the first flights in France at Bagatelle with a biplane which resembled a box-kite. His first flights were: October 26th, 1906, flew 80 yards; November 12th, 1906, flew 160 yards; then 230 yards. Afterwards, experimented with all types of machines. Latest achievement has been with an extraordinarily small monoplane, the Demoiselle, with which he has made a number of flights.

SAULNIER, M.—Pilots a Bleriot monoplane.

SAUMER, J.—French aviator. Flies a Wright biplane. Secured his certificate on August 9th, 1910.

SAVARY, R.—Frenchman. Is the designer and builder of the Savary biplane, a machine which has effected flights in France. Obtained his certificate on July 21st, 1910.

SAVOIA, Lieut.—Military pilot. Flies a Farman biplane.

SCHENDEL, Herr.—German airman. Has made flights at the Johannisthal aerodrome.

SCHLUMBERGER, MAURICE.—Pilots an Antoinette monoplane. Secured his certificate in December, 1910.

SCHLUTER, Herr.—German pilot. Flies an Aviatik biplane. Has made flights at Amerigo's school, Mulhausen.

SCHRECK, M.—Was at the Doncaster aviation meeting, 1909. Flies a Wright biplane.

SCHWADE, J.—German pilot. Flies a Farman biplane. Was granted his certificate in July, 1910.

SEER, M.—Voisin pilot. Obtained his certificate in August, 1910. A Frenchman.

SEMENIOUK, I.—Pilots a Bleriot monoplane. Russian airman. Learned to fly in October, 1910.

SEMODINA, M.—Pilots an Antoinette monoplane.

SERVIES, J.—French aviator. Flies a Sommer biplane.

SIDO, MARIE.—Flies a Farman biplane. French pilot. His certificate is dated May 2nd, 1910.

SIDOT, Lieut.—Military airman. Has made flights on a Farman biplane.

SILVA, LOUIS DE.—Brother-in-law of Mr Martin Harvey. Took lessons on a Tellier monoplane. Is now flying a Howard-Wright biplane.

SIMON, Herr.—German airman. Has made flights at the Johannisthal aerodrome.

SIMON, RENE F.—Took part in the Belmont Park aviation meeting, 1910, piloting a Bleriot monoplane. Won prizes.

SINGER, MORTIMER.—Learned to fly a Farman biplane at Mourmelon, taking his certificate on May 31st, 1910. Practising for the Heliopolis meeting on November 1st, 1909, he had a severe fall. Has only recently recovered from the effects of it. For 1911, Mr Mortimer Singer has offered a £1,000 flying prize for officers of the Army and Navy.

SISMANOGLOM, J.—Turkish airman. Flies a Bleriot monoplane. Secured his certificate in December, 1910.

"SMITH," Mr.—Has been interested in the construction of flying machines for some time. Recently learned to fly a Sommer biplane at Brooklands.

SMITH, S. E.—Obtained his certificate at Brooklands on November 22nd, 1910, piloting a Bristol biplane.

SMITH, W. W.—English pilot of a Sommer biplane. Obtained his certificate in September, 1910.

SNOWDEN-SMITH, Lieut. R. T.—English military pilot. Learned to fly at Brooklands on a Farman biplane owned by Mrs Maurice Hewlett and M. Blondeau. Chief flight from Brooklands to Farnborough and back.

SOMMER, ROGER.—French pilot. Flew for 2 hours 27 mins. at Chalons on August 7th, 1909. Flew at the Rheims meeting, 1909. Afterwards, designed a biplane which has been extensively used since. Carried six passengers on January 25th, 1911. Has also built a monoplane.

SOMERSET, SOMERS.—Flies a Farman biplane. Gained his certificate at Etampes.

SOPWITH, T.—Learned to fly in November, 1910. First piloted a Howard-Wright monoplane. Afterwards, learned to fly a Howard-Wright biplane. Chief flight was one of 169 miles from Eastchurch, Isle of Sheppey, to Thirimont, in Belgium, on December 18th, 1910, by which he won Baron de Forest's £4,000 all-British prize. On December 31st, 1910, flew for 4 hours 34 mins. at Brooklands. Flew for 3 hours 12 mins. on November 26th, 1910. On February 1st, 1911, flew from Brooklands to Windsor, alighting near the castle and being received by the King. His all-British biplane is driven by a British-built E.N.V. motor.

SPECKNER, Herr.—Pilots a Bleriot monoplane.

SPOTTISWOODE, J. H.—Piloting an Avis monoplane. Has made flights at Brooklands.

STEINBECK, Herr.—Pilots a Grade monoplane.

STOECKEL, M.—Flies a Bleriot monoplane.

STUART, Lieut. R.N.—Pupil at the Grahame-White school at Hendon.

STUCCHI.—Learned to fly a Voisin biplane at Camerii, Italy.

STUDENSKY, P.—Russian flyer. Pilots a Bleriot monoplane. His certificate was granted Nov. 8th, 1910.

SUTTON, E.—Flies a bleriot monoplane.

SVENDSEN.—Pilots a Voisin biplane. Has made oversea flights.

SYBERG.—Flies a Sommer biplane.

T.

TABUTEAU, MAURICE.—Winner of the Michelin Cup, 1910, flying 365 miles in 7 hours 48 mins. 31 secs. Pilots a Maurice Farman biplane, which is fitted with a Renault air-cooled engine. Has recently learned to fly a Morane monoplane.

TADDEOLI, M.—Pilots a Bleriot monoplane.

TANSUIA.—Pilots a Bleriot monoplane.

TARNOCZY, Herr.—German military pilot. Flies an Albatross biplane.

TARRONE, E.—Frenchman. Flies a Maurice Farman biplane. His certificate was issued January 4th, 1911.

TASSON, Captain.—Flies a Maurice Farman biplane.

TAURIN, M.—French aviator. Flew on Bleriot monoplane at Wembley Park in 1910.

TEMAIN, M.—Flies a Bleriot monoplane.

TENAUD, C.—A Peruvian. Secured his certificate on a Bleriot monoplane at Pau. Flying in Peru on February 4th, 1911, became entangled in overhead tramway wires and fell heavily, injuring his spine.

TETARD, MAURICE.—First flew a Sommer biplane. Appeared at the Blackpool aviation meeting, 1910. Now instructor at the Bristol flying school, Salisbury. Made a flight recently over Salisbury.

THELEN, Herr.—Wright biplane pilot. One of the first to fly these machines in Europe. On December 12th, 1910, while flying at the Johannisthal aerodrome with a lady passenger, some of the wires of his machine gave way and he fell. His passenger's ankle was broken. He escaped unhurt.

THOMAS, M.—Learned to fly a Bleriot monoplane at Pau.

THOMAS, H. J.—Nephew of Sir George White. Learned to fly a Bristol biplane on Salisbury Plain. Is 18 years of age. Instructor was M. Tetard.

[*Daily Mirror.*

MR. RAWLINSON'S WRECKED BIPLANE AT THE BOURNEMOUTH MEETING, JULY, 1910.
MR. RAWLINSON WAS BADLY INJURED BY THE FALL.

THOMAS, RENE.—Pilots an Antoinette monoplane. While flying at the Milan meeting, 1910, had aerial collision with Captain Bertram Dickson.

THORUP, M.—Flies a Bleriot monoplane.

TIMBERLAKE, R.—Pilots a Bleriot monoplane.

TISSANDIER, PAUL.—Was flying a Wright biplane at the Rheims meeting, 1909. Flew for 1 hour 5 mins. at Pau, May 20th, 1909.

TOKUGAWA.—Japanese airman. Gained his certificate at Etampes. Certificate is dated November 8th, 1910.

TOUSSIN, R.—French airman. Flies a Bleriot monoplane.

TRAIN, E.—Inventor of the Train monoplane. Has made flight of 1½ hours.

TRANCHENT, M.—Pilots a Bleriot monoplane.

TRODDON, M.—Has made flights on a Demoiselle monoplane.

TYCK, M.—Visited India in the autumn of 1910. On December 28th, at Calcutta, gave demonstration before large crowd of people.

V.

VALENTINE, J.—Has made flights at Brooklands on a McFie biplane, a machine upon which he gained his certificate.

VALETON, M.—Flies a Farman biplane.

VALLIER, E. P.—French flyer. Pilots a Farman biplane. Obtained his certificate on October 19th, 1910.

VALLON, R.—Flies a Sommer biplane. A Frenchman.

VASILEFF.—Russian pilot. Flies a Farman biplane. In January 27th, 1911, made a flight of 250 kilometres. 126½ miles.

VASSEUR, N.—French pilot. Flies a Hanriot monoplane. Was granted his certificate in November, 1910.

VEDRINE, M.—Flies a Goupy biplane. At Issy, on January 27th, 1911, made a flight of 250 kilometres. Has also flown over Paris, and round the Eiffel Tower.

VEDRINES, J.—Learned to fly a Bleriot monoplane at Pau.

VENDOME, M.—Is the inventor and pilot of the Vendome monoplane.

VERLIAE, A.—Pilots an Antoinette monoplane. A Frenchman.

VERNEYEN, M.—Pilots a Bleriot monoplane.

VERSEPUY, L.—First flew a Demoiselle monoplane. Is now instructor at the Bristol biplane school.

VERSTRATTEN, M.—Flies a Sommer biplane.

VIALLARD, C.—Pilots a Gyp monoplane. A Frenchman. Gained his certificate in July, 1910.

VIDART, R.—Learned to fly a Hanriot monoplane at Rheims. Has lately been flying a Deperdussin monoplane.

VIGNE, H.—A Frenchman. Pilots a Farman biplane. Was given his certificate in December, 1910.

VILLENEUVE, MARQUIS DE.—A Frenchman. Flies a Bleriot monoplane.

VIREL, DE.—Flies a Gyp monoplane.

VISSEAUX, M.—Chief pilot of the Sommer school. A Frenchman.

VUILLIERME, Lieut. L.—French military aviator. Pilots a Farman biplane.

W.

WAGNER, L.—French pilot. Flies a Hanriot monoplane. Flew at the Bournemouth aviation meeting, 1910.

WALDEN, Dr CHARLES,—Constructor of a monoplane in America. Was reported dead after an accident, but his injuries—a broken collar-bone and two ribs—did not prove fatal.

WALLETON, A.—French pilot. Flies an Antoinette monoplane.

WARCHALOVSKI.—Pilots an Etrich biplane, fitted with an Austrian-Daimler engine.

WARD, J.—Flies a Curtiss biplane. Is 17 years old. Has made cross-country flights.

WASSILEFF, A. DE.—Russian pilot. Flies a Bleriot monoplane.

WATKINS, Lieut. H. E.—Officer of the Essex Regiment. Gained his certificate at Brooklands, flying a Howard-Wright biplane. Entering for the De Forest contest, but met with bad luck, damaging his machine.

WEIR, J. G.—Learned to fly at Hendon, obtaining his certificate on a Bleriot monoplane on Dec. 8th, 1910.

WEISS, H.—German flyer. Pilots a Bleriot monoplane.

WEISS, G.—Flies a Koechlin monoplane.

WELCH, A. L.—An American pilot. Has made a flight exceeding three hours.

WELFERINGER, M.—Pilots a Demanest monoplane.

WERNTGEN, Herr.—German pilot. Has made flights at the Johannisthal aerodrome. Gained his certificate in November, 1910.

WEYMANN, CHARLES.—Cross-country flyer. Chief performance: Flight of 231 miles with three stops, from Buc to Clermont Ferrand, carrying a passenger, on Sept. 7th, 1910.

WICKHAM, R.—Learned to fly a Sommer biplane at Brooklands. Subsequently made flights on an Avis monoplane.

WIENCZIERS, —.—Pilots an Antoinette monoplane. Fitted this machine with a Gnome motor, but without satisfactory results.

WIESENBACH, V.—German pilot of the Wright biplane.

WILLARD, Mr.—American pilot. Flies a Curtiss biplane.

WILLIAMS, A.—Pilots a Curtiss biplane.

WILLS, W.—Constructed a monoplane at Madras, and made flights.

WINTREBERT, H.—Flies a Gyp monoplane. Obtained his certificate in November, 1910.

WITZID.—Flies a Liore-Dutilleul monoplane.

WLINSKY.—Pilots a Bleriot monoplane.

WOOD, Capt. H. F.—British officer. Learned to fly a Bristol biplane. Has made cross-country flights.

WRIGHT, ORVILLE. — Co-operated with his brother, Wilbur in their early experiments. Flying with Lieutenant Selfridge on Sept. 19th, 1908, the propeller of the machine broke, and the aeroplane fell. The officer was killed. Mr Wright broke his thigh. Subsequently went to Germany and made flights. Is now engaged by German military authorities in the production of an aeroplane for war purposes.

WRIGHT, WILBUR.—After studying flight by means of gliding machines, accomplished his first successful flights, with a power-driven biplane, in 1903, subsequently effecting several hundred flights. His early efforts are appended: 1903—Time in air, 59 secs.; 1904: Time in air, 5 mins. 17 secs.; 1905—Time in air, 38 mins. 13 secs. In 1908 he went to France and made a number of flights, winning the Michelin Cup, 1908, by remaining in the air for 2 hours 20 mins. 31 secs. Many machines of his construction have been bought by Government. Is now concerning himself with the construction of a light and speedy biplane.

WYNMALEN, MIJNIHEER.—Dutchman. Pilots a Farman biplane. Won the £4,000 prize offered in 1910 by the Automobile Club in France for a flight from Paris to Brussels and back to Paris with a passenger. Made the flight of 380 miles on Oct. 16th and 17th, 1910, in a flying time of about 15 hours.

X.

XAVIER, M.—Flies a Bleriot monoplane.

Y.

YENCE, R.—Frenchman. Pilots a Sommer biplane.

Z.

ZARA, L. DE.—Italian airman. Formed a corps of aviators in Milan to aid the Government in case of war. Has become chief pilot of the military school in Italy.

ZARKINE, J.—Russian airman. Pilots a Farman biplane.

ZELINSKY, MICHAEL DE.—Russian pilot. Flies an Antoinette monoplane.
ZENS, E.—Frenchman. Flies a Bleriot monoplane.

It may be mentioned, that, at the time of writing, more than 400 pilot aviator certificates have been granted by the French Aero Club. The first eight flyers to whom the Club granted this certificate form a very interesting list. They are :—

Bleriot	Delagrange
Esnault-Penterie	H. Farman
Orville Wright	Wilbur Wright
Captain Ferber	Santos Dumont

In the list of pilots given above, the certificates of aviators have been mentioned, where possible, to indicate their proficiency.

SECTION IV

AEROPLANE FATALITIES DESCRIBED AND ANALYSED

In this section, the causes of the aeroplane fatalities which have occurred are set forth, facts having been obtained and carefully sifted from the best sources obtainable. It is possible, from such an analysis as this, to appreciate how improvements in the construction of aeroplanes will minimise risk in flying.

—C.G.W.—H.H.

From September 17th, 1908, to February 9th, 1911—during slightly more than two years of entirely experimental work—there have been thirty-four aeroplane fatalities.

During this period appreciably more than a thousand men have learned to fly.

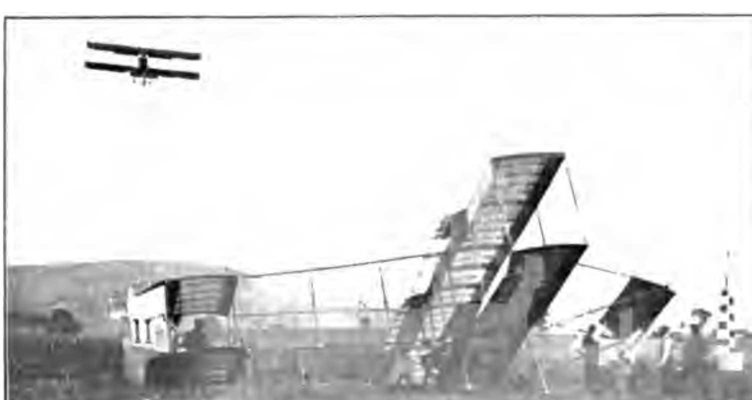
In one year—1910—ninety people were killed while mountaineering, and eighty injured!

I

In this section it is the intention to deal, in as full a way as possible, with the aeroplane accidents which have caused the deaths of those who have been in the machines.

In the thirty-four fatal accidents which have occurred up to the time of writing—February 9th, 1911—thirty-seven men have lost their lives.

[*Daily Mirror.*
KULLER'S ANTOINETTE MONOPLANE, AFTER A BAD DESCENT AT LANARK.—AUGUST, 1910.



[*Daily Mirror.*
CHAMPEL, ON A VOISIN, FLYING OVER CAPTAIN DICKSON'S WRECKED FARMAN AT LANARK.—AUGUST, 1910.

The difficulty in analysing these accidents is that their causes have not, in all cases, been easily understood. What has been done, in presenting this analysis, has been to sift, so far as possible, all the information procurable regarding each disaster, and to form a judgment upon the preponderance of testimony.

The question of aeroplane accidents is an extremely important one, seeing that many critics of the new science have condemned it as being in the highest degree dangerous, and have done their utmost to discourage its progress.

Fortunately, such a negative attitude, even on the part of large numbers of people, will not check the progress of aviation.

That such progress has necessitated the loss of life is a deplorable thing; but, from each fatality that has occurred, the makers of aeroplanes, and the men who pilot them, have learned lessons that are invaluable—as will be shown in the notes which follow.

It may be interesting, also, to direct attention to the table which heads this section. Seeing the enormous progress that has been made, the accidents in aviation have been surprisingly few.

As will be seen from a glance at the table mentioned, mountaineering is a far more dangerous sport, and is not being undertaken to further any particularly useful cause.

It may be mentioned, for the edification of those who decry aviation, that fifteen men lost their lives in connection with the construction of the first hundred miles of railway in this country; and yet, nowadays, the safety of railway travelling is proverbial.

It is interesting, before going fully into the details of the aviation fatalities that have occurred, to set forth the causes of these catastrophes. This is, therefore, done below. In each case, the testimony available has been carefully considered before a reason has been ascribed for any particular fatality. The table is appended :—

Cause	*No. of Accidents*
Breakage of some portion of machine . .	11
Pilot's loss of control	8
Failure of controlling mechanism . . .	3
Machine rendered uncontrollable by wind gusts .	4
Accidents while on ground	4
Failure of motor	1
Illness of pilot while flying	2
Unknown causes	1

The immediately striking point about this table is the fact that eleven accidents were due to structural weaknesses of machines, and another three to the failure of the mechanism controlling the movements of the aeroplane.

This point is particularly notable, seeing that, from the experience gained as the result of these fifteen accidents, the makers of aeroplanes are able to take steps to prevent further disasters occurring from these causes.

Thus it will be seen that the prospect for the future, as regards a diminution of accidents, is exceedingly hopeful. From the experience they have gained, manufacturers are building stronger machines, and are, in addition, strengthening and simplifying the method by which their aeroplanes are controlled.

Therefore, instead of increasing, as scaremongers have predicted, accidents with aeroplanes are likely to decrease appreciably. Not only have makers learned a lesson, but pilots have been learning, also.

A danger, in regard to flying, has been that it has appeared so easy. Instead of finding it immensely difficult to acquire the art, as he had imagined beforehand, a pilot discovers, as a rule, that the manipulation of a machine is astonishingly simple.

But here, as in most other things, there is a reservation. Flying is easy, but only when conditions are favourable, and the pilot essays no over-daring feat. Tempted by the facility by which he can handle his machine, more than one aviator has flown in too high a wind, or has attempted some dangerous turn or too steep *vol plane*. Then, all too suddenly, he has discovered that flying contains many hidden dangers, and that its apparent simplicity only applies to ideal conditions.

In introducing the list of fatalities which is printed below, it should be mentioned that the first two, by which Lilienthal and Pilcher lost their lives, were occasioned by tests with gliding machines, and were not due to falls from power-driven aeroplanes. The table of the aeroplane fatalities up to February 6th, 1911, is now appended :—

AEROPLANE FATALITIES

Date	*Airman*	*Place*	*Machine*
1896			
Aug. 10th	Lilienthal	Lichterfeld	Biplane glider
1899			
Sept. 30th	Pilcher	Stanford Park	Monoplane glider
1908			
Sept. 17th	Selfridge, Lieutenant	Fort Meyer	Wright (B)
1909			
Sept. 7th	Lefebre, E.	Juvisy	Wright (B)
Sept. 22nd	Ferber, Captain	Boulogne	Voisin (B)
Dec. 6th	Fernandez, Senor	Nice	Fernandez (B)
1910			
Jan. 4th	Delagrange, L.	Pau	Bleriot (M)
April 2nd	Leblon, H.	San Sebastian	Bleriot (M)
May 13th	Hauvette-Michelin	Lyons	Antoinette (M)
June 18th	Robl, T.	Stettin	Aviatik (B)
July 3rd	Wachter, C.	Rheims	Antoinette (M)
July 12th	Rolls, Hon. C. S.	Bournemouth	Wright (B)
July 13th	Kinet, D.	Ghent	Farman (B)
Aug. 3rd	Kinet, N.	Stockel	Farman (B)
Aug. 20th	Pasqua, Lieutenant V.	Rome (near)	Farman (B)
Aug. 27th	Maasdyck, C. van	Arnheim	Sommer (B)
Sept. 25th	Poillet, E.	Chartres	Savary (B)
Sept. 27th	Chavez, G.	Domodossola	Bleriot (M)
Sept. 28th	Plochmann, Herr	Hausheim	Aviatik (B)

[*The Gaumont Co., Ltd.*

LAFFONT AND POLA STARTING FOR THEIR FATAL FLIGHT AT ISSY-LES-MOULINEAUX, DECEMBER 28TH, 1910.

Oct. 1st	Haas, Herr	Wellen	Wright (B)
Oct. 7th	Matsievich, Captain	St Petersburg	Farman (B)
Oct. 23rd	Madiot, Captain	Douai	Breguet (B)
Oct. 25th	Mente, Lieutenant	Magdeburg	Wright (B)
Oct. 26th	Blanchard	Issy (Paris)	Bleriot (M)
Oct. 27th	Saglietti, Lieutenant	Centocelle	Italian-built Wright (B)
Nov. 17th	Johnstone, R.	Denver City	Wright (B)
Dec. 3rd	Cammarota (and passenger Castellani)	Centocelle	Farman (B)
Dec. 22nd	Grace, Cecil	North Sea (?)	Short (B)
Dec. 28th	Picollo, G.	San Paulo	Bleriot (M)
Dec. 28th	Laffont (and passenger Pola)	Issy (Paris)	Antoinette (M)
Dec. 30th	Caumont, Lieutenant	St Cyr	Nieuport (M)
Dec. 31st	Moisant, J. B.	New Orleans	Bleriot (M)
Dec. 31st	Hoxsey, A.	Los Angeles	Wright (B)
1911			
Jan. 9th	Rusjan, M.	Belgrade	Rusjan (M)
Feb. 6th	Stein, Lieutenant	Doberitz	Farman (B)
Feb. 9th	Noel (and passenger Torre)	Douzy	Sommer (B)

"B" Biplane. "M" Monoplane.

NOTE.—Since the compilation of this table, M. Cei—an airman who flew a Caudron biplane—met his death, on March 28th, 1911, by an unexplained fall from a height of 2,000 feet while flying over Paris. Thus the total of fatalities is increased to 35.

II

It is instructive, before proceeding to a description of each accident, to specify the machines which have been involved in fatal accidents. This information is contained in the following table :—

Wright biplane	8
Bleriot monoplane	6
Farman biplane	6
Antoinette monoplane	3
Aviatik biplane	2
Sommer biplane	2
Savary biplane	1
Breguet biplane	1
Short biplane	1
Nieuport monoplane	1
Rusjan biplane	1
Fernandez biplane	1
Italian-built Wright biplane	1
Voisin biplane	1

The first two victims of aviation, who are mentioned on our list, were very early pioneers of the flying movement. Both Lilienthal and Pilcher, although they had not the motive power with which to propel their machines, carried out a vast amount of useful work with gliding machines.

Both these men, in fact, gave up their lives to a study of the best forms of machines for gliding work. Their experiments provided those who followed them with invaluable data. This data comprised a great deal of information regarding the most effective shapes for planes, and also much interesting material regarding the way in which a power-driven machine could be controlled.

It was after he had carried out a very great number of experiments with a " glider " of biplane construction, that Lilienthal met with an accident, while actually in flight, which caused his death.

This pioneer did not give up his life in vain. Those who, following in his footsteps, had the petrol motor at their service, found that his investigations had been of the utmost service to them.

Pilcher, the Englishman, who followed Lilienthal in experiments with gliding machines, devoted a great deal of his attention to machines of the single surface, or monoplane principle.

His pioneer work, like that of Lilienthal, provided later experimenters with invaluable information. Pilcher's death, like that of Lilienthal, took place while he was making a glide, through the sudden plunging to earth of his machine.

This brings us to a consideration of the first accident which took place with a power-driven aeroplane. The victim of it was Lieut. Selfridge, an American officer, who ascended in a Wright biplane, with Mr Orville Wright, at Fort Meyer, on September 17th, 1908. The machine flew for some time with perfect safety. Then, when at a fair altitude, those who were watching the flight saw that something had gone wrong.

The biplane apparently paused in the air, and then came crashing to the ground. The aeroplane was hopelessly wrecked, Lieut. Selfridge was unfortunately killed, while the pilot of the machine sustained a broken thigh. It has now been placed on record that the cause of the disaster was the breakage of one of the two propellers which drive the Wright biplane.

The death of Lieut. Selfridge, the first victim of the aeroplane, naturally cast a very great gloom over the world of aviation.

Just upon a year elapsed before the second fatality, in connection with aeroplaning, was chronicled, The second man to sacrifice his life for the science was M. Lefebre, a particularly skilful pilot of the same type of machine that was involved in the first accident—the Wright biplane.

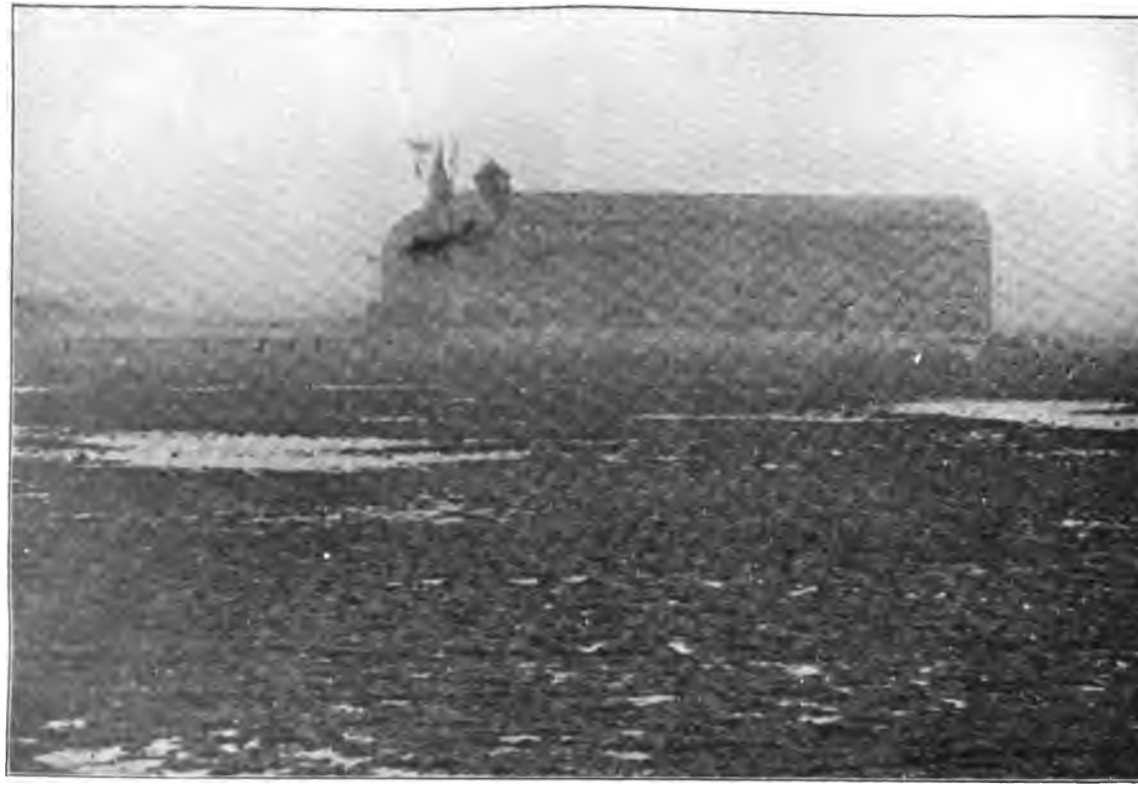
A month before his death, at the Rheims meeting, M. Lefebre had astonished everybody by the clever way in which he had flown this machine. He was, in fact, the first "trick flyer." On several evenings during the Rheims meeting, his evolutions in front of the grand-stand at Rheims evoked enthusiastic applause from the people who witnessed them.

He "climbed" quickly, darted down again, and turned his machine with extraordinary dexterity. It was not surprising, therefore, that a brilliant future was predicted for him.

As a matter of fact, however, M. Lefebre met his death in what might be termed an inglorious way. On the morning of September 7th, 1909, at the Juvisy aerodrome, he decided to test a new Wright biplane which had been purchased from the French company selling these machines.

He rose into the air, and had flown a short distance, quite close to the ground, when his machine was seen to dart down towards the earth.

With its engine still running, and its propellers



[*The Gaumont Co., Ltd.*

THE MONOPLANE OF LAFFONT AND POLA PHOTOGRAPHED WHILE ACTUALLY FALLING TO DESTRUCTION AT ISSY-LES-MOULINEAUX, DECEMBER 28TH, 1910.

revolving, it struck the ground with such an impact that it was hopelessly wrecked. The unfortunate airman, dreadfully injured, died almost at once.

Although the aeroplane was so badly damaged that it was very difficult indeed to ascertain what had actually happened, it was generally agreed, by experts who witnessed the disaster, that the controlling mechanism "jammed" in some way, thus making the machine dive suddenly towards the ground. This accident, naturally, taught its lesson.

The third victim of the power-driven flying machine was one of the great pioneers in France—Capt. Ferber. This military officer had practically devoted his life to a study of aviation. He first began with a number of very exhaustive experiments with gliding machines. He also invented many ingenious devices to determine the efficiency of aerial propellers.

When the first practical flying machines were evolved in France, Capt. Ferber learned to fly upon a Voisin biplane. With a machine of this type, at the first Rheims meeting, he appeared as a competitor under the name of "De Rue." He made several flights at this memorable gathering of the world's first flying men.

Afterwards, at a flying demonstration organised at Boulogne, Capt. Ferber made several flights. It was on the evening of September 22nd, 1909, that he met with his death. He had actually accomplished a flight, and was running along the ground with his biplane, or what is generally known as "rolling," when the wheels of his machine fell into a ditch. The aeroplane was upset, and badly wrecked.

The engine, dislodged from its position, fell upon the unfortunate aviator. Those who first came to him did not realise that he was mortally injured. In fact, he was able to speak, and move. It was only thought that he was badly shaken. But a short time after the accident, he suddenly collapsed, and died from the internal injuries which he had received.

This accident of Capt. Ferber's illustrated a danger which has been demonstrated upon more than one occasion since—the peril which an airman runs, in an accident, of the engine of his machine being torn from its bed and falling upon him. The disaster also showed the need, with these early type machines, of carrying out experiments on an aerodrome with a good, smooth surface. Capt. Ferber's loss was greatly mourned in France, where his pioneer work was thoroughly appreciated.

III

The aviator who followed Capt. Ferber on the list of martyrs was a quiet, unassuming, but very earnest, student of the problem of flight. It was Senor Fernandez. He has built a biplane to his own ideas, and brought it to the first Rheimes meeting in 1909. It was a very light simple machine, somewhat resembling, in its general details, the machine flown at this meeting by Mr Glen H. Curtiss, the American aeroplanist.

Through not having his machine quite ready, Senor Fernandez did not make any flights at the Rheims meeting. But subsequently, at Nice, he carried out a number of very successful flights. It was while making one of them, on December 6th, 1909, that Senor Fernandez met with the accident which caused his death.

He was flying at a height of several hundred feet when his biplane suddenly collapsed, and came to the ground. The airman, whose fall was witnessed by his wife, was killed on the spot.

Experts who were present, and who had an opportunity of examining the machine, did not hesitate to state that the cause of the catastrophe was the structural weakness of the aeroplane, which had probably been built too lightly to withstand the sudden onslaught of a gust of wind. This accident illustrated, in a very definite way, the need to build strongly.

Fifth on the list of airmen killed comes M. Leon Delagrange. He was originally a sculptor. His interest in aviation dated from the first experiments that were carried out at Issy-les-Moulineaux with the Voisin biplane. On a machine of this type M. Delagrange made a number of flights. An amusing race took place between this aviator and Mr Henry Farman as to who should hold the "duration" record, which, at this time, instead of being eight hours and more, as it is now, was a matter of minutes.

After testing a Voisin biplane very thoroughly, M. Delagrange designed a biplane of his own. Then, in 1909, he went to M. Bleriot's school, and learned to fly a Bleriot monoplane.

He will be chiefly remembered in England from the fact that he took part in the Doncaster aviation meeting in 1909. Here, M. Delagrange flew upon a Bleriot monoplane.

Towards the end of this meeting, there arrived for him, from France, a very interesting machine. The circumstance was tragic also, seeing that, with this machine, M. Delagrange afterwards lost his life.

The aeroplane was a Bleriot monoplane, the first to be fitted with a 7-cylinder revolving 50-h.p. Gnome engine. Up to this point, it should be explained, the Bleriot monoplane had been propelled by a 3-cylinder Anzani motor, which developed 25-h.p.

The experiment of doubling the horse-power was carried out partly with the idea of obtaining the use of the wonderfully reliable Gnome motor, and also with a view to increasing the speed of the monoplane.

This first introduction of the Gnome motor to a Bleriot monoplane is really historic, seeing that the extraordinary success recently achieved by this type of aeroplane has been through equipping it with this engine.

The result of applying this greater power to his monoplane was evident in the trials which M. Delagrange made at Doncaster. Whereas the flying speed of the Bleriot machine, with the Anzani motor, had been about 40 miles an hour, M. Delagrange was able to fly at a speed of 50 miles an hour with his Gnome motor.

After the Doncaster meeting was over, M. Dela-

[*The Gaumont Co., Ltd.*

THE ENGINE AND ONE WING OF LAFFONT AND POLA'S MONOPLANE, AFTER THE FATAL FALL AT ISSY-LES-MOULINEAUX, DECEMBER 28TH, 1910.

grange had his Gnome-engined monoplane sent to Pau, where M. Bleriot's school was situated. Here, at the beginning of January, 1910, the airman began to carry out a number of tests to determine the advantages, and disadvantages, of this high-powered monoplane.

On January 4th, he had made several flights, despite a slightly gusty wind which was blowing. He was returning from one of these flights, and was passing near the sheds at the aerodrome, when his monoplane was struck by an unusually strong gust of wind.

What happened, it has been stated on authority, is that one of the wings of the monoplane collapsed under the strain. It must be remembered that the aeroplane was being driven very fast, and that the stresses to which a machine was subjected, when flying, were not, at this time, very thoroughly understood.

The monoplane did not fall from a very great height, but the contact with the ground was so severe that the machine was utterly wrecked, and M. Delagrange was killed. Thus France gave up another of her pioneers in the cause of flying.

From this accident, it is a solace to remember, an extremely useful lesson was learned by the builders of aeroplanes.

It was a tragic coincidence that the next pilot to meet death, while flying, was the aviator who had shared with M. Delagrange the honours of the Doncaster meeting in 1909.

This was Monsieur H. Leblon, a man who had been, prior to his interest in aviation, a very well-known racing motor-driver. M. Leblon's choice of a machine had decided him to learn to pilot a Bleriot monoplane.

On a machine of this type, at the Doncaster meeting, he flew with very great daring. Particularly notable were his flights in winds. M. Leblon was a very quiet, unassuming airman, and he possessed all the attributes which go for success in the pilot of an aeroplane.

At the Doncaster meeting M. Leblon was piloting a Bleriot monoplane with an Anzani engine. Afterwards, however, he decided to try the same sort of machine as M. Delagrange, equipped with a Gnome motor. It was with a machine of this type that he was giving exhibition flights at San Sebastian at the beginning of April, 1910.

On April 2nd, after having been entertained at lunch by the municipal authorities of San Sebastian, M. Leblon essayed a flight over the sea.

While returning, and when quite close to the beach, the monoplane was seen, by the people who stood on the shore, to dive suddenly into the water. At the point where it struck the water, there were some rocks close below the surface. These the machine struck, and lay just submerged.

When a boat reached the airman, he was found to be unconscious, and he died quite soon. It appeared clear that he had been rendered senseless by the shock of the fall, and had afterwards been drowned. Although there was some controversy at the time regarding the precise cause of the accident, it has since appeared clear that it was M. Leblon's motor which failed, precipitating him into the water.

Another theory, which was advanced at the time, was that M. Leblon had been taken ill while flying, and had thus lost control of his machine.

M. Leblon's death was particularly regretted, seeing that everybody agreed that he was an exceptionally skilful pilot. Had he lived, he would, without doubt, have furthered the progress of aviation to a very remarkable degree.

IV

A strange, and wholly unexpected accident, was the cause of the death of the aeroplanist who follows M. Leblon on the list of martyrs.

M. Hauvette-Michelin, one of the young enthusiasts who have so greatly advanced the progress of aviation in France, had been learning, at Chalons, during the month of April, 1910, to handle an Antoinette monoplane.

Before he had become entirely proficient, M. Hauvette-Michelin was persuaded to take his aeroplane to the Lyons aviation meeting. Here, on May 13th, he brought out his monoplane for practice, after the events of the day had been decided.

The young pilot had made a short flight, and was "rolling" along the ground in his machine, when he came into collision with one of the wooden pylons, or mark towers, which indicated the course round which the airmen were to fly.

The impact was so severe that the pylon was broken in two. The top half of it, falling on to the aeroplane, struck the unfortunate pilot, and killed him. No very definite lesson could be learned from this catastrophe, save that, even when " rolling " on the ground, an aviator has to exercise the most careful control over his machine.

It was soon after M. Hauvette-Michelin's death, that pilots began to fly in gusty winds. Before the beginning of the year 1910, it had been agreed that flight was dangerous save in calms.

But increased efficiency in machine, and greater skill on the part of pilots, led to flights being attempted, in April, May, and June, 1910, in winds blowing at the rate of twenty and even twenty-five miles an hour.

It was through attempting a flight in a dangerously gusty wind that Herr T. Robl, the first German victim of the aeroplane, came by his death on June 18th, 1910. It was not, however, altogether an error of judgment on the part of the ill-fated airman that caused his death.

Herr Robl, who had been a well-known motor cyclist, before he turned his attention to aviation, had been giving, prior to his death, a number of exhibition flights in Germany. On the day that he met with his fatal accident, Herr Robl was providing one of these exhibitions at Stettin.

The organisers of the display found themselves in a quandary frequently experienced by those who organised these early demonstrations of flying.

A large crowd of people had gathered together and yet the wind appeared too gusty for any flight to be possible. At length, however, Herr Robl, who was eager not to disappoint the spectators, determined that he would attempt a short flight.

[*The Gaumont Co., Ltd.*

THE PRACTICALLY INDISTINGUISHABLE WRECK OF LAFFONT AND POLA'S ANTOINETTE MONOPLANE, AFTER THEIR FATAL FALL AT ISSY, DECEMBER 28TH, 1910.

There was, however, just as much danger in a short flight as in a long one. The airman had not been flying long when his aeroplane was caught by a sudden gust, became quite unmanageable, and plunged to the ground. Herr Robl was killed.

His life was certainly not sacrificed in vain. His death demonstrated, in a very painful but very direct way, that no man should risk his life, to please a crowd of people, simply because they have paid to see an exhibition of flying, and the organisers of the display do not wish to disappoint them.

Progress takes us to the second Rheims flying meeting, held in July, 1910, before we come to the ninth tragedy of the aeroplane. Again, as has seemed the fate with these disasters, the victim was an airman who could very ill be spared.

After a series of brilliant flights, carried out on his Antoinette monoplane, M. Charles Wachter was making an altitude flight, during the afternoon of July 3rd.

M. Wachter, as should be mentioned, was an instructor at the Antoinette flying school, and was regarded as being second only to Mr Hubert Latham himself, in his dexterity in handling this beautiful monoplane.

A skilled eye-witness of the accident by which M. Wachter met his death, thus describes what he saw.

" I actually had my field-glasses on the airman at the time," he said. " He was diving down from an altitude of about 1,000 feet. It was not a *vol plane* that he was making, as he had his engine running.

" The machine seemed to me to be moving very rapidly, and at a very steep angle, when the accident occurred. All that you could see was that the two wings of the machine appeared instantaneously to fold up. Then the monoplane fell.

" It reminded me, as it came down, of the way in which a handkerchief falls when it has a stone tied in it. As a matter of fact, fragments of the monoplane came falling to the ground some seconds after the machine itself had struck the aerodrome.

" Those who were nearer to the scene than I was, told me that they saw poor Wachter stand up in his machine, as it was falling, and grip the upright mast, just in front of his seat, from which the wires strengthening the wings are passed.

" He thought, perhaps, that by doing this he would lessen the shock of his fall. People do not realise how long it takes for an aeroplane to fall from any considerable height. Automatically, as I saw the aeroplane begin to fall from its height of 500 feet, I commenced to count.

" I had actually counted seven seconds before the monoplane struck the ground ! "

The Antoinette monoplane was totally wrecked by its contact with the ground. Wachter, the unfortunate pilot, was killed on the spot. Regarding the cause of the accident, there is little doubt.

In diving towards the ground, with his engine still running, M. Wachter must have subjected the planes of his machine to an abnormal strain, which caused either one, or both of them, to collapse.

V

An irreparable loss to British aviation was involved in the disaster which had to be chronicled very soon after the death of M. Wachter.

It was at the Bournemouth international meeting, which followed directly upon the Rheims fixture, that the Hon. C. S. Rolls, met with a fatal accident, whilst piloting a French-built Wright biplane, in the competition for the airman alighting nearest to a specified mark.

Mr Rolls, it should be explained, was flying an ordinary-type Wright machine with an important modification. It was a machine which, instead of starting into the air from a rail, as was the case with the early type of Wright machines, ran along the ground on a pair of wheels, and got its lift into the air like any other form of wheeled-machine.

To facilitate its rise from the ground, a new tail-plane had been fixed at the rear of the machine, behind the twin-rudders. This horizontal plane was operated in conjunction with the front elevating planes.

In addition to helping the machine to rise, this new rear-elevating plane also tended to increase the stability of the machine when in flight. This rear-plane corresponded, in fact, to that which has been fitted to Farman and other biplanes.

So far as Mr Rolls was concerned, this rear-plane, acting in conjunction with the front elevators, to which he was accustomed, was more or less of an innovation; it had been fitted to the particular machine he was flying only the day before.

This explanation concerning the new rear-plane is necessary, because it has an important bearing upon the cause of the accident we are about to describe.

As in the case of the accident to Wachter, it is possible to print the account of an eye-witness of Mr Rolls' fall, who was not only standing in a position which enabled him to see precisely what happened, but who had sufficient technical knowledge, also, to enable him to give an accurate, and reliable, description of what he saw.

His statement is, therefore, appended.

"It was just before the luncheon hour on July 12th, 1910, that Mr Rolls rose with the idea of making an attempt to win the alighting prize. A circle had been whitewashed on the aerodrome, not far from the principal stands, to act as a mark in which the aviators were to descend.

"Mr Rolls rose from a point near the sheds, and after attaining a height of about 150 feet, moved away with the wind, which was blowing across the aerodrome towards the grand-stands. This manœuvre on the airman's part meant that he passed off the aerodrome behind the grand-stands.

"Mr Rolls' idea was clear to those who saw what he was doing. He was so manœuvring his machine as to fly down a little distance with the wind, and then turn, so as to approach the mark against the wind. The value of this would, he evidently realised, lie in the fact that he would be able to come to rest on the ground more promptly were the wind blowing against his machine than were it following him.

"The day was quite a good one for flying. Mr

[*Daily Mirror.*

CAPTAIN DICKSON, AT MILITARY HEADQUARTERS, DESCRIBING AN AERIAL RECONNOITRING TRIP.—ARMY MANŒUVRES, SEPTEMBER, 1910.

[*Daily Mirror.*

CAPTAIN DICKSON'S BIPLANE "CAPTURED" BY A HOSTILE PATROL IN THE ARMY MANŒUVRES.—SEPTEMBER, 1910.

Rolls flew steadily a little way with the wind, and then circled round smoothly, and flew back against the wind towards the grand-stands. He did not pass over the stands, but a little to the right of them.

"I was standing not far from the grand-stands, and close to a barrier which divided the enclosure from the aerodrome. Between where I stood, and the judges' box near the centre of the aerodrome, lay the whitewashed circle which Mr Rolls was seeking to reach, and towards which he was now directing his machine.

"The circle itself actually lay about a hundred yards from where I was standing. Immediately after he had passed by one end of the grand-stands, Mr Rolls began to descend a little, evidently gauging his distance very carefully, so as to bring himself to earth at the desired point.

"I should say that, when he passed near the grand-stands, Mr Rolls was about 200 feet high. While traversing the short distance which lay between the grand-stands and the barrier dividing the enclosure from the course, he had descended to about 150 feet.

"Almost at the moment he passed out over the aerodrome, Mr Rolls made what seemed to me a very steep dip downwards. Without stopping his engine, he came down steeply till he was not much more than 100 feet from the ground, and about midway between where I was standing and the whitewashed circle.

"I have seen a great many *vol planes* by aviators, but it struck me, I remember, although I did not know that an accident was imminent, that Mr Rolls was coming down very steeply. Of what happened, in the next few seconds, I have a very clear recollection. It is beyond question that Mr Rolls realised, when he was about 100 feet from the ground, that his machine had got over at far too steep an angle.

"It is probable, I think, that a sudden gust of wind dipped the machine to a steeper angle than that at which the airman was actually gliding. I think this is what happened both from the sudden way in which the aeroplane appeared to get to a much steeper angle in the air, and also from the abrupt way in which the pilot appeared to attempt to 'straighten up' his machine.

"It is perfectly clear that Mr Rolls moved, very sharply indeed, the lever operating his front and rear elevating planes. It is conceivable that he forgot, for the moment, the fact that he was flying upon a machine which had a rear-plane as well as the two front ones normally fitted to Wright machines before this time.

"The aeroplane gave one the impression of being brought almost to a standstill in the air by the rapid manipulation of the pilot's lever. Then I heard a sound like the cracking of timber. The rear elevating plane gave one the impression of suddenly coming loose from the supports which held it in position on one side. It fluttered for an instant, as if tearing itself free, and then, instead of being in a horizontal position, I saw that it had become almost vertical.

"This meant, of course, that it had torn itself entirely free on one side. Naturally, what happened after this occurred with very great rapidity. There was a grinding noise from the rear of the machine. What was happening, at this moment, was clear from an examination which was subsequently made of the wrecked machine. The breaking away of the tail plane threw the back outriggers of the machine out of their proper position.

"They came into contact with the revolving propellers of the aeroplane, and were cut away. After this, with its equilibrium destroyed, the crippled aeroplane was altogether beyond the control of its pilot. With everything sheared away behind its main planes, it turned head downwards, and plunged to the aerodrome from a height of about 80 feet."

All that it is necessary to say, in amplification of the eye-witness's narrative printed above is that—to the inexpressible grief of his many friends and admirers—Mr Rolls was killed, practically on the spot.

There is no doubt at all, regarding the accident itself, that the tail-plane of the machine broke away from its supports. It seems reasonable to suppose, also, that the breaking free of the plane was brought about by Mr Rolls having made a too abrupt movement of his lever to check the downward dive of his machine.

Analysing this disaster, even more fully, it may be said that the first cause of it was the fact that some sudden gust of wind struck Mr Rolls' machine when it was at a critical angle, and forced it over a little more steeply.

From the point of view of the lesson taught by the accident, it was made clear, to the thoughtful amongst aeroplane builders, that machines must not only be built to withstand the stresses of fair weather flying, and delicate handling, but must also have a very definite margin of strength, so as to withstand such a violent strain as was put upon the machine piloted by poor Mr Rolls.

VI

The day following this lamentable accident. M. Daniel Kinet, a very well-known continental aviator, was killed while flying near Ghent upon his Farman biplane. M. Kinet, who had made a great many cross-country flights, was on this occasion setting out on an aerial journey from Ghent to a place called Selzoate.

He flew quite safely for a portion of his journey, and was then compelled to make a descent owing to engine trouble. He landed without accident in a field, and was " rolling " across it after making his descent, and before his machine came to rest, when he ran into a tree. The collision was sufficient to overturn the aeroplane. M. Kinet, falling beneath his machine, was fatally injured.

This accident taught no lesson, of course, regarding the stability of a machine. It illustrated, however, the dangers to which a pilot may be subjected when his engine fails him while flying. It demonstrated, too, the care that a flyer must exercise when making a descent on ground that he is not familiar with.

At the time this accident was being discussed, it was suggested that some form of brake should be

[*Daily Mirror*.

MR. T. SOPWITH BEING RECEIVED BY THE KING AT WINDSOR CASTLE AFTER HIS FLIGHT FROM BROOKLANDS TO WINDSOR ON FEBRUARY 1ST, 1911.

fitted to aeroplanes, so as to permit the pilot to bring them to a quick halt, should it be necessary for him to do so.

This idea has, to a certain extent, borne fruit in some of the recent machines. On one or two of the later types of Bleriot monoplanes one finds, for instance, that the running wheel under the tail of the machine has been replaced by a device in the form of a skid, which has the effect of quickly slowing up the machine after it has struck the ground.

A month after Daniel Kinet's fatal accident was chronicled, M. Nicholas Kinet, flying upon a similar type of machine at Stockel, came to grief, with fatal consequences, through flying in too high a wind. Details of the disaster are meagre.

But this much is certain: M. Kinet had been flying for some little time, and was at a good height, when his biplane was seen to lurch over, and fall. Descending, as he did, from a considerable altitude, M. Kinet's chances of escape were remote.

As a matter of fact, the machine was destroyed, and the airman killed. An analysis of this accident indicates, fairly clearly, that it was not the general strength of the wind that embarrassed the aviator, but the fact that he met, occasionally, a series of very ugly gusts.

One of these, following very quickly upon one the moment before, tilted over his aeroplane to an angle from which it was impossible for him to retrieve it.

The way in which a machine can be brought back after a bad sideway lurch, owing to the onslaught of a gust of wind, was illustrated by Mr T. Sopwith during the flight which he made, from England into Belgium, for the De Forest prize in December last.

He had been flying on for several hours, while the wind had been steadily rising. When he came to cross the frontier from France into Belgium, he encountered a number of hills. From one of these hills, just before he was forced to descend, he encountered one very disconcerting wind gust.

At the moment, he was flying at an altitude of about 800 feet. The gust caught his aeroplane sideways. He felt it tip up to an angle that it had never assumed before. He pulled over the lever, which brought the "ailerons" into play, with all his might, but the machine did not respond.

Whereupon, Mr Sopwith leaned as far as he could against the rising side of his machine, so as to throw his weight against the overturning movement. At this instant, as he had expected, the aeroplane began to "side-slip" through the air. Fortunately, the young pilot had the presence of mind necessary to do the only thing that it was possible to do.

As the machine began to slide sideways towards the ground, Mr Sopwith altered the angle of his elevating planes, so as to point the front of the machine downwards. The effect of this manœuvre was to add to the speed of the machine, and so help it to overcome the sideway fall.

Falling sideways, and at the same time diving forward, Mr Sopwith came down, at a very unpleasant rate of progress, from his altitude of 800 feet to a height of some 500 feet. Then his Howard-Wright biplane—a great tribute to its stability—managed to straighten itself up.

But one experience of this kind was quite enough for Mr Sopwith. His fall had taken place over a Belgian village, a fact which did not make him feel any the more comfortable while he was descending. So he flew on only a little way farther, and then came down.

Discussing this startling experience afterwards, Mr Sopwith made a very good point. He emphasised the need for high flying. "Had I been two or three hundred feet high," he remarked, "I should not have been able to get the machine under control before hitting the ground." Therefore, although some people have a prejudice against high flying, here was an instance in which it probably saved the pilot's life.

VII

A very promising young military airman, an officer of the Italian Army, was the next pilot, to meet his death while flying. Lieutenant V. Pasqua, one of the first officers in the Italian Army to devote himself to aviation, had learned to fly a Farman biplane during August, 1910, at the Centocelle aerodrome, near Rome.

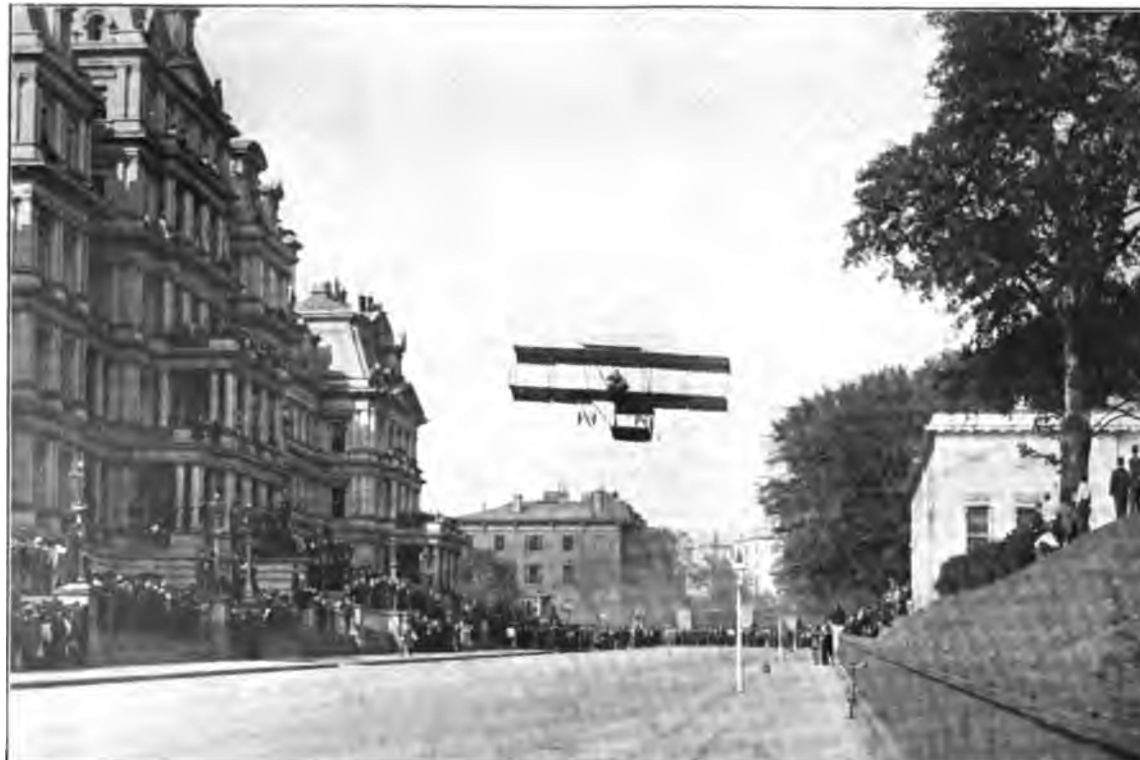
It was on August 20th that, after having made a number of flights round the aerodrome, he decided to start out upon a cross-country flight. The day was perfect for flying. Lieutenant Pasqua was accompanied, in his flight, by a fellow officer, Lieutenant Savoia, who was flying another biplane of the same make.

After the two officers had been flying for some little time above the country surrounding the aerodrome, the petrol supply of Lieutenant Savoia became exhausted, and he was obliged to plane down to the ground. This he did quite safely, picking out a good landing spot. A little while afterwards, the petrol supply of Lieutenant Pasqua, who had flown on, also became exhausted.

At the time that his engine stopped, the officer was at a height of 300 feet. What he should have done, in such a contingency, was to have pointed his machine downwards, and made a *vol plane* towards the best landing spot that lay below him. But it was clear that the young officer had had little experience in cross-country flying. From the testimony of eye-witnesses, he made no attempt to point his machine downwards, with the result that, after the engine had stopped, it slowed up until it practically stood still in the air.

Then, being completely out of control, the biplane fell, partly sideways, and partly backwards, into a field which lay below. The aeroplane was discovered to be in a hopeless state of wreckage, and the unfortunate young officer was killed, practically instantaneously, by his dreadful fall.

This accident illustrated a very practical lesson. It showed the danger of undertaking a long cross-country flight, before an airman has learned to be such a thorough master of his machine that he has the presence of mind to cope instantly with any difficulty or danger that may arise. It is, indeed, quite a different proposition for a man to undertake a long cross-country flight after he has done nothing before but fly round and round an aerodrome.



MR. GRAHAME-WHITE ASCENDING FROM A STREET IN FRONT OF THE "WHITE HOUSE," WASHINGTON, U.S.A. HE HAD PREVIOUSLY DESCENDED IN THE STREET.

No contingency calls for greater skill than that which arises when a pilot's engine stops while he is flying across country. From the land spread out below him, he has to choose, without an instant's delay, exactly where he shall seek a landing.

And the piloting of his machine on a glide to the spot selected, and the making of a safe landing there, requires manœuvring of his machine which calls for the greatest possible skill.

A pilot's loss of control of his machine, while flying, was the cause of the next accident which we have to chronicle. On August 27th, 1910, C. van Maasdyck, a 25-year-old airman, was piloting a Sommer biplane near Arnheim. He was flying at an altitude of about 150 feet, and had been carrying out a number of effective evolutions in the air.

In making a sharp turn, however, he was guilty of an error of judgment. It was plain to those who saw him that he "banked" his biplane over too sharply. Instead of moving forward, it seemed to hesitate for an instant in the air, and then slid sideways to the ground.

The unfortunate young airman was not flying high enough to correct this "side-slip" by a dive forward. So he crashed helplessly to the aerodrome, and lost his life. It appears, from reliable testimony, that the precise cause of the pilot's death was that the engine, wrenched from its position, struck him a crushing blow. A similar thing happened, it will be remembered, in connection with the death of Captain Ferber.

This accident emphasised in a very striking way, how ever-present is what might term the "danger line" in flying. The exaggeration of a turning movement, or the making of a glide which is a little too steep, may mean all the difference, sometimes, between perfectly safe flying, and a dreadful accident.

"With aeroplanes in their present stage, and having regard to the knowledge of the air possessed by pilots, it is criminal for any flyer to attempt to perform 'fancy tricks' while in his machine." The words are those of an international authority on aviation. No words could be truer.

A sporting journalist who had become an aviator. M. Edouard Poillet, was fated to become the fifteenth victim of the aeroplane. At Chartres, in September, 1910, M. Poillet had been learning to handle a Savary biplane. His progress was so good that he was, in quite a short time, able to carry passengers up with him in his machine—a type of aircraft with which several French aviators had met with success.

On the day that he met with disaster, September 25th, 1910, M. Poillet had been making a number of passenger flights. On the aerial journey which ended fatally for him, he took up, as a passenger, a young pupil named Bartiot. M. Poillet had made several circuits of the aerodrome, flying rather low, when his biplane was seen to tilt over sharply.

Through being so near the earth—another illustration of the value of high flying—the airman was unable to get his machine into control again before it came into contact with the ground. The aeroplane itself was badly damaged; M. Poillet himself was killed; but his passenger, M. Bartiot, had the very good fortune to escape with nothing but a few bruises.

The exact cause of M. Poillet's death was a fractured spine. The opinion of those who had seen the accident from the ground was that the aeroplane had been rendered uncontrollable by being struck by a sudden wind gust. The passenger on the wrecked aeroplane, whose testimony is not usually forthcoming in such a case as this, corroborated this view of the disaster.

M. Bartiot explained that the voyage had been rather a rough one from the beginning. The aeroplane, had, apparently, been struck by a series of dangerous wind gusts. The one which had fatal consequences heeled the machine over so far, said M. Bartiot, that the pilot, although he struggled strenuously to do so, could not get it back upon an even keel.

This accident indicates to those who are interested in flying the danger of making ascents, not so much in high winds, but in winds blowing gustily.

VIII

World-wide regret was expressed at the next catastrophe on the list of those who have sacrificed their lives in the cause of flying. It was after achieving one of the most magnificent flights ever carried out by an aeroplanist, that M. Georges Chavez, the Peruvian pilot of a Bleriot monoplane, met with his death under strange circumstances, while descending at a place called Domodossola.

Prior to the accident which caused his death, M. Chavez had piloted both a Farman biplane, and a Bleriot monoplane, with the greatest distinction, in all sorts of contests. Among his most meritorious flights, had been one in which he secured the altitude record while flying at the Blackpool meeting.

At the time he met with his accident, M. Chavez had actually flown across the Alps, and was seeking a descending point at the other side. Those who were at Domodossola saw the aviator planing down towards a smooth piece of ground, at a very high rate of speed. There was, however, nothing to suggest that an accident was about to take place until the pilot was very near the ground.

Then, instead of performing the evolution which is known as " straightening up " a machine, just before coming into contact with the ground, M. Chavez continued on his downward course, at a steep angle, and struck the ground with great violence.

The under part of his machine was smashed, and, when he was extricated from the wreckage, it was found that M. Chavez had broken both his legs. After giving the doctors who attended him hope that he would recover, M. Chavez suddenly sank and died. The shock of his fall had been too much for him.

Naturally, after such a strange accident as this, there was much diversity of opinion as to what had been the cause of it. It was generally agreed, by those present who had sufficient technical knowledge to judge, that no part of the machine had given way while in flight.

[*Daily Mirror.*

MR. GRAHAME-WHITE FLYING ROUND THE BLACKPOOL TOWER ON HIS FARMAN BIPLANE.

All that had happened, was, it appeared, that the aviator had failed to make the necessary movement of his *cloche,* or steering column, that would have checked the monoplane's dive just before coming into contact with the ground.

It could not have been, it was decided, that M. Chavez failed to do this owing to any carelessness or lack of skill. He was, as has been said, one of the most dexterous pilots of the Bleriot monoplane. The explanation that did gain acceptance, however, was that the pilot became so numbed with cold during his flight over the mountains that he could not make the necessary movement of his lever when nearing the ground. That a pilot does become numbed with the cold, after descending from a great height, was proved in the case of Mr Armstrong Drexel's record altitude flight at the Lanark International meeting of 1910. Mr Drexel while planing down from a height of over 6,000 feet, altogether lost feeling in one of his hands, and it was with the greatest difficulty that he kept control of his monoplane long enough to make a safe landing.

It is not improbable, therefore, that M. Chavez, after having subjected himself to even more intense cold, should have lost entirely the use of his hands while swooping down from the great altitude which he had attained above the Alps. At any rate, this explanation of the disaster, although it is not absolutely conclusive, is sufficiently reasonable to make it worthy of acceptance.

The grief that was aroused by the death of M. Chavez, particularly in view of the tragic circumstance under which he met his end, was very widespread and sincere. He was regarded, quite rightly, as being one of the cleverest pilots in the world of the Bleriot monoplane.

It is interesting to recall the fact that M. Chavez learned to pilot one of these machines at a single lesson. He had, prior to deciding to fly a Bleriot, been piloting a Farman biplane. One day, however, he made up his mind to see what monoplane flying was like. At the first time of taking his seat in a Bleriot, he rose from the ground and made a flight, which, although erratic, was carried out without any accident. M. Chavez was one of the most quiet and unassuming of aviators, and, had he not met his death, would have made an even greater reputation in the world of flying.

From the lamentable death of M. Georges Chavez, we have to turn to the disaster which occurred at Hausheim on September 28th, 1910, and, by which Herr Plochmann, a German aviator, lost his life. Herr Plochmann was piloting an Aviatik biplane, the name given to a machine of German construction, but on Farman lines.

It is a curious fact that, even at the time of writing, the cause of Herr Plochmann's accident is enshrouded in mystery. At the time at which he met with disaster, Herr Plochmann was flying at an altitude of some 150 feet. Suddenly, without any warning at all, the aeroplane fell to the ground like a stone.

Herr Plochmann was killed instantaneously, and his aeroplane was reduced to fragments. Neither from the wreckage of the machine, nor from the aviator's movements just before his accident, was it possible to decide what had happened. The most reasonable theory put forward is that Herr Plochmann suddenly lost control of his machine. It may have been an error of judgment on his part, or one of the controlling wires of his machine may have broken. Such accidents, for which no cause can be abduced, are fortunately very rare. But they are certainly very disquieting.

Concerning the death of Herr Haas, another German airman, who met with his death on October 1st, 1910, a very much more definite narrative may be told. Herr Haas was the pilot of a Wright biplane, a type of machine which has found a good many pilots among German airmen.

Herr Haas was, on the day of his death, carrying out some flights at Wellen. He had begun a short cross-country flight, and was at an altitude of about 500 feet when—as was afterwards ascertained—one of the chains driving his propellers broke. What happened after this was that the machine took a steep dive forwards, and never seemed to come within the control of the pilot again.

It continued on an abrupt dive until it reached the ground. The aeroplane was wrecked, and practically every bone in the unfortunate aviator's body was broken. It does not, of course, follow that, because one of his chains broke, the airman should have been in hopeless difficulties. This putting out of action of his power-plant should not have prevented him from making a *vol plane* to the ground.

But it is probable that, in addition to the breaking of his chain, some other portion of the pilot's machine was thrown out of gear, thus preventing him from bringing his machine safely to the ground. This accident, naturally, taught its lesson. It indicated that chains provide an element of danger. It is only fair, however, to state that the Wright machines have been singularly free from accidents due to chain troubles.

IX

Captain Matsievich, a Russian airman, who had learned to fly a Farman biplane at St Petersburg, with the intention of using the machine for military purposes, was the next pilot to meet with a fatal accident.

He was flying on October 7th, 1910, and had attained an altitude of some 1,500 feet, when those who were watching him from the ground, saw that he was in trouble. What happened first, it is agreed, was that some wires between the main-planes and the tail of his biplane suddenly broke. Some of these broken wires appear to have become entangled with the propeller of the machine.

After this, apparently losing all control over his biplane, the unfortunate officer literally fell sheer to the ground. He sustained fatal injuries, the aeroplane being reduced to fragments. In this case, it was clear, the accident was caused by a collapse of some portion of the pilot's machine, and was a very definite indication of the necessity for strong construction. It was not evident, of course, whether Captain Matsievich had subjected his machine, just

[Daily Mirror.

MR. ROBERT LORAINE FLYING OVER STONEHENGE ON A BRISTOL BIPLANE.

prior to the accident, to any severe strain. Had he done so, this might have accounted for the breaking of the wires.

The victim who followed Captain Matsievich on the roll of martyrs was another military officer, who had devoted himself to the study of aviation. Captain Madiot, the officer in question, was a very prominent man in France as regards the use of flying machines for purposes of war.

After conducting a very large number of experiments with kites, with which he succeeded in raising observation-officers to a considerable height, Captain Madiot learned to fly upon a Breguet biplane, a new form of machine which offers special advantages for military work, inasmuch as it is extremely portable.

On the day that he met with his death, Oct. 23rd, 1910, he was carrying out a series of flights, on his new machine, at Douai, in France, where there is a specially good aerodrome.

Captain Madiot's accident was a very confusing one. At the time he fell, he was flying at an altitude of some 300 feet. A number of spectators were watching him, and their accounts of what happened varied very greatly. Some said that they saw the captain turn his machine at too steep an angle, with the result that it slipped sideways, and came to the ground.

Others affirmed that they saw the aviator take his hands from the levers of his machine, remove the helmet he was wearing, and throw it away, as though overcome by some sudden illness. This latter view of the accident, seeing that it is better supported by the weight of testimony than the former one, is now generally accepted.

It is agreed in fact, that Captain Madiot was seized by some sudden indisposition, such as an attack of faintness, while piloting his machine, and that he lost control of it in consequence. This view was strengthened by the fact that Captain Madiot's machine, when examined after the accident, was found to have its control wires quite intact.

This proved that it could have been no weakness of his controlling mechanism which caused the accident. That the pilot of an aeroplane should be seized by a sudden attack of faintness is not a very surprising thing. Were a man not quite "up to the mark" through any physical weakness, a sudden attack of faintness, while rushing through the air in an aeroplane, could easily be understood. Racing motorists have, upon occasion, been similarly afflicted.

Another military airman, Lieutenant Mente, an officer of the Prussian Army, was the next aeroplanist to lose his life. He had been carrying out flights, at Magdeburg, on a Wright biplane. On October 25th, 1910, he had ascended to an altitude of 200 feet, and had been in the air some little time, when he decided to make a *vol plane* to the ground. He shut off his engine, and came planing down.

Suddenly, however, when not far from the ground, he started his engine again, for some reason not known, with the result that his biplane plunged suddenly downwards at a very steep angle, and passed out of control. It struck the ground with great force, and Lieutenant Mente's neck was broken.

M. Fernand Blanchard, the pilot of a Bleriot monoplane, met with his death on the day following the accident to Lieutenant Mente. M. Blanchard, had been making experiments, for some time, at Issy-les-Moulineaux, near Paris. He was returning from a flight on October 26th, 1910, and was only a hundred feet from the ground, when those watching his descent saw that he was in trouble. He could be seen tugging at the *cloche,* or steering column, in an endeavour to check the machine in its *vol plane,* by means of an alteration of the angle of the rear planes. Clearly, however, something had gone wrong. The machine did not respond in the slightest way to the movements of the lever. Suddenly M. Blanchard was seen to stand up in the seat as though in despair. A moment later, the machine struck the ground. It fell a little sideways, and was very badly wrecked, M. Blanchard, being very badly injured, and dying almost at once. It is clear that this accident was caused by a control wire giving way.

Lieutenant Saglietti, an Italian officer who had learned to fly an Italian Wright biplane, and who had been flying at the military ground at Centocelle, was killed on October 27th, 1910, while making a *vol plane.* Why he should have come to grief was not clear, as he was a thoroughly competent pilot. Lieutenant Saglietti was returning from a flight, and was making a *vol plane* from an appreciable altitude, when he appeared suddenly to lose control of his machine. It assumed much too steep an angle, and dived down to the ground without the pilot's being able to straighten it up in any way. The fall proved so serious that Lieutenant Saglietti was killed practically on the spot.

As regards this accident, it seems quite clear that the airman lost control of his machine while making the *vol plane,* through permitting it to get too steep an angle in the air.

Mr Ralph Johnstone, who was a famous music hall artist before he astonished everyone with his tricks while flying a Wright biplane, met with a fatal accident on Nov. 17th, 1910, while flying at Denver City. Mr Johnstone's skill in piloting this type of machine was so great that it led him to attempt making particularly daring evolutions. One of the tricks which he performed frequently when giving exhibition flights was to come rushing down towards the ground with his engine running, and then to make a quick circle in the air, banking over his machine to a very dreadful-looking angle.

It was while making such a "spiral glide" to the ground, as a conclusion to a number of aerial feats, that Mr Johnstone met with his death. It became apparent to those watching from the ground that the aeroplane suddenly passed beyond the pilot's control while he was swinging round in one of his circles. Most eye-witnesses agree that some portion of his machine collapsed. At any rate, he never regained control of it, being precipitated to the ground, with the result that he was killed instantaneously. Although this catastrophe must be placed in the list of those occasioned to the breaking of some portion of the pilot's machine, it is only fair to state that in

[*Daily Mirror.*

MR. SOPWITH FLYING OVER HURST PARK RACECOURSE, DURING THE PROGRESS OF A MEETING, ON HIS HOWARD-WRIGHT BIPLANE.

this particular instance, the pilot was probably subjecting his machine to an altogether abnormal strain. More recent reports indicate that Mr Johnstone's accident was due to his falling from the seat of his biplane.

The first double fatality with an aeroplane next grieved the world of aviation. Ascending at Centocelle on December 3rd, 1910, Signor Cammarota, an Italian military engineer, carried up with him as a passenger another engineer named Castellani. The machine they were flying in was a military-type Farman.

The most reliable accounts of the accident that befell them indicate that the pilot of the machine was making a turn, in a very sharp half-circle, when some portion of it collapsed. What it was that broke first, is not clear. But what happened was that the machine suddenly became quite out of control and fell to the ground. Both the occupants of it were killed. This accident may have been precipitated by the pilot making too sharp a turn in the air.

X

We now come to one of the most melancholy days in the history of British aviation—December 22nd, 1910. It was on this day that Mr Cecil Grace, one of the most prominent pilots in England, met with his death. Mr Grace was a competitor for the De Forest £4,000 prize for the longest flight into the continent by a British pilot, on a British machine, made before the end of December, 1910.

He had flown from Eastchurch, on the Isle of

Sheppey—the Royal Aero Club flying ground—to the cliffs above Dover a day or so before undertaking the flight which cost him his life.

The morning of December 22nd was quite suitable for a flight save that there was a little fog. Taking with him sufficient petrol for a seven-hour journey, and intending if possible to beat Mr T. Sopwith's 169 mile flight into Belgium, made on December 18th, Mr Grace crossed the English coast line on his Short biplane, at half-past nine in the morning.

The next thing that those who were at Dover heard was that the airman had landed at Les Baraques, near Calais, after a safe crossing of the Channel, at five minutes past ten. His reason for descending here, instead of continuing his flight inland was, as he explained to his friend Mr Le Cren, who was organising a service of steam tugs from Calais, that he had encountered an adverse wind on approaching the French shore, and so did not think that—even if he flew on for several hours—he would be able to beat Mr Sopwith's figures.

The latter, it should here be mentioned, had been favoured during the whole of his flight by a following wind.

Mr Grace lunched at Calais, and then decided to fly back across Channel to Dover, so as to be ready to make another attempt for the prize on the following morning. Steam tugs were sent out into the Channel prior to his departure, and the airman, after lunch, saw the captain of the passenger-boat crossing to Dover, in order that he might arrange with him to follow the steamer as a guide across Channel.

Mr Le Cren went on to the steamer in order to cross to Dover, and Mr Grace motored back to Les Baraques, so as to be ready with his machine to commence his flight as soon as he saw the Channel boat leave Calais harbour.

The afternoon was fine and sunny. There was no sign of fog near Calais, although weather experts had told Mr Grace that there might be some isolated banks of fog lurking in the Channel. A south-west wind was blowing. Its strength on the ground was not much more than 10 miles an hour; higher up, however, it was no doubt blowing at a speed of 20 miles an hour.

On this particular afternoon the boat train from Paris was late, with the result that the departure of the cross-Channel boat was also delayed. Mr Grace waited some time at Les Baraques for the boat to start. When it was twenty minutes late and there was no sign of its leaving the harbour, he evidently became impatient, fearing perhaps an increase in the wind, and so started his flight.

Mr Le Cren, from the deck of the steamboat in the harbour, saw Mr Grace pass almost directly overhead. Then he swung out over the sea and disappeared. The captain of the steamboat, who was standing beside Mr Le Cren, commented upon the fact that the airman did not seem to be heading a proper course for Dover.

In order to have reached his destination, it was necessary for Mr Grace to steer a course north-west from Calais; and, in order to have made allowance for the south-west wind, which would have meant a certain amount of leeway during the crossing, he should have been steering a point or two west of north-west. Instead of doing so, however, he was seen, at the moment of disappearing from view, to be directing his aeroplane on a course almost due north of Calais.

The next thing that was seen of the aeroplane was a view obtained of it by the captain of one of the two Calais steam tugs, which had been standing out in the Channel to be ready to pick up the airman should he fall into the water.

The machine was detected by this eye-witness flying at a good height across Channel. Two other glimpses only were obtained of it. The men on the East Goodwin lightship, which guards one end of the famous sands, and which is stationed some eight miles from shore, were looking out seawards, through a light and rather "patchy" fog, when they saw the aeroplane. Their view of it was only momentary, as it passed quite quickly from one patch of fog into another. It was flying at a good height. The airman was manipulating his lever with his right hand when the men on the lightship saw him, and was holding one of the upright spars between the planes with his left hand. One more glimpse of him, and one more only, was reported.

A few minutes after he had passed from the view of the men on the East Goodwin lightship, steering in what they made to be a northerly direction, he was seen by the skipper of a Ramsgate fishing boat. This man reported having seen the biplane pass almost directly over his boat. It was then apparently much lower than when it was seen by the lightship men. This would rather suggest that Mr Grace had

[Daily Mirror.

M. PRIER MAKING A "VOL PLANE," WITH HIS ENGINE STOPPED, WHEN ALIGHTING AT WORMWOOD SCRUBS, AFTER A FLIGHT ROUND OLYMPIA FROM HENDON

descended a little through the fog to see whether he had reached land.

From this moment, no further sign was seen of the aeroplane. All that can be assumed from the fact that Mr Grace did not reach the English shore, is that he passed out into the North Sea, and there descended somewhere owing to the giving out of his engine. In the mouth of the Thames, on this particular evening, there was a good deal of fog. It is quite conceivable that Mr Grace passed within a mile or so of the North Foreland without seeing it.

If his course is plotted out on a chart, up to the point where he was last seen near the Goodwins, it can be clearly proved that, all the way across Channel, he was making a good deal of leeway in a north-easterly direction owing to the influence of the south-west wind. If he had continued a northerly course after being sighted by the East Goodwin lightship, this would have taken him a mile or so seaward of the North Foreland, and inevitably out into the North Sea.

What his precise fate was, no one, now, is likely to know. From the fact that the unfortunate airman's body has not been recovered, it is adduced that, when the biplane struck the water, he was unable to extricate himself from it, and sank with it.

This view is somewhat disproved, however, by the fact that a mute witness to Mr Grace's fate was washed up on the beach near Ostend. This was the flying cap he was wearing, with a pair of motor goggles attached to it. Had Mr Grace sunk with his machine it is not likely that this cap, with the goggles, would have been found. To remove the cap, the aviator would have had to untie a string which passed under his chin and was fastened at the top of his head.

It is clear, in making what explanation is possible of this very sad disaster, that Mr Grace must have made the initial mistake of steering a course that was too northerly. This error, magnified by the leeway that the wind forced him to make, brought him outside the Goodwins instead of being near the cliffs at Dover. One inexplicable feature of the case is as regards the airman's timing of his flight.

It was Mr Grace's habit, and there is no reason to doubt but that he did so on this occasion, to time very carefully all his flights. This he did by means of a watch hung conveniently on one of the uprights where he could see it. From the moment he left Calais, until the time he was seen off the East Goodwins, a period of approximately an hour had elapsed. Had Mr Grace been timing himself, one would have assumed that, consulting his watch at this period, and discerning no land below him, he would have reckoned that something was wrong.

He would have known, for instance, that an hour's allowance of time ought to have seen him well across the Channel. When, therefore, he saw that the hour had elapsed and that he was still over the sea, one would have thought that he would have known beyond question that he was out of his course. Had he consulted his watch in this way, and realised that he was out of his course, the most natural thing for him to have done, it would have appeared, would have been to have made a turn to his left hand, or rather westwards, so as to get over the land. That he should have done this appears all the more probable when it is remembered that a south-west wind was blowing and that the airman must have realised that his tendency was to make leeway towards the North Sea.

But instead of making a westward turn, Mr Grace appears to have held on his northerly course, and to have passed out into the North Sea beyond the reach of land. This is the most mysterious part of this tragic affair.

So far as British aviation is concerned, Mr Grace's loss was of the utmost gravity. He had studied the problems of flight in a most complete and pains-taking way, was one of the best allround flyers in the world, and had given the greatest encouragement, in a practical way, to the home industry.

XI

M. G. Picollo, the pilot of a Bleriot monoplane, met with his death on December 28th, 1910, while giving a demonstration of flying at San Paulo. Springing out of his machine, after a short flight, to avoid running into a barrier, he was struck by the tail-planes of his machine, and fatally injured.

The well-known flying ground at Issy-les-Moulineaux, was the scene of the disaster with which we have next to deal. M. Laffont, one of the most expert pilots of the Antoinette monoplane, ascended on December 28th, 1910, to make a trial prior to a long cross-country flight, carrying with him a passenger, the Marquis de Pola. The machine used was a passenger-carrying Antoinette monoplane, which had been well tested beforehand. At the time the flight was made the wind was rather high, but it was not considered dangerous for an Antoinette, which is, of course, a wonderful machine for wind flying.

When about 500 feet high, and after having been in the air for some minutes, the monoplane was seen to rock violently, as though struck by an unusually heavy gust. Then it made a dart downwards, and, in the opinion of those who were watching, one of the wings of the machine collapsed. The monoplane fell like a stone, being smashed to an unrecognisable mass, while both its occupants were killed.

One of the theories propounded to account for the disaster, was that the wires controlling the wing-warp had jammed in some way, rendering the machine out of control. But the most generally accepted explanation is that one of the wings of the machine gave way under the stress of an exceptionally heavy wind gust.

Lieutenant Caumont, piloting at St Cyr a Nieuport monoplane, was the next victim of the aeroplane. Lieutenant Caumont had been carrying out several trial flights, and was descending from one of them, when his monoplane apparently got beyond control at an altitude of about 200 feet. The pilot failed altogether to steady it when it came into contact with the ground, and the monoplane was wrecked, Lieutenant Caumont being killed.

The explanation of this strange accident is that the rear control of the monoplane became inoperative, owing to the breaking of wires, and that

the pilot could do nothing to prevent its dive to the ground.

Flying at New Orleans on a Bleriot monoplane, with the intention of creating a long-distance record, Mr John B. Moisant met with his death on December 21st, 1910. It seems beyond question that Mr Moisant went out in a very high and gusty wind. After flying in it a little time it became clear that he had had quite enough of it. As he came gliding down with the wind behind him, a gust appeared to turn the machine at much too steep an angle, and it struck the ground with great violence.

The monoplane was wrecked, and Mr Moisant was extricated from it very badly injured. He died while on his way to the nearest hospital. There is no doubt but that Mr Moisant sacrificed his life to his belief in the power of aeroplanes to fly in high winds. He was never tired of stating that if they were to be any good, aeroplanes must be ready to go out in all weathers, and during his visit to America, he had astonished many experts by the daring way in which he had made light of adverse winds.

On the same day that Mr Moisant lost his life, another American airman of great prominence, Mr A. Hoxsey, was killed at Los Angeles while piloting a Wright biplane. Mr Hoxsey was giving an exhibition flight, and was gliding down from a considerable altitude, when his machine appeared to get out of control, and turn over in the air. It then fell to earth and the pilot was killed.

At the time it was thought that some part of the machine must have collapsed, but recent advices point to the fact that Mr Hoxsey lost consciousness owing to his very rapid descent through the air and was thus unable to control his machine. Mr Hubert Latham, who saw Hoxsey's fall, attributed it to the pilot's having encountered an "air hole" in his descent.

An airman who was piloting a machine of his own design, M. Rusjan, was killed on January 9th, 1911, while flying at Belgrade. One of the wings of his monoplane broke while he was in flight, and his machine fell, quite uncontrollable. The pilot was killed almost instantaneously.

The last accident but one with which we shall have to deal concerns the death of Lieutenant Stein, a German military officer who was killed on February 6th, while flying at Doberitz on a Farman biplane. Lieutenant Stein had not much experience as an aviator. While flying quite near the ground he appeared to lose control of his machine, and actually fell out of it before it hit the earth, sustaining mortal injuries.

On February 9th, 1910, carrying out some military tests at Douzy with a military-type Sommer biplane, M. Noel, a clever French airman, and his passenger, Senor de la Torre, were both killed. After a number of successful tests, including one of an hour's duration, the airman was piloting his machine back to the ground when he apparently dipped it too steeply while making a glide.

It got out of control, and the pilot was unable to prevent it making an abrupt dive to the ground. The machine was wrecked, and both its occupants were killed.

SECTION V

PREVENTION OF AEROPLANE ACCIDENTS

By CHARLES G. GREY *(Aero. Amateur.)*

In this section, Mr Grey deals with a subject that he has studied very carefully—the constructional features of an aeroplane which spell either peril or safety to an airman when he is involved in a fall. His writings on the subject have been translated with approving criticism into French, German, and Austrian aeronautic journals, and a German machine has been built to his designs.

I

FEW as fatal aeroplane accidents have been, considering the youth of the science and the inexperience of its exponents, it would be much better for the progress of the science, the sport, and the industry if the number, as well as the proportion, of the accidents, fatal or otherwise, could be materially reduced; for there is no doubt that, owing to the way fatalities have been advertised, quite a number of probable recruits to the sport have been frightened off it for the time being, either because they themselves fear damage, or because their relations, who would provide them with the necessary funds, refuse to do so on account of the supposed danger.

I have in mind one fine young sportsman in London whose wealthy parents absolutely refuse to allow him to fly because "it is so dangerous," and yet they provide him with unlimited money to go climbing about on Alps, happily ignoring the fact that a fall off an Alp is just as fatal and rather more probable than a fall in, with, or out of an aeroplane. I say "rather more probable" advisedly, for there were last year 100 fatal accidents in Swiss Alpine climbing alone, besides about twice as many serious injuries, and I very much doubt whether there were between 32,000 and 36,000 climbers, which would be about the right proportion; that is actual climbers, and not simply ski-ers, bob-sleighers, and other holiday-makers who of course run into millions.

Now let us consider the causes of a few fatal accidents, and then we can consider how some of them might be avoided. The first case of a fatal accident in connection with an aeroplane was Lieutenant Selfridge's, who was a passenger with Orville Wright when the machine came down sideways, owing, it is said, to a chain or propeller breaking. The machine was quite close to the ground, but Selfridge was flung out and broke his neck, or his back.

Now in a Wright machine one sits right on the front edge of the plane, as indeed one does on the Farman and all machines of similar type, and one stands a good chance of being pitched out on to one's head and breaking some part of the spinal chord.

This is reported as being what actually happened in the fatal accidents to Lefebvre, Haas, and Mente (all pilots of Wright machines). In Ralph Johnstone's case the machine collapsed in the air

AN EVENING FLIGHT BY MR. GRAHAME-WHITE ON THE FARMAN BIPLANE.—BOSTON, U.S.A.

MR. GRAHAME-WHITE, FLYING AT DUSK, AT BOSTON, U.S.A.

owing to a sudden stress put on a badly repaired part by some tricky manœuvre on the part of the pilot, but in Hoxsey's case the pilot apparently simply lost control of himself, and consequently of his machine, which came down badly, but not so badly as to break it up, and Hoxsey was caught and crushed by the engine.

In the case of the Hon. Chas. Rolls, he came down at a very steep angle, tried to flatten out, and broke his tail, with the result that the machine came down on the point of the skids and turned a somersault. Rolls went over with it, and, having nothing to hang on to except his levers, was thrown on to his head.

Now I maintain, and I have many practical men on my side, that if these men had been seated in a properly designed body, with something to hang on to, with the engines in front, and with plenty of woodwork to crumple up between them and the ground, none of them except Johnstone would have been killed, and probably some of them would hardly have been hurt.

In proof of this I may cite the case of the Morane brothers, who, when the working of one wing of their Bleriot either broke or jammed, came down from many times the height of Selfridge and Orville Wright, and escaped with broken legs, and even broken legs might have been avoided.

Another case, which I saw myself, was when George Barnes, in a machine on Bleriot lines, had a wing break at Brooklands, and came down fully thirty feet, but hung on to the fuselage and escaped with a bruised toe. There have been hundreds of similar cases, any one of which might have been fatal if the pilot had been seated at the front of his machine instead of at the back.

II

Next let us consider another species of accident, namely that which accounted for the deaths of Captain Ferber, Saglietti, Cammarota, Van Maasdyk, and one or two others, besides just missing killing Christiaens and several more, namely the case is which a machine of the Voisin or Farman type, with the engine and propeller at the back, either comes down and hits the ground nose first, or else lands quite properly (as Captain Ferber's and Christiaens, did) runs along the ground, hits a bank or any other obstruction and turns over on to its nose.

In either case the pilot is crushed by the engine. If he is not crushed he is flung out and may break his neck, as in the Wright type of machine. Sometimes both happen at once, as in Cammarota's case when his passenger Castellani had his neck broken. This kind of accident can, like those to which Wright-type drivers are liable, be avoided by placing the driver behind the engine.

So far it may seem that all my examples simply amount to arguments in favour of putting the pilot behind his engine and behind his main planes in a fuselage, or body, of the kind used in the Bleriot, Goupy, Avis, and other similar machines, but there are still other points to be considered, namely the causes of fatal accidents in machines of that very type.

Several flyers of such machines have been killed, or seriously injured, and their accidents may be divided into two kinds. Firstly, those in which the machine has come down head first or has hit an obstruction on landing and turned over, throwing the pilot out on his head. In this category come the fatal accidents to Blanchard and Moisant, and the injury to the Hon. Alan Boyle.

Fatal results can be avoided by the pilot sticking to his seat, and the turning over can be prevented in many cases by fitting the machine with adequate skids, which are long enough to take most of the shock by crumpling up if the machine should come down head first, and are curved up high enough to ride up on to a bank or, say, a tree trunk if the machine runs into it on landing, instead of tripping over it and turning turtle as do the machines of to-day, whether fitted with swivelling wheels, or with the absurdly short skids generally fitted.

The second kind of accident to which this type of machine is liable is that in which the pilot, instead of being thrown out on his head, is shot feet first into the front of the machine and is telescoped upwards. In this way Chavez in his Bleriot and de Caumont in his Nieuport were killed, and the two Moranes in their Bleriot, Labouchère in his Antoinette, and Laurens in his R.E.P. had their legs broken.

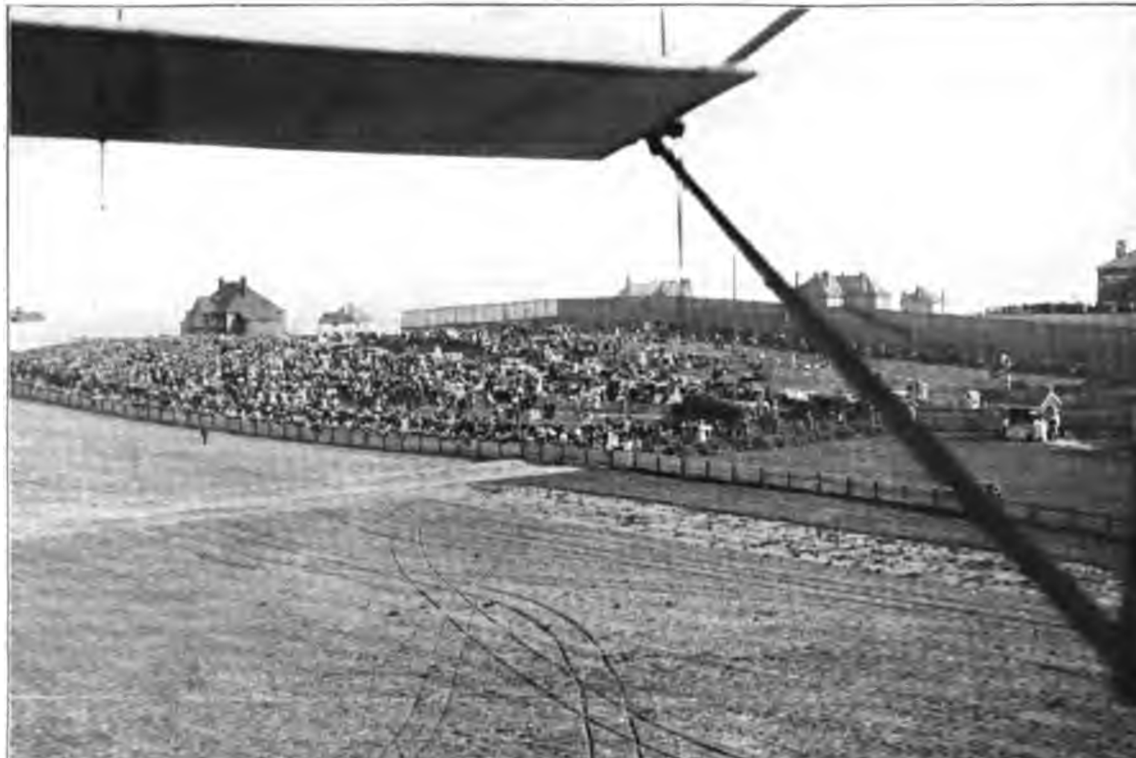
In all these cases adequately long and properly strutted skids would have lessened the impact, and even as things were the results would not have been fatal if the pilots had been kept in their seats by properly designed elastic belts. Such are now used by all R.E.P. pilots and they have saved many serious smashes since they came into use, for while the R.E.P. machine was still in an experimental stage accidents were constantly happening to it.

The Antoinette pilots also use belts, but they make the fatal mistake of using no elastic. The belts are rivetted to the hull of the boat-like body and clasped in the middle, and are perfectly rigid, so that they either snap with the shock, as Labouchère's did, and as Laffont's did, or else they hold tight and tear the man to pieces in a very bad smash, which is what happened with Laffont's unfortunate passenger Pola.

The belts should be wide, extending from hip to breastbone, much like a horse-sling, and should be fastened to the fuselage by stout rubber cords, which should vary in strength with the weight of the user. Such belts would also have a chance of saving a man if his machine came down sideways with a collapsed wing, as in the case of Delagrange, who was flung out sideways from his Bleriot, fractured his skull, and was killed, or of Bournique whose old-type R.E.P. came down sideways and broke his arm.

Yet another type of accident may be considered; one which is peculiar to machines such as the Farman, Sommer, old Voisin, and those of similar type, in which the propeller blows a draught on to the tail which causes it to lift.

If the engine should stop and the pilot should hesitate for a second about shoving the nose of the machine down to a gliding angle, the tail will drop,



[*Daily Mirror.*

PHOTOGRAPH OF THE ENCLOSURES, TAKEN FROM MR. GRAHAME-WHITE'S AEROPLANE AT BOURNEMOUTH.

and the machine will fall down backwards in an absolutely uncontrollable way.

Such a cause is generally believed to account for the deaths of Daniel and Nicholas Kinet, Vivaldi, and Robl, but most of the accidents of this kind which have occurred have happened to beginners when flying low, with the results that the machines have come down flat (or "*en vol pancake,*" as it is humorously called), and the machines have been demolished without much damage to the pilots.

The obvious way of avoiding this is to do away with the lifting tail, and to use a tail which is simply directional, and not part of the carrying surface.

III

That these various points are appreciated by practical flyers is proved by the fact that there is a general tendency to produce new machines of the type which have the engine in front, and the pilot behind. The late Cecil Grace, in conjunction with Mr Horace Short, had, at the time of his death, just completed a biplane with a large deep fuselage, in which he sat just behind his planes, with the engine in front. The Caudron and Goupy, two excellent French biplanes, are similarly arranged.

Mr Jezzi, a member of the Royal Aero Club, produced in the autumn of 1910, a singularly light and efficient machine of a somewhat similar type, but with two tractor screws, the only machine of its kind, I believe. Probably by the time these notes appear two of the leading British aeroplane firms will have produced biplanes on something the same lines.

And of course there is the outstanding example of the Roe triplane, the first British machine which ever got off the ground. This has the engine in front, with a tractor screw, and the pilot sits behind.

No machine at Brooklands has had as much knocking about, owing to the number of pupils who are always playing with it, and it has had numberless appalling "headers," any one of which might well have killed the driver if he and the engine had changed places, yet no one has ever been hurt, though the machine has been smashed up over and over again.

The Antoinette, Hanriot, and Martin-Handasyde monoplanes, with their long slim fuselages, are probably the prettiest machines in the air, but in all of them the pilot sits on the deck of the boat-shaped fuselage, and consequently has no protection against a sideways slide, or against a fall to one side if a wing hits the ground and collapses. Therefore, though they are not so pretty and probably absorb more power, owing to wind-resistance, I prefer the very deep fuselages of the R.E.P., Nieuport, Bleriot and some others.

Though not a direct cause of accidents, however, there are many objections to having a propeller in the front, and that is why many designers stick to putting the engine at the back. The objections are that even a slightly bad landing, or the slightest collision, even with a bush, on landing will smash up £10 to £20 worth of propeller; also it is very unpleasant and inconvenient to have the draught of the propeller, with its accompanying oil and smoke, in one's face; further a propeller is undoubtedly more efficient when working behind a plane instead of in front of it.

Therefore I strongly advocate putting the propeller at the back and the engine either in front of or below the pilot, the propeller being driven by a shaft. I fully realise the difficulty of fitting a satisfactory shaft, but it can be done, as is shown by the fine flying of the De Pischof monoplane built on somewhat the lines which I suggest.

Using a shaft has the further advantage that it permits of gearing the propeller down, so making it possible to use a very high-speed engine, which means big power for little weight, at the same time as a slow running, and consequently more highly efficient, propeller.

It is to the gearing down of the propellers that one may largely attribute the high efficiency of the Wright, Cody, Maurice Farman, and Jezzi machines, and it is only surprising that the geared down propeller is not more used.

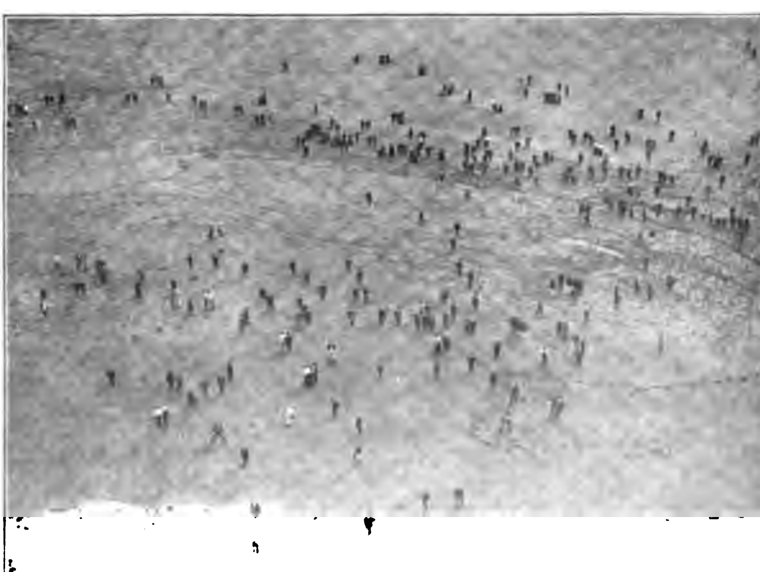
IV

There is yet another kind of accident to which I have not yet referred, namely the accident due to faulty construction. It might be libellous to mention names in this connection, but it is fairly certain that several deaths have been caused through the collapsing of wings in the air, and through the failure of control levers, wires and other parts. In many of these cases death might have been avoided by building the bodywork, and placing the pilot and engine as I have suggested above, but nevertheless bad construction in an aeroplane is positively criminal.

I have seen wing-ribs with the bark still on them, showing they were cut from the wrong part of the wood; and control-lever joints made of bits of brass tube, with little plugs soldered in the ends to act as bearings, these in turn taking their bearing in holes drilled in bits of strip iron. I have seen the main wing-stays on monoplanes, which have to carry the whole weight of the machine, and which are themselves calculated to stand a breaking strain of several tons, coupled up to little bolts which would break under a strain of a few hundredweights; and elevator levers, on which the whole safety of the machine depends, made of aluminium castings which have broken under a sudden jerk while in the air. Many of such constructional mistakes have not even the excuse that they save weight, for greater strength could be obtained by better design and workmanship, without adding to the weight.

Certain accidents have undoubtedly been caused by the gyroscopic action of rotary motors, in that the motor has held the machine straight on a certain course, and a control has broken in trying to pull the machine out of that course against the gyroscopic force. This certainly had something to do with the deaths of Van Maasdyck and De Caumont, and quite possibly with those of Chavez and Blanchard, as well as the accident to the Moranes. For this reason I am not particularly in love with rotary engines, unless one could use two, running in opposite directions, and so obtain the virtue of stability with a

SOUTHPORT, AS PHOTOGRAPHED FROM MR. C. COMPTON PATERSON'S AEROPLANE.



SPECTATORS, AS PHOTOGRAPHED FROM AN AEROPLANE ABOUT TO PASS IMMEDIATELY OVER THEM.

balance which would avoid undesired gyroscopic effects.

Still this question is outside the scope of these notes, and I can only hope that what I have said will help some of the readers of this book to realise that most of the deaths which have occurred could have been avoided by the use of a little ordinary common sense, and that on the whole, flying is not the desperately dangerous game it is popularly supposed to be.

SECTION VI

THE AEROPLANE IN WARFARE

By Colonel J. E. CAPPER, C.B., R.E.
(Late Commandant of the Government Balloon School at South Farnborough.)

Colonel Capper's pioneer work in connection with military aviation, embracing experiments with the first dirigibles and aeroplanes constructed for the War Office, extended over a period of more than seven years.

I

PRELIMINARY

In considering the effect of aviation on war, we are dealing with matters which must be largely guess-work, as we have, as yet, no practical experience of the use of aeroplanes for military purposes, except in peace manœuvres.

There are, however, definite data on which to form our conclusions, and by considering them, we may arrive at certain general opinions as to the probability, or otherwise, of the claims made as to their utility, being upheld.

We know definitely that there are already in existence machines which, in the hands of good pilots, are capable of making long cross-country journeys in fair weather. We know also that whilst pilots have not infrequently lost their way, many are able to set out with the object of reaching definitely fixed points, and of safely alighting again at their starting place by the same, or another route; also that these cross-country journeys can be made at heights of 2,000 or 3,000 feet, and that flying is easier at these heights than close to the ground where air currents are less regular.

We know also that, if required, heights far greater than these can be attained in a few minutes, and descents safely made from them at tremendous speed.

We know that an average speed of 40 to 50 miles an hour, on a circular course is not an unreasonable speed to expect; and that long distances can be traversed by a machine carrying a passenger as well as the pilot.

We know that the movements of the machine, whilst flying, are smooth enough to enable the passenger to use both hands for writing notes, sketching, taking photographs, etc., and that with practice he can use moderately powerful field-glasses.

We know, too, that the machine can remain in the air whilst being turned in a short circle, so that it can be kept, for a considerable time, practically above any particular spot.

We know, also, that natural phenomena, such as vertical currents and whirls, may unexpectedly wreck a machine; that the breakage of a single stay may cause immediate disaster; and that any defect of the engine, or fuel supply, may enforce a descent to earth.

The above may be taken to be facts which are the results of actual experience, and the truth of which need not be discussed. For ordinary peace work, we can form our conclusions as to the usefulness of a flying machine, for any purpose, on these facts alone.

In war, however, there are other factors to be reckoned with; and before we can form an accurate opinion as to the utility, or otherwise, of flying machines for different purposes in war, it is necessary to consider also these other factors. These are :—

(1) The effect of artillery or infantry fire, and the probabilities of hits.
(2) The accuracy of observation, from a flying machine, of terrestrial objects.
(3) Firing light weapons with accuracy from flying machines.
(4) Hitting terrestial objects by bombs thrown or discharged from flying machines.
(5) Recording and communicating information gained.

All these points will be discussed in due course.

II

USES OF FLYING MACHINES

The possible uses to which a flying machine may be put in war appear to be :—

(1) Reconnaissance—that is, the examination by

PHOTOGRAPH OF THE MOTOR TRACK AT BROOKLANDS, TAKEN FROM A HOWARD-WRIGHT BIPLANE BY MR. MANNING.

THE SHEDS AT BROOKLANDS, AS PHOTOGRAPHED FROM A HOWARD-WRIGHT BIPLANE BY MR. MANNING.

trained officers of definite tracts of country, or localities, with a view to ascertaining the nature of the country, the roads, railways, rivers and bridges, battle positions, the nature and extent of fortifications, position, numbers, and nature of the enemy's troops, positions of supply trains, magazines, military depôts, and military movements that are in progress.

(2) The harassing and delaying of an enemy by discharge of light bombs on encampments, bivouacs, and large formed bodies of troops, and of incendiary bombs on his supply stores.

(3) Attack on an enemy's flying machines and airships.

(4) Direct attack on convoys and on troops on the march, or halted in close formation, by flying machines carrying machine guns.

(5) Quick transport of staff officers and despatches, etc., and inter-communication.

As regards reconnaissance, we can form fairly accurate conclusions from peace experience. As regards the other points we can only form opinions.

In any case, however, success can only be attained presuming the flying machine and its occupants are not destroyed and brought to earth by the enemy before attaining their object, and it is therefore convenient, before discussing any of these points, to discuss the probability of the enemy being able to interfere with them.

III

THE EFFECT OF ARTILLERY AND INFANTRY FIRE

Putting aside for the moment counter attacks by other flying machines and airships, the only means that at present exist for damaging flying machines in the air are artillery and infantry fire.

As direct hits by common shell would be almost hopeless, the missile used by the artillery would be the shrapnel shell. This consists of a metal case containing a small charge of explosive sufficient to burst the shell, a fuse which can be set to explode the charge at any required distance from the gun, and a number of bullets, which, when the case is burst, spread out over a considerable area, and move forward at a speed sufficient to break any portion of a flying machine with which they may come in contact.

In order to obtain a hit under the simplest conditions it is necessary :—

(1) That it should be possible to elevate the gun to such an angle that the shell will go as high as the level at which the flying machine is moving.

(2) That the range should be accurately known.

(3) That the fuse should be set to burst the shell at the right moment.

(4) That the gun should be aimed, not at the machine itself, but at some point in front of it, the distance of which from the machine at the moment of firing is dependent on the speed of the machine, the speed of the projectile, and the distance from the gun.

It is obvious that in order to ensure a hit even under these conditions, both gun, projectile and fuse must be of the greatest accuracy, and the gunners must be trained to a very high standard of efficiency, as the range has to be obtained with extreme rapidity, the fuse to be very accurately set, and the gun most carefully and quickly aimed.

Allowances have also to be made for direction and strength of wind, which affects the projectile in its flight, and for the height of the barometer and the height at which the machine is flying. It appears obvious that, with any aeroplane moving at 40 or 50 miles an hour, a hit must be very difficult to secure even by the best artillery in the world.

When we also consider that; assuming the effective range of the gun to be 5,000 yards, a machine moving directly across it at 50 miles an hour would only be within range for under 3½ minutes; that under the most favourable circumstances the gun would have during this period to traverse across an angle of 60 degrees and alter its range down to 4,330 yards in the first 1¾ minutes, increasing it again gradually to 5,000 yards in the next 1¾ minutes, the likelihood of a hit appears somewhat improbable.

But this is not all; we have only as yet considered the probabilities under the simplest conditions, of the machine keeping constantly at one level and moving directly across the gun at its most convenient range.

The difficulties are greatly increased if the machine alters it level or is moving obliquely to or from the guns, as the range and elevation constantly alter as well as the direction, whilst the period during which the machine is within effective range may be very much reduced, or it may circle directly above ordinary field artillery without any possibility of their being able to fire at it until it moves further away from them.

Moreover, quick-firing guns have but a small angle of elevation, and even the field howitzer can hardly hope that its shells will reach a height of more than 3,000 feet except at very short ranges; so that at any considerable height the machine will be absolutely immune. The howitzer also suffers from the serious disability of only being able to traverse through a comparatively small angle, without having to shift its trail.

As regards the damage likely to be inflicted on an aeroplane by shrapnel shells—a hit on the man, on any vital part of the engine, the radiator, petrol tank or propeller may enforce a speedy descent, whilst the cutting of an important stay or control wire may mean entire wreckage of the machine, but the greater portion of the exposed area consists of fabric which may be penetrated by many bullets without seriously affecting the flying capability of the machine.

By the expenditure of a great quantity of ammunition it may be possible to ensure a hit and a lucky shot may also get home, but when we consider the extraordinary value of artillery shells in battle, and the amount of transport required to bring them up, it appears doubtful whether the offchance of bringing down a flying machine will justify the great expenditure of artillery ammunition that will probably be required.

[*Daily Mirror*.

PHOTOGRAPH OF THE CROWD AT BOURNEMOUTH, TAKEN FROM MR. GRAHAME-WHITE'S AEROPLANE.

Special guns, mounted on automobiles, and capable of being elevated nearly vertically, have been introduced abroad, and have the advantage over ordinary field artillery that they can fire at any angle to the horizon, and their shells can reach great heights; but they have no better prospect than ordinary guns of hitting a flying machine, unless it is circling above them; and again it appears doubtful policy to expend money, men, and transport on a special arm only to be used for the single purpose of combating flying machines.

Flying machines are not conspicuous at any considerable distance, such as three or four miles, and might well, even in the clearest weather, escape notice until well within range, so that the moments available for shooting at them, whilst still in range, would be few indeed.

As regards infantry fire, the period during which a machine would remain within range would be short, but the number of aimed shots that can be fired from a magazine rifle in a minute is considerable.

A company of 100 men would probably be able to get off three thousand shots or more at a machine crossing over their heads, and might make a certain number of hits; but many of the shots would have to be fired from very awkward positions, there would be no time to change the sights, the ranges would be unknown, and altering very rapidly, whilst, unless shooting directly to the front, there would be considerable danger to their own troops from their bullets. So that the opportunities for shooting would not be so many as would appear at first sight.

The same remarks as to the result of hits on different portions of the machine by infantry fire, apply as in the case of hits by artillery fire.

There is also one very important point to bear in mind in considering the question of firing at flying machines, from the ground, at long ranges. This is the difficulty of ascertaining whether the machine be a friend, or an enemy.

Though doubtless every machine will ordinarily carry its country's flag, the flags will not necessarily be visible at long range, and unless each combatant employs solely, machines of some distinct type (which appears to be, in the highest degree, unlikely) troops will have little means of ascertaining whether any individual machine is an enemy reconnoitring, or a friend going or returning with despatches, until it is too late to take effective action against it.

The direction in which the machine is flying is no guide, as the enemy can fly round and approach from the rear or from one flank as easily as from the front.

All things considered, it may be taken that, though the occupants of a flying machine must run some, and possibly considerable, risk in flying over territory occupied by hostile troops, the risk is not so great but that they will be perfectly justified in facing it in the interests of their own country.

Having determined the probabilities of the flying machine being able to move over an enemy's country, we can now consider what uses it can be put to.

IV

RECONNAISSANCE

The first and most obvious use is reconnaissance. War may, to a certain extent, be likened to a game of chess. At the beginning of the game, the player, who is the General officer commanding-in-chief, knows the number and position of the opponent's pieces. Directly the game is begun, however, the great difference begins.

The chess player knows with certainty each movement made by his adversary, and can take steps to counteract its effects. The general knows little or nothing of his adversary's movements, except from information gained by one means or another, and war becomes like an extraordinary game of chess, which is played on two boards, by players separated from each other, and only communicating by means of others, who occasionally move one of the enemy's pieces to another square without any reference to intermediate moves and sometimes remove one of our own pieces as taken, or say it is temporarily unable to move. Meanwhile, we have to use our judgment, or guess what moves the enemy is making.

Under such conditions, a very inferior player, with all movements of both sides recorded on his board, would have little difficulty in defeating the finest player in the world, were the latter kept in almost complete ignorance of his movements.

So it is with armies. The finest plan of campaign may be upset if we are ignorant of the enemy's movements; and instead of well thought out and decisive movements, based on a knowledge of the whole situation, paralysis and uncertainty set in, leading to almost certain demoralisation and probable loss of the campaign.

A certain blind doggedness in adhering to a plan originally formed, may carry us through, but this is not logically probable, as it is evident that the plan, to be successful, must be based on a knowledge of existing conditions, and should these conditions be entirely altered, the plan in all probability becomes a bad instead of a good one.

A knowledge of what the enemy is doing is, therefore, of the utmost importance to any commander, and every effort must be made, and all possible means taken to obtain it.

Information has, hitherto, been obtained from spies, by newspapers, by sending out specially trained scouts, by balloons, and by using large bodies of cavalry or other quick-moving troops; and often serious fighting, involving much loss of life, has to be incurred in the effort to obtain it.

So important is information that it is customary to cover the front of all armies with a cavalry screen, to prevent the enemy's scouts and cavalry getting through to ascertain the movements in the rear of it.

The flying machine will not displace any of the existing methods, but it furnishes a supplementary means of the highest importance.

Moving as it does at a speed which enables it to cover, in an hour, a greater distance than cavalry can cover in a day, and moving independent of physical obstructions such as blocked roads, broken bridges, impassable rivers, or broken and moun-

PHOTOGRAPH OF THE RIVER AT WASHINGTON, U.S.A., TAKEN FROM MR. GRAHAME-WHITE'S AEROPLANE WHILE FLYING.

A PHOTOGRAPH OF WASHINGTON, U.S.A., TAKEN FROM MR. GRAHAME-WHITE'S AEROPLANE IN FLIGHT.

tainous country, it can be used where all other methods must fail.

It cannot in itself, however, be absolutely depended on. The present-day machine is largely dependent on favourable weather conditions; it is helpless in high winds, in heavy rain, in mist, or fog; and it has not as yet been used at night (when it could not hope to obtain much useful information); and it is liable, at any moment, to be brought to the ground by failure of the motive power. In heavily wooded country, also, the movements of troops would be largely concealed from its view.

With all these disadvantages, nevertheless, the occasions on which it can be used, with every prospect of success, would be very numerous in any ordinary campaign, in obtaining information affecting both the strategical movements, which may alter the general plan of campaign, and the tactical movements which may necessitate alteration in the orders for, or during a battle.

The observer in a flying machine cannot be expected to give much detailed information as to the movements of individuals, or small bodies of troops which may easily be passed over without attracting observation. But these are rarely of importance, and when so can generally be ascertained by other means. The flying machine will only be concerned with larger matters, such as the movements of considerable bodies, and those referred to under the definition of "reconnaissance."

Under favourable conditions, however, it may be possible for the observer to take photographs which can rapidly be developed, and give very detailed information as to fortified positions, or depôts.

As regards the number of machines required, it must be remembered that the flying machine will probably only carry one or two pairs of eyes, that its movements are rapid, so that it is possible that something may be missed on the way, that at a height of 2,000 feet or so above the ground you cannot calculate with certainty on good observation of a strip of country more than three miles in width, whilst if you ascend to greater heights, you may more often be in cloud and lose sight of the ground, and objects appear less distinct, whilst there is always the possibility of the machine having to land, or being brought down by the enemy's fire.

It would appear advisable that flying machines should always be used in pairs, so that each would corroborate the other's observations, or, in case of accident to one, the observations should not be lost.

In order that information obtained may be of use to a commander, its rapid transmission to him is a matter of the highest importance. Wireless telegraphy may, at some future period, be found satisfactory for this purpose, but at present there is no certainty as to its suitability, and the only existing method is for the aeroplane to return itself, with its news, to some place whence messages may be sent by ordinary land arrangements. This, in itself, necessitates the duplication of machines on each route, one continuing to scout slowly in the required direction till rejoined by its companion, when both again go on together.

In order to thoroughly reconnoitre a strip of country, a hundred miles wide, it would be necessary to employ sixty or seventy machines, or allowing a safe margin of 50 per cent. for casualties, loss by enemy's fire or losses in aerial battles, it is probable, that for reconnoitring purposes only, a fleet of one hundred aeroplanes would not prove in any way excessive. Much useful work might undoubtedly be expected from far smaller numbers, but the use of a large number should ensure that nothing of importance was omitted.

V

DISCHARGE OF BOMBS

The question as to the practicability of harassing or delaying an enemy by the discharge of bombs is very controversial.

Whilst some hold undoubtedly exaggerated ideas as to the value of this aid to war, others go too far in the contrary direction, and hold that it is a negligible quantity.

It is best to consider the possibilities and then the probabilities of success, before deciding as to the utility of the flying machine for this purpose. The points to consider are, whether—

(1) The flying machine can reach the required spot.

(2) It can carry sufficient explosive or incendiary material to do real damage.

(3) There is a reasonable prospect of a fair proportion of hits on the objects aimed at.

(4) Much damage is likely to be done.

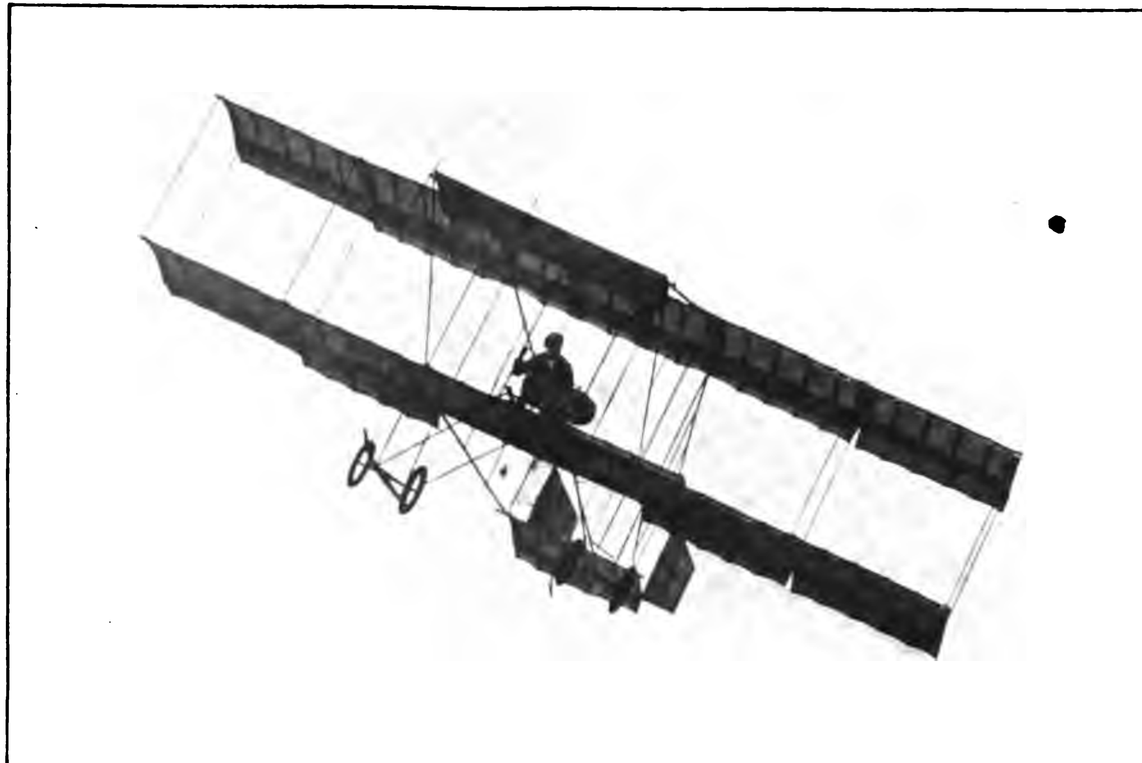
In order to discharge a bomb with any reasonable prospect of making a hit the machine must fly low. The smaller the mark the lower it must fly. If it flies very low in the daytime it will not present such a difficult target to artillery and infantry fire as if it is flying at a considerable height. If it flies low at night it will run considerable danger of flying into obstacles.

At early morning or dusk, it is, however, comparatively invisible except at very short ranges, and its attack would be in the nature of a surprise. It is at this time that it would appear to have the best chance of reaching its objective, though, of course, it can fly high till it approaches it, and descend at great speed.

Unless the machine has automatic stability it would appear necessary to carry a passenger for the bomb throwing, but, as the question of automatic stability has been now partially, if not entirely solved, we may eliminate the passenger, and consider his weight as available for spare explosives.

The amount that can be carried is dependent on the lifting capacity of the machine, and the distance of the objective. Many existing machines can carry fuel for eight to ten hours run. Allowing an average speed of fifty miles an hour and a fifty horse-power engine, if the objective is within fifty miles of the start, over 250 lbs. weight of bombs could be carried and the greater percentage of this weight would be high explosives or incendiary mixture, as the walls of the bombs need not be heavy.

If the objective is over a hundred miles distant the amount of explosives carried could hardly be more than 150 lbs.



MR. GRAHAME-WHITE TURNING ON HIS FARMAN BIPLANE, WITH THE MACHINE WELL "BANKED OVER,"

The explosive would be carried in one or two large bombs, or a number of small ones, according to the objective aimed at.

Private experiments, made by aviators, tend to prove that, without considerable practice, the dropping of bombs from a fast moving machine on to any but the largest objects, is a very difficult matter, unless the machine is quite close to the ground. With practice, however, the percentage of hits is likely to increase rapidly, and a considerable number may be expected to land in a rectangle of 100 yards by 20 yards from heights well above a 1,000 feet; and with reduced heights, the accuracy increases.

Large areas, such as camps and bivouacs of considerable bodies of troops, rail and other depôts, supply stores, appear suitable objects for the attack by small explosives and incendiary bombs; whilst big railway bridges, arsenals, dockyards, railway centres, etc., suggest themselves as objectives for the larger bombs.

As regards the actual damage likely to be inflicted it is obvious that only a proportion of the bombs would hit anything but the ground, and the direct damage might be small, except in the case of inflammable stores, which might readily be lighted by bombs exploding on the ground, and scattering fire in all directions.

The moral effect cannot, however, be eliminated. A light squadron of aeroplanes, making these attacks evening after evening on troops expecting to enjoy repose behind their outposts, must prove excessively annoying; whilst far in the rear, all along the lines of communication, points that would otherwise need no defence, will require garrisons and careful watching, and remove from the active army a number of men out of all proportion to the numbers employed in these petty attacks.

And occasionally damage must be expected. Fifty machines making two trips each per diem, within a radius of 100 miles, would drop each day 15,000 lbs., or about 6½ tons of bombs, on any selected area. It is inconceivable but that material as well as moral damage would be caused by such a quantity of explosives falling in a short space of time on a comparatively crowded spot.

On the whole, the probability is that a half-hearted use of single machines by untrained men using extemporised bombs, would prove almost entirely ineffective, whilst the judicious use of several flying squadrons of ten or a dozen machines, by men well trained in the art, and using bombs the composition and form of which has been determined by chemical and mechanical experts, might be of the highest importance in its effects on a campaign.

VI

ATTACK ON ENEMY'S AIR-VESSELS

If the flying machine is to prove useful to us, it will prove equally so to our enemy. It is, therefore necessary to consider how we may prevent him from benefiting by its use. The only certain method appears to be to attack his air-vessels in the air. Ramming an adversary can hardly be considered feasible, as the result would prove equally disastrous to both, so that the attack must be from a distance.

For this purpose, every flying machine must be armed with a quick-firing, small-bore gun or rifle, and the aeronaut must be trained to use it whilst in rapid flight.

In addition, a few small deadly explosive and incendiary bombs should be carried for the destruction of hostile airships.

Now that the flying machine has proved its capacity to rise speedily to heights of over 10,000 feet, and to journey long distances, it will constitute the gravest menace to airships.

The latter will be readily visible at distances at which the flying machine cannot be seen. It is slower in speed, so that it cannot escape by flight, nor can it escape by rising, as the present day airship is not calculated to manœuvre at heights of much over 6,000 feet, and even by sacrifice of all fuel and ballast, can hardly hope to reach 10,000 feet.

Except in the case of rigid airships which can be designed with a look out, and possibly with a gun, on the top, the greater portion of the sky is invisible from the car of an airship, so that anywhere in this vast tract of air the flying machine will be quite immune.

Let us imagine ourselves on a flying machine gliding along at fifty miles an hour 2,000 feet above the earth. Suddenly, in the far distant, we see a speck which our trained intelligence soon tells us is an airship. Is it one of our own, or an enemy's? In any case, our action is the same.

We know we are invisible from it, and if it is a friend we can do no harm by going above it; if an enemy, it is all important to us that we should reach, and keep, the upper level. Little time have we to decide on our action, we were only twenty miles apart when we first made it out, and at five miles we ourselves may be visible.

We are rushing towards each other at tremendous speed, and in ten minutes that fifteen miles will have been covered.

We turn backwards on our course, push the motor to its utmost limit, and rise. Now our speed is reduced to that of the airship, and five minutes hence we are still fifteen miles apart. But we are 3,500 feet high.

Another five minutes and we pass the 5,000. Still another five and we are at 6,500 feet, higher than the probable level of the airship, so we can afford to close with her. We turn again, and rush full speed towards her. She looms up larger and larger, and we recognise her as an enemy—a stately, graceful creature, moving on serenely unconscious of her peril.

Five minutes pass, six, and still she holds on her way. Seven—see, she suddenly turns, her bow shoots up, a stream of ballast falls from her. She has seen her danger, and is trying to escape it by rising, and by flight. Can she do it?

Every moment is precious. It is certain she was well below us when her look-out first saw us, probably not more than 5,000 feet. Had we only escaped notice one minute longer, and were her captain and crew novices at their trade, her destruction had been assured.

[*Daily Mirror*.

MR. GRAHAM GILMOUR IN THE QUICK-STARTING CONTEST AT LANARK.

[*Daily Mirror*.

THE HANRIOT MONOPLANE STARTING A FLIGHT AT LANARK.

But her crew are perfectly disciplined and trained. They have not lost a moment; still, the turn has taken her nearly a minute, and we are but three miles away. She has risen 200 feet during the turn, and can now rise at 600 feet a minute, whilst our utmost power is only 300 feet a minute. Our speed is twice hers, so long as we do not rise, but only equal to hers when we are rising fast.

We keep straight on, still at 6,500 feet. Two minutes pass. Only two miles are now between us; but she is now on our level. It must be a chase to the highest altitudes. The sky is cold and clear; without one grateful cloud in which she can wrap herself impenetrable, and hide from her mosquito torment.

Minute after minute passes. We rise, pursuing her. Each minute she gains 300 feet of altitude on us, and we gain no single inch in distance. But no matter. Stream after stream of ballast pours from her side; and see, now they are throwing their petrol tins, garments, anything to enable her to rise still higher.

Their only hope is to keep up and up, trusting our fuel may give out, or the engine cease to take us upwards. Vain hope. Our engine is working as well as ever, and we have fuel for several hours yet.

It is only a question of endurance now. At such a level no airship yet built can have any reserve of fuel left; ultimately, her engine must stop, and she will drift a helpless mass before the wind. Her ballast will be exhausted, and even before the flying machine can reach her level, she may begin to fall.

Nor can her guns touch the machine which can keep out of range until the huge body of the airship masks her own guns.

Once the flying machine is above her, it is simple for it to glide within a few feet of her envelope, and place a bomb with absolute certainty in it, bringing instant destruction to both airship and crew.

The ethics of such a fight will present some difficulty. Can an airship which is a helpless bubble in the air, incapable of obeying orders, surrender? It seems needless barbarity to destroy the ship and crew, but the flying machine cannot tow her, nor can it take off her crew before destroying her; whilst, unless the fight takes place over our own territory, if we let her get to ground she may entirely escape.

It appears as if such destruction must be faced, and airships must carry parachutes for each member of the crew, to give them some chance of escaping such a death.

The risks to airships in the presence of hostile flying machines are so great, that it appears probable that no airship should engage in war without a small squadron of flying machines to guard her. So guarded, she might be justified in running the risks which are impossible for her alone.

In a fight between flying machines, victory will go to that which can fly and rise fastest, manœuvre easiest, and shoot the straightest.

Some machines can be easily upset by an enemy's "wash," but this involves very close approach, whilst rifle fire may determine the issue before such close contact is reached.

Numbers and tactics will have their effect, just as in fights on sea or on land, and numbers must be employed to break down opposition and enable us to utilise our own machines to their fullest extent.

VII

ATTACK ON LAND TROOPS FROM THE AIR

The attack on troops by bombs has been shown to be probably unsatisfactory as regards practical results. Can machine guns, however, be used against them with effect?

That a machine gun can be carried in, and fired from, a flying machine, there is no doubt; but the machine must be specially designed for the purpose, and carry a passenger, and the necessary ammunition.

Some of the modern flying machines could carry the passenger and gun and fuel for two or three hours' run, together with about 2,000 rounds of ammunition.

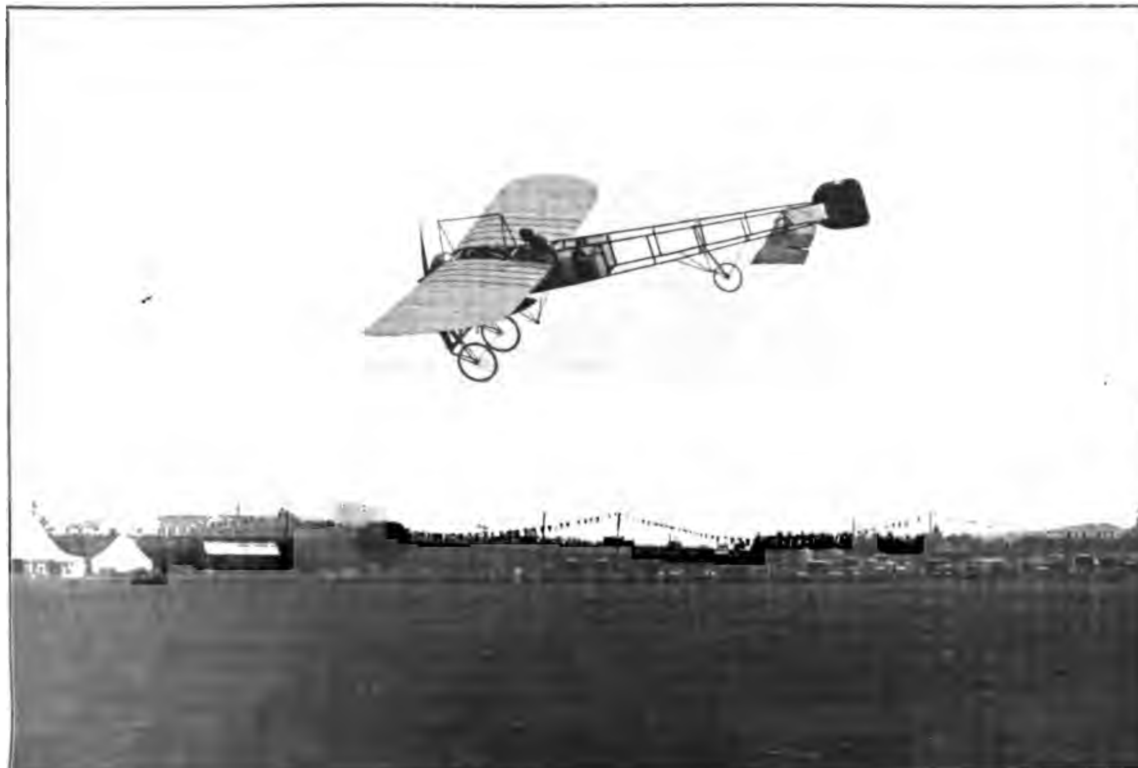
In a battle, reserve troops, artillery, transport trains, the horses of guns in action, troops marching along roads, etc., form targets on which a machine gun can be brought to play with considerable prospects of success, all these targets are within ten or twenty miles of points from which our flying machines can readily set out, and therefore can be reached by machines carrying little fuel.

Further, a machine can ascend, fire off all its ammunition at a target ten miles distant from the start, and return again in about half an hour; so that a single machine, remaining uninjured, would carry out numerous attacks in the course of a day, whilst a number of machines, ascending at intervals of a few minutes could carry out an almost continuous attack.

Only actual experience can tell whether such attack would prove of value, but it appears more than probable that the effect, upon such targets as are suggested, would be very considerable, and the elucidation of this point should by no means be neglected.

If such attacks are effective, the result on the tactics of the battlefield would be far-reaching. Deployments must take place at distances far beyond those now accepted, and the progress of attack would be correspondingly slow; concentration of troops, for counter attack, would prove very difficult, and no massing of troops behind cover would be permissible, whilst overhead cover, for fortified positions, must be provided in increased quantity—and larger numbers of troops would be absorbed in the endeavour to protect horses, and horsed convoys from this harassing enemy.

Cavalry, which depends for its shock action on massing in the immediate neighbourhood of the enemy, might find itself incapable of carrying out its most important rôle in battle. Casual attack, by a few independent machines, would probably prove of little value, but the concerted action of numbers should attain results of quite unexpected importance.



[Daily Mirror.

CATTANEO MAKING A TURN, AND "BANKING OVER," AT LANARK.

VIII

TRANSPORT OF STAFF OFFICERS, ETC., AND INTER-COMMUNICATION

Notwithstanding the excellence of modern methods of communication in war—telegraph, telephone, wireless telegraphy, and signalling—there are often occasions on which it is important that officers should move personally from point to point, and that communications should be sent by hand to outlying forces.

The motor-car and motor-bicycle are replacing the horse for this purpose, but are not always satisfactory. Many officers cannot ride a motor-bicycle, whilst the motor-car is often held up on roads by blocks of troops and transports, and in its turn is a hindrance to their rapid movements.

Roads moreover, are often unsuitable and necessitate long detours. The flying machine offers an excellent substitute, the advantages of which are apparent to everyone.

It requires only a clear space on which to land, and from which to start; once in the air it is independent of land obstacles, is uncommonly speedy, and, in suitable weather, would be peculiarly useful for this purpose.

IX

TYPE OF FLYING MACHINE

So much for the uses of the flying machine in war. The next question to consider is the type of machine. No one type can be equally suitable for all these purposes.

For long distance reconnaissance, and for fighting airships and flying machines, a small, fast, handy, quick-rising type, capable of taking two men, a small machine gun, with a limited supply of ammunition, and a large fuel supply, is required. It is also necessary for the crew to have a clear view above and below.

For attack by bombs, or on land forces, a larger weight-carrying and less rapid machine, with less fuel supply, will suffice, whilst the view below and to the front is especially important.

For transport of staff officers, a light, speedy two-seated machine with exceptionally good landing gear, and small fuel supply, would be suitable. A clear view is not of the first importance. This type need not be armed; but, in all other types the vital part of both man and motor should be protected by thin armour casing, shaped so as to deflect bullets as far as possible.

Motors should, as far as possible, be silent. There is no need to advertise one's presence more than necessary.

The machine should possess a large amount of automatic stability, so that slight injury to the pilot would not involve bad flying, and it must be of the type best suited to withstand high winds and strong air currents, so as to allow of its use under unfavourable conditions. It should be easy to learn, as it is requisite to train large numbers of pilots.

Several existing machines fulfil these requirements in part, and in the immediate future there is promise of much greater progress towards the evolution of a really satisfactory military machine.

Even to-day, squadrons could be put in the field which would, on many days of the year, be capable of successfully taking part in any of the military operations touched on in the preceding pages.

X

THE PILOT

We now come to a not less important part of the whole question, and that is the pilot and his training.

The chief requirements for the pilot of a flying machine are courage, coolness, and presence of mind. A military pilot requires, in addition, a thorough knowledge of map-reading, ability to steer by compass, sun, or star, a quick eye, experience as to the look of things from above, and last, but not least, a sound tactical training. Owing to their lack in this latter respect, the best of civilian pilots are often incapable of reporting facts in such a way as to be useful to a military commander.

There is some difficulty experienced, in many flying machines, on account of the noise, in communicating between a pilot and his observer, and though good work may be done by a military observer, carried by a civilian pilot, equally good work has been carried out, in the French manœuvres, by a military pilot, without an observer; and, in any case, it is a pity to waste one pair of eyes in each machine if training can make them of use.

Besides the above qualities required for reconnaissance, skill in bomb throwing, and in firing from the air with a machine gun, are required for offensive work.

Everyone, pilot or passenger, in a flying machine, except in those used solely within our own lines, should be able to take charge in an emergency; otherwise, should the pilot be incapacitated, by a bullet, or sickness, both may be killed, the machine wrecked, and useful information lost.

The training required to make a good pilot, a good observer, and a useful shot must be considerable, and, as many may prove unsuitable for the work, numbers should be tried, in order to obtain the best results.

The risk of such training grows daily less, the safety of the machines, and the ease with which they can be learned, is constantly increasing, so that, before long, it may prove no more difficult to learn to manage one than to learn to drive a motor-car, and the staff officer will look on the manipulation of a flying machine as part of his ordinary education.

XI

COST AND TRANSPORT

The consideration of the introduction of any new arm in war would be incomplete without touching on the important questions of cost and transport.

The actual cost of a present-day flying machine is usually out of all proportion to the real expense of production. The demand for machines of any individual type has not been so great as to admit of their economical manufacture.

[*Daily Mirror*.

LIEUT. WATKINS FLYING HIS HOWARD-WRIGHT BIPLANE.

MR. GRAHAME-WHITE "CLIMBING" UPON HIS FARMAN BIPLANE.

With a definite demand for large numbers of any individual type, the cost would be largely reduced, and we may take £600 as a fair average price to pay for a military machine, if numbers are ordered.

The cost of a fleet of 100 flying machines would, therefore, be about £60,000.

It would be unnecessary that all these machines should be in use at peace time. At least half could remain stored.

Portable sheds, workshops, etc., could be provided and fitted up for about £20,000.

Allowing £20,000 for expenditure on flying grounds, motor-cars etc., an initial expenditure of £100,000 would suffice for the provision of a fleet of 100 flying machines.

The personnel required is not large, but the proportion of officers to other ranks would be very high.

Assuming 100 officers constantly employed, and 200 N.C.O's and men, their upkeep should not amount to over £60,000 per annum, allowing for good pay for all ranks.

Providing for 40 new machines annually would cost £24,000.

Repairs and upkeep of those in use, fuel, etc., would be liberally provided for at £16,000, so that an original outlay of £100,000 and an annual grant of £100,000 would suffice for the provision in peace of a fleet of a 100 flying machines including the renewal of the whole fleet every 2½ years.

In comparison with the cost of a fleet of airships the cost is very low.

Six of the latter, at the prices asked by the French makers for their modern airships, would cost over £100,000, whilst the provision of the large sheds for these would entail great outlay of capital, and the upkeep of an airship is a very expensive matter.

It is not contended that the airship is an expensive luxury, but it is necessary to consider the cost of the alternatives in deciding as to the relative proportions of each that can be kept up.

In war, though economy must always be practised questions of cost are not of the first importance.

The question of transport, however, is vital in war. Anything that tends to increase the huge train of an army must be scrutinised with the utmost care before being adopted.

How does the flying machine come off in this respect?

Assuming a base of operations across the seas, unless the distance to be traversed is very small, the machines must be conveyed in ships. The risk of losing machines by descent into the sea is and must for a long period remain considerable. But, as long as sea transport is available, a few hundred tons more or less of "impedimenta" are of little consequence. The same is to be said in a lesser degree, as regards rail transport, the real exigencies of the problem only arising when we leave the rail behind. Then every ton becomes important.

What are the necessities for a flying machine? Fuel, bombs, ammunition, food for the crew, and possibly portable sheds. The machine itself should require no transport except in case of breakdown. It can, if necessary, fly from the base at the coast, and need not be carried even by rail.

It should rarely, if ever, be necessary, except in countries ill served by railways, to carry its shed beyond the line of rail.

Fifty miles to or fro from its shed will be a little matter to it, whilst it may remain in the open for many days together if required to do so.

Bombs and ammunition, whatever the arm that uses them, must always be carried to the proximity of the enemy, so entail no increase to the transport of the army, a new arm possibly proving a substitute for some portion of an old one.

Fuel, and food for the crew, remain. In many cases the machines will start with their fuel from the rail, but it will always be necessary to have a reserve supply close up to the main army. But this does not entail much in the way of transport.

A single four-horse wagon will carry sufficient fuel and oil to enable a typical military flying machine to travel a distance of 16,000 miles, or a fleet of 100 machines a distance of 160 miles; so that a very small train of wagons would enable a sufficient supply of fuel to be kept up.

In case of emergency, moreover, five flying machines would be able to carry, in a single day, the load of a whole wagon to a distance of 50 miles from the base, and thus the fleet could supply itself with fuel.

The food of the crews is a trifling amount, though their bedding and kit must be carried by land.

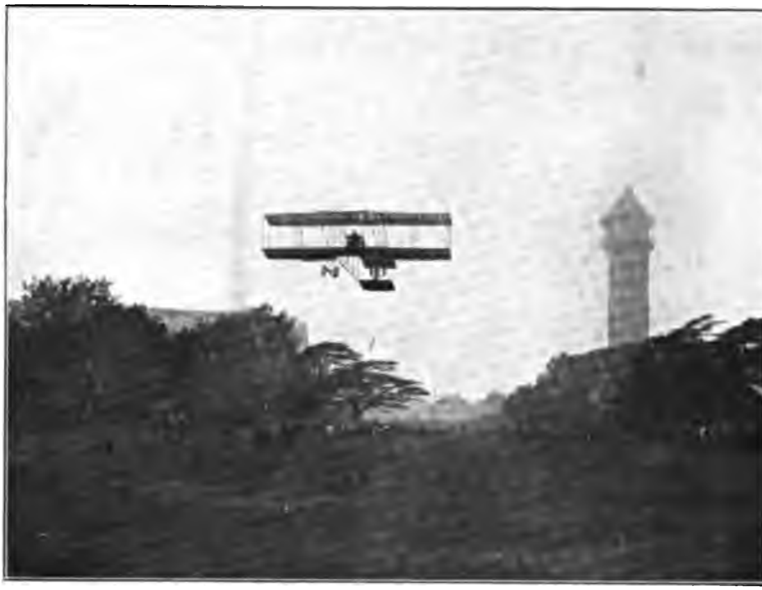
It will also be necessary to provide small, quickly moving trains for tools and mechanics in order to effect urgent repairs in the field.

On the whole the addition of the transport of a fleet of 100 flying machines, to that of an army, would be infinitesimal, compared with the importance of the objects likely to be obtained by its presence.

XII

CONCLUSION

It is hoped that enough has been written to show that whilst the occasional use of a few flying machines may, at times, give invaluable information to the commander of an army, there is scope for their use on a far greater scale. I firmly believe that their systematic use in large, well-trained squadrons may revolutionise the tactics of the battlefield, may alter all accepted views as to the security of troops, supplies, and lines of communication, and may have the most far-reaching effect on a campaign. In order to attain such results, however, no haphazard aggregation of individual machines and pilots, on the outbreak of war, can be relied on, but the best military machines must be provided and kept up in peace, and numbers of officers and men be thoroughly trained in their uses, by constant practice, both as individuals, and as units of regular flying squadrons.



[*Daily Mirror.*

MR. GRAHAME-WHITE FLYING AT THE CRYSTAL PALACE, 1910, WHERE HIS TAKE-OFF AND LANDING WERE BOTH VERY DIFFICULT.

MR. GRAHAME-WHITE ALIGHTING AFTER OVERSEA FLIGHT TO BOSTON LIGHTHOUSE (U.S.A.), 38 MILES IN 34 MINS. 38 SECS.

SECTION VII

SPORTING AND COMMERCIAL POSSIBILITIES OF THE AEROPLANE

By M. LOUIS BLERIOT

In this section, M. Bleriot—world famous both as a pilot and a constructor of monoplanes—discusses very fully the prospects of aviation, both from the point of view of the aeroplane as a pleasure craft, and also as a regular passenger-carrying medium, in competition with existing methods of communication.

I

The aeroplane as it exists to-day, really stands upon the threshold of the most amazing, sporting, and commercial possibilities. Occasionally, in order to obtain a mental grip of the rapidly changing position as regards flying, I look back at the days before I flew across the Channel from France to England.

What was then the situation? Engines, which one may liken to the heart of an aeroplane, were weak, uncertain things, which bore one up into the air for a few minutes only, as a rule; then failed, became overheated, and let one without ceremony down to the ground again.

There were critics in those days, technically sound, who did not hesitate to tell me that I was wasting my time in endeavouring ever to get an engine to run reliably in face of the almost impossible conditions required for aeroplane work.

It is as well, perhaps, to estimate what those conditions were. On a motor-car one's engine runs on a series of gears. That is to say, the engine revolves rapidly on its first speed, when a maximum amount of power is required for setting the car in motion; more slowly on its second speed, when the car is under way; more slowly still, while propelling the car more rapidly, on its third and fourth.

The result of the gear changes one is constantly making, when traversing a give-and-take country road, is that one's engine is working under varying loads. Thus it gets rests as a rule, just when it wants them. Suppose you take a car and run it up an exceptionally long hill on its first speed, with the engine racing round, you will find that, almost however efficient its cooling system may be, it will become very much overheated.

I mention this because I want to make a definite point here. It is this: the engine of an aeroplane is practically set the task of climbing one long and perpetual hill. It has to run at a very high speed, and it never obtains a rest. Furthermore, it must be made exceptionally light.

Therefore, with far more arduous work to do than the engine of a motor-car, the aeroplane engine is called upon to do far more difficult work. No wonder, therefore, that the people with little faith declared, in the early days of aeroplaning, that we pioneers would never obtain an engine to perform the heroic task demanded of it by the exigencies of aerial locomotion.

In my first monoplane flights, of 1907, 1908, and 1909, I tried one engine after another. The results were sufficient to tax the patience of any man, however good-tempered. Overheating of the engines, both air and water-cooled, was the main trouble.

After only a few minutes in the air these engines began to flag and fail. Not only was overheating a trouble, but bearings gave trouble also and there were any number of irritating minor delays.

In these early days, planes were not as efficient as they have now become, and it was considered necessary to fine away the parts of an engine, to reduce its weight, to an extent that would now be considered absurd.

The result of this weight-paring was a machine that could not be relied upon. Fortunately, however, as time went on, men began to learn more about the lifting powers of aeroplanes; and they realised that some of the cut away solidity of their motors could be restored.

But motors for aeroplanes were generally unsatisfactory until, in July of 1909, an engine was introduced which was of a quite revolutionary character. To some extent I had expected this; it seemed that a lightened car engine, with its water-cooling system to dispose of about the aeroplane, was not the ideal. Neither, by the same token, was the air-cooled motor, which would not keep itself cool enough. Hence it seemed necessary that some engine specially created by the demands of flying should be introduced.

It came. An air-cooled motor, the "Gnome," with seven cylinders which turn around their crank-shaft, affording an altogether new principle as applied to the petrol engine, was introduced. It was seen in public for the first time at the Rheims flying meeting of 1909, which will be ever memorable as the initial appearance of airmanship as a public exhibition.

From this time, onwards, the Gnome motor has played an enormously important part in the development of flying. It provides a remarkable illustration of the effect of a new method of doing something. By the revolving of the seven cylinders of the motor the difficulty of cooling them was most effectively disposed of.

Following each other round at the rate of 1,000 revolutions a minute the "Gnome" cylinders were found to keep themselves very cool. This system of construction provided, also, for simplicity, and strength. Above all, it eliminated the vibration which had been shaking other motors almost to pieces. Against the "Gnome" was its rather heavy consumption of petrol, and the fact that it required an abnormally large quantity of oil. But flyers very gladly paid this price in order to be able to purchase reliability.

It was astonishing to note what progress was made directly airmen began to have confidence that their engines would run for a reasonable period, at least. Long cross-country flights were attempted; pilots even ventured over towns. The position of the Gnome engine is indeed unique. It has enabled the industry to advance by leaps and bounds.

There is some diversity of opinion as to whether the "Gnome" will eventually provide the ideal

MR. GRAHAME-WHITE COMPETING IN A BOMB-DROPPING CONTEST AT BOSTON, U.S.A.

[*Daily Mirror.*

MR. RADLEY PERFORMING A "VOL PLANE" AT LANARK, 1910.

motor for aviation purposes. Many experts still pin their faith to the belief that the fixed-cylinder engine, like that of a car, will gradually come into its own. They point to the generally lower petrol and particularly oil consumption of a fixed cylinder machine. They state that a fixed cylinder motor has a longer life than a rotary one.

Upon this point, however, the rotary engine has been very greatly maligned. It does not wear out with the rapidity that has been declared. It proves, in fact, to be practically as long-lived as any other. I myself reckon that, from the absence of vibration, the rotary engine is likely to last longer than the fixed cylinder one, with which the wear and tear is largely increased by vibration.

Although there may be something quite new to hand during the coming year, in the way of aeroplane and motor construction, I am of opinion that the rotary principle for engines, since it has been so surprisingly demonstrated, will provide us with many further improvements.

Despite the airman's ability to fly for five and six hours, and indeed longer, it having become to a certain extent merely a question of petrol carrying capacity, there is much still to be done before the propulsive power of a flying machine anywhere approaches perfection.

But the strides made, in two years, are so extremely hopeful that I regard the future of flying, from the engine point of view, as being assured. Higher powers will soon be applied, seeing that increased speed is what is demanded.

Already, pilots are becoming quite annoyed should mechanical trouble bring them down. They begin to feel the greatest confidence in their engines, despite the fact that, a short time ago, it was considered quite unsafe to venture away from an aerodrome.

This confidence means a very great deal. It means that, having been made so reliable, an aeroplane motor can be made far more reliable still. The promise of 1911 is for remarkable progress in the propulsive equipment of the flying machine.

II

As regards construction, a very great deal still remains to be done. Undoubtedly we have reached a stage when greater strength is possible. In its early stages, the aeroplane was constructed on the theory that it must be amazingly light—otherwise it would not raise itself from the ground at all.

What a machine would lift, save in theory, was not known. As with the making of propellers, nothing was known definitely until actual tests, under varying conditions, took the place of paper calculations. Gradually, therefore, it was shown that a little more strength could be imparted here, a little more there. The stresses and strains upon machines in flight became better understood.

Therefore we find machines assuming, very quickly, quite a definite and practical shape. In the quite early specimens of construction which really flew, one rather interesting, and perhaps amusing thing was to be observed.

The landing mechanism did not receive the thought that should have been expended upon it. As a matter of fact, no aeroplane—however well it flies—is of any practical value unless it has an efficient system of either wheels or skids so that it may take its run along the ground safely before rising, and descend again equally successfully, with the undercarriage so constructed as to withstand, if necessary, quite a severe shock.

But, in more than one case, the designers of our first aeroplanes seemed to have paid but scant attention to the landing chassis. Perhaps it was that they did not really think any such device was necessary, seeing that very few of these experimental machines would fly.

At any rate, I have seen more than one aeroplane, a capital piece of work in other respects, which would have collapsed ingloriously when returning to the ground, owing to the absurd frailness of its chassis, had it ever actually raised itself into the air.

Dealing necessarily in generalities, I have described how construction was strengthened. This process has been going on up to the present time; and in this respect designers have learned invaluable lessons by some of the accidents which have happened. Not one breakage of a portion of a machine but what has taught its lesson—a lesson never to be forgotten.

In this connection I may digress a moment to comment upon the extraordinary immunity from injury usually enjoyed by a pilot who is involved in an aeroplane accident. Frequently, on the flying grounds, one sees a machine suddenly dive to earth from a height of 50 or 60 feet, owing to the inexperience of a beginner, and become a hopeless wreck.

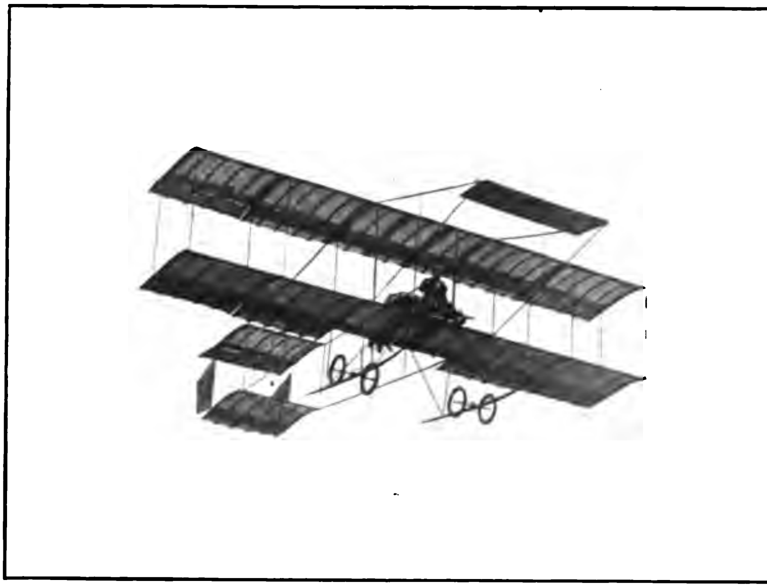
Just as one imagines that the unfortunate man in the machine must be either dead or dreadfully injured, he wriggles out from under the debris with a rather scared expression of countenance, but quite unhurt. This appears a miracle upon a first occasion; but these amazing escapes are being chronicled every day.

For myself, when determining by actual tests with experimental machines, what the most practical form of monoplane should be, I had nearly a dozen really bad falls. More than once, I fell from heights which would have made death a certain result had I descended in anything but an aeroplane. But I escaped with only cuts and bruises.

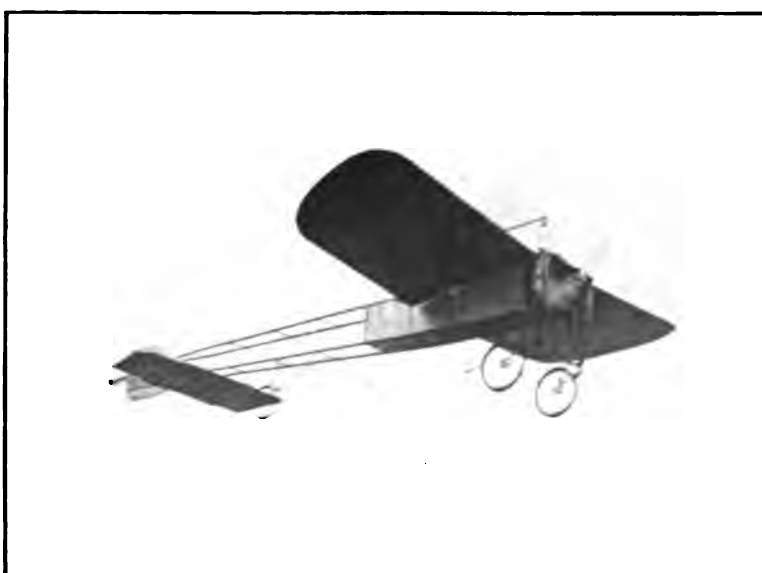
What "scrapes" a man can get himself out of, when flying, is almost incredible. In America, for example, at the time of the last Gordon-Bennett race, M. Leblanc, piloting a 100-h.p. Bleriot monoplane, suddenly ran out of petrol, and was swept off the aerodrome by a strong side wind.

Momentarily losing control of his machine he dashed full tilt into a telegraph pole as thick round as a man's waist. At the moment of impact, the monoplane was travelling at the rate of 70 or 75 miles an hour.

Constructionally, save for the big engine in its bow, the aeroplane was made of nothing more solid than wood and wire. Under such conditions as this, it would have appeared to the uninitiated that the pilot was face to face with certain death, but he escaped with nothing worse than a shaking, and a cut face.



MR. GRAHAME-WHITE FLYING A FARMAN BIPLANE.



MR. GRAHAME-WHITE IN FLIGHT ON A BLERIOT MONOPLANE.

More than once, owing to lack of skill, I have seen a pilot send his aeroplane upwards at such a steep angle that the machine first came to a standstill in the air, and then, losing all steerage-way, slid back tail-first towards the ground.

From the height of 100 feet, this would appear a fatal error. But on quite a number of occasions, when this accident has happened in precisely the way I have described, and the aeroplane has been reduced absolutely to matchwood by the force of the impact with the ground, the airman has sustained no more serious damage than a shaking.

Such a well-known pilot as Mr Hubert Latham has—as an example of immunity from injury—had some dreadfully serious-looking falls without breaking a limb or suffering anything more than a temporary shock. This ability to come crashing to the ground without hurting oneself does not lie in any special cleverness on the part of the pilot. It lies in what one might well term the elasticity of the aeroplane.

What happens, when an aeroplane strikes the ground, is this: first some wooden rod or strut breaks, and then another, until perhaps half the machine has been either crushed or beaten in. The breaking of these parts, one after another, absorbs the shock of the impact with the ground. Thus a very bad shock is gradually "damped," as it were, until it has lost the greater part of its violence by the time it has reached the pilot.

Thus the very frailness of the aeroplane has proved its pilot's salvation. It is possible for one to feel this dampening effect in progress. Even a bad fall, from a fairly appreciable elevation, does not appear a violent shock when one comes in contact with the ground. One feels, rather, an effect as though the machine was telescoping upon itself. This is, as a matter of fact, just the feeling one might expect to have as chassis members and struts yield under the shock.

It becomes clear, when this safety aspect of the aeroplane is considered, that the pilot's driving position is very important. What is necessary is a seat in such a place that a sudden dive to the ground, either forward, sideways, or backwards, will allow a maximum amount of damage to be done to the machine before the airman is reached.

Above, and well behind his planes, is a good position; in the front of them is a bad one. It is certainly dangerous, also, for a man to sit immediately in front of his engine. A serious fall may tear it out of its wooden bed, and it may strike him in the back. To have many wires upon a machine, near the pilot, provides another element of danger. In many accidents, the pilot has struck his head or face against a wire, sustaining serious cuts in consequence.

Of course, in present methods of construction, such wires are generally unavoidable. But something can, and generally is done, by binding them up with tape, so as to lessen their ability to cut. The building of aeroplanes, at the existing stage of the industry, is a particularly arduous and trying occupation. First a machine has to be designed, then built and tested.

As a rule, an infinite number of small modifications have to be made. In connection with the first two-seated monoplane I designed, for instance, months were expended in workshop tests and practical experiments in the air.

The greatest care has to be taken that each piece of wood used in the building of a machine should be perfectly sound, and capable of standing the strain imposed upon it. Likewise every nut and bolt and wire must be absolutely equal to its work. The failure of any portion of a machine, while in flight, may spell death for the man piloting it. Naturally, therefore, an exceptionally heavy responsibility falls upon the maker of an aeroplane.

Although, to some extent, we are standardising factory equipment for the production of aeroplanes, it is not safe to do much in this direction until types settle down into some definite path of development.

Whether they will do so soon, it is somewhat difficult to say. Certainly, however, one must prepare for a far greater solidity in the construction of aircraft. The progress of this wonderful industry would be sadly limited were building to be always restricted to the production of aeroplanes of wood, canvas, and wire.

At present, it is true, while we are finding out new facts every day about engines, and the effect of the speed of machines, and are exploring unknown heights, a comparatively unambitious machine is all that we aspire to.

But if flying is to progress towards practical and commercial ends, more ambitious aeroplanes than those we are at present using will be necessary. The passenger-carrying machine is, for instance, a definite need of the future.

It was only the other day that a friend asked me whether I thought a machine to carry 20 people, as well-equipped as a ship at sea, could be described as a thing of the fairly immediate future. He asked me, at the same time, to make a rough sketch of such a machine, were I able to do so.

I told him that I thought such a passenger-carrying machine was a matter of development. I certainly did not feel inclined to predict the period at which it would arrive. But I added that I had every confidence in its coming.

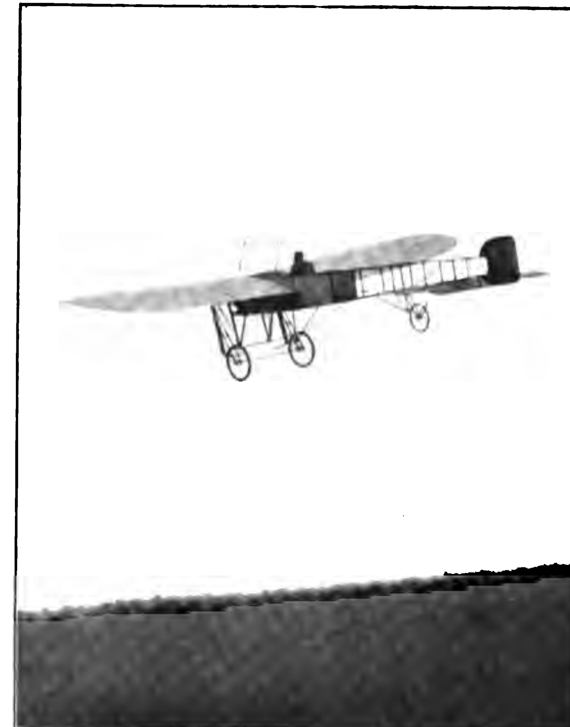
To put plans on paper for such a machine is what I certainly did not feel competent to do. I explained that the position as regards the development of flying was one in which a prophet would have to tread warily.

III

What, as a matter of fact, is our position at the present time? We have machines to carry two passengers; and quite soon we shall have them to carry at least four passengers as a regular equipment. This will mean practically an aerial motor-car. This increase in passenger carrying can be effected with such engines as we at present possess, and also without varying to any appreciable extent—save in a greater solidity—the existing methods of construction.

But when an aeroplane to lift even more people than this is brought into question one cannot at the moment, see exactly how some of the difficulties

MR. GRAHAME-WHITE FLYING OVER THE GRAND STAND AT THE HARVARD BOSTON AVIATION MEETING,—SEPTEMBER, 1910.



[*Daily Mirror.*

MR. ARMSTRONG DREXEL FLYING AT THE BEAULIEU SCHOOL IN THE NEW FOREST.

which would arise are to be overcome. Not that they will be insurmountable: that I do not for one moment believe.

At the moment, in fact, we are like the early constructors of motor-cars were when asked, on the spur of the moment, how they were going to produce the perfected vehicle we see on the streets to-day.

They knew it *was* to be done; they felt sure it could be done; but they did not know exactly how to do it. How are you going to launch, and bring to earth, a really large passenger-carrying aeroplane? What will its engines be like, and how will the power be transmitted to the several propellers which would be necessary? What method of construction will be employed? How will such a vessel be controlled?

One after another, such questions rise in one's mind. And, at the moment, answers are certainly not forthcoming. But this does not prove, as sceptics might argue, that flying will always be classed as nothing more than a scientific toy.

It merely shows that flying is progressing along very healthy and normal lines, and is not forced to an unnatural stage of development. How long ago was it that man could not, even after centuries of striving, imagine how a machine could be made to fly?

And now the thing is done every day; it has become a common-place, although the aeroplane is still a crude construction. Who, therefore, can dare to say that the regular passenger-carrying aeroplane will not come? I, personally, can see nothing to hinder its advent but the logical, and quite sufficiently rapid, development of a new industry.

What I, and others, are doing, is to overcome one obstacle at a time. As soon as the engine makers are satisfied with the reliability of 50 and 100 horse-power engines, and we can obtain motors of an even greater horse-power, we shall begin at once to plan more ambitious aeroplanes.

At present, however, and for a little time to come, we are in the process of perfecting, and reviewing carefully, all the progress that we have made. It is so short a time since aeroplanes would scarcely fly at all that we cannot be expected, all in a breath so to speak, to astonish the world with huge machines.

What earnest attention is being devoted to, rather than to the development of ambitious passenger-carrying craft, is an increase in mastery over the wind. The aeroplane cannot be regarded as a completely practical " proposition " until it has acquired the power to fly in winds which are higher than those which at present impose limitations upon it—until it can, in fact, fly in any wind short of such a gale as drives ships to shelter.

Any such power as this was, not so long ago, declared to be an impossibility by more than one quite competent authority. But already we see our way quite distinctly to this end—in the same way as we shall, before long, find the path smoothed for the production of the large, passenger-carrying machine. It is all a matter of development, as I have said before.

Regarding the vitally-important question of flying in winds, the history of the airman's endeavour has been a very interesting one. At the very first stage of all, man was filled, quite naturally, with the very greatest possible respect for the wind. In the early flights which were effected it was made a definite rule not to ascend at all in any wind above five or six miles an hour. What pilots felt, indeed, was that they were not competent to get a machine upon an even keel again should it be struck suddenly by an adverse gust of wind.

Very gradually, and with growing confidence, these pilots ventured aloft in winds of ten and fifteen miles an hour. They discovered that, given the skill and confidence required, an aeroplane could be manœuvred, quite safely, in comparatively gusty winds.

Thus, partly by the pilots growing accustomed to being in the air, and partly by improvements in the controlling mechanism of aeroplanes, we soon saw flights being made in winds of as great a velocity as 25 and 30 miles an hour.

But at this stage, with comparatively slow-flying machines, it was seen that a limit had been reached. With an aeroplane flying at a speed of 40 miles an hour, it is not possible, as a general rule, to combat in safety a wind of more than twenty miles an hour.

With a monoplane flying at a speed of 50 miles an hour skilled pilots have, on more than one occasion, flown successfully in winds of 30 miles an hour. Very soon, indeed, after flying in winds became a feature of flying, it was seen that speed was the chief aid of a pilot in being able to keep his machine under control when hit by a treacherous gust.

The stability of a monoplane flying at high speed was demonstrated most conclusively at the second Rheims meeting, held last summer. M. Morane, piloting a Bleriot monoplane with a 100-h.p. motor, at a speed of 70 or 75 miles an hour, passed with immunity through the rush of air from the propellers of several machines in front of him.

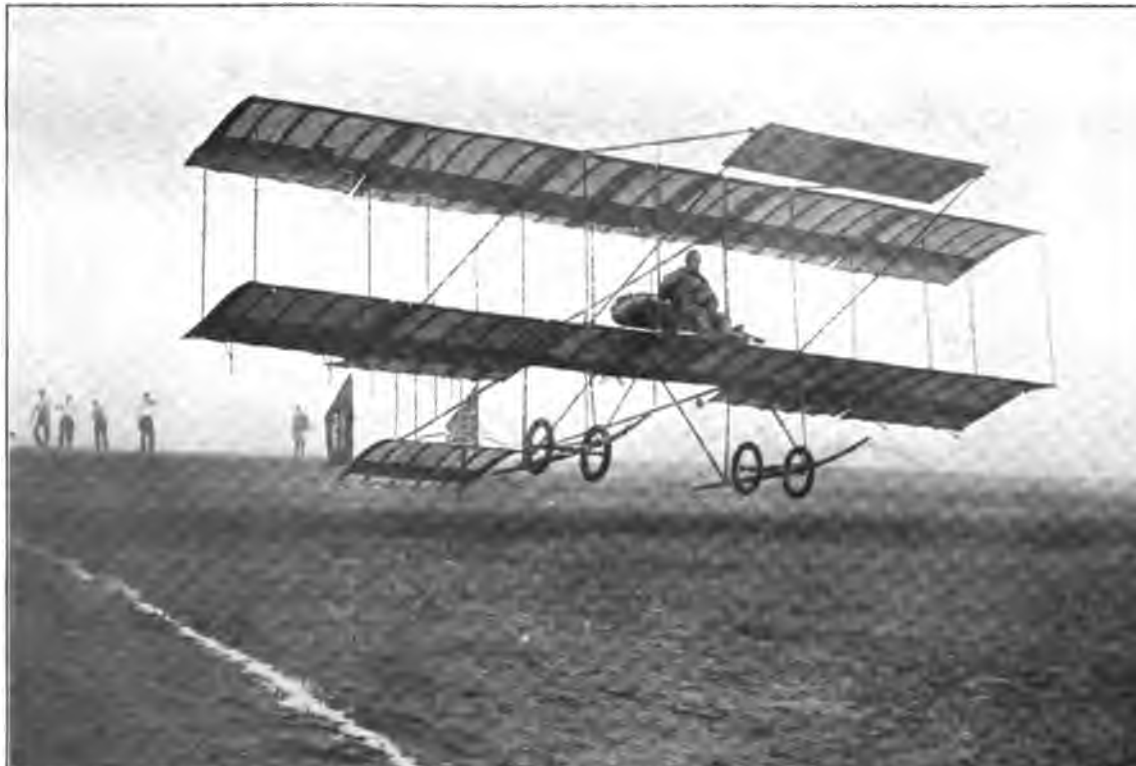
With a more slow-flying machine this would have proved a fatal experiment. On several occasions, in fact, an aeroplane has been overturned by being struck from the fast-moving column of air sent astern by the propeller of a machine either crossing in front of it, or flying directly ahead.

But the great speed of M. Morane's racing monoplane enabled it to thrust its way, without faltering, through the wind waves. This leads to the very definite conclusion that speed is a great aim in flying.

That conclusion is, in substance, perfectly right. A high-speed machine is an ideal wind flyer. But difficulties arise in connection with aerial speeds of 80 and 100 miles an hour. As at present designed, the aeroplane has practically but one flying speed. It cannot rise at a slow speed, increase its rate of travel to a maximum after it has attained an appreciable altitude, and descend again at a reduced pace. It is a fact, of course, that the speed of a machine is checked when the engine is stopped, and a *vol plane* to the earth is made.

But it is also a fact that a problem of some difficulty arises when you have to run a high speed machine along the ground prior to a flight. Any great speed, when actually flying, makes it necessary to move at a high speed when at the moment of leaving the ground, and getting into the air.

An aeroplane flying at a speed of 40 miles an hour



MR. GRAHAME-WHITE, IN A "QUICK-START" CONTEST, LEAVING THE GROUND IN 21 FEET 3 INCHES.

leaves the ground at a rate of 30 miles an hour. An 80 mile an hour monoplane does not get into the air until its rate of travel, along the ground, is nearly 60 miles an hour.

This speed of passing along the ground is almost out of the question upon any save smooth surfaces. A machine travelling at this rate through the air is compelled to descend, also at a very high speed. This, again, makes it almost essential to have a perfectly smooth piece of ground below the pilot when he descends.

A machine with these restrictions obviously needs improvement. The high speed machines which have, so far, been introduced, have been used almost exclusively for racing round aerodromes. Here they have had smooth starting and alighting grounds.

What it is now clear will be necessary, before very high speed machines can be used safely in ordinary cross-country flying, is a variable speed machine. It must be able to leave the ground at a fairly moderate pace, increase its speed rapidly when once clear of the earth, and descend again if necessary—supposing an indifferent surface presents itself for landing—at a comparatively slow speed.

This necessitates the production of a machine which has planes which can either be altered in the actual extent of their surface or in their angle as opposed to the air. In the first case the operation would resemble that of reefing the sails of a ship. At rising from the ground, the machine would present a large surface to the air. This would make it lift while moving forward at a safe speed over comparatively uneven ground.

Once in the air, the pilot would reduce his plane area, and move forward more speedily, being able to increase it once more when it became necessary to descend again at a slow pace. As an alternative to actually increasing or reducing the area of the planes, it should be possible to alter the angle of a plane.

According to the present methods of aeroplane construction, however, any system which would interfere with the rigidity of planes would be very difficult to put in operation. Being made of fabric and wood, the wings of a present-type machine only obtain their strength by being held in position by straining wires.

Any alteration in the surfaces of planes would, it is seen, interfere with the wiring of the machines, and so impair its rigidity. This objection is, in fact, so serious a one that it is perplexing many highly skilled builders.

That this machine with variable speeds will play a highly important part in the development of the aeroplane is, however, my firm belief. With new methods of construction, and the ability to build an aeroplane more solidly than is at present the case, I am convinced that the mechanical difficulties of increasing or reducing plane surfaces will be overcome.

IV

From the point of view of the man who wants to buy an aeroplane purely for his own pleasure, and not for exhibition work, or prize-winning, I am convinced that a variable speed machine would make a powerful appeal.

To the man who is a beginner at flying, a machine to rise and descend slowly would be manipulated with far more confidence than one only controllable at high speeds. More than one beginner has, for example, told me: "I am not at all perplexed or worried at the idea of flying. But the noise of the engine, the rush of wind, and above all the speed at which one darts into the air and returns again are, at the first few lessons, enough to frighten any ordinary man, and make him lose his head."

Touching upon the question of the noise of an aeroplane engine, and its effect upon a pupil who is learning to fly, I have on more than one occasion seen a man absolutely unnerved and taken aback by the din when his engine has been started up for the first time. And yet, as an indication of how one can accustom oneself to any unusual circumstances, I have noticed that a pilot becomes so completely used to the noise of his engine that he does not notice it at all.

One of my pupils, I remember, a man of an original turn of mind, used to sit in his shed, with the engine running, so as to make himself thoroughly accustomed to the clatter. "I feel I must become used to the noise," he said, "otherwise I cannot remember a thing that I ought to do when actually sitting in the machine, with the engine thundering away near me." This trick of his struck me as being a sound one.

The sudden roar of an aeroplane engine has a very disconcerting effect upon many people until they become used to it. But it is really astonishing, despite any small drawbacks such as this, to note the wonderful rapidity with which many apt pupils acquire the knack of piloting an aeroplane.

Some of them learn to fly, as a matter of fact, more quickly than many people find it possible to handle a motor-car.

Given a man who is really enthusiastic, who has a clear, cool head, and who profits by all he learns, flying can be acquired, not in weeks or days, but often in hours. More than one beginner has, in fact, flown at the very first time of being on a machine.

Such phenomenal dexterity is not usually met with, naturally. Many pupils find it quite easy to fly up and down an aerodrome in a straight line, but take some time to make a turn in the air.

A turning movement requires more dexterity, in fact, and also a little confidence. Making safe and neat landings are, however, an airman's first difficulty. The speed one travels through the air, and one's inability, at first, to judge distances while flying, make an acurate landing a most vital problem for the novice.

At his first few flights, being nervous at the prospect of bringing his machine to earth, he descends very far wide of his mark, generally a long way before he comes to it. This is caused by a miscalculation of the speed the machine travels at.

It is also difficult for the novice to calculate the effect of a side wind when he is making for any specified landing point. I have, for instance, seen

MR. GRAHAME-WHITE INSPECTING THE GNOME MOTOR ON HIS FARMAN BIPLANE.

MR. GRAHAME-WHITE TAKING THE MAYOR OF BOSTON, U.S.A., FOR A FLIGHT.

more than one beginner swept sideways by the wind some distance away from the point at which he desired to effect a descent.

Judging one's "leeway" in a wind is, indeed, a great difficulty when flying. One may steer towards a certain point by one's compass, and find oneself a long way wide of it, upon completing the aerial journey, having been drifted one way or the other, quite without realising it, by the influence of a side wind.

As regards sea travel, of course, the drifting influences of certain currents are accurately known, and charted. But to the voyager in the aerial ocean the strength of any particular side wind can only be estimated at the time of starting his flight.

With such an estimate clearly in his mind he can, of course, make a definite allowance in steering for the leeway he may make while journeying to his destination. An illustration of this may, perhaps, be possible.

Suppose a pilot has to start away from Calais, on a misty day, to fly to Dover, with a south-westerly wind of twenty miles an hour blowing. This illustration has a particular significance, because such a set of circumstances prevailed when poor Mr Cecil Grace commenced his ill-fated voyage back to England last Christmas-time.

The speed of an aeroplane making such a flight may be set, for the sake of argument, at forty miles an hour. Steering by his compass north-west from Calais, the proper direction, the airman would, in the course of his flight, make just about ten miles of leeway in a north-easterly direction. He would, in fact, strike the English coast, not at Dover, but at a point ten miles north-east of it.

Of course, were he to make accurate allowance for this leeway, he would reach his destination quite well. But the wind might vary in strength during the crossing. Steering by compass, therefore, with no intermediate guides to tell the pilot how he is progressing, is a very tricky business.

But it is beyond question that, with the growth of aerial traffic, airmen will be provided with sufficient landmarks, both by day and night, to enable them to steer from point to point. There appears little doubt to me, in this connection, but that aerial traffic between countries will, in the future, be conducted by means of regular "airways." That is to say, the aerial craft passing between London and Paris will fly *via* a definite aerial route, in the same way as the cross-Channel steamers pass across the water from one shore to the other by a fixed path.

The Atlantic will, also, beyond doubt, have its regular "airway"; and flights between towns will be made by settled routes. Along these "airways," it is only reasonable to assume, signals will be placed so that they can be read by the pilots of machines passing overhead.

Towns will, as has already been advocated, be indicated by a prominent "aerial" sign setting forth their names. Thus the airman passing from point to point will, in the future, have no difficulty in finding his way—in the daytime by special signs, and at night-time by specially-arranged lights.

V

One can scarcely touch upon such a question as this without thinking of the commercial possibilities of flying. Here, I must confess, I cannot understand the attitude of many clever men.

They contend that, although mankind has conquered the air after the failures of centuries, no practical good will come of it. More than one talented man, and deep thinker, has told me plainly that the aeroplane cannot become of any real use to man, and that the sooner we make an end of foolish experiments, involving loss of life, the better it will be for mankind.

Well, as I have said, this is an attitude that appears to me to be entirely incomprehensible. Were the future of flying black, instead of being as hopeful as it is, I should still work on with the same assiduity, feeling absolutely convinced that we have not conquered the air for nothing.

Why, indeed, has this amazing new power been suddenly placed in the hands of man? Surely it is for the advancement of the world. I, for one, as a practical airman, have absolutely no doubt whatsoever upon this score.

Now that we have not only proved that man can fly, but can fly already with a great deal of reliability, there is absolutely nothing to prevent flight becoming one of the greatest developments in the world's history.

To the man who contents himself with emphasising the present limitations of machines, and who asks the blunt question: "What real use will an aeroplane ever be?" I have a very direct answer in the form of another question : "Is it not of use to man to be able to move absolutely as the crow flies from point to point, and at a higher speed than would be possible by any existing means of land or sea locomotion?"

If the aeroplane can, in fact, be placed in the hands of the human race as a machine just as safe as any on land, and yet of a speed impossible save with the air as a medium, then I say that the aeroplane is bound to effect a complete revolution.

And this aircraft, enormously swift and yet safe to handle, is—I am convinced—bound to come. To those who regard aerial traffic as being essentially dangerous I should like to address an especial word.

It is my firm conviction—as it is the conviction of those who are intimately acquainted with the progress of flying as far as it has gone—that the air, once completely conquered, will be an extremely safe element to move about in. The airman who flies to-day resembles the first men who launched little cockle-shell boats upon the sea, and marvelled at the size of the waves.

As a matter of fact, the men who fly are making extraordinarily good progress, considering the crudity of their apparatus. The very first aeroplanes flown, handled by men who knew nothing of the new sea upon which they were launching themselves, evinced a safety and a stability which were, under the circumstances, perfectly remarkable.

The evolutions which men were so quickly able to perform in the air, the really amazing confidence they displayed in rising to great heights, and flying across country, and the extraordinary rapidity with

MR. GRAHAME-WHITE STARTING FOR A FLIGHT WITH A PUPIL, MR. R. WICKHAM.

which beginners mastered the rudiments of flight—these facts, when I pondered over them, made me feel absolutely convinced that, in the end, the air would prove not only to be man's new servant in the matter of speed, but also in respect of its safety.

What speeds will eventually be obtained with aerial craft? How many times I have been asked this question, I really should not like to think. I may say, too, that I have never liked to reply to it.

The reason is simple: No one, least of all myself, can prophesy the speed at which aeroplanes will, when they are perfected, pass through the air. A person studying this aspect of flying superficially is apt to imagine that, because 70 and 75 miles an hour is a speed possible with a racing monoplane to-day, it is almost purely a question of engine-power to make this speed leap up to 100 miles an hour, and even more.

In thinking this, however, a great mistake is made. The pressure upon the planes of a machine, at these very high speeds, is so great that some very much stronger method of construction than that at present used will need to be employed before speeds of anything like that imagined can be safely attained.

Apart from this, the power-plant of a machine will require great development before any very appreciable increases are made on the speeds obtained to-day. The improvement of propellers, as regards their efficiency, is also a very necessary step forward before a really high-speed machine can be evolved. And there is also the question of landing at high speeds, to which I have referred before.

Therefore, it will be seen clearly that to produce the 100 mile an hour machine there are more questions involved than the mere fitting to a machine of an engine of additional power. Such difficulties as I have ennumerated do not, however, prevent me from thinking that the attaining of phenomenally high speeds through the air will be only a matter of development.

From the first moment that the problems of flight engrossed my thoughts, I came to the conclusion that the air was the absolutely ideal medium for the very high speeds of transit that the future will demand.

When the world is ripe for a new era, that era usually comes. And the novelty of the future is to be the general adoption of the flying machine as the conveyance for getting rapidly and pleasantly from place to place.

Even with enormous power, and shipbuilders exercising the most wonderful ingenuity in construction, it has become scarcely possible to add even a knot to the speed of ocean-going steamships. And, even if it were practical, the expense would be almost prohibitive.

As regards railways, what do we find? It requires the most strenuous effort to improve, even by a minute or so, the running time of any important express. Land and sea transit, quickened and quickened again to meet with man's persistent demand, has, at length, come almost to its limit.

It can be "speeded up" no more. And yet men have been so educated to the conveniences of speed that their demand for quicker travel is scarcely to be denied. It is at this juncture, therefore, that flying dawns upon the world's horizon as a solution of all difficulties.

What aerial locomotion will be able to achieve, in the way of speed, is still something of a closed book. But, even if our most moderate calculations are proved to be right, the aeroplane will soon—in the matter of speed—excel any train or steamship as a regular method of getting people from place to place.

And there is another very important aspect of the question to be discussed as soon as the aeroplane is regarded from its purely commercial side.

It is this : How would an aerial passenger service between any two points compare, in the matter of expense, with land or sea traffic. Here, without going into any minute calculations—which would, at this juncture, surely be open to question—I am perfectly assured that the air traffic of the future will be conducted with very much less expense than is that of either the land or sea.

The general wear and tear upon an aerial craft will be extremely low. The conductors of an aerial service, unlike the management of a railway, will be unburdened with any heavy expenses in the upkeep of a permanent way.

From the commercial point of view, in fact, viewed in comparison with any existing methods of travel, the aerial service has the most promising future imaginable. Cheapness, safety, great speed! Does mankind want more, particularly seeing that there is no more exhilarating way of getting from place to place than a journey through the air?

One cannot, indeed, lay too much emphasis upon the delights of aerial travel. Immediately ordinary folk can be assured that flying has become as safe as traffic by land or sea, there will be an enormous movement in favour of it.

The man who drives the finest motor-car obtainable along the roads to-day does not enjoy a tithe of the pleasures of a man who steers an aeroplane in a swift flight across country. There is, in flying, all the joy of a swift rush through the air with none of the discomforts, such as dust and vibration, which attend high speed travel on land.

In driving a fast motor-car on ordinary roads, it must furthermore be remembered, an eye-straining watchfulness is ever necessary to avoid obstacles that may present themselves. In the air, with a sense of absolute freedom, one feels able to enjoy the sensation of speed to its very limit.

There is in flying, indeed, a sense of power and conquest very hard to describe. But of this I am confident: when a suitable machine can be put before him, the motorist, however ardent, will forsake the road for the joys of the air. And that machine will not be very long in coming.

From the sporting and pleasure-seeking point of view I feel sure, in fact, that aeroplaning will provide enormously important developments. What can be done in the way of pleasure expeditions it is, indeed, hard to describe for the reason that the possibilities are practically boundless.

The tourist who makes a long flight upon pleasure bent will see the beauties of nature from an entirely new, and tremendously impressive, point of view. And now as to a final word: airman-

MR. GRAHAME-WHITE DISCUSSING AVIATION WITH PRESIDENT TAFT, DURING THE AIRMAN'S AMERICAN TOUR.

ship has reached a stage when it cannot go back.

The possibilities of the future are just beginning to unfold themselves. We see already, however, that flying is to open a new page in the world's history.

SECTION VIII

THE HUMAN FACTOR IN FLYING

VIEWS OF THE LATE MR CECIL S. GRACE

"On the evening of December 21st, 1910, while we were staying at the Lord Warden Hotel, Dover, in connection with the De Forest prize, Mr Cecil S. Grace discussed with me the scope of our book, and outlined his views for this section, promising to write them on our return to London at the conclusion of the contest. But the next day, to the inexpressible grief of all his friends, he disappeared, in a sea fog, while flying back from Calais to Dover. In order that we should not lose the value of his frank opinions, I have set them down here, as far as possible in the straightforward way he expressed them."—H. H.

I

"MAN is a blunderer at flying. What do I mean? I mean that in five years time, the present day airmen will be regarded as clumsy fellows. Although we have progressed so far, we have only the very vaguest notion of what can be done in the new element we are exploring.

"So many people speak only of the improvement in machines. Faster planes, better engines, greater stability in flight! These are all very excellent things, but they must not lead us to forget the human factor. What about the man who flies?

Is he going to improve as satisfactorily as does his mechanical equipment?

"After all, however much an aeroplane is improved, the keynote of success, or safety, will rest with the man who flies it. This point, however, seems scarcely to be reckoned with as it should.

"But it is quite evident to me that man's skill, in flying, will increase very greatly. Take, as an instance, any very well-known pilot of to-day. He has an improved machine, it is true; but only, in a general way, as regards the reliability of his engine.

"He has just as much to do himself, when in the air. And yet an experienced flyer finds himself, almost unconsciously, improving in his flying. I myself have found that, to a very marked extent.

"Learning to fly is a perplexing business. The beginner finds it very difficult indeed to keep his head. He first sits in his machine, with a great engine rearing away behind, or in front of him, as the case may be. The din which this engine makes renders it impossible for him to hear a word that is said by those about to start him off.

"To make things worse, if he is in a monoplane, his breath is almost taken away by the rush of wind from the propeller in front of him. Then, when the men who are holding back the machine let go, it darts away across the ground, providing the now worried novice with a new sensation. He should remember, of course, all that has been dinned into him before starting; but the chances are that he does not.

"One of the first things that he should recollect, but very seldom does, is that only the very smallest movements of his hand lever and foot rod are needed to control the aeroplane.

"It is, as a matter of fact, extraordinary how slight a movement will either turn an aeroplane, or cause it to rise and fall. A famous jockey is generally credited with possessing fine 'hands,' which means that he uses his reins with gentleness, and yet with dexterity. The hand of an airman, or rather the right hand with which he actuates his elevator and ailerons, with the combined movement of a lever, requires a most sensitive power of what one might call 'touch.'

"This fact accounts for the criticism one often hears levelled against some even successful pilots—'Oh! He's a clumsy flyer.' What is meant by this is that the airman in question does not manipulate his levers adroitly, but is apt to jerk them too much when he is rising or falling, or balancing his machine.

"But, as regards the beginner, his career—unless he possesses almost superhuman coolness and judgment—is at first generally rather humorous. 'Whatever you do,' he is told, 'don't try to get into the air right off. Run your machine about on the ground first of all, and so get used to the control movements.' Well, very excited as he usually is—although he won't confess it—the beginner does run about on the grass for a little. But this soon begins to pall. He gains a little confidence, and so decides to try just a short flight.

"Sometimes he avoids disaster—more by luck than judgment, it is true. Very often, however,

[*Daily Mirror.*

MR. MACARDLE ARRIVING BY MONOPLANE AT BOURNEMOUTH FROM BEAULIEU—WITH HIS PORTMANTEAU ON HIS MACHINE.

[*Daily Mirror.*

M. PRIER, INSTRUCTOR AT THE BLERIOT SCHOOL, HENDON, WITH MR. FRANK HEDGES-BUTLER—FIRST PUPIL AT THE SCHOOL.

such a premature flight ends in the following way: the pilot, making an altogether too abrupt movement of his lever to ascend, jumps his machine 20 or 30 feet into the air. Startled at so rapidly leaving the ground, he makes a reverse movement with equal impetuosity.

"The result can be imagined. The aeroplane dives helplessly back to the ground, and makes such a pell-mell landing that a considerable amount of damage is bound to be done. I have seen this happen not once but a dozen times. The temptation to take a short cut to proficiency, and fly too soon, is practically irresistible to some beginners. The penalty they pay is in a pretty extensive bill for damages.

"Proficiency, as regards flying under ordinary conditions, comes very readily, however. Considering the small margin for error that is allowed in flying, the skill that beginners quickly attain is indeed remarkable. If a man learning to ride a bicycle makes a mistake, he has a slight tumble, that is all; but if the novice at aeroplaning forgets to do the right thing, when in the air, a wrecked machine is often the result.

"This makes learning to fly a very tantalising business, as a rule. You are only a few minutes actually in the air, with probably days of waiting between each flight. I remember, for example, that a man who had been more than six months at a flying school, and had been busy every day—mostly repairing his machine after some injurious experiment—told me that he had, during the whole six months, been less than half an hour in the air.

"I do not wish to discourage beginners at all; by no means. In fact, the only point that it is necessary to make is that you require rather an unusually cool head if you want to become a flyer fairly expeditiously, and without spending a small fortune upon repairs. Once a man has learned to fly, and is keen upon the sport, it is surprising what progress he makes.

"He soon finds himself doing things in the air that seemed impossible to him at first. He quickly discovers that the aeroplane is a most beautifully responsive thing to drive. It responds instantly to its rudder, elevating plane, or ailerons. The really skilful pilot only moves his hand lever a matter of inches; the clumsy novice, on the other hand, may jerk it a foot from side to side.

III

"With strength of wrist, and delicacy of touch, is an aeroplane controlled. In such movements as landing, or turning, for example, an experienced airman finds a joy in just applying his control movements with sufficient power, and with no more. In landing, for instance, you let a machine dive towards the ground until you are within a few feet of it. Then, you straighten her out with a checking movement of the elevating plane, and touch ground without a jar. In turning, too, you 'bank' the machine over a little—like a motor-car turning the corner on a racing track—and then sweep round, making the very minimum of 'leeway' as you do so.

"Flying is, indeed, a magnificent sport; how a man can become tired of it quickly, or regard it as too dangerous to proceed with, I cannot understand. Motoring is as nothing compared with it; one cannot really describe the exhilaration of flying across country on a good day, and with one's engine running well. And, regarded from the danger point of view, I have always striven to work the thing out logically—and without jumping to scaremongering decisions, as so many people have been inclined to do.

"My own experience has, I may say, taught me that flying can be made extraordinarily safe. The very ease with which a machine can be controlled, its responsiveness to its controlling mechanism, and the safety with which one can make a landing, even after your power has failed you, prove this.

"But there is also another aspect of the question—call it the dangerous aspect of flying, if you like. You cannot afford to have anything go wrong with your machine when you are in the air. Every part of her you must be able to rely upon implicitly. Not only must the machine be built with absolutely the finest material, but it must be constantly under supervision, to see that nothing is wearing, or suffering from strain.

"Now, turning for a moment to the list of deaths due to falls from the air, how many do you find due to the sudden collapse of some vital part of a machine. Very many. Some airmen, despite the dreadful consequences of being careless, are careless. They leave machines entirely to the care of mechanics. They merely get into them, and drive, as a man drives a motor-car.

"And, constructionally, I do not—and never have—regarded many aeroplanes as being strongly enough built. There is no reserve of strength about many of them. They are merely built to withstand such stresses and strains as are generally known to be thrown upon them. When some quite unexpected strain is suddenly imposed upon them they have not the strength to withstand it.

"So much is, as yet, unknown as to the stresses which may, in any given set of circumstances, be thrown upon the machine, that it is obviously necessary to build with a very liberal margin of safety. And yet this very necessary precaution has, in many cases, been quite ignored.

"As predisposing causes of more accidents than I should like to mention there have, in fact, been a lack of sufficient strength in a machine, and a carelessness on the part of the pilot as to the condition of his machine. Aeroplane mechanics, fine workmen as a class, are only human. A tension wire may be on the point of giving way, or a control wire be on the verge of wearing through. These are little things, but in this stage of aviation they may cost a man his life. And mechanics, however good they are, cannot be expected to be infallible.

"But such dangers as these can be obviated. There is no reason why a machine should not be kept in thoroughly safe trim. A frequent glance over it requires no very special pains on the part of the pilot."

IV

"What I mean is this. If you have an absolutely well-built machine, in the hands of a thoroughly competent pilot, and a man who sees that it is all right in every way before he starts a flight, and if that flyer does not take unnecessary risks, then I say you have a sport that is extremely safe, and very enjoyable.

"But the trouble is that flying has developed so very, very fast. There has been a great demand for aeroplanes; they have been built quickly. Machines have been bought by all sorts of people. Wild feats have been attempted by mere novices. Prizes have been offered for flights that should never have been made. The result is a death-roll that makes ordinary people say that flying is a most dangerous business.

"But I am sure these accidents will not have a permanently harmful effect on flying. It is bound to survive them, because—as soon as the causes of accidents are more readily understood—there will cease to be any long list of smashes and ill-advised flights. Besides, not only will the skill of airmen increase, but the machines they fly will improve.

"I am tired, myself, of slow speed flying. I do not regard a speed of 40 miles an hour through the air as being of any practical good at all. The faster you can fly the better it is, all round. You are less likely to get into trouble with awkward wind gusts, and you have a greater control over your machine.

"I must confess I am impatient with manufacturers who, apparently satisfied with the slow-flying machines we have got at present, are turning their attention to passenger-carrying, and making such machines more comfortable. There is one thing that we have all got to work for. That is speed. As a practical flyer I can see the absolutely vital need of speed.

"We can, indeed, progress no farther than we have done without it. I want to see speeds of 80 and 100 miles an hour through the air obtained quite soon. Then I shall think that flying is beginning to make some real headway. There is no question at all about one thing: the air, if it is going to be of any practical use to us at all as a new medium to be getting about in, must be moved through fast.

"Of course, to make them suitable for very high speed work, aeroplanes will have to be very greatly strengthened. But I do not anticipate there will be any insurmountable obstacle in the way of a much stronger and more reliable form of construction. As regards power, we already have a wonderful piece of work in the existing petrol engine. But there is no reason to doubt but that this will be very greatly improved upon before long.

"Certainly we have not heard the last word as regards the motive power for aeroplanes. As a matter of fact, we are all mere fumblers at the moment. The more we realise it the better, because we shall be less discouraged by failures if we do so. And we must not allow criticism, or the declaration that flying has no future, to discourage us in the slightest degree."

[Daily Mirror.

MR. ROBERT LORAINE, EQUIPPED FOR A LONG OVER-SEA FLIGHT, WEARING A LIFE-BELT, AND WITH COMPASS AND MAP-CASE STRAPPED TO HIS KNEES.

SECTION IX

THE NATIONAL ASPECT OF FLYING

By Mr G. HOLT THOMAS

Mr Holt Thomas, who is an international authority upon flying, particularly in its military aspects, regards the apathy towards aviation in England as a national disaster.

I

The authors having paid me the compliment of asking me to contribute a section to this book, and having allowed me to select my own subject, without any hesitation I choose that in which I am most interested, viz.: the demonstration of the enormous progress made in France during 1910, and the immediate adoption of aeroplanes by other nations, contrasted with the apathy displayed in this country by the public, the Government, and those who should be interested from a commercial point of view.

Perhaps in this case the last should be first, as it is in working from the commercial aspect that most attention will be drawn to the subject, and most accomplished.

Moral success usually goes hand in hand with financial success, and that is exactly what is happening in France to-day, and has been going on to a large extent the whole of last year, and it is exactly that which nobody will recognise on this side of the Channel.

It is more or less easy to draw attention to a certain thing for the moment, as I did to the progress in aviation, by bringing Paulhan to fly at Brooklands and Sandown Park in November, 1909, but it is impossible to keep on doing so, unless one's pocket is unlimited.

It was largely the commercial side that attracted any interest at all in England during the past year, but it has been in the form of meetings which, from the promotion point of view, it was hoped would be profitable, and from the aviator's point of view, offered large rewards in the shape of prizes.

But that phase has passed, and the business should be in the manufacture and sale of aeroplanes, a business which must necessarily include flying, and naturally lead to progress and public interest.

By the time this is in the press, things may have altered, as I am convinced that there will be, sooner or later, a rush into this trade; but, at the moment, it is quite impossible to convince most men, practical on all other points, that there is any future in aviation. One regards it as an acrobatic feat; another wants to know who is going to buy the machines when made; and all, without exception, regard the accidents that have taken place as fatal to the movement.

Whilst dictating these words I have just received a letter from one of the most influential bodies in London connected with commerce, who announce that an aviation dinner, to which I had been invited, has been adjourned *sine die,* owing to the number of accidents that took place at the end of the year. This is a practical proof of what most people are thinking.

I have followed flying since the day when it might have been more accurately described as hopping a yard a month. In 1906 I was responsible for the offering of the *Graphic* and *Daily Graphic* £1,000 prize for a straight mile, a prize which aroused a great deal of interest at the time, as it was the first practical one offered. Shortly after this I retired from the management of the paper in question, and as no competitors came forward, the prize was withdrawn. But what extraordinary progress has been made may be gathered from the fact that it was not until the beginning of 1908 that Farman won the Archdeacon Prize for a kilometre, and flying may be said to have started from that time, excluding the effects of the Wright brothers, who undoubtedly had been making marvellous experimental flights in private. At that time Farman was waiting, and always waiting, for a motor that would run for five minutes consecutively.

I simply mention the fact that I have followed everything for many years, especially in France, as there are so many men, including numerous acquaintances and friends, who simply regard flying as an acrobatic feat, and who regard me as an enthusiast, badly bitten with the subject.

I am not in the least. I know the progress that has been made; I know what is being done abroad, and I regard the apathy in this country as a national disaster. From the commercial point of view, we are doing exactly what we did with regard to the motor-car, and although we have caught up in that trade now, many valuable years were lost.

But, from the national point of view, flying is much more important than motoring. We are no longer an island. The sea is no longer our protection. Flights, which are becoming almost daily occurrences, come within the limits of London and Berlin. Paris is an easy flight.

II

It was with that sort of idea at the back of my head that I engaged Paulhan to fly near the Metropolis. But with what result? None at all, beyond inspiring a few daring amateurs with the desire for flight. The onlookers thought it very wonderful, and there their interest ceased. Paulhan would have had the London-Manchester prize, at that date, if it had not been for fog; and it was then that I promised him my assistance if he would go for it, hoping, at anyrate, to prove by that, that we must regard aviation as a practical proposition.

The London-Manchester flight *did* arouse a very great interest, especially owing to Grahame-White's (who was then a novice) plucky attempts at it.

Perhaps nothing could fix in one's mind the enormous progress made in 1910 better than the recollection that both Farman and Paulhan told me, at the time of the London-Manchester flight, only in April last, that it would be some years before the *Daily Mail* second £10,000 for a 1,000 mile flight round England would be won.

But Hey, Presto! Within a few months, the Circuit de l'Est of 800 kilometres is an accomplished fact, and nobody doubts but that the *Daily Mail* prize will be gained this year.

And that extraordinary change of front is a matter of a few months only. Can any number of accidents stop or even hinder the science or sport, call it what you will? The accidents have been sad and most distressing, but people are amazed when I say that I regard them as nothing at all.

Having seen most that has gone on, and having seen, moreover, that many machines are unsafe, that aviators are deliberately risking their lives in attempting, if not the impossible, at any rate the improbable, I am surprised, not at the number of accidents, but at the paucity of them.

Especially if all these fatal accidents are analysed, is one convinced that they will have no effect in hindering progress, beyond the one important effect of preventing practical men regarding it seriously.

Many of the accidents have undoubtedly been due to faulty construction, but many more to over-confidence, and the attempt of feats which might well be left until machines are more perfect.

Many also have certainly been due to the nature of the competitions. Personally, I do not see how anyone can be surprised at thirty-three deaths, when one remembers that in January, 1908, Farman succeeded in flying a kilometre, and yet, by December, 1910, the Alps had been crossed, a height of more than 11,000 feet attained; a distance of 200 miles in a single flight accomplished; and that an aviator had flown for more than eight hours without coming down. Many flights with one, two, three, four, and five passengers have been made.

Machines get safer every day. Prizes are offered for more practical purposes; and gradually many of the risks will be eliminated. It is always invidious to mention names, but to give an instance of my confidence in the future of flying, I say without hesitation that I think no more of flying with Henry Farman, any time he asks me, than of getting into a taxi.

Why?

I am not particularly courageous, and perhaps no one realises more than I do the risks run. My reason is that I have absolute confidence in the pilot to start with. I know that he is as careful to-day as when, at Issy, he was flying a yard a month.

I know that he recognises the limits of the machine, and statistics do not show me that I stand any risk of the machine falling from the sky.

Something may go wrong with the control. Certainly it may, but there is no reason why it should, if properly looked after.

If the motor stops, what happens? Nothing, but a glide to terra firma. But, if the machine is *not* looked after, if it is *never* examined, if precautions that Henry Farman, skilled aviator as he is, always takes, are never taken, naturally the result is an accident.

And, with all one's faith in aviation, one must recognise its limits and its dangers, which cease to be dangers if fully recognised. Therein lies my faith, therein lies my failure to see that the accidents are going to arrest progress.

Many machines I lack confidence in for various reasons. One has far from practical landing apparatus, another is difficult to control, yet another is constructionally weak.

[*Daily Mirror*.

THE HON. ALAN BOYLE ABOUT TO START ON HIS "AVIS" MONOPLANE AT WOLVERHAMPTON.

[*Daily Mirror*.

M. AUDEMARS STARTING A FLIGHT ON HIS "DEMOISELLE" MONOPLANE.—BOURNEMOUTH, 1910.

And so it is with aviators. One is over-confident, another is careless of his machine, yet another will never really attain the art. But none of these points shake my faith in flying. In a short time *all* landing chassis will be good, *no* machine will be difficult to control, and *all* essentially strong in construction. Then the aviator may be over-confident if he likes; he may be careless; he may be unskilful; the machine itself will have sufficient margin of safety to allow for all these faults. Even now a good pilot can be engaged at £300 to £400 a year. Does not that help to show that aviation is becoming practical?

III

Up to this point I have tried to show what I know to be and am convinced is, the case—that flying has come to stay, and that, in view of the great industry that will undoubtedly ensue, it behoves our great manufacturers (and presumably those constructing motors are the most suitable) to share the confidence that I possess, and to enter into the question from a commercial and national point of view. But there are other national aspects, as well as commercial, viz., for purposes of offence and defence.

I think the most interesting week I spend in 1910 was that at Grandvilliers in Picardie, during the French manœuvres.

Nothing more was necessary to demonstrate, in the most emphatic way, that not a moment should be lost by our War Office and Admiralty in at once taking up, and dealing seriously with, the questions of aeronautics.

Up to that time, the aeroplane was regarded as a toy. What one felt, at the French manœuvres, was not so much what was done, as what would be done when the machines were perfected.

As it was, the result showed extraordinary foresight on the part of the military authorities, as arrangements for the completely equipped Parcs d'Aviation must have been made a long time before, and the manœuvres were centred on aviation, with the result that, as far as military engagements were concerned, every arrangement was completely upset.

Flying was confined to aerial scouting, and no attempts at bomb-throwing or similar experiments were carried out; but it was conclusively proved that the army without aerial scouts would have no chance against a force possessing them.

That was absolutely proved, and I do not think anyone present would for one moment attempt to controvert it. Admit that, and can anyone doubt the enormous importance of at once tackling the question?

After fully describing my experiences at Grandvilliers, our War Office did admit it. They were good enough to consult me, and I procured them two machines. But much, very much, remains to be done. The question still requires seriously tackling, and the simple purchase of a machine or two is nothing. What we want, and what we must have, is a military and a naval school, and that at once. Not a moment must be wasted, if we are to keep up with other nations.

It is sometimes said that aviation is more important to European countries with frontiers touching, but my view is that to no country can it be so important as to our own, as we have always, to some extent, depended on the sea as our protection.

I have been taken to task for saying that the question of aviation is as important as the great and popular question of Dreadnoughts. Is it not? What chance will the Dreadnought stand against another completely equipped with aerial scouts, travelling at 80 or 100 miles an hour, apart altogether from bomb-throwing.

Some affect the opinion that aeroplanes will easily be brought down, but up to the present all experiments point the other way. Our own trials at Portsmouth of towing a dummy dirigible showed that it was not easy to hit, but how much less easy to hit an aeroplane, say at a height of 1,500 or 2,000 feet, travelling at 90 miles an hour.

Mr Grahame-White, in a bomb-throwing competition, let fall the projectile plumb in the middle of the deck of a dummy battleship every time.

An American officer, on a Curtiss machine, with a rifle, hit a target four times out of six, and got one bull. Latham is reported to have shot a buck, and a bird, from his machine. So far, then, as actual experiments are concerned, the results are in favour of the aviator.

But, even if some machines are brought down, it does not suggest the idea that we should not at once adopt aeroplanes, but rather that we should have double the number we require.

IV

I say most emphatically that if we have not almost immediately at least a hundred aeroplanes attached to the War Office, and a hundred attached to the

Admiralty, and if we are not conducting experiments each day and every day, we shall be a long way behind other nations.

At present, countries like Japan, indeed, even Peru, are away ahead of us, whereas with European nations we cannot be compared. Germany, with its large force of dirigibles, will have in addition a hundred aeroplanes and pilots by this summer.

This year, as announced in the *Kölnische Zeitung*, numerous aeroplanes will take part in the great Germany army manœuvres, in which the High Seas Fleet will take a very prominent part, and will have to prove that they are capable of fulfilling their purposes, both for the Army and the Navy.

Russia has twenty machines in use, at least, and will have probably more by the time these lines are in print. Japan has ten aeroplanes and has ordered twenty-two more.

The question of national machines, so far as construction is concerned, does not seem to have entered into the matter; it is a question of the best, acquired as quickly as possible. It is impossible to state the exact number possessed by France, as it increases every day, but some months ago the army possessed over a hundred, with a total of 500 in the country to call upon, and even Italy had seven. The idea in France is to teach *every* officer practically to fly, whatever regiment he may belong to, and to attach an aviation department to *every* military camp.

Is the two-power standard as necessary in aeronautical as in naval matters? "More so" I think should be the answer; as every aeroplane possessed by a foreign force weakens not only our army, but every ship, from a torpedo boat to a super-Dreadnought, regarded from the aerial scouting point of view alone.

That the French military authorities realise the importance of aeroplanes is shown by the prize they have offered £48,000 for the machine which best fulfils their specifications, and their offer, after the prize is won, to purchase so many replicas of the winning machine, at a price very remunerative to the fortunate manufacturer.

What we must do, by hook or by crook, is to arouse an interest in a subject which I regard as most important to us, as individuals, and to us as a nation. We have the men; we need not blush for our aviators.

We have as fine aviators as any other nation, but they are not numerous enough. Both in the Navy, and in the Army, volunteers would be forthcoming in their thousands; but machines and schools must be provided for them, and for this we must willingly and cheerfully vote the money—and, after all, what a trivial amount is required!

N.B.—Nothing could show the progress made more than the fact that many of the figures I have given in this chapter, written only a few weeks ago, are all altered. The Puy de Dome prize, offered in 1908, has been won, and I am invited by the *Standard* to assist in the organisation of the circuit of Europe (Paris-Berlin-Brussels-London-Paris) crossing five countries, and yet it is not a year since the London-Manchester prize was won.

SECTION X.

THE "POWER UNIT" OF AEROPLANES.

By Mr HOWARD T. WRIGHT.

Designer and constructor of the British-built Howard-Wright Biplane, upon which Mr. T. Sopwith flew for 169 miles from England into Belgium on Dec. 18th, 1910, winning the De Forest £4,000 prize, and establishing a cross-country world's record.

I.

THE motor and propeller of an aeroplane should be considered as one unit, because the action of each is so dependent upon the other.

Many of the faults attributed to the motor are due to the propeller, and vice versa.

The combination of motor and propeller can conveniently be termed the "power unit," which includes all the apparatus necessary for the proper working of the motor and the propeller.

There is no feature of an aeroplane which receives more abuse than the "power unit."

Whenever an inventor makes an aeroplane designed on beautifully theoretical lines, but lacking the necessary capabilities to fly, it is often regarded as the correct thing to blame the "power unit."

Should the plane fly well, however, praise is then given to the beautiful design of the aeroplane, with

[*Daily Mirror.*

MR HENRY FARMAN ADJUSTING MR. GRAHAME-WHITE'S BIPLANE AT PARK ROYAL PRIOR TO MR. GRAHAME-WHITE'S FIRST LONDON-MANCHESTER FLIGHT.

the grudging tribute that the motor is probably just doing its duty.

Someone has said, and with a good deal of truth, too, that it is possible to make the ordinary domestic "tea-tray" fly, provided that one fits to it a propeller and a motor in the correct position.

This, naturally, is true only more or less; but it illustrates the altogether vital importance of the "power plant." Aeroplanes may be good, bad, or indifferent, and still all of them may fly; but the "power plant," if flight is to be achieved, must always be efficient.

It is generally thought that the aeroplane motor is a factor quite well understood, on account of the large and varied experience which makers have obtained with a similar motor in automobiles.

This is very largely true, so far as the motor itself is concerned; but when the aeroplane motor is taken in combination with the aeroplane propeller, the matter is entirely different.

Strangely enough, all motor manufacturers, and most aerial motor builders, can exhibit their aeroplane motors running on the test bench for five or six hours at a stretch, quite satisfactorily.

But, when you come to fit a propeller, and then place the motor in its place on an aeroplane, it will frequently not run for more than five or six minutes.

When this unfortunate result is reported to the engine builder, his reply is often the obvious one that "the cause of the trouble must be something outside the motor, because the motor itself was working quite satisfactorily before being put into the aeroplane."

This comment, although undoubtedly true, does not assist the purchaser very much. It is the duty of an aerial motor to run when on an aeroplane, and in the air, as well as in bench tests.

It has been suggested that aeroplane motor builders should supply a propeller with their motor, and allow them to be tested as one "unit." This does not meet the case, however, for two reasons.

In the first place, a propeller may run delightfully with the motor stationary, and yet be absolutely useless for flying. This may be explained as follows:—When stationary, the propeller is not acting as a propeller, but simply as an air fan. That is to say, the propeller is moving the air, and not itself. These two conditions, although opposite, are certainly not equal, notwithstanding the well-known law that "Action and reaction are equal and opposite." There is nothing wrong with this law, but in such a case as this it is not a question of "Action and reaction" entirely.

The second reason why the aeroplane motor builder cannot supply a standard propeller with his motor is that every type of aeroplane should have a propeller specially designed for it, and over this, of course, the motor maker could have no control.

A very good suggestion in this connection has been made, however. It is that the motor and propeller should be tested upon a truck running upon rails at the speed of the aeroplane when in flight. This does not, of course, meet the need of special propellers for various types of machines.

HT.

Voisin	Howard Wright	Howard Wright	Cody	2 Seater Bleriot	Military Type Farman
Biplane	Biplane	Monop'ne	Biplane	Monop'ne	Biplane
Gnome	E.N.V.	E.N.V.	Green	Gnome	Gnome
38	50	40	60	38	38
7 Rotary	8 V.	8 V.	4 Vertical	7 Rotary	7 Rotary
Voisin	H.T.W.	H.T.W.	Cody	Regy	Chauviere
8.25	8.25	6.5	10.0	8.08	8.58
4.29	5.10	3.0	10.0	5.28	4.29
493	516	170	540	266	760
710	750	380	1280	500	910
1040	1420	810	2000	980	1340
200	450	220	500	250	200
2.0	2.8	4.8	3.7	3.7	1.7
27	28	20	33	25	35
35	36	38	40	40	32
32	32	21	38	30	44

II

Given a motor which is well designed, and of a sufficient mechanical strength—and there are now quite a number of such motors to be obtained—it is reliably estimated that fully 60 per cent. of the mechanical trouble with aeroplanes is due to propellers.

Why is this? It is because many designers of propellers, and particularly inventors of them, do not perfectly understand what one may call the "A.B.C." of engineering.

They understand quite well the higher branches of engineering, and can amply prove all that they claim; but they have simply not taken the trouble to know the "A.B.C." of engineering as they should know it. Incidentally, of course, this state of things is not unknown in other directions besides engineering.

Take, as a practical example, the unit of power which is known as a horse-power. Everyone has heard of this; but how many could define it? Of those who can define it, how many more are there who thoroughly understand it?

At the risk, perhaps, of being considered childish, I shall endeavour to explain myself more fully on this point.

In the early days of engineering, when it was found necessary to create a unit of power, a large number of experiments were carried out with horses, which were made to raise a weight by means of an arrangement of pulleys and ropes.

The results of these tests showed that the average horse could exert sufficient power to raise 33,000 lbs., or about 15 tons, to a height of one foot in one minute. This, therefore, was called "one horse-power."

This is all very simple and easy; where the pitfall comes is that there are people who know this, and yet do not realise that there are in this calculation three elements—time, weight, and distance!

It is equally a horse-power to lift a lb. one foot in the 33/000th part of a minute.

If you take a propeller which gives a push of 100 lbs., and exerts that push for 330 feet in one minute, that also is a horse-power. You can alter the figures in any way. So long as they make 33,000 feet lbs., it is still a horse-power.

One would think it difficult to misunderstand this point; but the makers of a well-advertised propeller claim that the push of a propeller on an aeroplane is the same at all speeds.

It will easily be seen that, were this statement true, and one could only make the aeroplane travel fast enough, one would soon reach a point where many times more power was being used than the motor was actually giving out.

A petrol motor generally consumes about three-quarters of a pint of petrol an hour per horse-power. That is to say, the energy derived from three-quarters of a pint of petrol is equal to raising a weight of 900 tons one foot in one minute.

Some idea of the energy contained in petrol will be realised when it is remembered that a good motor only uses 12 per cent. of the heat in the petrol. The remaining 88 per cent. is lost in the heat in the exhaust, and from other causes.

There is no part of an aeroplane about which so much nonsense is talked, and written, as the propeller.

There is a widespread delusion that the propeller of an aeroplane is a very wasteful apparatus for using power; and, further, that the waste of power is due to the fact that the propeller is not properly understood.

Nothing could be further from facts. Almost daily one hears of inventors who, by some wonderful contrivance, are going to save anything from 25 to 50 per cent. of the power required to drive a propeller.

They have heard that the efficiency of the propeller of, say a Farman biplane or a Bleriot monoplane, is only from 50 to 55 per cent. of its power, and they come to the conclusion that the makers of these machines could not get a better efficiency even if they desired to do so.

As a matter of fact, these makers could easily increase the efficiency to from 75 to 80 per cent., but the disadvantages of getting the extra efficiency are considered greater than the advantages.

III.

The chief point which rules the efficiency of the propeller is the relation of the "pitch" to the diameter. The diameter should be as great as possible, and the "pitch" about 1¼ times the diameter; this means of course, that, with a given horse-power, the propeller has to run very slowly.

One has to take into consideration the inconvenience and weight of large diameters, and the mechanical troubles of any form of gear when working with a petrol motor, where the power is obtained by a succession of explosions against a moving piston with the result that the crankshaft, and propeller, tend to revolve in a succession of jerks.

The result is that one makes a compromise, in order to attain the best results that the conditions admit. It is in the balancing of these advantages that advancement is to be looked for, rather than in a radical change in the aeroplane propeller itself.

As a matter of fact, any well-designed propeller will have a practical efficiency of about ninety-eight per cent. of that " theoretically possible " under the conditions at which the propeller is set to work; and, as above stated, the theoretically possible is dependent upon what is called the " pitch ratio "—that is, the relation of the pitch to the diameter.

What is known as the " pitch " of a propeller is not easy to describe, except by means of the analogy of the wood screw. If the distance from one thread of an ordinary wood screw, to the next, is a quarter of an inch, the screw will travel into a piece of wood a quarter of an inch when the screw is turned round once, because the wood is solid, and the " pitch " would be one quarter of an inch.

If, instead of screwing into wood, one used some yielding substance, such as soap, and the screw were turned round once, it would push the soap back slightly while it was working itself forward. The amount which the soap was pushed backwards would be called the " slip."

[*Daily Mirror*.

MR. ALEC OGILVIE ON HIS WRIGHT BIPLANE.

[*Daily Mirror*.

MR. ALEC OGILVIE FLYING AT LANARK.

It is quite general to look upon the "slip" as a loss. This, however, is not strictly accurate. If you consider the blade of a propeller as a plane, it will be understood that, if one has to get *any* push, it is necessary that the blade should strike the air at some angle; this angle is known as the "slip angle."

Suppose the propeller blade is made at such an angle that, when it is turned round once, it would travel forward five feet, and if you had moved it forward five feet it would strike the air at no angle at all; but if you moved it forward four feet, it would strike the air at an angle of 1-5th of the angle at which the propeller was made. Therefore, it is the so-called "slip" of the propeller which gives the push when the propeller is travelling through the air.

At starting, of course, the whole angle of the propeller is "slip"; therefore, the push is greater when the aeroplane is stationary than when moving; and, as the propeller moves forward, the angle at which it strikes the air reduces.

Therefore, the power required to turn the propeller decreases, but at the same time the speed of the motor increases. Therefore, the push does not fall off so rapidly as may be imagined.

Some propellers will accelerate as much as 150 revolutions when travelling. The larger the pitch, the greater the acceleration.

IV

Bound up with the question of "slip" is the point of placing the propeller either behind or in front of the aeroplane, If it is placed in front, it works in undisturbed air and has a plentiful supply.

Further, as the air is travelling backwards, it passes partly under the man p lanes, and helps the lift of the machine, especially at starting, when all the push is " slip " ; but, as the plane gathers speed, this falls off to a large extent, as above explained.

If the propeller is placed behind, the air all round about the propeller is travelling in the same direction as the aeroplane, owing to the disturbance, and the propeller, of course, is helped to that extent.

It is a similar case to a ship travelling with a following tide. There is no doubt that the efficiency is slightly greater for the propeller itself; but there is not so much difference as is generally thought, and it is quite easy for several disadvantages of construction to cancel the advantages.

If one can satisfy very aerodynamical consideration, and still keep the propeller behind, by all means do so; but it is not worth while to make any important concessions.

Of course, the propeller behind is a personal convenience to the pilot, although not to so great an extent as is sometimes assumed.

There is another very general mistake. This is that the air enters the propeller from the front side and is, to a large extent, thrown by centrifugal force from the tips of the blades, outwards.

Many patents have been taken out for preventing this, by corrugating the blades, and even placing rings or short tubes for the propeller to work in.

Anyone can appreciate the fallacy of this contention for themselves, by taking an ordinary ventilat-

MR. GRAHAME-WHITE BEING CONGRATULATED IMMEDIATELY AFTER WINNING THE GORDON-BENNETT CUP AT BELMONT PARK.—OCTOBER 29TH, 1910.

FROM RIGHT TO LEFT: MR. GRAHAME-WHITE, MR. ARMSTRONG DREXEL, AND MR. W. E. MACARDLE. (PHOTOGRAPHED IN AMERICA.)

ing fan, as found on office tables. The fan is provided with a wire cage for protection, which is carried round the outside diameter of the fan.

Fasten small silken threads to this wire and start the fan. It will be found that, instead of being blown outwards, as they would be if the air were being thrown out radially they are drawn into the fan.

As a matter of fact, the chief air supply to a propeller is taken in at the blade tips and thrown out parallel with the axle.

This action is very much more defined when the screw is working as a propeller than when it is working as a fan.

V.

If you could make a propeller light enough, of large enough diameter, and run it at a sufficiently slow speed, it is quite possible to get a stationary push of a ton when using only one horse-power; but it would be perfectly useless for flying, on account of the extremely fine pitch which it would be necessary to use. The blade would soon have no angle at all if you moved it forward.

Owing to the fact of the explosions in the cylinders of a petrol motor (above referred to), the power given off from the motor is of an uneven character. This is technically known as the "variation of torque."

Expressed differently, one may say that at one fraction of a revolution the motor is exerting more power than at the other part of the same revolution.

This inconvenience is inherent, but its effect can be counteracted in two ways. Firstly, by allowing a larger number of explosions per revolution, that is to say, by increasing the number of the cylinders; or, secondly, by having something which acts as a "flywheel."

A flywheel is simply a weight travelling in a circular path. Owing to the laws of "momentum" and "inertia," when a weight is moving, it has a desire to keep on moving, and would do so for ever unless something stopped it; and when a weight is at rest it will stop so for ever unless some force moves it.

In other words, a moving weight resists any alterations in its speed. The tendency to go on is called "momentum," while the tendency to stand still is "inertia."

A flywheel counteracts the desire of the motor to turn at different speeds. It is quite possible to have a considerable variation of speed, in the short space of one revolution, even though the motor may be working at 2,000 revolutions in a minute, or thirty-three in a second.

A piston has an extremely busy time of it when a motor is travelling 2,000 revolutions per minute. The piston has to start from a motionless position, get up its maximum speed, and be brought to rest again 4,000 times in a minute. If the stroke is six inches, the maximum speed which it has to obtain is at the rate of 60 feet per second.

It is general to fit no flywheel to an aeroplane motor, because it is thought that the propeller will give the same effect. There is no doubt that the propeller is a "weight travelling in a circular path."

But it is generally made of wood; it has a certain amount of spring; and, undoubtedly, the "uneven torque," combined with the springiness of the wood, sets up a vibration in the propeller, which has been aptly termed the "propeller flutter."

It will readily be seen that, if the propeller is vibrating, as well as revolving, it is equivalent to increasing the thickness of the blade, to the extent of the vibration.

Consequently one is driving through the air a block of wood, instead of a propeller blade of such a shape that the air does not know how big it is—that is to say, of "stream line" form.

There is little doubt that it is this phenomena, or rather the absence of it, which accounts, to a large extent, for the success of the Gnome motor. It will be remembered that the whole of this motor revolves, and that all of its weight is flywheel.

VI

An interesting experiment has been recently made. A propeller which was made for the Gnome motor, and which the Gnome could turn at 1,000 revolutions, was fitted to an eight-cylinder ordinary motor, which will develop 60-h.p.

This motor turned the same propeller at only ten revolutions faster than the Gnome. This is somewhat extraordinary when it is remembered that the Gnome only gives 38 effective horse-power.

A very large proportion of this tremendous difference is accounted for by "propeller flutter." Of course, it is only fair to say that the propeller was designed for a Gnome, and was not quite the same as one would design for a reciprocating engine. But, on the other hand, the Gnome weighs 186 lbs., as against the weight of the other motor—450 lbs!

If a flywheel had been added, the weight would have been further increased by at least 35 lbs. Therefore, there can be no doubt that a horse-power, as given off by a Gnome, is more useful, for driving an aeroplane, than a horse-power given off by any other known reciprocating motor.

It is not thought, by any means, that the Gnome is the last word in aerial motors; but it undoubtedly leads at the present time.

Reliability will no doubt be increased, and the weight diminished per horse-power. The Gnome now weighs 2¼ lbs. per horse-power. It would not be very surprising to see this very considerably reduced in the near future.

Another experiment was tried recently to illustrate "Propeller flutter." Upon a 60-h.p. reciprocating motor two propellers were fitted, one very thick and solid, and the other less solid, but identical as to pitch, diameter, and surface. The motor turned the solid propeller 100 revolutions per minute faster than the lighter one, which, undoubtedly, would "flutter" more than the other.

The blades of a propeller should be considered as a plane travelling through the air in a spiral path; and exactly the same laws apply to it as to the main plane of an aeroplane.

Naturally, allowance has to be made for the fact that it is travelling at a very much greater speed, and that the speed is different all along the blade, on account of its travelling in a smaller circle, and, of course, at the same number of turns per minute.

The tips of a propeller blade are travelling at a speed of over 310 miles per hour, with a diameter of 9 feet, and running at 1,000 revolutions per minute.

The wind pressure, lift, or push, whichever you prefer to call it, on the tips of such a blade is about 250 lbs. per square foot. This is very interesting when one considers that, with present planes, travelling at from 40 to 60 miles per hour, the lift works out at from 2½ lbs. on a Farman, to about 6lbs. on a Bleriot or R.E.P.

This comparison is not put forward as a proof of anything, but simply as an illustration of how the lifting power increases with the speed.

VII

In the present state of airmanship, the difference between a good flyer and a brilliant one is just the question of the care of the motor, and the care of the motor is simply a case of what Carlyle describes as genius—"a transcendent capacity for taking trouble."

The very good motto relating to motor-car engines, "if it is running well, leave it alone," does not apply to aeroplane motors, which should be most carefully cleaned and inspected after every long flight; and the valves should be carefully looked at after every 10 hours' running, whether they want it or not.

The best aeroplane mechanic is the man who finds out faults before they take place, and not he who knows how to remedy them afterwards.

Plenty of men are able to place their hand on a fault at once, and put it right in a very few minutes; but it is only a few who can prevent the occurrence of such faults. When one finds a man like this, he should be kept very jealously; all first-class airmen have such an assistant; or, better still, can do it themselves.

Notwithstanding what has been said about the Gnome motor, there are certain cases where the reciprocating engine is better; for instance, in a school machine, for the simple reason that the speed of the Gnome cannot be varied to any great extent.

In the earlier stages it is a great advantage to be able to reduce the speed of the motor, so that the plane will run about on the ground at a slower speed than that at which it will fly.

With the Gnome motor this can only be done by cutting off the motor, and switching on again rapidly, which, of course, takes a little attention, while the "budding airman" requires the whole of his attention to get used to the strange and new surroundings, and the control of the machine itself. It is, undoubtedly, unwise to learn to fly with a Gnome motor.

VIII

The table given at the end of this section includes most of the better-known aeroplanes. The figures given can only be taken as approximate; this particularly applies to the horse-power which, in most cases, is the rated horse-power of the motor. The

MR. C. COMPTON PATERSON WITH HIS FRIEND, MR. R. A. KING, ON A FARMAN BIPLANE.

[*Daily Mirror.*

MR. HUGH D. ASTLEY IN A MONOPLANE.—AT BROOKLANDS.

actual horse-power is generally less than that stated; but, in some cases, it is greater, depending upon the skill of the various airmen in getting the best out of the motor, and the speed at which the motors turn.

The Gnome, for instance, has been taken at 38 horse-power, which is what it is stated as giving, although it is called a 50 horse-power motor.

The weight lifted per square foot is very interesting; but it is difficult to understand the wide differences of this, until one appreciates that the weight lifted is in proportion to the square of the speed, directly as the angle, and varies also with the camber, or curvature of the plane.

It will be noted that the R.E.P. monoplane has lifted the most per square foot, and the Farman biplane the most per horse-power.

SECTION XI

THE CONSTRUCTIONAL FUTURE OF AEROPLANES

By Mr HENRY FARMAN

Mr Farman, one of the greatest pioneers of aviation, both as an airman, and as a builder of biplanes, discusses in this section, apart from constructional improvements in machines, the methods by which practical flying may be encouraged in the near future.

I

Much has been written about the future of flying. Some views that I have read have been over-enthusiastic; others have been far too pessimistic. It seems, indeed, very difficult for people to adopt anything like a reasonable attitude when they are discussing problems of flight.

As a matter of fact, it seems perfectly clear to me that aviation has advanced in the most reasonable and logical way, and will continue to develop in a sound and practical manner. By the building of machines, and the flying of them, have men learned what they know; and by more flying, and the building of more machines, will their knowledge increase.

Because flying developed with extraordinary rapidity up to a certain point, as it might have been expected to do, many critics have declared that our sounder, although slower, progress during the last few months has spelt something in the nature of a set-back.

It has meant nothing of the sort, of course; at first, with the daily improvement of engines, and of machines, enormously rapid strides were naturally made. Now, however, we have embarked upon a policy for improving our present machines, in what may be called the matter of details, and in devising machines which shall mark the next definite stage in development.

As regards this next step forward in flying, I have no doubt at all, in my own mind, as to what is necessary. Now that engines have been made so reliable, and flights of eight hours have become possible, aeroplanes themselves must be improved.

Improvement will lie, very clearly, in a general simplification in the construction and control of machines. For effecting such improvements, manufacturers have had a very sound indication of what is necessary in the experience gained in the past year's flying.

It is obvious, therefore, that the next step forward in connection with the aeroplane, must be to widen the circle of those who may be relied upon to purchase machines. This can only be done by improving existing machines as regards their safety, practicability, and ease of manipulation.

Progress in this direction will not be difficult. First of all, man's ambition did not lie beyond making a machine fly. Then, following upon these early triumphs, came improvements in the construction of engines, and also in the building of machines. Now, as a natural step further forward, we find it necessary to make aeroplanes more portable, more simple in their method of construction, and as easy as possible in control, so that we may eventually reach the ideal of producing a machine that will be as reliable as a motor-car, and will require no more skill and nerve to fly it than does the driving of a car.

Much has been said, and written recently, about the need of very high speeds. Here, although I agree that, in the future, the aeroplane will almost certainly be developed into a very high-speed craft, I do not altogether coincide with the view that very much greater speeds than are now possible will be necessary in order to fly in high winds.

My own experience, and observation, in this connection, has shown me that the matter of wind flying is one which rests very largely upon the individual skill of pilots. The capacity of present-type machines, in weathering high and gusty winds, when skilfully handled, is not quite well enough understood. It is astonishing what winds it is already possible to fly in, always granting, as I have pointed out, the skill of the pilot who is flying a machine.

Such a biplane as that I build will fly perfectly well in very high winds, provided that the aviator who is in control of it is sufficiently dexterous to handle the machine in the way it should be handled. Very great skill is, of course, required; hence it is that the possibilities of the present-type machine, in this connection, has not been altogether fully revealed.

In the first stages of aviation, it must be remembered, men flew only in calms; they would take no liberties with a new element. Then, as their skill and confidence increased, they began to fly in breezes. Nowadays, skilled aviators are ready to fly in gusty winds. In the future, I consider that the skill of pilots, in this matter of wind flying, will be even more strikingly demonstrated.

In the immediate future, of course, the speed of aeroplanes will be increased very materially, none the less. A distinct and very important line of progress is opened up in this direction.

Much speculation is rife as to the highest speeds that will be attained, during 1911, in connection with the many prize contests in which fast flying will be the chief consideration. Personally, judging from what I know of the possibilities of the situation, I estimate that the maximum speed which will be reached, during the year, will be 150 kilometres an hour.

This will, of course, represent a very important stride forward. But what the limit will be, in this matter of high-speed flying, it is practically impossible to say. So many factors, which one cannot properly estimate at the moment, enter into the problem. That astonishing speeds will be attained, I feel quite sure; but it is not safe to make any definite estimate of the highest rate of speed at which a machine will pass through the air.

But one can, already, see very clearly one of the developments of the future, and a very important one, too. When the perfected aeroplane is an accomplished fact, I have no doubt at all but that its speed, and stability, will enable it to fly successfully in practically any wind, however high and gusty.

What this will mean, in regard to the practical aspects of aeroplaning, it is not necessary for me to emphasise. Opportunities for a commercial use of the aeroplane will then occur in all directions.

Turning to the more immediate future of flight, I can foresee one very useful development. This is as regards passenger-carrying by aeroplane. I am not looking quite so far ahead as the establishment of regular passenger-carrying services between fixed points.

I foresee a very interesting stage which will come before this more practical development. My idea is the organisation of aerial tours by aeroplane. This, I feel sure, will be a novelty of quite the immediate future.

Special aerial tours will, I foresee, be arranged to take place, in favourable weather, and with the idea of visiting the beauty spots of various countries. These tours, besides providing a quite novel and delightful sensation for those taking part in them, will have a very important effect in making the aeroplane popular as a means of transit.

There would be no difficulty at all in arranging such aerial tours as I have described during the coming summer. Long distances could be covered. The beauties of the country below could be seen, by the aeroplane tourist, from a new and altogether charming point of view. As compared to touring in trains, or by means of motor-cars, the aeroplane offers inducements that are in every way preferable.

If such tours were organised, as the first means

[*Daily Mirror.*

MR. GRAHAME-WHITE ON HIS FARMAN BIPLANE.

[*Daily Mirror.*

MR. LATHAM ON HIS ANTOINETTE MONOPLANE.

of indicating what the aeroplane could do as a practical passenger carrier, I am convinced that they would become very popular indeed.

II

Judging the aeroplane from the structural point of view, it is clear that the present methods of building them will be abandoned as further progress is made. I have little doubt but that wood will give way to metal in the construction of machines, and that they will enter upon a stage of much greater strength and solidity. That such improvements will be essential, for regular passenger-carrying machines, and also for very high-speed flying, is quite clear.

Such strength in construction will also, of course, tend to greater safety in flight. Machines will, I am sure, be made exceedingly safe as methods of manufacture, aided by experience, improve. Not only from the structural point of view but, as I have indicated, from the point of view of ease in manipulation, will aeroplanes improve as regards their factor of safety.

In this connection, much misapprehension exists as to the so-called danger of existing aeroplanes. There has been a great deal of exaggeration upon this score. The significance of accidents has been overdrawn; in some quarters a sort of panic followed one or two disasters which happened to occur close upon each other.

One of the great dangers, in flying, lies, in my opinion in the use of what one might call abnormal or " freak " machines. By this I mean that danger lies in the use of such machines as are built specially to attain phenomenally high-speeds, and with all other considerations made subservient to this one object. To fly such machines safely requires very great skill indeed; the element of danger, in using them, is very greatly increased, from several points of view.

And another very decided element of danger lies in the use of machines, by inexperinced aviators, which are not well and safely built. The development of flying has been so rapid, and such a large number of machines, embodying all kinds of ideas, have been constructed—often by people of no great experience—that the risk, owing to the collapse of some part of a machine while in the air, has been very great indeed.

Nothing requires greater experience, and greater skill, than the building of an aeroplane of the type we know to-day. Nothing, either—which is an unfortunate fact—appears, upon the face of it, more easy. Hence the distinct element of danger, to which I have referred, of flying upon machines which are not constructionally sound, and perfectly safe.

While discussing this point, it may be remembered that many inventors declare that the danger in flying, through what one might call " the human element," or the loss of control, or mistake, of a pilot, will be obviated, in the future, by the adoption of some device to give an aeroplane automatic stability while flying.

My experience, however, does not make me at all hopeful on this score. Personally, in fact, I do not believe that any satisfactory device will ever be obtained to give an aeroplane an absolutely automatic stability while it is passing through the air.

Apart from any question of what we may be able to achieve in the future, I regard what danger element that may at present exist in the use of aeroplanes as being due, very largely, to either one of two causes—(1) the use of machines that are not properly built; or (2) the lack of skill on the part of aviators who have not had sufficient flying experience before embarking upon difficult feats.

There is no doubt at all but that the year 1911 will be a very interesting and instructive one as regards the development of the areoplane. Many new ideas will be tested; much will be done to illustrate the practicability of machines; a great many more men will learn to fly. Were I asked to specify what I thought would be the principal developments of the year, I should put them under three heads, as follows:—

1.—That more weight will be successfully carried by aeroplanes.

2.—That machines will be demonstrated to be safer, and generally more practical.

3.—That much higher speeds will be attained through the air.

One must not forget, either, a reference to the aeroplane motor. This will, I am convinced, be improved until it is as reliable as the engines now fitted in motor-cars. Such a stage has, as a matter of fact, almost been reached at the present time.

I have been asked to predict, more than once, the engine-power that I considered would be necessary to attain a speed of 100 miles an hour through the air. But I have preferred to venture no opinion on this score. It would not be safe to do so. So much will, apart from the motor, depend upon the aeroplane.

Many people, looking into the fairly immediate future, apparently hope to see the use of large, passenger-carrying aeroplanes. But here, I think, development will be fairly slow. I certainly do not anticipate seeing any really large, passenger-carrying machines for an appreciable time to come.

What I do think is a very great need of the immediate future is that the donors of prizes—who have helped so much to develop the industry—should give special encouragement to long cross-country flights of all kinds, and particularly that they should encourage flights in the nature of aerial tours over large tracts of country.

In this popularising of cross-country flying, and in demonstrating the practicability of the aeroplane as a means of getting from point to point lies, in my opinion, one of the most important developments of aviation. Many critics of the aeroplane declare that it will be a very long time before it becomes anything like a useful means of transit. But, as a matter of fact, it offers itself already for many uses in this respect.

In my view, existing aeroplanes could be far more used than they are at present as a practical means of transit, were men more accustomed to this new way of getting about, and also were the idea not so prevalent that flying is dangerous.

Therefore it is essential that long, cross-country flights should be encouraged as much as possible. Also, it is time that provision were made for landing places at various centres throughout countries. Sheds need to be erected, and regular aerodromes arranged.

If such improvements as these are made, and cross-country flights are undertaken, as a means of transit, and as a matter of daily occurrence, I am convinced that a highly important step forward will be taken—in a very practical way—to advance the cause of the aeroplane as a rapid and safe means of communication.

SECTION XII

THE FASCINATION OF FLYING

"The task of giving any adequate idea of what the fascination of flying really is proves an extremely difficult one; but that the fascination is there, and is a very potent one indeed, goes almost without saying." —C. G. W.

When it was suggested to me that I should write a brief section upon the fascination of flying, the undertaking appeared, at first sight, to be an easy one. But, when one sets about such a task as this, many difficulties crop up.

"What, really, is the fascination of flying?" The reader, having an idea of the number of aeroplane flights that I have made, will, no doubt, remark: "You, of all people, ought to be able to tell us, without any difficulty, what the sensations are."

But there is, as many other aviators would declare also, a very great difficulty indeed in describing, in an informing way, to those who have not flown, just what one's sensations are when travelling by aeroplane.

The comments of the passengers one carries with one in flights are not very helpful, either. It is an amusing fact that, when they have descended after a

[*Daily Mirror.*

MR. O. C. MORRISON, WHO FLEW FROM BROOKLANDS TO BRIGHTON (40 MILES) ON FEBRUARY 15TH, 1911.

[*Daily Mirror.*

LIEUT. GIBBS'S AEROPLANE BEING TRANSPORTED TO TAKE PART IN THE ARMY MANŒUVRES, 1910.

flight, the majority of people seem entirely incapable of giving anything like a satisfactory impression of what their sensations have been.

Their exclamations, although a sufficient evidence of their general exhilaration, do not convey, to interested earth-folk, any complete picture of the wonders of aerial travel. The remarks of many of my passengers, after flights at meetings and elsewhere, have been in the following vein : " Wonderful ! " " That's splendid ! " " Fine ! "

This inability to describe " what it is like " has led, on more than one occasion, to quite amusing scenes. I remember, once, taking up a very distinguished person, in the early days of flying. For such an individual to brave the perils of an aeroplane flight was, in those days, quite an interesting and important event.

There were, therefore, when he descended, quite a number of newspaper correspondents waiting near the aeroplane sheds to interview my distinguished passenger, in order that they might telegraph to their respective papers a good account of what he considered the chief sensations of passing through the air in a flying machine.

" And what does it feel like, sir, *really* ? " This was the question framed by one correspondent, hoping for something in the nature of a word-picture, as the distinguished passenger was well known for his oratorical powers.

" Ripping ! " was the reply of the aerial voyager, who was still slightly out of breath. A look of disappointment crossed the faces of the journalists. They waited a moment or so, and then tried again.

"Glorious!" was the reply they obtained to another pointed question. This, however, did not satisfy them at all, as may be imagined.

Very politely, but very persistently, they tried for some minutes longer to extract from my passenger a phrase, or a sentence, that would give anything like an illuminating impression of the joys of aeroplane flight. But they could obtain nothing but incoherent expressions of combined wonder and delight. And so they retired, more than a little surprised at their lack of success.

What had happened, in such a case as this, I think, was that the mind of the passenger had received such a strong impression by his altogether unusual experience in rising from the ground, and flying through the air at the rate of 40 miles an hour, that he was, temporarily, quite incapable of forming any sentences that would convey what he actually felt like while he sat behind me in the machine.

More than one passenger I have carried has promised his friends, before setting out on a flight round the aerodrome, that he would make a careful and intentional note of his sensations, in order to be able to tell them, on his return to terra firma, exactly what flying was like. But, in practically every case, his friends have been disappointed. He has looked very perplexed when questions were rained upon him afterwards, and has given replies that have altogether failed to impress his hearers.

One man of a rather humorous turn of mind, I remember, got out of the predicament of being literally pestered with questions by curious acquaintances by declaring: "Well, if you want to know really what it is like being up there, the best thing I can liken it to is to be sitting on a *blanc-mange*. Does that convey anything to you?" Apparently it did, for the questions ceased amid general laughter.

One thing, I think, has an important bearing upon this inability of people to describe their sensations after flying. Most of them start up with pre-conceived notions of what it is going to feel like. Then, when they actually get into the air, they find that it does not feel a bit like what they had imagined. This confuses them; and their minds are in a jumble, more or less, until they get back on the ground again. Then, when they try to remember what they have felt like, they cannot do so, and have to say the first thing that comes into their head.

A motoring friend of mine, after a fairly long flight by aeroplane, the first he had made, was asked by his friends, after his return to the ground, the usual question—"what was it like?"

He gave what I thought was a good reply. "It is very like moving forward in a fast car," he said, "with the important difference that you can feel no road at all beneath you, and that, although you *seem* to be moving very quickly, you have no means of judging that you are, because the ground does not appear to be moving away very quickly below you." When flying at a good height, as a matter of fact, one's progress does appear slow when one glances down at the ground.

Anoher explanation of what the feelings of a passenger are was given, I remember, by a naval man. He, naturally, took an example from the sea, by saying: "The sensation seemed to me very like being on a fast torpedo-boat-destroyer, moving ahead over a perfectly calm sea, and yet with a very slight swell on it every now and then."

One lady passenger whom I carried tried very bravely, and I think very successfully, to describe what her sensations had been during an aerial tour of the flying grounds at an altitude of about a couple of hundred feet.

This is what she said, being, quite excusably, a little excited at the time. "It's like being *suspended* in something, you know. You feel all the time that there's something quite firm and solid beneath you, and yet there isn't, of course. You get tiny little rocks to and fro every now and then. Otherwise, it's just like sliding along on something quite *smooth*. And all the time you feel a steady wind blowing in your face, and the engine makes a big sort of hum that does not seem very loud, and yet it dins in your ears all the time."

Apart from the remarks of people after actually flying, it is quite an education, at a flying demonstration of any kind, to watch the faces of people who see an aeroplane in flight for the first time. Some of them, evidently persons of an imaginative turn of mind, seem moved almost to tears by their appreciation of the wonderful sight which they are seeing.

Others, clearly of an entirely practical and unemotional temperament, look on quite unmoved; and they appear, after quite a little while, as though they were rather bored with the spectacle, and expected the aviator to turn a somersault in the air, or do something equally remarkable.

It is very interesting, in this connection, to compare the demeanour of French and English crowds at a flying meeting; such a comparison reveals, in a striking way, the difference between the temperaments of the two people.

At the first Rheims meeting, for example, the enthusiastic French crowd threw hats into the air, waved handkerchiefs, cheered itself hoarse, and in many cases cried with mingled joy and pride as the aeroplanes flew past.

At the English meetings that followed, on the contrary, there was a little outbreak of cheering occasionally, but, in a general way, the people did not appear anywhere near so moved by a demonstration of the wonders of flights as the Frenchmen had been. Defending the English crowds, a friend of mine remarked that their lack of demonstration did not mean their lack of interest, but was merely characteristic of their greater restraint.

This may be true enough, in a sense; but it is an indisputable fact that, in England, people have not realised the wonderful thing that has been achieved, after centuries of striving, by the actual flights of men in power-driven flying machines. The development of flying, no doubt, required a people with the enthusiasm of the French; hence the outstanding position which France has taken in all matters of aviation.

The fascination of flying, in its most impressive aspects, was, naturally, shown in connection with the very earliest flights. When M. Santos-Dumont first flew at Bagatelle, for example, men could scarcely believe the wonder that they had seen, although the aeroplane made but a wavering flight of a few yards.

And again at Issy-les-Moulineaux, when Mr Henry Farman made his first few flights, those who saw them were altogether overcome, by the significance of the spectacle, when his big, heavy-looking biplane actually raised itself a few feet into the air, and *flew,* after a long run along the ground.

Since then, although it is so short a time ago, flying has become quite an ordinary sort of thing, in the estimation of many people, and it requires a flight of eight hours, or the ascending of a man to a height of more than 10,000 feet, to cause any particular astonishment. This, to my mind, is a striking indication of the blasé days in which we live. A thing is a wonder for five minutes, and then we turn to something else.

But I set myself the task, in writing these notes, to describe, so far as possible, the fascination of actual flights. And I must certainly try to be more explicit than an aviator friend of mine who, when asked to talk about the experience of flying, remarked : "Oh, well, you know, it's such a jolly quick way of getting about."

There is, at the back of one's mind, so to speak, when flying, a sense of power. This may be rather hard for anybody else to understand, but it is there none the less. When you descend from a flight, so far as it is possible to analyse one's feelings, there is a distinct sensation of pride—a sensation of having

[Daily Mirror.

LIEUT. L. D. L. GIBBS ON HIS FARMAN BIPLANE.

MR. GRAHAME-WHITE IN HIS BLERIOT MONOPLANE.

accomplished something that a man might well be proud of.

This is, doubtless, a feeling brought about through the fact that, when you are flying, you have an instinctive realisation that you are achieving something that inventors have striven in vain to achieve for so many generations.

The sense of power, too, comes from the exhilarating feeling you obtain from the smooth thrust forward of your motor, and the knowledge that you are completely in control of the aeroplane. It is a very fine sensation indeed that comes to you when, at the very slightest movement of your controlling lever, you feel the aeroplane respond without an instant's hesitation.

Of course, a great deal of flying, like a great deal of anything else, blunts one's first impressions. But the general feeling of pleasure in the sport remains. I cannot understand anybody becoming *tired,* quickly, of flying. It far exceeds, in exhilaration, any other way of getting from point to point that mankind has yet invented.

Although I have done a great deal of flying, so far as one judges it in this early stage of the sport, I still find it one of my greatest pleasures to go out to the flying ground, and take a turn on one of my machines.

The fascination of flying across country by aeroplane, on a fine summer's day, is one that must be experienced to be realised adequately. Flying is, indeed, so enjoyable, and a passenger experiences so little feeling of danger, even with our experimental machines of to-day, that I feel sure there will be something in the nature of a great "boom" in aviation quite soon, when manufacturers are able to introduce a machine which is a little more simple, and a little more practical, than those we are using now.

Every passenger I have taken for a flight has longed for another. People who have been a little nervous at starting, and have suggested, timidly, that a short flight would be enough for them, have—after we have got into the air—urged me to take them higher and higher. Everybody who is brought into anything like practical touch with flying becomes, at once, keenly enthusiastic about it.

As soon as a suitable machine is evolved I am convinced, therefore, that England will wake up from her somewhat apathetic attitude, and that the aeroplane will enter into a period of great popularity.

SECTION XIII

AERIAL LAW

BY MR ROGER WALLACE, K.C.,
(Chairman of The Royal Aero Club.)

Mr Wallace, in his official position as chairman of the Royal Aero Club, has studied the problems of aerial law with great interest. He holds the wise view that flying must not, in its infancy, be hampered by irksome restrictions.

I

AERIAL Law presents many problems which will have to be solved in the future. Already, however, many rules have been suggested.

The majority of them, framed by practical authorities, deal with international law and require detailed consideration and acceptance by the nations.

A question that arises, immediately this subject is discussed, is the landowner's right of property in the air above his land. This right has, already, been qualified by statute in Germany, Switzerland, and other Continental States.

But in English law the maxim: "Cujus est solum ejus usque ad coelum" applies.

Perhaps, however, as our common law has always managed to adapt itself to the wants of the people, our judges may decide, when damages are claimed for a trespass in the air, in favour of aerial navigation on the ground " De minimis non curat lex."

The legal point remains to be argued. That a landowner's right of property in the air above him will be established in its entirety is not likely.

What is probable is that he will only be able to prevent an aircraft passing over his property if he can prove that it is a nuisance, or does damage by doing so.

Such a famous legal authority as Lord Ellenborough made the pronouncement, a long time ago, that an aviator can wander about in the air as he likes so long as he does no damage to anybody.

However, it is generally agreed that regulations should be framed to meet the contingencies likely to arise in the near future rather than any unwieldy set of laws to govern a state of affairs which may not come about for years hence. And these must be so drawn up that nothing be done to check the development of a science and art which promise to be of immense value to mankind.

Three practical rules have already engaged attention. One is to prevent unnecessary flying over towns. Another is to prevent intentional landings of machines save on aerodromes or other stated spots. A third is to frame rules to be observed by pilots when flying.

I am reminded that wireless telegraphy first drew attention to the national rights in air spaces. It was at a meeting of the Institute of International Law at Ghent, that it was agreed that a State should be able to prevent the passage of wireless messages by means of balloons or aeroplanes.

I shall now review what has been done in connection with the framing of aerial laws. Some of the work has been haphazard; a great deal of it has been tentative; but much useful data has been compiled.

The Hague Conference, sitting in 1899, considered aerial law rather closely. A vote was passed prohibiting aircraft from discharging projectiles or explosives.

At the next Hague Conference the same rule was passed again, but this time some nations, notably Germany, France, and Italy, did not give their consent to it.

Reporting to the Institute of International Law in 1902, M. Paul Fauchille laid down some thirty rules to govern flight. He advocated the freedom of the air, holding that States should only be given such rights as would allow them to protect the public.

He suggested, also, that machines should, if necessary, be made to fly at a certain height.

How fully M. Fauchille went into his subject may be gauged by the fact that he suggested the following rule:—

Crimes committed aboard airships, in whatever part of space they may be, and whether by the crew or anybody else aboard, fall under the jurisdiction of tribunals of the nation to which the airship belongs, whatever be the nationality of the author or victim.

II

At the Ritz Hotel, on January 11th, 1909, the International Aeronautical Federation made a beginning with the discussion of some of the rules that should be made to govern international sporting contests with aeroplanes.

The International Aeronautical Congress at Nancy, in the same year, discussed a proposal to restrict aerial traffic of every description to fixed routes.

This was, however, abandoned in favour of a proposal forbidding the landing of airships and aeroplanes except at certain points to be determined by considerations of public safety.

The subject was considered to be so highly complex at this period that one well-known authority remarked: "Only actual warfare will reveal what abuses are to be checked."

Germany has taken a most practical interest in the matter of aerial law. General von Stieber, addressing the German Air Fleet League in March, 1910, called for strict State supervision of passenger air traffic, and outlined rules for the control of aerial navigation with a view to the prevention of espionage.

General von Stieber gave it to be understood that Germany would seek to forbid airship lines passing over any of the German fortresses.

In March, 1910, also, Herr Kopken, of the Prussian Ministry of Justice, outlined a number of points that he recommended for the consideration of legal authorities.

[*Daily Mirror.*

M. AUDEMARS IN HIS "DEMOISELLE" MONOPLANE, PREPARING FOR A FLIGHT.

[*Daily Mirror.*

M. AUDEMARS IN FLIGHT ON THE "DEMOISELLE" MONOPLANE AT BOURNEMOUTH, 1910.

These he enumerated as follows :—

1.—The frontier rights of nations.

2.—Private property rights as affected by unpremeditated landings.

3.—Damage caused by the discharge of ballast from airships.

4.—Aerial areas in which it will be illegal to navigate.

5.—Precautions for the protection of airship and aeroplane passengers.

The Committee of the French Aero Club, meeting in March, 1910, gave lengthy and detailed consideration to aerial law-making.

They decided that all aerial craft passing each other should do so on the right. They agreed that aeroplanes, when in flight, should give way to dirigibles.

Towns must not, they held, be flown over unless with special permission. Aircraft must, in the future, they affirmed, bear license numbers in large characters. Tall buildings should at night, they recommended, carry lights.

They also suggested that the names of villages should be painted on the roofs of railway stations for the guidance of aircraft.

Furthermore, discussing night travel through the air, the Committee decided that an aeroplane must have a green light on the right hand and a red one on the left, and a white one in front, low down, and shining downwards.

III

Then followed the most important conference that has, as yet, taken place. I refer to the International Conference on aerial rights, held in Paris from May 18th to June 29th, 1910, at the instance of the French authorities.

The British delegates were :—Rear-Admiral Sir Douglas Gamble, Captain Murray Sueter, Lieutenant-Colonel Macdonogh, Captain A. J. G. Chalmers, Mr W. Byrne, and Mr H. B. Butler.

Although inconclusive, the Conference was most interesting in regard to the extent of the ground traversed.

The points that were raised at the Conference by the representatives of the many countries which attended it, I have summarised below :—

That aircraft should carry identification marks easily recognisable at a distance.

That there should be a national register of airships, containing details of the construction of all craft, with particulars of the distinguishing marks on the machine, and the owner's nationality.

That nations should exchange lists of aircraft.

That, when flying, airships should carry certificates of nationality, and also navigation certificates, and that there should be special tests for the latter.

That pilots, chief engineers, and others, must have certificates of competence.

That one country should allow the airships of another to fly over its territory with reservations regarding the safety of the inhabitants.

That air traffic should be prohibited in certain zones.

That nations should exchange lists of "danger zones."

That aircraft should make signals of distress when obliged to descend in danger zones.

That there should be a code of signals between earth and air, such as horns by day, and lights by night.

That each aircraft should keep a log while flying, giving course, altitude attained, number of passengers carried, etc.

That each country should have full Customs supervision, and that aircraft on an international voyage should alight when required at spots indicated by the Customs.

That wreckage of airships or aeroplanes should be restored to the owner, providing he can identify it, but that he must pay 5 per cent. of its value, and also the finder's expenses.

That airships temporarily coming to rest in a foreign country shall be exempt from any duty.

That there shall be no duty on provisions or working materials.

That passengers' luggage shall be allowed, by the Customs, and treated as if it had come by sea or land.

That the State may seize photographic apparatus.

That an airship on an international voyage must notify to the authorities its departure and arrival.

That wireless apparatus must not be used by aircraft except for purposes of safety.

That military airships must not land in foreign countries without permission.

That each country shall be allowed to regulate the passing of foreign airships over its territory.

It is interesting to record the fact that M. Bleriot, among others, was called before the Conference as a practical authority.

He voiced the opinion, among other suggestions, that an aeroplane should always give way to an airship when meeting one in flight.

The Conference was adjourned, with the intention of meeting again in November of the same year. But, instead, it was suddenly decided to adjourn it *sine die*.

It was generally understood that there were strategical and geographical reasons for differences of opinion between the representatives of the Powers. On some hands, it was understood, the desire was expressed to retain the right to close frontiers against aerial vessels when it was thought fit. This view did not, however, meet with general acceptance—or so, at any rate, it was stated.

IV

In June, 1910, an action was brought in the Paris courts against a monoplane pilot who had run among the people at an exhibition of flying.

It was decided that, although the machine had swerved, the aviator was not responsible, as it was not proved definitely whether the accident was due to his carelessness or the action of the wind.

This case is interesting, as an instance of aerial law actually in application.

Some careful observations upon legal problems as affecting flying were made by Dr H. T. Hazeltine, reader in English law at Cambridge, in a series of lectures delivered at King's College, in December, 1910.

He took the view that a State should have full dominion in the air space above its territory, and territorial waters.

He contended, also, that the nationality of an air-vessel should be the same as the nationality of its owner, rather than be determined by the domicile of its owner.

The question of the freedom of the high seas is often quoted in connection with laws of the air. The high seas are certainly free, but it is not considered reasonable, in view of the laws of gravitation, that the air should be entirely free also.

A shipwrecked sailor, according to law, can land on any shore. His right, on account of his extremity, is greater than that of the owner of the shore, who might seek to prevent his landing.

This point is used to raise the claim that an aviator in distress should also be able to land anywhere when it becomes a question of his personal safety.

Many responsible authorities have suggested that, when aeroplane flights become of common occurrence, a fixed fee should be charged the pilots for descents made on private land.

It is generally agreed that, if negligent in making a landing, an aviator should be held responsible for any damage caused. But many points have been raised as to whether a pilot should be held responsible for damage, should his machine get out of control.

In this connection, the case is cited of the owner of a bolting horse, who was exonerated from liability for a collision with another vehicle.

The German Civil Code states that a landowner, although owning the entire air space above his land, cannot object to the passage of aerial craft across his property in cases where such passage does not interfere in any way with his proper and legitimate interests.

The German police authorities hold that flights made over towns endanger the security of the inhabitants. For any such flights, a fine of £3 is imposed. Unnecessary flying over towns is also discouraged by the Royal Aero Club of the United Kingdom.

So as to gain a complete control over aerial traffic, Germany proposes only to sanction the use of private airships on her territory by the issue of special licenses.

Many questions have been raised as to aeroplanes becoming " nuisances." It is held if they flew low over towns they would become nuisances.

Also, if they made landings on highways, they would be accused of obstruction. An aviator is indeed technically a trespasser save when landing on his own property.

That an aeroplane, flying low, may be said to endanger the privacy of individuals on the land below has been contended on several occasions. More than one legal expert has argued that a man might

[*Daily Mirror.*
MR. RADLEY WITH HIS BLERIOT MONOPLANE.

[*Daily Mirror.*
MR. RADLEY IN FLIGHT ON HIS BLERIOT MONOPLANE.

declare that an aeroplane flying low over his garden annoyed him to the extent of giving him a right to take legal action against the aviator.

Regarding the question as to the use of the air by aeroplanes, I am reminded of a case concerning a swing bridge which occurred at Cleveland, Ohio.

In this instance, the bridge passed through the air at a height of some 30 feet over private land. The constructors of the bridge were called upon to purchase the right of the air through which the bridge passed.

Already, leagues and societies have been formed to put restrictions upon aviators. In one instance in Paris, a league was formed to guard against "Excess in Aviation."

Some of the rules suggested by this league were that no aeroplane should fly a speed more than 20 miles an hour; that descents on military territory, or cultivated land, or on pleasure grounds should be prohibited; and that aeroplanes should be taxed at a tariff of 1-10th of a penny per square centimetre of their surface.

It is by good government, however, that any public outcries against aviation are to be prevented.

V

It is generally conceded that a landowner might object to the use of the air over his land if he happened to be near a flying school, and machines were continually passing over his property.

As a safeguard against any action on this score several of the proprietors of flying schools have obtained permission from landowners to fly over their property.

This point makes it interesting to refer to a case, actually brought in the French courts against a well-known aviator who had established a flying school in an agricultural part of France.

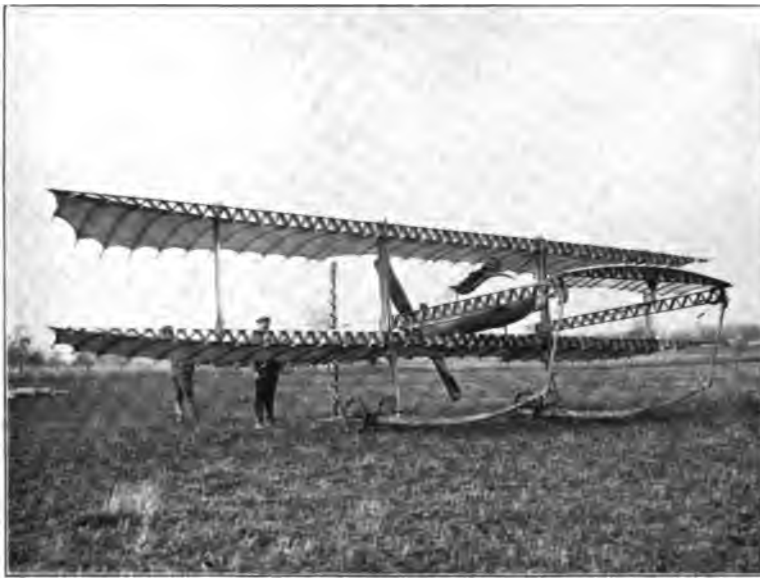
Several of the landowners near by sought to obtain an injunction against him, stating that the constant passing of aeroplanes over their houses disturbed their privacy, that the noise of the engines frightened their game, and that the labourers on their farms neglected their work in order to see the aeroplanes fly over their heads. At the time of writing, I cannot say how this case has gone.

At the Blackpool flying meeting in 1910, a lady sought to obtain damages from the proprietors of the meeting on the ground that a splash of oil had descended from one of the machines in flight, and had ruined a cloak she was wearing.

But the lady was proved to have been seated in a carriage on a public road, outside the aerodrome, when the splash of oil fell. Therefore, the proprietors of the meeting did not hold themselves responsible. Nobody could find out, either, who the pilot was from whose engine the oil had fallen.

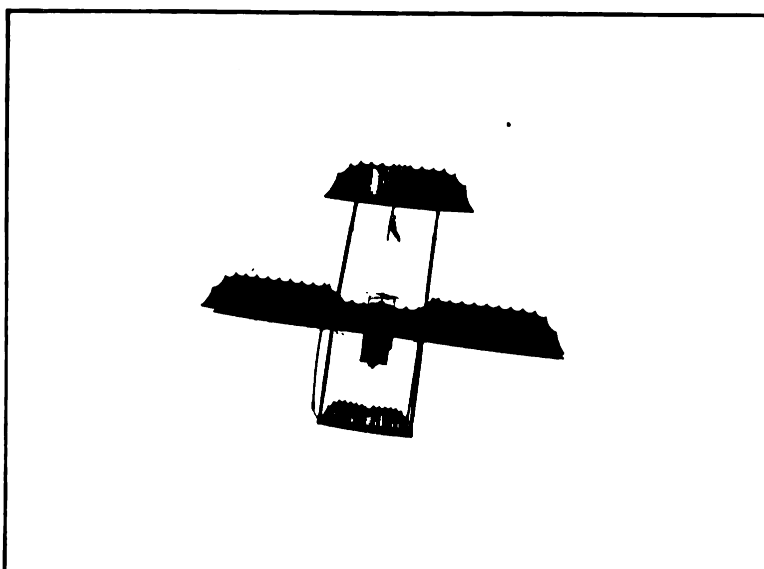
Upon the point of trespass, I may append an interesting note written by Mr H. G. Meyer, in the *Law Magazine* of November, 1910. Mr Meyer states :—

"To constitute trespass, which may be defined as the wrongful entry upon or the interference with the possession of the land of another person, proof of entry, either actual or constructive, is necessary.



[*Topical Press.*

THE PORTABLE MILITARY TYPE BIPLANE, DESIGNED BY M. LOUIS PAULHAN OF WHICH THE WAR OFFICE PURCHASED A MODEL.



[*Topical Press.*

THE PAULHAN BIPLANE IN FULL FLIGHT, PASSING DIRECTLY OVERHEAD.

Constructive entry includes every interference or entry other than actual or physical entry, and it is submitted that, on the existing authorities, the flight by an aviator over the land of another without alighting is a constructive entry and constitutes an act of trespass. There seems every reason to support the proposition that the mere flight over a person's ground is an act of trespass, and that the action would lie against the offending aviator."

Mr Meyer also discusses what force a landowner might use to "remove" an offending airman. Mr Meyer says :—

"It is not easy to see how the owner could enforce his right, except by shooting at the aeroplane with the object of frightening the aviator away, or of winging his machine, and compelling him to descend; and the question at once arises, would the owner be committing an illegal act, and what would be his liability if the aviator were injured or killed?"

Fortunately, when one regards the legal problems of aerial traffic seriously, it is quite evident that there need be no friction between those who use the air, and those who remain on the land.

All that it is necessary to do is to frame wise rules, as the number of aircraft grows, and to prevent the aeroplane becoming in any way a "nuisance," or a source of danger to the public.

As regards the international aspect of flying, I think enough suggestions have already been made to enable the nations to frame a very comprehensive set of rules.

The real difficulty is however, that their respective interests clash, and prevent agreement.

SECTION XIV

THE FUTURE OF FLYING

BY M. LOUIS PAULHAN

M. Paulhan, one of the world's most famous flyers, will be chiefly remembered in England as the winner of the *Daily Mail* £10,000 prize for the flight from London to Manchester.

With additional notes by MR MERVYN O'GORMAN, MR J. T. C. MOORE-BRABAZON, MR S. F. CODY, MR F. K. MCCLEAN, MR A. V. ROE, and MR V. KER-SEYMER.

I

ONE of the most dangerous things to do in flying matters is to set up as a prophet. Men who have done so, have lived to regret it. Something they have said is generally remembered at an inconvenient moment, particularly when it has been proved to be wrong.

Someone was ready, I am told, to bet the sum of a million pounds that the flight from London to Manchester would never be made by aeroplane. But it was made—as I have reason to know.

Another prophet, who has had rather an unhappy time since, took upon himself to declare that no aeroplane would ever rise higher than 5,000 feet. Some people were willing to agree with him, seeing that, at the time he was speaking, the greatest height attained was a matter of 500 feet.

But he has lived to be proved entirely wrong. Already, the record stands at something over 11,000 feet, and this record may probably be beaten at any time.

So there is no doubt that the prophet in matters of flight has an unfortunate time, as a rule. I was not placed in a happy frame of mind, I must confess, when I was asked to say something about the future of aviation in order that it might be published in this book.

"Whatever you say," a friend told me, "you will be accused either of exaggerating, or of not saying enough."

But when I studied the questions that had been put to me, it occurred to me that nobody who is concerned in flying should be afraid of his own opinions.

People expect a man who is an aviator to know what he is talking about. When he is asked whether a certain thing is likely to happen or not, he should be ready to say "Yes," or "No," giving it as his honest opinion, of course.

It does not follow that such a thing is going to happen, but it shows that he has the courage of his conviction. If aviators, and the manufacturers of aeroplanes, are afraid to say anything about the future, because they do not know whether what they say is likely to happen or not, the people who want to know will declare that there cannot be much in it, or these men would know.

This reflection made me go into the matters put to me much more readily. I felt that it was a case of doing my duty towards the flying movement. The first question I find that I have to answer is this :—

What do you yourself consider will be the next important development in connection with the aeroplane?

To this, I have very little hesitation in giving a reply. Recent work in France has made the immediate future of the aeroplane pretty clear.

I see no reason at all to doubt but that the use of aeroplanes for military purposes on land, and for naval work at sea, will be the next definite and practical advance which will be made.

Already, in the French manœuvres, the aeroplane has shown what it can do. The trials of specially built machines for military work, which are to take place in France in the Autumn of 1911, will show some astonishing results, I can foresee.

The use of machines at sea is likely to be a development of the near future. Already, ships are being built from the decks of which an aeroplane can rise, and to which it can return again after a flight. This will mean a good deal of experiment, of course, before such a system is made perfect. But I am quite sure that both armies and navies will make regular use of the aeroplane.

The next question put to me is :—

Will it be possible to run a machine reliably with one motor, or will several be necessary?

This question raises a point that has been widely discussed by the makers of aeroplanes, and the pilots of machines. In considering it, I think people should remember that engines have already become very reliable. The reliability will be increased during 1911.

The aeroplane engine will, I am convinced, be

MR. GRAHAME-WHITE'S BLERIOT MONOPLANE BEING HELD BACK, PREPARATORY TO THE START FOR A FLIGHT.

made as reliable as that of the motor-car. There is no doubt about this. There will not, therefore, be urgent need to have two engines on a machine, or perhaps more. But I think, all the same, that aeroplanes will be built which will have more than one engine to propel them.

My third question raises a very interesting point. The query is :—

> Do you think that very high speeds will be necessary, in the future, to give a machine power to fly in a high wind?

My reply, as a practical aviator, is certainly that high speeds will be required, if anything in the nature of a high wind is to be overcome. One's experience, when flying, tells one this. I have seen it contended that high speed will not be of use in battling with contrary wind gusts. All I can say, however, is that flying shows one that speed is of the utmost assistance in giving a machine stability when in gusty winds.

This leads me to a very difficult question to answer, off-hand. It is :—

> What do you think will be the maximum speed that it will be possible to attain through the air?

The difficulties of answering this question are many. One does not know what machines we may have in the future. It is possible, as many friends tell me who are well qualified to speak, that an engine giving more power for its weight than does the present form of petrol motor, will be invented New types of planes may be brought out. A great many things may, indeed, happen.

But, so far as I can see, the fairly immediate future is this. We shall certainly see speeds through the air of from 100 to 150 kilometres an hour.

This answer, of course, needs acceptance with some reserve. Much depends on what propulsive force we may attain. But it will, I think, give a very fair indication of what I think will be done in the very near future.

A much higher estimate has, I know, been made. This may make my figures appear low. But I have in mind what may be expected to be done, within a reasonable time, in the way of high speed flying.

The question of fast flying suggests, naturally, another question—that of combating wind gusts. I was, therefore, prepared for the next question which is asked me. It is :—

> What speed do you think an aeroplane will have to attain before it is independent of any adverse winds?

In making a reply to this, I do not think I can do better than form an opinion from my experience in wind flying when piloting various machines.

It seems to me that if we are able to get a speed of 150 kilometres an hour we shall be able to fly in practically any high wind. This must not, of course, be taken as too definite a statement.

In gales the air will probably not be navigable even with speeds such as this. But when we can fly at 150 kilometres an hour we shall be able to fly on practically any day of the year. This will, of course, make a very great difference to aviation.

II

Many time I have been asked to foreshadow upon what structural lines the aeroplane will proceed. A similar question, addressed to me now, places me in a difficulty. At the moment, having regard to the stage of development which the aeroplane has reached, it would be unwise—in fact, it would be almost impossible—to make a safe prediction as to what lines we shall be working on say a year hence.

So many things may happen to change methods of construction. The best and most reasonable answer to any question such as this is to say: "The lines upon which the aeroplane will perfect itself must be governed by our experience, and nothing else." Such a reply may be disappointing, but it is the only feasible one.

Much discussion is taking place in the aviation world as to what developments are likely to be noted before anything approaching a perfect machine is evolved.

Personally, in regard to this question, I can give a very definite expression of opinion. In my view, judging from my experience as a pilot, and also as a constructor, I see one prime difficulty in the path of progress.

That difficulty is the obtaining of sufficiently high speeds through the air. If this difficulty, and some attendant difficulties, can be solved, then I think our forward progress will be rapid.

Who will be the next purchasers of machines,

> apart from governments, and pilots seeking to win prizes?

This question is of great importance. Makers must have a market for their machines. As aeroplanes become more reliable, the field of sale is sure to be increased. Flying is the most exhilarating and delightful amusement that man can follow.

I see a definite market for aeroplanes among rich travellers. The aeroplane will afford them a new amusement and, once enjoying its fascination, they will become enthusiastic.

There will be a large number of people also who will be eager—when a more perfect machine is at hand—to make pleasure voyages through the air. In both these directions, the aeroplane of the future will be provided with a very valuable trade development.

In the consideration of the machine which will, in the future, become a regular pleasure craft of the air, one is brought to another question rather more definite than the previous one, and certainly more difficult to answer. This question is :—

> What will be the features of the machine that the wealthy motorist will buy, in the same way as he now purchases a car?

Here, although one can do more than speculate, it is scarcely safe to make any predictions.

What comes into my mind, however, is that the wealthy man's aeroplane will be very much more comfortable than are the machines upon which we fly to-day.

I foresee that such a perfected aircraft will have a closed and very carefully suspended body, so that

A PORTION OF MR. GRAHAME-WHITE'S FLYING SCHOOL AT HENDON. IN THE PHOTOGRAPH A DAMAGED MACHINE IS BEING REPAIRED.

the travellers in it may be protected from the rush of the wind, and may also be free from any shock or vibration when the machine starts or finishes a flight.

Undoubtably, too, the rich man's aeroplane will be nicely lighted, so that, when he makes a night flight—such flights will become common in the future—he will be able to see to read.

More important still, perhaps, will be the means taken to provide for the comfort of passengers in the way of heating aeroplanes.

It is very cold work rushing through the air at a high speed. Therefore, there is no doubt but that the bodies of the perfected aeroplanes, such as I am describing, will be very carefully heated by artificial means. These are merely suggestions that come to my mind.

In regard to the next question I am asked, my answer will, I have no doubt, provoke criticism from those who have not so great a belief in the future of flying as I have. The question I am asked is :—

> In your view, will flying be ever made sufficiently safe for ordinary individuals to buy, and fly, machines?

To this question, I am able to give an answer that is definite and emphatic. It is, "Yes." I have, indeed, no doubt at all upon this subject. The progress that was made in the past, the progress that we are making now, and the progress that the future now promises all lead me to feel perfectly confident as to the future.

Already, under proper conditions, flying is safe.

The machines we are using to-day are admittedly experimental. As they improve, as they promise to do, the factor of safety will naturally be increased. Air traffic will not, I am quite sure, present any great dangers when the perfected aeroplane is to hand.

Reference to the aeroplane of the future leads me to the question which is now asked me :—

> How long do you think it will be before a machine sufficiently safe for ordinary use is evolved ?

Here, naturally, I cannot be as definite as I have been before. Such a machine may, for all we know, be arrived at before the end of 1911. But I scarcely think so.

What I do think, however, is that we shall be in possession of such a machine before the end of the year 1915.

One is led to make such a prophecy after a consideration of the practical difficulties which lie in the way of the building of such a machine.

Although I have given the year 1915 as a limit, I think we shall have a thoroughly practical and useful machine some time before that date.

III

Questions affecting the construction of aeroplanes in the future are invariably difficult to answer, because one is not sure upon what lines construction will develop. Thus, one is embarrassed by such a question as is next put to me. It is :—

How do you foresee the aeroplane being used first as a passenger-carrying machine?

This opens up possibilities of construction which are very difficult to concentrate in the direction of a comprehensive reply.

Personally, although one cannot help being vague in such a direction as this, I can foresee myself that the passengers in an aeroplane which represents the first of its kind will be grouped together in the centre of the machine.

They will, in fact, be seated as though in a carriage. This machine which I have in mind, does not represent a finished product by any means. It represents such an early-type passenger machine as will carry perhaps half a dozen people from point to point.

The question of the commercial outlook of the aeroplane is always a very interesting one. People are prone to ask one rather difficult questions in this regard. I am not surprised, therefore, to be asked to reply to a query such as is appended :—

Do you think that the aeroplane can ever be employed as a carrier of merchandise?

Such a question as this is certainly of interest to the great majority of people, who are not much engrossed in the sporting or military aspects of flying, but who like to be told when the aeroplane may become of everyday use.

Personally, I do not think that the aeroplane is likely to be used as a general carrier of goods. In this respect land transit will, I believe, hold its own.

One very clear opening that I see for the practical employment of aeroplanes lies in regard to the carrying of mails. In this field I calculate that machines will be engaged in quite a short time.

For carrying mails over difficult or inaccessible country, the aeroplane should be of very great use. There is no reason, either, why the aeroplane should not be utilised as a means of conveying valuables from point to point. Here, as a rule, speed is of importance, and the question of cost is not a vital one.

In the next question addressed to me, I am asked to make a very definite statement indeed. I am asked :—

> Do you calculate that the aeroplane will always remain small—like the motor-car—or do you see the day coming when large passenger-carrying machines will be used?

Here, it is evident, the prophet is treading on dangerous ground. Exactly what size aeroplanes will eventually attain, depends upon many circumstances.

What I can do, however, is to glance into the fairly immediate future. If I do this, I can answer that I consider aeroplanes will remain medium sized for a fairly considerable time to come. When I say medium sized, I mean that I reckon that no machine will be built in the immediate future with a passenger-carrying capacity greater than that for a dozen travellers.

One of the ambitions of enthusiasts in regard to aviation has been the crossing of the Atlantic by aeroplane. Regarding it, many prophecies and predictions have been made.

The late Mr John B. Moisant, I remember, gave it out that he thought this great flight would be accomplished within five years of the time at which he was speaking—the summer of 1910.

I now find that I have the question before me as to when I think the flight will be possible. I do not care, as may be imagined, to make any very conclusive answer. So much depends on how we go ahead during the year 1911.

But I do think that the Atlantic will be crossed by an aeroplane in a few years time. When I say this I think I am indicating the confidence that I have in the immediate future, because such a feat will require a very remarkable machine to perform it.

Many experts have been perplexing themselves recently in regard to the way in which an aeroplane of a large size will ascend and descend. To the question which is addressed to me on this point I am afraid I cannot formulate anything satisfactory in the way of a reply. So very much depends upon the experiments that will have to be made with passenger-carrying machines that all one can answer is that the precise form of landing chassis employed in a large machine, will have to be determined as a result of these exhaustive tests.

A question which has a relation to this problem can, however, be answered without trouble. The question is :—

> Will the very large aeroplane move on wheels, or will it be launched from a special slipway?

My reply to this is, that I consider, even with a very large machine, that wheels will be employed. The idea, in connection with the slipway, is that a machine should glide down a prepared track, until it has attained sufficient speed to rise into the air. But to this system, unless extremely large vessels are under consideration, there are many disadvantages.

IV

Some enthusiastic people, when talking of the future of flying, are apt to go rather too far in their hopeful phophecies. Many of these enthusiasts would, I think, answer in the affirmative, the next question that comes before me; but I shall reply distinctly in the negative. The question is :—

> Can you foresee the time when, both for passenger-carrying and goods traffic, the aeroplane will oust all land methods of communication?

I am afraid, although no one is more keenly interested in the future of flying than I am, that I cannot see such a result being attained. That there will be very great advances made goes without saying, of course. But I cannot see the aeroplane ousting land traffic altogether in regard to passenger-carrying and the carrying of merchandise.

Much divergence of opinion exists as to whether the aeroplane will go ahead, from now onwards, with very rapid strides, or whether the advance will be retarded. This question is summarised in the following query, which is the next one addressed to me :—

> Is progress during the next few years likely to be slow, or will it be rapid?

In my opinion, judging by present conditions, progress will be somewhat slow for a little time to come. During the years 1909 and 1910 the industry went ahead at quite a phenomenal rate.

Now we have arrived, not at what one can call a check, but a breathing space. I do not wish it to be assumed, from what I have said, that the development of the aeroplane is likely to stand still.

What I mean is that, following upon the very rapid strides that have been made just recently, we shall go ahead less surprisingly. But progress will be made, none the less.

The next question addressed to be is rather a remarkable one. It is :—

> Is there, in your opinion, likely to be any more risk in flying a perfected aeroplane than in travelling in an express train?

This, of course, means looking ahead a good deal. But, from my estimate of what will be done with aeroplanes in the future, I should say that there will, ultimately, be more actual risk in travelling in a very fast train than in passing through the air in the most approved type of passenger-carrying aeroplane.

After having made this observation, it is not difficult for me to find an answer for the following question :—

> Are you yourself absolutely confident that the aeroplane will so improve itself as to become of practical value as a means of rapid transit?

To this inquiry, I have no hesitation at all in answering " Yes." But when I am asked to particularise upon this point, my task becomes more difficult. Thus, one might be expected to hesitate in formulating any reply to such a question as is appended :—

> How long do you think it will be before the world see the first aeroplane passenger service established, and running regularly between cities?

Although I may be proved to be wrong, and although it may be somewhat unwise to make any prophecy at all in such a matter, I shall say that I expect to see such regular passenger services through the air, as are mentioned in the question, in regular operation when we reach the year 1920.

I am now led to the consideration of a very ambitious question. It is contained in the following words :—

> What will the passenger-carrying aeroplane be like? Will its body resemble that of a ship or of a motor-car? How will it be controlled? Will one man operate the elevating and balancing levers? Will its stability, even in a wind, be automatic?

I have thought this question out as carefully as one may, in view of what we know to-day. I imagine that the passenger-carrying machine, such as is indicated, will have a boat-shaped car body.

One man will be at the helm of the aeroplane. I am quite certain that the stability of such a large machine will be automatic. Other considerations suggest themselves, of course, but it is scarcely wise to go any further into such a doubtful problem as this.

I am now asked a much simpler question. It is :—

> Will the perfected aeroplane, when it has been evolved, be cheaper than the present type motor-cars?

An aeroplane to carry, say four people will, in my opinion, be purchasable at the same price one now pays for a motor-car of similar capacity.

This introduces another question on similar lines. It is as follows :—

> Will the aeroplane of the future be more economical to run than a motor-car?

To this I have no hesitation in answering "Yes." My reason for making this answer is as follows: On the aeroplane there will be no wear of pneumatic tyres, and there will, in addition, be no question of the upkeep of roads.

A striking question comes next. It is :—

> What are the conclusions, to which you have come, which make you confident that the aeroplane will open up a new era in the world's history?

My reply to this is not a long one. Man has already achieved a partial triumph over the air—an element occupying immense space. When he has made this partial victory a complete one, the world will find that it has, in the air, a swift and sure means of transit.

The next question that is put to me concerns, again, the question of the aeroplane and the motor-car. It is :—

> Do you think the development of the aeroplane

has been more rapid than that of the motor-car?

One need not hesitate in answering this question. My reply, most assuredly, is "Yes"; and this brings me to the last point with which I am asked to deal. It is contained in the words:—

Commercially, do you think the aeroplane will open us as big a field as the motor-car has done?

My answer to this is that, in my view, the commercial field which will be opened up by the aeroplane will be much more important than was that produced by the motor-car.

[*Appended are the notes by the other contributors on the subject.*]

I

MR MERVYN O'GORMAN

Superintendent of the Government Balloon Factory at South Farnborough

Although, from the commercial point of view, I see no prospect of large aeroplanes, carrying large numbers of passengers, competing either in price, convenience, safety or even in speed, with trains, I do, however, anticipate that aircraft of one kind or another will, within the lives of the younger airmen, convey considerable numbers, say ten or twenty persons, under those conditions which warrant the taking of a certain measure of risk. Foremost amongst them is war.

As regards commerce, there are doubtless parts of the globe about which it will eventually be possible to predict with certainty either (a) the absence of wind or (b) the absence of turbulent or gusty wind for appreciable periods consecutively.

If such quiescent or orderly region of air exist over fairly level land, as is probable, and also if such lands be connected by seas over which the air is reasonably orderly, the limitations which we are apt to put upon the future flying in England (whether by airship, which is by far the more important, or by aeroplane, which is for the moment the more advertised method of progression) will be locally (for such places) removed in an extraordinary degree, and all the ordinary phrophecies as to progress utterly eclipsed.

In my opinion, meteorology, elaborately organised and extending to the study of vertical air movements the same or even greater attention than has hitherto been devoted to horizontal air currents, is the one great study in which progress must be made for such results to be attained.

Endowments are required for this, and owing to the unsensational character of the work, money for such purposes is not easily raised, though it may prove to be, to a people scattered over the earth as the British are, remunerative in the long run.

As regards the elimination of danger from flying, the time is very near when the breakage of a part of the machine in the air will be a very rare matter indeed and no aeroplane that cannot plane easily and steadily at a reasonable angle will be accepted by any buyer.

Danger when flying mostly arises from four causes, over and above the errors which the pilot makes simply through lack of experience.

(*a*) The breakage of a part which either supports or guides the machine under any load including such abnormal efforts as the pilot may cause when making a mistake of movement.

(*b*) The necessity for alighting at a high speed of travel.

(*c*) The unexpected disappearance of the support on which the machine rides—the air, especially by a local down rush such as may affect one wing only, or the equivalent of a down rush, viz., the overtaking of the machine by a following wind which may move forward " solid " at more than the machine speed.

(*d*) The failure of the motor power at a time when the air and land conditions make it essential that the machine shall not attempt to alight.

The removal of the first danger is nearing fulfilment and will be complete within the decade.

The removal of the second danger will probably never be complete till the matter of landing places is seriously taken up—and large stretches some 400 yards in diameter at least, with no ditches and fairly level, are formed in various parts of the country as aeronautic bases.

Then it will be possible for an airman to fly at such a height that one of these landing bases will always be within the circle which his height commands by planing down. Without here entering into the why and wherefore, this involves the current use of engines having a large reserve of power and of aeroplanes with small gliding angles. I see no scientific or mechanical reason against the early attainment of both these desiderata—and expect that the reserve of power used for steep rising will be continued in the shape of a duplicate engine.

The third danger will disappear but slowly and depends on the perfect charting of air movements. *Nemo repente turpissimus*: Not even the air suddenly becomes wicked. Hence the airman will, we hope, be able from the forecasts or the winds to know that the space he is flying into will not, for some hours, be the scene of a cyclonic, or turbulent movement.

Having this knowledge correctly he need run no risk. Even if he starts in a swift horizontal wind, he need not be in danger, provided he knows what class of land configuration turns such a wind into an enemy on alighting. I do not think there is much accumulated lore on this subject which has, as yet, been made public by any government possessing it, even to a limited degree.

The removal of the fourth danger depends like the first upon the solution of a problem which is simply mechanical, and therefore quite sure of being found within much the same time interval as was needed to perfect the steam locomotive, the motor-car, or the submarine. I do not think it will be necessary for the user to be a mechanic, but the most punctilious attention will be required to the simple action of tank filling—keeping water out of the petrol and off the electric gear—listening to all unwonted noises by which wear is disclosed, etc.

For this last reason alone there is no doubt but that the engine will have to be silenced and the airman shielded from the wind, two steps which are entirely foreign to any airman's present day statement of first essentials for safety.

II

Mr J. T. C. MOORE-BRABAZON

I do not think a large, passenger-carrying aeroplane, faster than trains or steamers, is already in view in this country owing to the high speed of the average winds, which is 20 miles an hour.

From the sporting point of view, one can obtain an aeroplane now which can be handled, easily, by a motorist of experience. The future of the aeroplane, from a utilitarian point of view, so far as England is concerned, is, to my mind, small.

I think danger will be eliminated from flying, in the future, by building stronger machines, using more reliable engines, and by making less absurd flights for the sake of advertisement.

Mr S. F. CODY

In about ten years time, in my opinion, we shall have a large passenger-carrying aeroplane, able to compete successfully with steamers and trains. Progress within the next year will tell us a good deal regarding the future.

In a year or so, aeroplanes should be sufficiently perfect for any experienced, cool-headed motorist to be able to pilot them with ease.

For the next four or five years, I think, aeroplaning will become daily more dangerous, owing to the experiments which must be made towards conquering very strong winds. When this end is attained, the danger element is, to a great extent, eliminated.

MR F. K. McCLEAN

From the point of view of freight carrying, the prospect of success with the aeroplane is undoubtedly still very distant.

For carrying " mails," there is a good possibility of use in certain cases, but only where there is considerable difficulty in land or water transport.

For carrying up to half a dozen passengers of ordinary weight, this is possible at any time, but is hardly to be considered a commercial undertaking, as the expense would be very great.

For rivalling trains or steamers, in carrying capacity, the prospect of the aeroplane is unlikely.

The aeroplane of 1911 will certainly be as easily manipulated and as safe as a motor-car, provided that continuous care is taken, and only well-tried machines are used.

This must, however, be qualified by the restriction that the machine is only used in reasonable weather. No motor-car is expected to stand a cross-country run at 40 to 50 miles an hour.

A large factor of safety must always be employed, to stand any uncalculated stresses due to wind gusts tending to damage the planes, or due to an uneven landing and starting ground, which will injure the under-carriage. The latter is as important as the former both from the point of view of actual danger and from the consideration of large repair bills.

Also incessant care is absolutely necessary to see that no bolts or split pins or wires are in a dangerous condition. All controls should be doubled.

Forced landings, due to engine troubles, would be eliminated by the use of two engines running entirely separate, which will probably be in common use at an early date. Even if one engine alone is insufficient to keep the machine flying—it would so increase the landing radius that danger would be minimised.

Mr A. V. ROE

I certainly think, before another twenty years have passed, we shall be crossing the Atlantic in about eighteen hours by aeroplane.

When in America this summer I could not but help thinking how popular small aero-hydroplanes would be, capable of carrying three or four passengers, for it is these machines that will no doubt lead the way to the huge machines. There are thousands of square miles of smooth sea between New York and Boston, protected by the islands along the coast. Likewise one can find fairly smooth water in the Solent and other places around the British Isles. Of course the larger the machine, the rougher water it would be able to start from and alight on.

These suggested Atlantic aero-hydroplanes would float on the water when at rest. The body and wings would be so many feet above the water according to size of the machine. There would be mounted on stream line section struts which would rest on long torpedo-shaped floats. Under these floats small hydroplanes would be arranged, so as the speed increased the floats would leave the water, and the machine would rise into the air like an aeroplane.

Had we the engines now, we could very soon build such a machine, but it will take several years to develop the powerful and light engines required.

Every day we are learning more and more about aviation, and have almost reached the stage where a really safe machine is possible, both as regards construction and manipulation.

As regards the safety of flying, there is no doubt that the engine in front, with a tractor screw, makes the safest machine, for it is almost impossible for the engine to be thrown on to the driver; the tractor also is hardly likely to do any damage in the unlikely event of it bursting. By placing the aviator in the centre of the machine he is protected on all sides, and unless he is reckless there is little chance of him losing his life.

The triplane system lends itself particularly well to safety, for should any one wire or bolt give way among the main-planes there is always another to take up its work. Each part of the aeroplane is independent of any other, whilst each portion helps to support the remainder. In this way much of the aeroplane has to be broken before the machine collapses.

Mr V. KER-SEYMER

I doubt very much if the large passenger-carrying aeroplane, faster than trains and steamers, is likely to be constructed in any great numbers for many years to come. In this country, where a network of railways admirably supplies all conditions of transport quickly, and with infinite reliability, such a machine is by no means a necessity. This being so, one can see no commercial future for it. In other lands, notably in Central and South America and Africa, where, owing to their vast expanse or natural difficulties, railway construction is limited and expensive, a large passenger-carrying aeroplane could render invaluable service, and it is here, probably, that the development of the commercial aeroplane will take place in the future.

It is a difficult task to construct a flying machine which shall be "fool-proof," which must be an indispensable condition to its general use among sportsmen. Just as there are many wealthy men who have no desire to handle a boat, so there will always be a large proportion of sportsmen who have no wish to travel in an even less stable element. The discomfort necessarily attendant on rapid flight through the air is yet another argument against the general adoption of the flying machine in a generation where—vide the luxurious carrosserie of the modern motor-car—comfort and ease play so important a part in the mind of sportsmen.

To entirely eliminate the danger element in flying cannot perhaps be hoped for, but there is no doubt whatever but that every day brings us somewhat nearer to that devoutly to-be-wished for goal. Each tragic death in the small but brilliant band of pioneers of the air has taught its lesson; these valuable lives have not been sacrificed in vain.

Undoubtedly, the safety of the aeroplane increases daily. The experience of the pilot becomes greater with every ascent he makes; strains, stresses, and material are the object of special study by the constructor, whilst the designer of the engine devotes all his knowledge and skill to obtaining increased reliability for his engine. Surely, with all these great minds at work, it is not too much to prophecy that the aeroplane of to-morrow will be as safe a machine as one can hope to find in this imperfect world?

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