

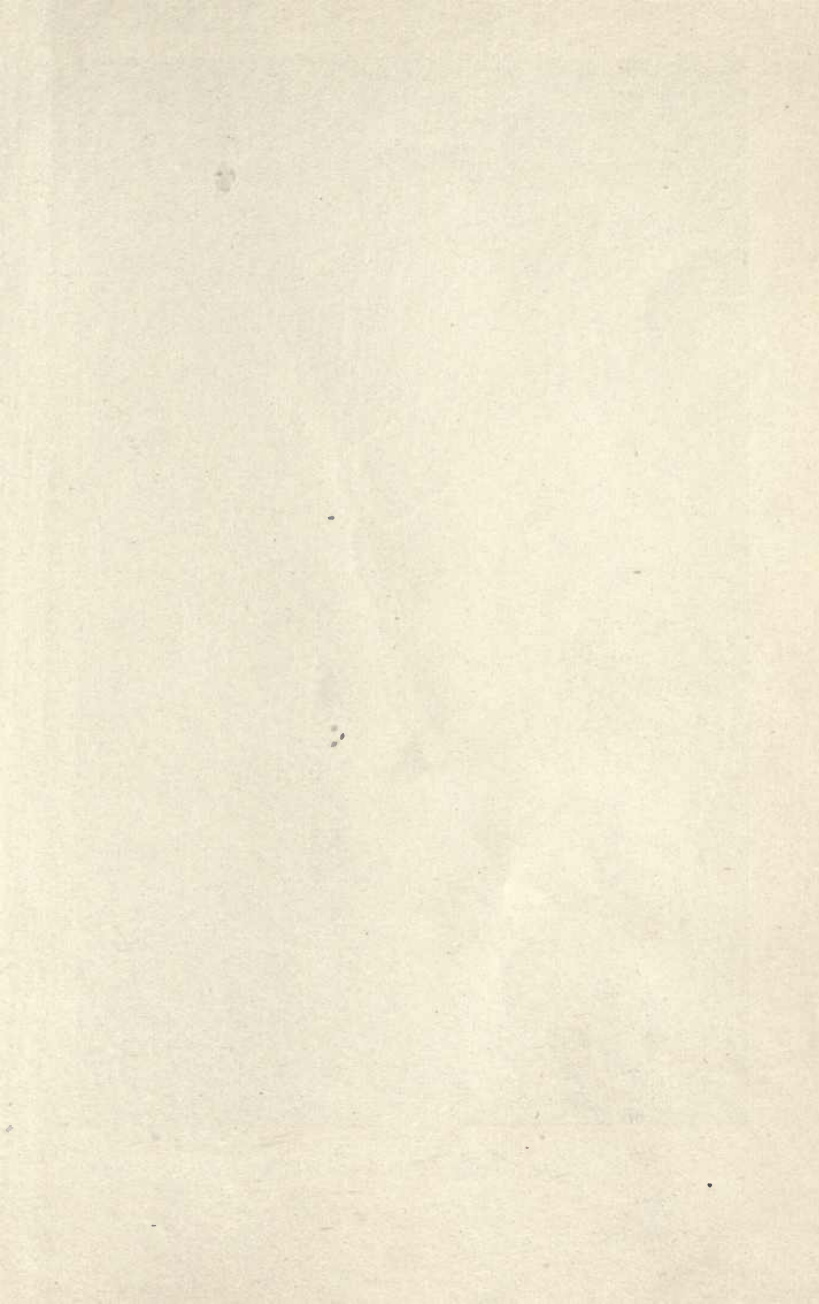


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FLYING MEN
AND THEIR MACHINES

“Nunquam Non Paratus”





CLARENCE ARTHUR CHARLES WINCHESTER

FLYING MEN & THEIR MACHINES

A LITERARY AND PHOTOGRAPHIC RECORD OF
FACTS CONCERNING FLYING WITH SPECIAL REFER-
ENCE TO THOSE PILOTS WHO HAVE SO BRAVELY
SACRIFICED THEIR LIVES AND TO THOSE WHO
HAPPILY STILL PRACTISE THE NEWEST OF ARTS:

AVIATION

BY
CLARENCE WINCHESTER
("ORNIS")



WITH NUMEROUS PORTRAITS
AND OTHER ILLUSTRATIONS

LONDON, PARIS AND TORONTO
J. M. DENT & SONS LTD.
NEW YORK: E. P. DUTTON & CO.

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C. I.

IN MEMORY OF MOMENTS SPENT TOGETHER IN THE AIR
THE AUTHOR

AFFECTIONATELY DEDICATES THIS VOLUME

TO HIS DEVOTED WIFE

CONSTANCE KATHERINE

INTRODUCTION

FOR many years there existed a certain set of progressive and adventurous spirits who, with a small amount of money and a large amount of ingenuity, experimented with pieces of wood, steel, and canvas in order to attempt to solve the problem of aerial navigation. In the early days these people met with more than their share of discouragement, so much so, that it is a wonder to me that aeroplanes exist at all to-day in such an advanced condition as they do.

In one way the great European conflict has proved a blessing in disguise to the noble art of aviation, and although war has perforce taken its toll of our brave aviators—and what is more, taken some of the most experienced—we of the aeronautical world cannot deny that, if there had been no war the public would still be as sceptical as it ever was concerning travel by air.

However, the war brought with it such high praise for aviation from the naval and military authorities, that the public could not fail to realise the importance

of the good work accomplished by our naval and military flying men, and it is for this reason I have thought it provident to issue a volume likely to appeal to that section of the public which is now taking a new interest in aviation. It will be seen, therefore, that this book pretends to be nothing more than an elementary introduction suitable for the lay mind, and I would urge this point upon those critics whose technical knowledge may warrant respect, lest they in their haste should judge me harshly. The public cares nothing for the value of x . Those members of the community who do, have already sufficient volumes at their disposal to satisfy their curiosity.

For most of the aviators' photographs I am indebted to Mr. F. N. Birkett, of 97, Percy Road, Shepherd's Bush, W., who possesses the finest collection of aviators' portraits I have ever seen. Concerning the other illustrations, many of these I have photographed myself and others have been loaned to me from various sources.

I desire to express my cordial thanks to the Editors of *Flight* and *The Aeroplane* in allowing me to reproduce those photographs duly acknowledged, and I also wish to express my gratitude to the Editors of the *Daily Mail*, *Evening News*, *Motor Cycle*, and Tillotsons' Newspaper Literature for their kindness in permitting

me to reproduce certain articles from my pen which first appeared in the particular papers mentioned. To any other person who has given me the slightest help I offer my sincerest thanks.

The photographs of pilots are chiefly those of English aviators and one or two of our Allied friends, and this I think is proper for a publication produced during a period when such profound patriotism is sweeping over the Allied forces.

Some restraint has had to be exercised in the selection of aeroplane illustrations. The photographs reproduced deal with pre-war machines only, and although I should like to include some of the latest specimens of English workmanship and design it has been thought inexpedient to publish illustrations of the latest craft. Perhaps Germany could not gain much from photographs that display no details of construction, but even so it is unwise to run up against the authorities unnecessarily. As it is, I am permitted to reproduce the photographs in this book, and I am accordingly grateful for any small mercies I receive during an era when censors are most active and writers most emphatically silenced.

In conclusion, I wish to impress upon the lay mind that England is no longer invulnerable owing to her position as an island. This we have already seen for

ourselves. Therefore the necessity arises of possessing at least three aeroplanes to every one of another country. As she already rules the sea, the Motherland must now, whilst the opportunity exists, make the supreme effort that will shatter Germany's aerial fleet so effectively that our enemy cannot by any chance either through numbers or efficiency gain the supremacy of the air.

CLARENCE WINCHESTER ("ORNIS").

1916.

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FLYING MEN AND THEIR MACHINES

CHAPTER I

THE EARLY HISTORY OF FLIGHT

ALTHOUGH, perhaps, the real history of practical aviation as known to the Englishman commenced with Blériot's famous cross-channel flight in 1909, it must by no means be concluded that flying was not dreamed of long previously. In point of fact aerial navigation was thought practicable as far back as the twelfth century, and ever since then many attempts have been made to copy the birds in their graceful art. It was but natural that man, seeing the birds fly so easily and gracefully over hill and dale, river and sea, from one end of the earth to the other, should seek to emulate these feathered creatures, for nothing appeals to the imagination more easily than the idea of travelling through the air on some gigantic bird, or perhaps upon a magic carpet, or something else that will go at will to any desired spot via that ever-changeful element—air.

Various weird inventions were made in the early

days, some which showed undoubted signs of promise, and others which might well have been at the outset scrapped as hopeless. However, in spite of the great lack of success which at first accompanied man's efforts, the experimenter always proved himself a courageous person, for he was never daunted in the slightest degree until, perchance, Fate took an irresistible fancy to him and added his name to the long roll of honour attached to the art of aviation (or attempted aviation) in every century.

The first record that can be traced by actual illustration shows us a weird shell-shaped coracle in which presumably the ancient aviator was *intended* to sit, and attached to this most unique construction were four or five balloonets. Apparently this attempt foreshadowed the present-day dirigible airship. In the centre of the coracle two masts were erected for the purpose of carrying sails after the manner of a ship. The balloonets were supposed to be filled with a light gas to give the concern support, and the sails were provided to catch the air and thus propel the craft after the manner of the yacht of to-day.

Of course, man had previously attempted to fly purely and simply under his own power by fitting wings to his body and flapping them up and down in a small elliptical form just in the same way as all birds do. It was even quite a long time before the discovery was made that the human being could never be sufficiently strong to support his own weight in the

air, and thus at the same time was it proved that the birds are proportionately far stronger than human beings. Many were the cases of inventors meeting sudden death by casting themselves from some church steeple or high tower and trying their fortunes on the wings of chance. All of them, of course, soon became possessors of more spiritual wings, although not a few, realising that discretion was the better part of valour, merely climbed their steeples or towers and then, like wise men, descended by the legitimate stairway or ladder, much to the disappointment of a clamorous crowd which hungered unceasingly after sensation. One man, however, once announced that he would fly over a certain part of the hills north of Brighton now used for races, and being confident of securing a good advertisement for his projected scheme he sent out numerous invitations to his many friends in order that they might witness the flight. Thousands of people gathered on the day named to see this wonderful Ariel, but they neither saw the flight nor had the opportunity of experiencing that intense internal excitement which makes itself evident in everybody when a man sets out with the full purpose of doing or dying in his particular adventure. The great seeker after advertisement, who must have been the forerunner of the modern Press agent, merely slid down a wire and flapped two alleged wings as if he were naturally flying, but as the wire could not be made invisible the crowd of onlookers showed great dissent,

and very probably the adventurer had to run all the way home and to lock his door securely when he arrived there.

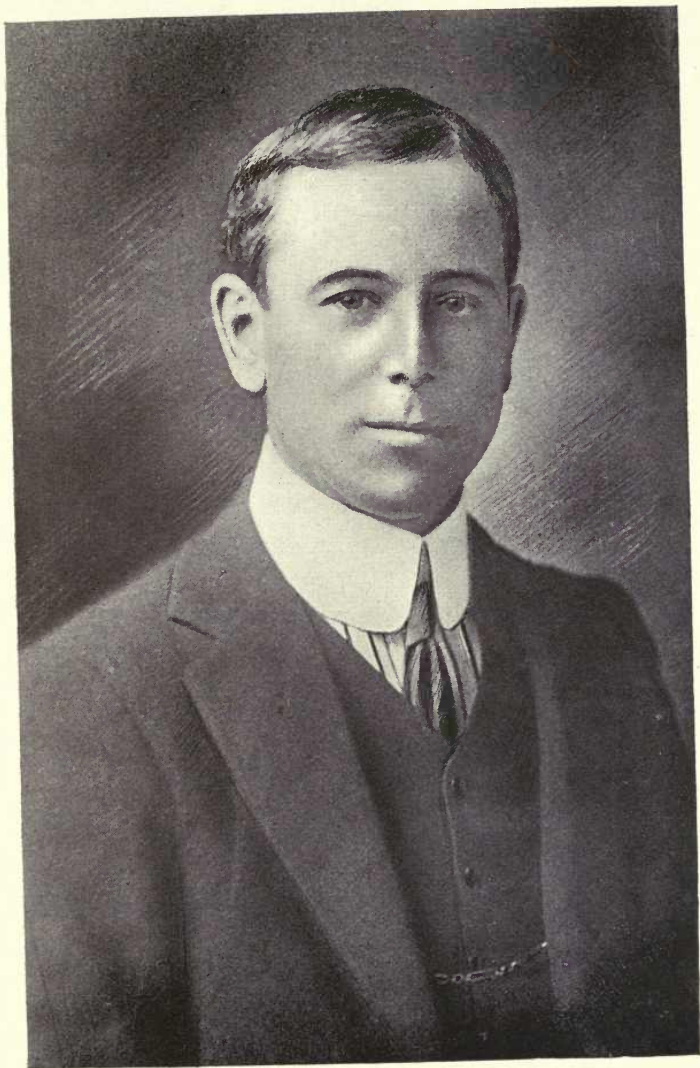
In the eighteenth century two brothers, by the name of Montgolfier, commenced experiments with a large type of hot air balloon such as one sees at garden parties, fêtes, and the like, and it is recorded that one of the brothers attached a seat to his construction, lighted the fire beneath, and somehow burnt himself severely, "whereat he swore in great volume," as the chronicler states. Modern aviators are certainly not backward in following Montgolfier's wicked example of swearing in great volume! This digression will be readily excused by any one who happens to know an aviator, a mechanic, or any individual who has spent a few months at any modern aerodrome.

Of course, balloons opened the way for the experiments with heavier-than-air machines, and after Messieurs Charles' first ascent in a hydrogen balloon, repeated experiment and repeated failure, with an occasional success thrown in, led up to the construction of dirigible airships, and then gliders and aeroplanes as we know them to-day. Hydrogen, the lightest gas obtainable, was discovered early in the eighteenth century, and yet it was some considerable time before it was used in connection with aircraft experiments. It is now universally applied to balloons and airships, as nothing up to the present has been found more satisfactory.

Over a hundred years ago a German constructed a long fish-like airship, and this in reality was the forerunner of the modern Zeppelin, of which we have had a reasonable amount of personal experience. The German government, unlike most governments, always encouraged progress of any sort, and although it was sceptical at first with regard to the possibility of aerial navigation, it made many substantial grants to inventors, and thus helped forward the grand little army of aviatic pioneers who were for ever struggling against public opinion, failure, and often financial distress.

One of the most important English pioneers was one named Sir George Cayley, who spent considerable time and money on the study of aerodynamics and wrote many treatises on the subject. He was, in fact, the prophet in the true sense of the word of the present-day aeroplane. So minute and correct were his calculations that practically every principle on which the modern aeroplane is based was worked out by Sir George in the early part of the nineteenth century. It was a pity that the petrol engine did not exist in those days, for had such an era been reached Cayley would no doubt have been the first man to accomplish a free flight in an aeroplane. Under the existing circumstances, however, he was never able to construct a mechanically - propelled aircraft, although he undoubtedly possessed the key to aerial navigation in his wonderfully scientific head.

In point of fact, the first man to make an extended glide on a heavier-than-air machine was Herr Lilienthal—a German scientist, who had for many years been devoting his time to the study of bird flight and to the study of the anatomy of various birds noted for their gliding and soaring capabilities. However, after building a glider to his own theory and making many experiments on this and other craft, he met with an untimely end whilst actively engaged in his admirable work. His experiments had been watched with some misgiving, but even in spite of this there were other people ready and willing to go on with the work where Lilienthal left off. Various countries became interested in the art of gliding, notably France and America, and soon a very keen rivalry sprang up between these two countries as to which could produce the better record. The rivalry certainly gave great impetus to the work, and it must be admitted that both countries contributed much in the way of research and practical experiment which has since been exceedingly useful. In America the Wright brothers worked silently and with great perseverance until in 1903 and 1904 they were making remarkably long flights for that period. Certainly it was strange that these two men did not proclaim themselves to the world until some time after they had been making comparatively long journeys. They accomplished distances of thirty miles or more, yet the world was ignorant of the fact that flying was a marvellous reality, that two Americans



ALLIOT VERDUN ROE

ABSENCE

had journeyed through the air on a frail craft made of wood and canvas, that at last some definite headway had been made in the direction of aerial navigation. Surely flight was but a fancy, a mere subject for the dreamer of dreams and fit only for the poet's imagination! But Orville and Wilbur Wright, those silent men of genius, knew otherwise, for they had tasted of the joys of flight and had been intoxicated by new sensations and new discoveries. Their accomplishments were kept secret, for they worked unceasingly on the lonely Devil's Island and cared little for the praise or censure of the world without—if such praise or censure existed.

In the meantime Farman, Blériot, Delegrange, and Latham, as well as many other pioneers, were progressing slowly but surely in France. They were all unaware of the rapid strides which the brothers Wright had made, and in January or February of 1908 Henry Farman startled civilisation by flying in a closed circuit a distance of over a mile.

Then the shock came. The American brothers at last emerged from their obscurity and proclaimed themselves the real pioneers of practical aviation. But no one believed in their claim. France was particularly incredulous, for had not Henry Farman flown nearly a mile? If the Wrights were so wonderful they had better give some substantial proof of their capabilities. Europe could not believe without seeing for she was populated with doubting Thomases

throughout. In fact, even when some of the doubters had actually seen with their own eyes they were still inclined not to believe! In the middle of 1908 Orville and Wilbur journeyed to France in order to substantiate their claims. They were received indifferently, but were unperturbed by the reception accorded them. They had journeyed there to fly and not to criticise criticism. So they flew, and with a vengeance, too, for they covered thirty to forty miles at a stretch and thus put all the previously accepted records entirely in the shade. This was a stunning blow to France, and Henry Farman, whose name practically represented that country in an aviation sense, set his shoulder to the wheel and worked like a nigger to re-establish his country's earlier aeronautical reputation. Farman was not a man to be beaten. Assiduously he stuck to his task, and after considerable pains evolved the Henry Farman biplane which easily beat the records first established by the Wrights. To some extent England felt proud of his success, for Farman, although a naturalised Frenchman, was born of English parents. Still, England took very little serious interest in the new art, and her comparative superiority now is something to wonder at considering the apathy with which she at first viewed anything in the nature of flight. Still, it was always thus with the Motherland, and presumably it will always remain one of the national traits of the Englishman—to be at first apathetic, then enthusiastic, and finally un-

beatable. Such was and is the case with aviation, anyhow.

Hubert Latham then arrived with his artistic Antoinette monoplane, and Blériot with a machine of his own design. Many other experimenters also sprang into existence. On behalf of England, Moore-Brabazon, an Englishman, acquired a knowledge of the Voisin biplane, which machine he flew in France during the early part of 1909. Samuel F. Cody also entered the flying world about this time, and carried out many excellent flights on Salisbury Plain. A. V. Roe had previously been experimenting with his unique little triplane at Brooklands, and had suffered a great deal of criticism, but by this time he was making quite an appreciable amount of headway. It was Roe, by the way, who made the first actual flight in England, and who really originated the tractor type of machine which is so popular to-day. Hampered by lack of finance and encouragement, this energetic pioneer worked day in and day out upon his invention until at last he persuaded it to leave the ground. It is said, strictly among his friends of course, that A. V. Roe was so enthusiastic in his efforts to perfect a flying machine that he totally forgot to have his hair cut, for in those days his appearance gave one the impression of a musician rather than that of a practical scientific investigator.

Going back again to Blériot and Latham, there was much friendly rivalry exhibited between these two,

who had both determined to fly La Manche and thereby win the £1000 prize offered by the *Daily Mail* for the first flight across the English Channel. It may not be out of place to mention that the sportsmanship shown by the proprietors of the *Daily Mail* in offering large prizes for various accomplishments in connection with the progress in aviation did much to favourably enhance public opinion on the question of aeronautics and to develop aviation generally. The first man to attempt to fly the Channel was Latham. He started from Calais one morning in July 1909, and his heart soon began to palpitate with joy. He had accomplished three-quarters of the journey and there before him lay the white cliffs of old England. The honour of being the first human being to fly the narrow strip of water and the magnificent prize of £1000 were both within his grasp. But Fortune did not favour the brave, for when within easy distance of the shore engine trouble set in and the pilot and machine were forced to descend into the sea where they were eventually picked up by a trawler. Imagine the heartache suffered by this brave pilot, who was so near to his goal yet so far from it. A trick of Fate, a whim of Fortune, with the result that the trophy was snatched out of his hand. The airman was not perturbed however. He lighted a cigarette, waited for the arrival of the boat sent out to rescue him, and resolved to make another effort. Such trials had to be undergone by these early adventurers in the air,



LOUIS BLÉRIOT

and greater tests of sportsmanship could hardly be devised.

On the morning of the 24th of July 1909, at about 4 o'clock, Louis Blériot commenced preparations for what was to prove one of the most famous flights known to history. An unassuming little man, with a machine which has since proved itself excellent in many respects, set out on the same task which had already foiled the courageous Latham. A start was made, and anxious were the moments spent by the pilot as every instant he came nearer and nearer the cherished goal. Would the engine stop? Would any unkind gust upset the stability of the frail little craft? Would the exhilaration of almost reaching the goal ultimately prevent its attainment? These and many other questions rushed across the aviator's mind. But all these interrogations were soon answered, for by five o'clock Blériot had completed the journey. The Channel had been flown at last! The prize of £1000 had been won. The honour belonged to Louis Blériot and, forget it not, his admirable little machine. Poor Latham! He was at once informed of his rival's success, and although it was a terrible blow to be beaten, he heartily congratulated his conqueror and thus displayed the genuine sporting temperament to be found in most navigators of the air even to this day.

The year 1909 was the most eventful and prophetic one for aviation. It taught sceptical folk that flying

was not a sport only to be indulged in by maniacs and people who desired to commit suicide respectably, but a stern reality to be faced by this and every other country that valued its safety. Strange as it may seem in this so-called civilised world, aviation at once advertised itself as a future arm of the services, if not as an independent service of its own. Views are diversified as to whether flying should be an adjunct of the Army or Navy, or whether it should become an independent service under the supervision of a special air ministry, but granting the great progress aviation has made during the past year or so, it would not be difficult to make a determined step in the formation of a ministry of the air, and there is much to be said in favour of such a new office.

After 1909 the new art or science—call it what you will—made steady headway, always, however, exacting a certain toll from the enthusiastic and plucky disciples of the air, who sought to conquer an element abounding with unknown terrors, which were always ready to seize the frail human adventurer with a giant hand and crush his body to powder as the mill stones crush the corn. Death came with grinning features and put out its bony hand for its due. And its demand was not refused. Many brave aviators lost their lives in attempting to bring the art up to its present state of perfection. Machines were not made with such a high factor of safety in those days as they are made now, and oftentimes, just as a pilot

was feeling the elation which always accompanies the sight of a looked-for goal, just as he was about to descend at his destination, perhaps a part of his machine would break and send him hurtling to his doom. Once more would man be outwitted. Once more would the Press describe in harrowing details the circumstances of his death. Once more would the anti-scientist wail at the event and proclaim that aeronautical experiments must be forbidden by law, because the brave and courageous attempts to conquer the air were contradictory to the intentions of God. If man were intended to fly, these anti-progressives urged, he would have been provided with wings after the manner of birds. But the enthusiasts merely smiled, or put forward their argument in reply. Said they, if man were intended to swim, God would have given them fins after the manner of fish. And so the discussion went on indefinitely.

To show the reader how prejudiced some sections of the public were even as recently as 1913, the following statements are reprinted from a London daily paper:—"How much longer are we to be horrified almost daily by these appalling aviation disasters? If this 'flying' had any sufficient object for benefiting mankind one might be in measure reconciled to the ever-growing tale of violent deaths, but apparently aviation is only, or chiefly, to provide a new engine of war. It is not as though there were a reasonable prospect of the navigation of the air becoming in time

as free from acute danger as, say, railway or motor-car travel. In most of these, in their beginnings, audacious innovations, there must be a regrettable percentage of risk to the pioneers, but the mortality of flying men (and women) has been something new and phenomenal in the history of adventurous experimenting, and I submit that the practical objects aviators have in view do not justify a continuance of this legalised suicide—which is about what it amounts to.

“ In all probability humanly devised machinery can never be absolutely reliable. The most scientifically made apparatus must always, in the nature of things, be fallible, subject to hidden flaws, and to consequent breakdown and stoppage. If your rail-road or marine engine suddenly fails to work, your liner or express simply comes to a stop, while at the worst still safely at rest on the water or solid earth. But the case of the heavier-than-air machines is different. . . . The comity of nations has, I believe, vetoed the soft-nosed bullet. Why should there not be an international agreement vetoing the use of both air and submarine craft for naval and military purposes? ”

The above appeared in the correspondence columns of the *Daily News* on August 27, 1913, and although the last sentence might have stood in those days it would certainly not be permitted to stand now when international agreements are but “ scraps of paper ” to be unscrupulously thrown to the wind at the will

of an intemperate ruler. A suitable reply, written by the author of this book, was sent to the correspondent. It is unnecessary to give details of that reply, but the following response by the first writer is not without amusing interest, considering how far aviation has advanced to-day and how useful the new art has really become.

“ The air-chutes of which Mr. Clarence Winchester writes with appropriate airiness look simple enough in print, and even more so as one watches the graceful gliding of the gulls, but one of the many terrible drawbacks to aviation is that this mode of extricating a flyer from a horribly tight place, judging by the awful percentage of fatalities, so often cannot be resorted to.

“ One admires the optimism of these heroic pioneers, but it is idle, culpable even, to underrate and minimise the dangers of this pseudo-flying. One gladly congratulates your correspondent on his immunity, so far, but to the actuary or underwriter the prospect of any airman must appear sadly precarious. The outsider sees most of the game, and a dispassionate observer may be excused for regarding such flights as have yet been made, splendid achievements many of them, very much in the way of ‘ flukes.’ The navigation, the necessary navigation, mark you, of the sea continues, after centuries of theory and practice, to baffle human skill to a serious degree, but the caprices of the sea are as nothing to those of that unchartable libertine, the air.

“ And it is not only the safety of aviators that one is concerned for. Nothing short of a special Act of Parliament has restrained these modern Icaruses from conducting their crude experiments over the streets and gardens of thickly-populated centres, so that the legislature is not blind to at least one serious aspect of this question. The too frequent abuse of the motor-car and bicycle to the common annoyance and danger should sufficiently forecast what would be in store for us if ever (as Mr. Winchester seems to anticipate) reckless folk in any numbers should be in the air—in more senses than one—with their luckless persons and disabled machines hurtling on our devoted heads.

“ Enough has been done for fame, and reasonable public requirements do not call for your correspondent’s ‘ lifeboats ’ of the air, a term which reads like a sarcasm in face of the facts. This very partial ‘ conquest of the air ’ is bought at an impossible price.”

Of course an advance of three years has shown us exactly what our pilots and machines are capable of doing. It would indeed be amusing—to other nations—if our government passed an Act of Parliament prohibiting any further flying whatsoever. How convenient it would be for countries possessed of hostile intentions to send a fleet of aircraft over our poor little island and totally destroy us! Such a dire occurrence would not be impossible if we had no means of meeting the enemy in the air itself. And so we have much to be thankful for, that the above correspondent’s sug-

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SAMUEL FRANKLIN CODY

gestion in 1913 was not carried into effect. After all, has this conquest of the air really been bought at an impossible price? Of those who would be the first to reply in the negative are the many brave pioneers who gave all their time, money, and even their valuable lives in the cause of a great art—the art of aviation—an art which has revolutionised civilisation, revolutionised warfare, and even revolutionised the temperament of the younger generation. To mention but a few names—Rolls, Le Blon, Graham Gilmour, Samuel Cody, Cecil Grace—these, with many others as brave and as courageous, gave their all in the endeavour to attain the mastery of the air. What sport, science, or art can boast of such a sublime type of manhood and sportsmanship as was found in these great men? Great, indeed, they were in the true sense of the word, and but for their stubborn perseverance and dogged grit flying would still be a dream of the future instead of a reality of the present and an accomplishment of the past.

In spite of such inevitable fatalities, aviation still retained a certain hold on the public imagination, but after a little while interest lapsed until Claude Grahame-White announced that he would make an attempt to win the £10,000 prize offered by the *Daily Mail* for the first flight accomplished from London to Manchester. London to Manchester! Impossible, sneered the ever-present pessimists. “Only a madman would attempt it!” cried some; but Grahame-White was

very far from being a madman. He was a far-seeing young man anxious to make headway in the new world of flight, and it is well known that he did make headway although he never won the London-Manchester race of 1910, much to his regret and the sorrow of all Englishmen. The honour went to a young French mechanic, M. Louis Paulhan, who was already known to a selected few as a successful and intrepid flyer. He brought a Farman biplane over to England and erected it at Hendon, where afterwards the world-famed aerodrome grew up. Through the long night hours worked the energetic Paulhan and a few helpers. Gradually the pieces of wood and canvas assumed a definite outline. The wires were tightened, the controls connected, the planes were in place—and lo! there stood the Farman biplane which was to carry its human cargo to Manchester, the £10,000 goal. No wonder Paulhan's heart beat with anxiety as he eventually surveyed the completed craft. No wonder the little band of helpers succumbed to hero-worship, for although nobody thought the journey would be achieved there was not a soul who did not admire the plucky Paulhan for even essaying to attempt it.

Late in the afternoon the machine was ready. Petrol and oil had been put in their respective tanks and the propeller was lustily swung. Away roared the engine and with a wave of the hand young Louis Paulhan embarked on a flight which won for him everlasting fame and the hearty congratulations of

the whole world. In the meantime Claude Grahame-White had erected his machine at Wormwood Scrubbs. Between the two popular aviators existed a friendly relationship, but at the same time there was also prevalent a keen rivalry. They both had their eyes glued on the £10,000 prize and they were both sportsmen enough to know that "the other chap might win it." They both tried hard, too. No one could have worked more assiduously than Paulhan or White in their respective efforts to conquer each other. Alas! on the Englishman Fate laid an unkind hand. Engine trouble, gales, and disappointment were the lot of the one, while Success, smooth and kind, was the lot of the other. Paulhan was victorious and his victory was hailed with delight by all his countrymen, and rightly too. The Englishman was beaten, but he had at least done his uttermost and had fought bravely to uphold England in the realms of flight. What more could an English sportsman do?

After the London-Manchester flight aviation went ahead more rapidly. The fatalities, though, were very high, and perhaps it was not surprising that some people had little faith in the new achievement of science and art. But such lack of faith was not justified ultimately, for the whole world has seen the importance which the air services have attained and their attainment but reflects the advance of aviation generally. The percentage of fatalities gradually grew smaller and smaller, machines were improved

to such an extent that flying soon became as safe as railway travel and certainly much more enjoyable. Pilots increased their knowledge and enlarged their experience to such an extent that looping the loop became mere child's play, and it was but a daily habit to describe aerial letter S's and Z's. It was undeniably proved that an aviator, if his machine fell, stood every chance of recovery provided he kept his head and happened to be flying at a sufficiently high altitude. Thus was it proved that high flying was safe flying. The advance in the actual construction and the design of aircraft was very noticeable, so much so that it calls for special attention. The early experimental aeroplanes usually flew at a speed of somewhere near thirty-five to forty miles an hour and sometimes not even at that rate, which, of course, was comparatively slow travel in an age of speed. The engines varied from 25 h.p. to 50 h.p., and very little reliance was to be placed on any aircraft motor in those days of fickle fortune. Engine failure was one of the chief disadvantages of aerial travel, and for some time it seemed that the prevalent trouble would never be overcome. Perhaps for weeks one little engine would give two or more big mechanics uncomfortable and sleepless nights. Hours and hours would be spent on some particular engine part, and anent this matter the remark of an early mechanic gives a general idea of the conditions then prevailing: "The gov'nor might just as well walk to Eastchurch as to go by

CLIPART



CLAUDE GRAHAME-WHITE

1000

these — aeroplanes. It's far quicker to walk, my boy, and a jolly sight cheaper!" So much for the conditions in those days! Improvement upon improvement has since been made; aeroplanes are more strongly and scientifically built. The engines are higher powered and the reliability of some types, notably the Renault, leaves little if anything at all to be desired. And so the present stage of efficiency is reached. The great English and Continental races and reliability trials helped to develop aeronautics to a really marvellous extent. No sooner had one record been made than it was broken, and that only in its turn to be further beaten by the stimulating effect promoted by the keen competition which existed between rival aviators and manufacturers.

CHAPTER II

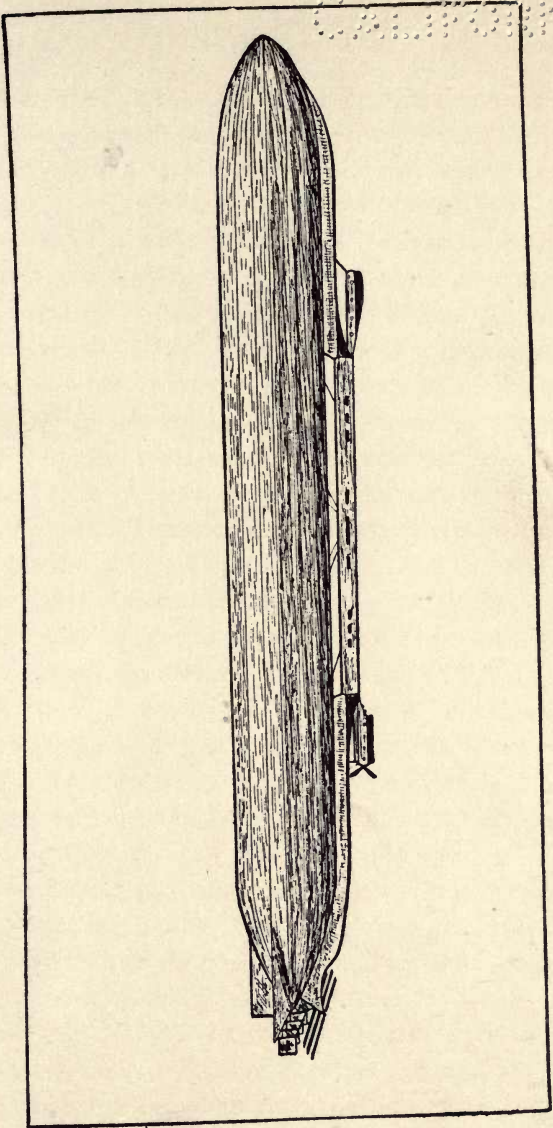
RECENT HISTORY

It would be possible to fill a whole volume with data of aeronautical history, but as much of it would be needless repetition of matter which would appear comparatively unimportant against the light of recent developments of aviation in modern warfare, it may perhaps be advisable to select for consideration the most eventful and important year aviation has ever known—the year 1915. Certainly in this year many preconceived notions of the part aircraft would play in warfare must have been dashed to the ground with unsuspected violence. At one time it was widely prophesied that the dirigible airship, if used in conjunction with a modern army or navy, would prove itself worse than useless. Such an assertion has been practically and quite rightly contradicted—not by the valueless raids on London, which have accomplished nothing, but by the very useful work carried out by airships in connection with sea patrolling which has been effected for the purpose of “spotting” submarines. It is well known that seen from a reasonable altitude water becomes very translucent and it is possible to view with ease any rocks, wreckage, or other matter which may be beneath the surface. So

it will be apparent that the dirigible, which of course can hover silently over any particular spot, is quite a valuable asset in many respects and particularly in the one indicated. This is but a single instance of the displaced notion. Practical experience has taught us more in one year than imagination and indefinite conclusions have taught us in six years. We have seen the possibilities of the rigid airship, we have seen the capabilities of our worthy pilots, and we have known the aerial capacity of our enemy. By these things we have been taught many lessons, and it is doubtful if any year of the future will show us so much to our advantage as we have been shown by the year 1915.

The first month of the year saw a good deal of active aerial service carried out by all countries possessed of sufficiently reliable craft, and on New Year's day a squadron of French aviators flew over Metz and Armaville, doing considerable damage with many large bombs. Anti-aircraft guns were directed against the French machines, but fortunately no serious damage was effected, although one biplane returned to its base with over eighty bullet holes in both planes, and another returned with an injured pilot. He had embarked upon a fierce battle with a German monoplane. It was in this month, too, that various Zeppelins became most active, particularly in the neighbourhood of Dunkirk, where many civilians were killed. On one occasion 100 bombs were dropped

by enemy aircraft, but an Albatross taube had the infinite pleasure of being brought down by an allied airman. For two or three years preceding the war much speculation was rife as to whether a Zeppelin would be capable of reaching the British Isles or not if it started from any base in Germany. The consensus of opinion was in favour of a negative view, and although it cannot now be doubted that Germany despatched airships to this country in peace time, any one-time effort to prove the possibility of such an occurrence was at once received scornfully as a newspaper scoop based upon unreliable information and put down as erroneous. Still, in the January of 1915, the first serious air raid on England was carried out, and despite the fact that no damage of any military value was done, it produced a profound effect on the mind of the average Englishman. Bombs were dropped on Yarmouth, Sheringham, and King's Lynn, and altogether four people were killed. If Zeppelins could successfully reach Yarmouth, surely it was no great difficulty for them to find London? No, it was not; for, indeed, as everybody knows, two or more enemy airships bombed the Metropolis with such enthusiasm that many people sat up nightly awaiting their re-arrival purely from the spectacular point of view. Still, damage to civilian property was heavy, but it became extremely obvious that airships, after all, were worth developing, for where night work is concerned they are unequalled for efficiency.



DIRIGIBLE AIRSHIP

THE UNIVERSITY OF CHICAGO
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True, the aeroplane can fly at night, but the dirigible has its supporting envelope filled with hydrogen gas and so in the event of engine trouble there is no need to descend in order to make repairs or adjustments. The engines can be put right without coming down at all. It has been observed, too, that the aerial enemy always made a point of coming in north of London when there was a north or north-westerly breeze blowing, and the engines would therefore be switched off and the craft was thus enabled to drift silently down with the breeze and then suddenly surprise us with its presence by casting a few bombs overboard. The arrival over London was therefore usually unheard, the first sign of the enemy's presence being the trail of sparks left by the bombs and then the sudden noise of the sickly explosions.

About February or March it was rumoured that Germany had constructed a giant aeroplane capable of carrying 2000 lbs. of explosives in addition to pilots, passengers, and enough petrol and oil to last for an eight or ten hours' flight. The engines were presumed to be Mércèdes and numbered four, with the extraordinary total of 1000 h.p., each engine giving 250 h.p. As a matter of fact the rumour was not founded on a machine which had actually been constructed, but upon one which was then under course of erection. It made its appearance later in the year, and proved beyond all doubt that the giant battle-plane is an important accessory to warfare.

The Russians already possessed two or three large high-powered machines, and it was reported that one of these had been captured by the Huns and immediately copied. There could, however, be little truth in that report, for all of Russia's large craft were accounted for and the huge German aeroplane bore no resemblance whatever to the great Sikorsky—a machine which embodied practically every modern convenience with the exception, perhaps, of a bathroom. It is giving no secret away to say that every country, including England, is now in possession of larger craft; and it may be safe to assume that further developments will be made in the direction of increased size and increased power, not only for use in warfare, but also for machines as commercial propositions. Increased size and power are, of course, very conducive to increased lifting capacity and to all round efficiency as required by the strenuous conditions now prevailing.

In March there came to hand the extraordinary news that the French air service, up to the end of January, had flown altogether over 18,000 hours since the outbreak of war, and this news is surely sufficient testimony to the loyalty and courage of pilots who fly for our brave Ally. They are not attracted to the air service by the offer of financial reward, for in France an aviator is considered merely an ordinary fighting unit rather than as a superior being privileged to smash the country's aeroplanes *ad lib.* In England, pilots are well paid compared

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By Courtesy of]

“SOMEWHERE” OVER FRANCE

Taken from a Caudron biplane. Notice the Maurice Farman machine flying below

[“Flight”

with members of many other branches of the service, although one would not suggest for one moment that patriotism is lacking in the good fellows of our own flying services. But the comparison of reward is interesting. A French military aviator holding a non-commissioned rank receives less than the ordinary private in this country, whereas our own flying men get anything from £4 weekly upwards. A second lieutenant receives approximately £1 per day to start, and an additional annual bonus of £150, provided his character has been reliable and his service up to necessary standard.

In the middle of the month three or four Zeppelins bombarded Paris, but the damage done was slight. The French capital is well fortified, and the German gas-bags were probably sorry that they attempted the bombardment, for in addition to being fired at by a large number of guns, a squadron of aeroplanes started in pursuit. There can be little doubt that the effect produced by the excellent fortifications of Paris relieved that city from many further attacks by night—or day. Unfortunately, London has always been an unfortified town, and the resources at our command for defence of England's capital were not very great, so for some little while the German craft played havoc with the city until better means of defence were found.

On March 17, the Royal Naval Air Service distinguished itself in a very large raid on many coast towns occupied by the enemy in Belgium. This was

undertaken by a squadron of aeroplanes all of which carried bombs, and the effect on the enemy's positions was disastrous. Later, the famous Cockerill Yards at Antwerp were paid the compliment of an aerial visit by two of our airmen. Explosives were dropped, a large portion of the works was seriously damaged, and two, if not more, submarines were totally destroyed. These important yards have been the subject of more than one attack, and each occasion has exhibited the value of the aeroplane and the personal skill of service pilots who, in all weathers and at all times, have taken their lives in their hands for the sake of re-establishing the peace of the world and upholding the traditional honour of the British nation. It is impossible to emphasise too much the debt we owe to our aviators, for often their skill and initiative have been the sole cause of an ultimate effect which has meant much to the mother country and her allies. In seventy-two days preceding April 14, flying was carried out on all but eight days, in spite of high winds and the continual rains which were ever prevalent. Altogether over 130,000 miles were covered by the Royal Flying Corps (Military Wing) machines, which fact speaks volumes for the personnel and organisation of this department.

Again the British Isles were visited by enemy airships, this time at Lowestoft and Newcastle, where four or five bombs were dropped at both places. On the same day an Aviatik seaplane came over, but did

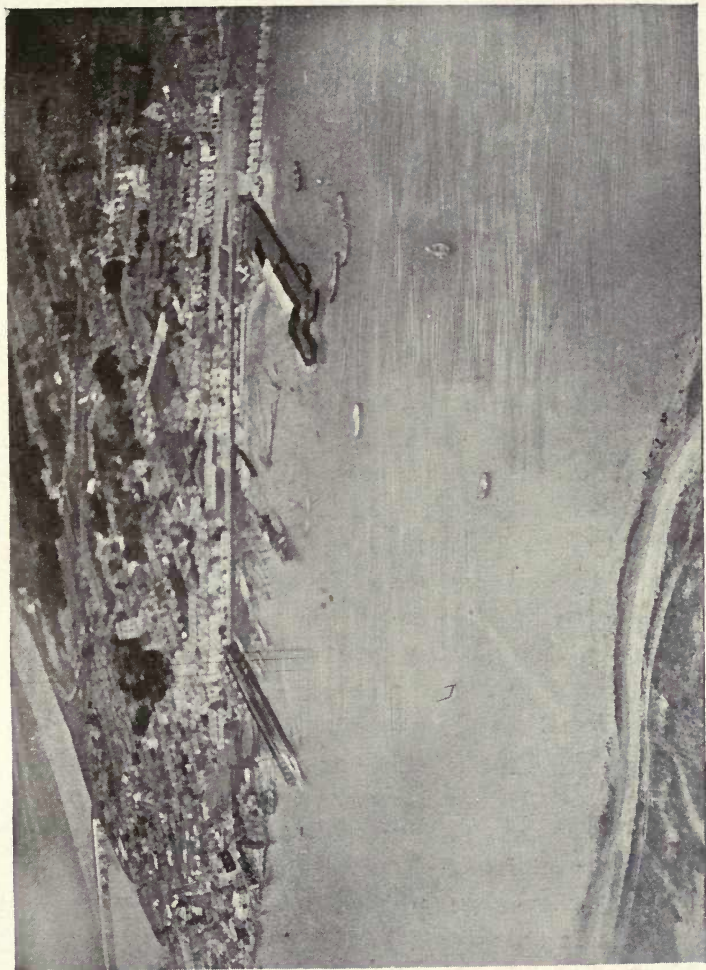
little damage although it released explosives on several East Coast towns. Certainly by this time it was plainly evident that Germany had demonstrated beyond all doubt that both her aeroplanes and airships could reach this country with comparative ease. There was no further need to smile cynically at the enemy for the boast she had made of her aerial fleet. Zeppelins were stern realities, not psychic phenomena. The aeroplanes which she sent obviously had their base at Heligoland to which place more than one English heavier-than-air machine had been delivered before the war.

At the end of the month Lieutenant W. B. R. Moorhouse won the first V.C. awarded to the Royal Flying Corps, but the officer unfortunately died from his wounds before receiving the honour. He destroyed the railway junction at Courtrai, receiving serious injuries from gun-fire, but even though he had almost lost consciousness through loss of blood he struggled home a distance of twenty or thirty miles and made his report to his commanding officer.

In May a firm effort was made by the enemy to carry out its air raids on a larger scale. A visit to Southend was therefore made, and 110 bombs were launched upon the luckless inhabitants. It is possible that such apparently unjustified attacks are viewed with too much importance by the average peaceful citizen, for although loss of human life at any time is a sad factor to relatives and others, the actual

military value of air raids has been absolutely nil. In fact, if a personal view may be expressed, rather than having been of value to the Germans themselves, each successive raid has been of use to us, for it has brought with it an increase in the number of recruits, and what is more those at home have been called upon to understand something, if only a little, of the agonies of mind suffered by the brave fellows at the front. To carry the argument further, a great impression has been created on the mind of the lay public—the public which sees but does not know, at least, in an aeronautical sense—and as a result of this impression every one realises the importance that has been attained by aircraft in general. If airships could be used for the purpose of killing a few non-combatants, it would be just as reasonable to suppose that they might also serve the practical purpose of destroying plenty of actual combatants at the front, or be of use in making observations at night, when the use of aeroplanes would be more or less impracticable. Of course, raids were made on England not so much with the idea of doing any damage of military importance, but rather in order to create a panic amongst the inhabitants. In this effort the Germans signally failed, as nothing could have been cooler than the way in which everybody received the Zeppelins. There was much suffering and anguish, true, but of real panic there was none.

One dirigible—either a Zeppelin or a Parseval—



SHOREHAM AND THE RIVER ADUR
Taken from an aeroplane by Clarence Winchester.

attacked Ramsgate early one morning, but on its return journey several Naval aeroplanes went up in chase from Belgium, and one succeeded in outclimbing the gas-bag. The pilot was fortunate enough to place a couple of bombs well on the rear of the envelope. The enemy craft, however, managed to get back to its base, but the damage sustained was considerable. This was the first time an aeroplane successfully dropped bombs on an airship, and the event calls to mind the difficulty experienced in hitting a given object from a fast or even slow-moving aircraft. When a bomb is released it does not, as might generally be imagined, fall perpendicularly downwards. The speed at which the aerial vehicle is travelling thrusts the bomb forward, and so instead of striking the ground at a point immediately below the spot of departure from the aircraft, it reaches the earth some hundreds of yards ahead. The author once ascended in a moderately fast biplane at a well-known aerodrome and carried with him half-a-dozen dummy bombs. The grass had previously been marked out with a very distinct white circle measuring twenty-five feet in diameter, and it was proposed to drop the dummy explosive in the centre of the circle. A height of 1000 feet was reached, and the first of the bombs released. It fell, however, about 280 feet outside the intended mark, despite the comparatively low altitude from which it was launched. A thousand feet after all is not a remarkable height when it is considered that

service flying is usually carried out at anything from 10,000 feet or more. Of course, under certain circumstances when on important expeditions, pilots descend very low indeed in order to make more certain of their aim, but low flying is always fraught with a considerable amount of danger, so that except when it is absolutely necessary to come down low it is far safer to keep at a decent altitude where the chances of escape are greater. Now, referring again to the author's bomb-dropping efforts, the remaining five dummy bombs fell at the following distances from the target:

1	.	.	.	250 feet
2	.	.	.	202 „
3	.	.	.	62 „
4	.	.	.	100 „
5	.	.	.	60 „

It will readily be seen, therefore, that, even allowing for the author's bad markmanship, it is no easy matter to hit a given object from the air, notwithstanding that the altitude may be as low as 1000 feet. As previously pointed out the speed of the aeroplanes makes a deal of difference, but there are also other things to be taken into consideration as well. The direction of the wind is another factor to be taken into account and, if a bomb is dropped through space from a great height, it should be remembered that during its journey towards *terra firma* it may meet

two or three, or even more, changes in wind direction. At 500 or 1000 feet the wind might be due north, but at 3000 feet it is just as likely that it would be blowing due south. In this manner an aviator is often compelled to tack his way home somehow after the manner of the yachtsman.

On May 27, eighteen aeroplanes set out for Ludwigshafen—claimed by the Germans to be an open and undefended town—and here explosives were dropped on a large chemical factory which immediately burst into flames. The whole building was completely destroyed, and the number of deaths has never been made known by the German officials. From a fighting standpoint this raid was extremely successful, for the factory contained a large number of valuable chemicals which were, of course, lost. The German authorities could not be otherwise than annoyed, and in consequence a great deal of mock-indignation was aroused in the German press at the “attack of the English on an undefended German town!” More raids were then made by Zeppelins on the *defended* town of Ramsgate and upon the *well-fortified* suburbs of London!

June brought with it the really wonderful spectacular feat of Flight Sub-Lieutenant Warneford, a young naval officer trained at Hendon, and who, single-handed, succeeded in destroying a Zeppelin airship between Ghent and Brussels. Previously two other officers of the Royal Naval Air Service had attacked

a shed which housed a Zeppelin, and thus two German dirigibles were destroyed in one month—an excellent accomplishment for the Allies.

July was an unfortunate month in England from one point of view, for in that month an English airship at Wormwood Scrubbs blew up accidentally and killed or injured eleven mechanics. Germany has experienced several such accidents to her dirigibles, but this was the first of its kind to occur in this country. At the end of the month a raid of forty-five allied aeroplanes took place over Wissenbourg and district as well as over Freiburg. At the latter place the Aviatik works were partially destroyed, and it is understood that there were many complete war machines in the building all ready for testing, and it is believed that most of these were destroyed.

In August the East Coast was again honoured by the attention of hostile dirigibles which dropped their usual supply of bombs and killed a good many harmless civilians. One visit took place on the 9th and 10th, resulting in about fifteen casualties, another on the 12th, this time with a death roll of six, and another on the 17th which succeeded in killing ten people. The cost of these aerial bombardments must have been exceptionally heavy to the enemy, yet there has not yet been one instance where damage of strategic importance has been done. When these raids took place there was the usual outcry made immediately afterwards for reprisals, but it goes to the credit

of those in command that the raids undertaken by the allied flying corps have always had some damage of military importance in view, and this method has entailed no exorbitant waste of men, ammunition, and money, as is entailed in sending Zeppelins all the way from Germany to England for the mere pleasure of murdering a few women and children.

The British height record which was made by Mr. Harry Hawker in June was officially recognised by the Royal Aero Club in August, and up to the moment of writing this record has not been broken. The height reached was 18,393 feet and Mr. Hawker flew a Sopwith biplane in accomplishing the feat. It must not be presumed that this is the highest altitude ever reached by an aeroplane, for it is purely a British record and falls far short of the world's record for altitude, which was made by a German, Herr Olerich, who attained the wonderful height of just on 26,000 feet. On such an extraordinary flight as this special breathing apparatus has to be fitted, and the pilot must be very sound physically to stand the trying ordeal.

Squadron Commander Arthur Wellesley Bigsworth this month succeeded in destroying a German submarine. He flew very low over it in spite of the risk entailed, dropped his bombs, and had the satisfaction of seeing the thing blow up. This was the first incident of its kind ever recorded, and presumably Bigsworth can claim to be the first aviator to be responsible for destroying a submarine in this way. The feat was in

every way a praiseworthy one and not at all easy to carry out, for, as already explained, it requires extraordinary skill to successfully drop bombs from any kind of aircraft.

September might very reasonably be re-named Zeptember. Altogether there were six raids on various parts of the country causing about 180 casualties altogether. Five were made by airships and one by an aeroplane, but still no military damage was caused. It should be noted, and not forgotten, that during September eighty-four combats took place in the air, and out of this number only one English aeroplane was defeated, which goes to show that the personal skill of English aviators far surpasses that of the German aviators. This is but further evidence to prove that the none too good climatic and geographical conditions prevailing in England are a splendid means of developing the aerial branch of services. In eighteen days alone forty fights had occurred, and in every single combat the enemy had either been beaten to the ground or compelled to make a hasty retreat. The Germans, as a general rule, have not proved themselves at all adepts in the aerial art, and one of the most distinguished features about their flying is its persistent clumsiness. It seems as though artistry is non-existent in their veins, and in consequence the lack of this very necessary flying quality has cost them a great deal in men and machines. One of the most important and essential characteristics in a clever

pilot is a light artistic touch with that sensitiveness of temperament which is appreciated by and bestowed chiefly upon poets, musicians, and painters. A strange point of view, to be sure, but nevertheless quite a reasonable and true one.

During the latter part of the year so much aerial work of importance was carried out by both the Royal Naval Air Service and the Royal Flying Corps that it would be useless to single out every particular flight, and, in fact, this would be practically impossible considering that flying is accomplished day in and day out and often throughout the night. Flying in war is almost as universally resorted to as the use of motor cycles and horses, so to give anything like a detailed account would occupy more space than the unceasing repetition of similar events would be worth. However, the splendid feat of Flight Sub-Lieutenant Viney, R.N.A.S., and his observer, who in November successfully destroyed another German submarine, should not be forgotten, for this was but the second event of its kind. At the end of the year, too, the first twin-engined Caudron machine to be built in England made its appearance at Hendon, where it carried out several successful flights before embarking on a more strenuous career in connection with active service. About this time the first English giant machine also made its appearance at Hendon, but it is impossible to give any account of either craft at this present juncture. Suffice it to say that the latter put

every other machine in the shade where size was concerned, and one pilot forcibly expressed the difference by saying that he felt ashamed to fly the ordinary "miserable little worm of an aeroplane" when the big machine was about.

Owing to the stringent restrictions placed upon the writers and editors of aeronautical books and publications it has been impossible to give certain information in general outline let alone in detail, so for any shortcomings in this respect the reader must accept the author's apologies.

CHAPTER III

SOME FACTS ABOUT FLYING MACHINES

THE trend of modern design in aeroplane construction is based upon an increased effort at perfection in stream-line or tapering form. Stream-line may be illustrated by referring the reader to the fish or torpedo, or, in fact, to anything which by its nature is compelled to plough its way through a fluid like air or water. The yacht particularly, as well as ordinary sea-going vessels, is a good example of stream-line, although it is preferable to compare the aeroplane with the submarine or torpedo, both of which are entirely submerged in the element of water. In this way comparatively they are similar to aeroplanes and airships, which, whilst in flight, are, of course, also submerged in their particular element, having atmosphere above, below, and all round them.

Air is a very unstable element. In fact, it is roughly just under 800 times less dense than water, but even this apparent lack of density does not detract from the amount of resistance which the lighter element offers to objects passing rapidly through it. To test the validity of this statement it is only necessary to quickly pass a flat piece of cardboard from right to left and *vice versa*, holding it vertically in the hand

all the time. The faster the movement the more pronounced will be the resistance. Then reverse the position. Place the flat surface horizontally but still pass the object rapidly backwards and forwards, and immediately you will notice that the resistance has decreased almost to nil. This matter of resistance was the foundation in reality of the stream-line principle upon which the shape of all speedy vehicles and more essentially the modern aeroplane is based. The common or garden dart, the fish, the racing motor-car, the arrow, and many other things too numerous to mention are all in some shape or form embodiments of this very necessary principle of design. It is not improbable that you have seen, especially since the outbreak of war, an aeroplane or aeroplanes travelling through the air at an almost incredible speed. If it has been flying low, which is unlikely, or if you have been able to bring it closer to your vision by means of field glasses, you may have expressed astonishment at its remarkable outline. On such very fast craft the "nose" or leading portion is usually shaped somewhat similarly to the nose of a bullet. So noticeable is this in some instances that the soubriquet of "the bullet" has been conferred by all and sundry in the aeronautical world on all these lightning-speed aeroplanes to distinguish them from other machines which possess stream-line form in a lesser degree. Now, the reason for the peculiar formation of these very fast flying craft is

perfectly obvious, for taking the resistance of the air as a very powerful force which has to be contended with, the stream-line principle applied to the various parts naturally gives additional capability to the machine of forcing its way through the opposing element, air, and thus supplies an increase of speed, which, in war time, is a very important consideration. For scouting and bomb-dropping expeditions speed is absolutely an indispensable factor. The pilot, let us imagine, is unable to see the ground beneath him owing to the interruption of fogs or clouds. If he has been sent up for the main purpose of dropping bombs on a certain ammunition factory, railway station, junction, or any other point of military importance, he is, in this case, at an enormous disadvantage, for the simple reason that owing to the intervening clouds or mists he can catch but momentary glimpses of local landmarks which under ordinary circumstances would serve as excellent guides. In consequence he is compelled to fly low at intervals in order to take his bearings, and it is essential that he should lose as little time as possible on his mission, for should the enemy have any idea as to the whereabouts of his destination a number of fighting-craft would at once be sent up to foil the raider in his attempt to reach the desired point of military importance. Perhaps, too, on reaching the actual place upon which his bombing energies are to be exclusively devoted, the pilot may still be at a great disadvantage owing to

the low-lying clouds or mists, and so for this reason, or may be because he wishes to make certain of carrying out his destructive intentions effectively, he again has to descend to a meagre altitude. This necessitates grave risk, and it is a wise pilot who, having dropped his bombs, climbs again as rapidly as his machine will carry him to the safer altitude of 10,000 feet or more. It is when such low flying becomes a *sine qua non* to carrying out an expedition that speed can be considered the prime factor, and often has speed alone been the means whereby the life of many a service pilot has been saved. Hence will be seen the importance of paying such close attention to the details of aeroplane design and to such matters as the perfecting of stream-line form.

Not only are the bodies, or "fuselages" as they are technically called, tapered or stream-lined, but a great many other smaller but no less important parts of the aeroplane are treated on the same basis. For instance, the wheels, which number either two or four according to the type of machine, are fitted with discs after the manner of racing cars. Less forward resistance is therefore obtained when discs are used, but the side resistance is greater than if the wheels were left uncovered and exposing the spokes. The upright struts which hold the two main planes of a biplane together are most accurately stream-lined, and those which bear the greatest strain are centred with steel. In some cases, but notably in the machines of fairly

recent production, the cross-wires which help to strengthen the whole craft are also treated scientifically and stream-lined, so that instead of finding ordinary round piano wire as used generally, it will be seen on closer inspection that the wires taper away at the trailing or rear part almost to a sharp edge. This is particularly noticeable in German machines.

Whilst writing on a matter concerning resistance, it might be of interest to recall that it has been found from scientific research that a vibrating wire offers as much resistance as a solid surface equal to the area of the vibration. Thus, if a loose wire vibrates to an extent of two inches, just as much resistance is met with as if there were two inches of solid material for the whole length of the vibrating wire, so that if the wire measured forty inches there would actually be 40 inches by 2 inches perfectly solid resistance. All these small things count. Nothing by any stretch of the imagination can be considered unimportant in the construction of aerial vehicles. Extra speed is secured by attention to details, and often through lack of such attention an aerial battle or a valuable prize may be lost. The main issue has for some time been war, and peace competitions have almost been forgotten. In a Zeppelin chase speed is the chief factor, so the public need marvel no further at the infinite pains taken by aeroplane manufacturers over the little items which do not outwardly appear significant yet upon which rests probably the demise of an enemy airship.

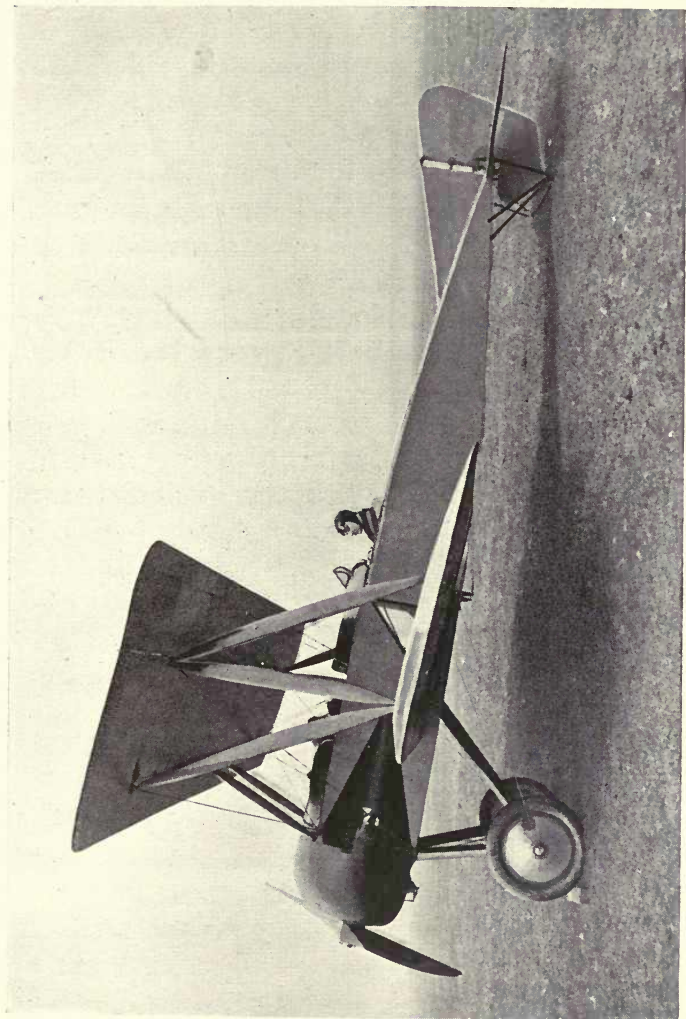
The Zeppelin itself is yet another instance of the art of stream-line, and it would not be unreasonable to assert that much of the success achieved by this type of dirigible is due to the designer's careful experiments in securing the best possible shape for the gigantic envelope. Germany, of course, directed all her efforts on the production of a practical airship, and no one can deny that her success, achieved through hard experience, disappointment, and ill-luck, has been phenomenal. Still, directly Germany saw that the aeroplane could also be made a practical proposition as applied to warfare, she at once began to experiment with aero engines and heavier-than-air machines. This decidedly sensible step was but a natural movement on the part of a powerful military country. The commercial and sporting side of the new invention appealed to England, but to Germany there arose the irresistible idea of the possibility of developing a new and exceedingly useful engine of war.

In the early days the toll exacted from Germany was indeed heavier than that paid by any other country in the whole world. At Johanisthal, one of the most important aviation centres on the Continent, as many as three pilots a week accidentally met their doom. It was remarkable, too, how frequent aerial collisions became directly the aviation movement was thoroughly established. Sometimes, when the sun was setting and throwing long-drawn shadows across the huge flying ground, there would be thirty, nay,

frequently as many as forty machines in the air at the same time. No wonder collisions were more than occasionally unavoidable! But the life apparent at any German aerodrome was a remarkable contrast to the dull and dismal flying grounds which prevailed in England in those days. The German schools were systematically controlled, and the machines used for tuition were really sound craft—not pieces of patched canvas stuck together and decorated with wires and things to look like aeroplanes, such as I have seen in use at more than one school in this country.

Aeroplane builders in Germany first took the bird wing for the basis of their design, hence the prevalence in the early part of the war of the *taube* or dove-winged type. The daily press has rather mislead the public concerning *tauben*, so much so, that the average individual is under the impression that a *taube* machine is of a particular manufacture rather than of a particular type. As a matter of fact there are many individual machines totally different in themselves yet all of them might be accurately described as *taube* craft. For instance, the Albatross monoplane, Etrich monoplane, Rumpler monoplane, and the D. F. W. biplane are all of *taube* type, yet every one has its different qualities and disadvantages. The idea of copying the bird wing is to preserve the natural stability and to decrease the amount of effort which is usually and continuously maintained by the pilot in order to keep his craft on an even keel. If a gust of wind, let us

say, strikes the right plane so that the machine is tilted up sideways, the aviator at once pulls a central lever over to the side which has been struck by the gust and thus he immediately recovers his equilibrium. Now such actions on a windy day are continuous and fatiguing, especially if the aerial journey happens to be a long one. It is nothing more or less than a repeated wagging of a central stick and a continual effort to counter-move the effects caused by the numerous gusts which every moment strike some part of the machine. On a calm day, of course, matters are different. The chief advantage claimed for *taube* or bird-winged aeroplanes is, therefore, that of reduced fatigue. It is possible to leave the controls entirely alone and the machine will look after itself for a considerable length of time, and on a long voyage, or particularly when the pilot wishes to engage his hands in other directions, this advantage is one that can readily be appreciated. The wings are so scientifically constructed—the shape is so aerodynamically correct—that when a puff of wind or even a strong gust strikes them the craft immediately “rolls” and returns to its normal path of flight. This is but another instance where aircraft may be likened to sea-going vessels. It must not be supposed that action on the part of the pilot is never brought into play, for, obviously, if no attention whatever was required to keep the machine balanced, truly the absolute mastery of the air would already be an accom-



THE GRAHAME-WHITE SCOUTING BIPLANE

Compare this smart-looking machine with some of the early aeroplanes

plished fact. The *taube* design merely lightens the labour usually required of the pilot, and does not by any means entirely exonerate the aviator from work! Still, if a census of opinion were taken it is probable that the majority of pilots would vote in favour of working, at least in the air, as there is admittedly a sublime feeling where self-reliance and occupation of mind are concerned. Of course, if the vote were taken in regard to work on *terra firma* the result would naturally be quite different, although a few aviators have been known to spend at least some time in the workshops! To keep the mind occupied while in flight perhaps is a point worth considering. A machine that flies itself leaves the mind of the human element with nothing to do, and as all people who have made a long flight know, the sense of loneliness at a great height is so impressive and vast that an almost irrepressible desire to shout makes itself very prominent. A passenger in an aeroplane has usually no occupation for his mind. He must sit there, 5000 feet up maybe, and just look around or below or above. Beneath him may be long immeasurable stretches of rolling white clouds. Perhaps the earth is not in sight except for a few moments when the clouds condescendingly provide a tiny peep-hole. Then only can he catch a glimpse of land to which he must sooner or later return. The pilot is in this case behind him controlling the new dragon of the air. And so to all intents and purposes the passenger is

alone. The engine's roar has become a long monotonous drone, and the draught from the propeller presses heavy on the exposed portions of the face. Before I took up practical flying myself I had often been a passenger under such conditions as related above, and as I became accustomed to flying and the novelty had to some extent worn off, I was often overcome with alternate fits of depression, extreme loneliness, and remarkable elation. For one moment I would feel extremely excited, then would come the lull and loneliness would make itself felt as distinctly as if I had been gripped by an iron hand. It has often occurred to me that aerial locomotion has opened a new field for psychological students and nerve specialists, for it is really surprising what a large number of bewildering sensations it is possible to experience in the air.

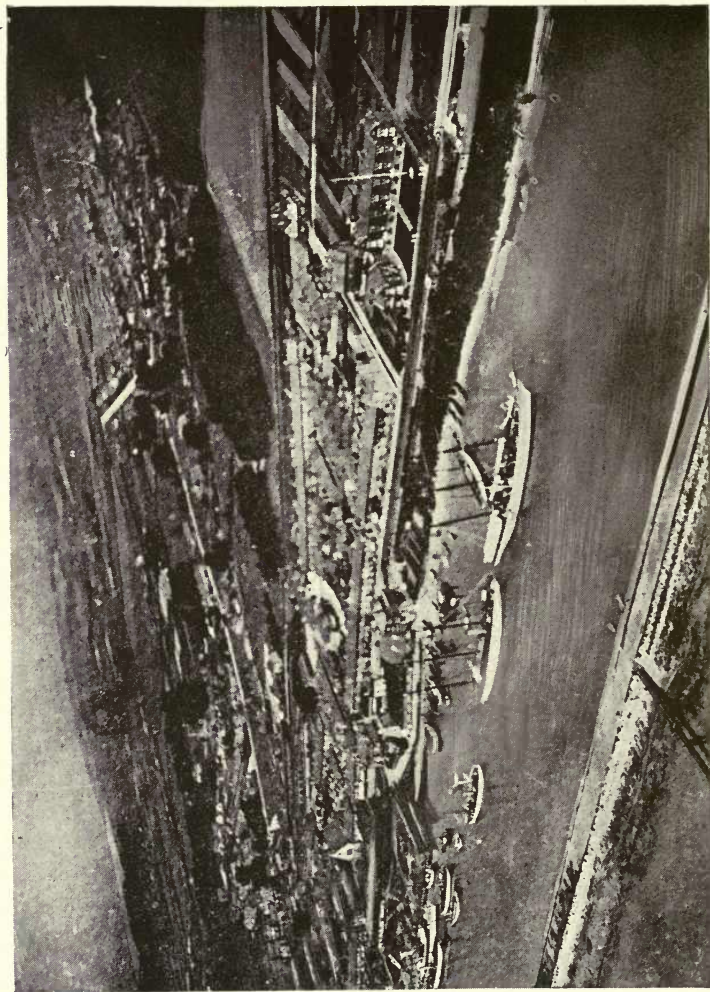
It is for these reasons, therefore, that the majority of pilots seem to prefer a machine which requires ability to handle. The mind has some occupation, and what has been overlooked somewhat is that the individuality of the flyer is also exhibited. No two pilots fly the same machine in the same manner, and often it is possible to identify an aviator purely by his individual style of flying. One of the most pronounced *taube* machines of English manufacture was the Handley-Page monoplane, but in the words of one of her pilots "she was a pig to land." This is very often the case with naturally stable machines, for on

attempting to land, ground gusts strike the planes, the machine rolls, and perhaps the earth intervenes before the roll is completed. Result — flying suspended *pro tem.*; increased energy produced in workshops. The Handley-Page biplane, however, was an all-round 'bus and differed considerably from the monoplane, which, by the way, never wanted to come down when once it started for a flight. The biplane accomplished a great deal of work, and it is surprising that it was not manufactured in very large quantities.

Contrary to general belief very few *tauben* are used on active service. The Germans have for some while relied on building fast scouting biplanes and monoplanes that bear no resemblance to the bird whatever, but rather follow the lines of the English aeroplane, conforming more to standard rules and conventions. The twin-engined biplane is also being rapidly produced in Germany as well as in many other countries. With development on proper lines it should prove a feather in the cap of those enthusiastic disciples who have for so long been crying for the larger machine. If, to use an aeronautical colloquialism, one engine "gives up the ghost" or is rendered *hors de combat* through gun fire, the other may be the means of bringing both pilot and gunner safely home to their base instead of being compelled to land in enemy territory where capture of everything would be imminent. Very little was done in experimenting with multiple-engines in this country before the war, although, had the triple

engined Radley - England waterplane been played with a little longer, this particular branch of the aeronautical service would be two years or more in advance of what it now is.

Of course, at the moment we enjoy an aerial supremacy undreamed of a year or so ago. It is due more to the personnel than to the matériel of the flying services, for our men have always proved themselves sportsmen under the most discouraging of circumstances. There is one thing more than anything else which has gone a long way in making the English air pilot as near perfect as it is possible to be. That one thing is the country itself. England's diverse geographical and climatic conditions are but natural advantages to the modern Icarus. Do not suppose that there is no country worse than this little island. Norway would be a hard training ground indeed, and there are others which would perplex the 'cutest pilot. But taking it all round, England possesses the distinction of being not too difficult and, on the other hand, certainly not too simple to navigate aeronautically. And it is for this reason that the personnel of the English air services have so successfully achieved the proud position of being absolutely the best. France and Germany are both comparatively easy countries from an aviator's point of view, and there are an extraordinary number of flying officers who will bear testimony to this statement. In one way, therefore, the hard training at first experienced by our plucky



SHOREHAM HARBOUR
Taken from Farman biplane by Clarence Winchester

aviators has been invaluable to the many who have served or are now serving the cause of the Allies at the front. Still, it would be foolish to rely too much on our present supremacy. Other countries, as they see or already have seen the importance of a powerful aerial army, will go on building as rapidly as they can, for sooner or later there will come a period when a country without an air force will be almost in as bad a position as a country without ammunition. Therefore, as three keels to one has applied in the past, three planes to one must apply in the future. Still, this leads us somewhat away from our subject.

In the construction of aeroplanes there are now so many different systems employed in matters of detail that it is absolutely impossible to lay down any hard and fast rules as to types of fittings used on the various kinds of aircraft. Aeroplanes are now so multitudinous that there are a dozen and one little attachments all actually used for the same purpose yet each of which is different in design and principle. Steel and wood chiefly are used in construction, although the all-steel machine has not yet become so popular as its various qualities might make it. Therefore ninety per cent. of the machines you will come across will be built up of ash and spruce. Ash longerons usually support the engine, which in some cases is right in front of the machine and in others somewhat far back. The former carries the tractor in front and the latter uses a propeller behind, and respectively the types

are called "tractors" and "pushers." The pusher machine is an excellent craft and is admirably suited for gun work. There is nothing in front of the pilot to obstruct the view or to interfere with the firing, and for observation purposes and aerial photography it would be difficult to beat the pusher. There is, however, one great disadvantage to this type. As has been stated previously, the power plant, oil tanks, and petrol tanks are all situated behind the pilot, and in spite of the many advantages of this system the one great shortcoming is important enough to prejudice a large number of our best pilots against these machines. If the craft suddenly nose-dives and not at a sufficient altitude to enable a recovery to be made, the aviator, being several yards in front of everything else, is naturally the first object to strike the ground. That is not all, either, for immediately follows a heavy engine with the addition of a couple of tanks. These items are no light matter both figuratively and literally speaking, for many an able pilot has lost his life through such an accident actually happening. In the tractor machine, of course, the engine strikes the ground first and in this case the human cargo has at least some chance of escaping premature death.

The struts of an aeroplane—a biplane for our purpose—are set in steel or aluminium sockets, thus connecting the top and lower plane surfaces. As already mentioned, some of these struts, notably those which bear the greatest strain, are centred with steel,

and often they are hollowed out for the sake of lightness as well as for the purpose of giving better results constructionally. Every strut on the machine is very carefully stream-lined, and between each strut there are diagonal cross-wires which are kept taut by means of wire strainers or turnbuckles. The cross wires give increased rigidity to the whole structure, and before ascending a careful pilot always looks over his machine, twanging wires here and there to see if they are of the required tautness. If one is discovered loose it is immediately tightened up by twisting the turnbuckle or strainer round and round until it again becomes quite taut; but I am afraid most adventurers of the air are so careless of everything and particularly of themselves that they rarely take the trouble to see if their machines are in proper flying trim. They just jump in and fly! Open confession is alleged to be good for the soul, but, nevertheless, it is bad for the reputation. I will risk that, however, and whisper that when I was flying at X—— one evening a piece of the tail of my machine blew clean away, and yet for some long time I had been glancing round the while watching it flap merrily in the breeze! Let it be stated that that was three years ago, so perhaps increased age has brought with it increased sense. The planes themselves are carefully built up with numerous ribs and usually two main spars. These are interspersed with wires which are tightened with turnbuckles after the style of the outside wires. Over the ribs and

spars is stretched a fabric specially manufactured for aeroplane construction, and this is externally treated with a dope which draws the material so tight that when tapped it resounds like a drum. The elevators and rudder are similarly treated and, in fact, all the fabric on the machine is doped over. The effect of this dope on the persons employed in using it is very remarkable, and in big firms where much doping work has to be done the men or women work in short shifts to prevent their becoming too intoxicated. Through breathing the fumes from aeroplane dope a stupefying effect is produced, and there have actually been several deaths caused through the peculiar poisonous nature of the substance. The wheels of an aeroplane are fitted with special shock-absorbers so that the effect of any heavy descent may be considerably minimised.

The pilot's seat and passenger's seat are so situated and arranged over the centre of gravity that very little difference is noticed in flying the craft with or without a passenger. If such an arrangement were not followed the addition of a passenger would doubtless make the machine nose heavy or tail heavy according to where the additional weight was placed and in consequence the machine would be difficult to fly, and what is more, the proper efficiency would not be extracted.

CHAPTER IV

HOW AEROPLANES FLY

Now that aviation has advanced to such a high degree of importance, it is but natural for the "man in the street" to wish to know the why and the wherefore of the aeroplane. A year or so back he cared little about flight and even less about how an aeroplane actually takes the air. To some extent this attitude of indifference was excusable. Flying was looked upon as a pastime for rich young gentlemen who had no objection to dying in an untidy manner if Fate called upon them to do so. This apathy was exceptionally pronounced in England, but in France and Germany the average man took at least a surface interest in both civilian and military aerial navigation.

The first question which usually comes from the uninitiated is, "Does an aeroplane fly like a bird?" and another interrogative which is frequently thrust upon those who happen to know something about the new art is, "Does an aeroplane fly itself or has the pilot to keep it level by balancing?" The former can at once be answered in the negative. An aeroplane does not fly like a bird in that there is no wing-flapping employed in the acceleration of the craft of the present day, although experiments have been made

and are still being carried out by numerous enthusiasts who claim that the future of flying exists in the successful development of wing-flapping.

As to whether an aeroplane flies itself or whether the pilot must balance it as he would an ordinary bicycle depends entirely upon the type of machine. It may be stated, however, that no aeroplane entirely maintains its own balance perpetually without any attention on the part of the pilot, although as already explained in the foregoing chapter some machines have come remarkably near to achieving such a quality, which may or may not be desired. The average aeroplane requires balancing in the same manner as does a bicycle, and just in the same way that one becomes naturally accustomed to riding a bicycle, so does the pilot of an aeroplane become accustomed to controlling his craft in the air and also upon the ground. Movements become instinctive. It is not necessary for each individual action to be a matter of careful forethought except in the case of the student learning to fly. He, of course, has to be instructed in every movement, and therefore takes time in assimilating the list of directions for controlling aircraft.

The universal controls of an aeroplane consist of one central lever for the purpose of raising and deflecting the elevator, a rudder bar worked by the feet, and the usual appendages to a petrol motor, such as switch, throttle, etc. The central lever, familiarly

known as the "joy stick," is always held in the hand, and if the craft makes a sudden dip forward, to correct this movement and to keep the machine on an even keel the stick is pulled back slightly. Alternately, if a gust of wind forces the nose of the machine up too much the lever is pushed forward and thereby corrects the dangerous angle. This is called longitudinal control, *i.e.*, control fore and aft.

There are two general methods of maintaining lateral control, which means the control entirely reverse of fore and aft. One is by using a system known as "warping," and the other by the movement of "ailerons" or wing flaps. The Wright brothers were the first aeronauts to originate wing warping—a system by the way which does not seem so efficient as aileron control. It consists of warping or turning the trailing edges, or, more explicitly, the rear edges of the plane or lifting surfaces, so that a certain resistance is caused on the one side or the other which thereby effects a "bank," and in consequence a turn is effected to the right or left according to the pilot's desire, or a counteraction of disturbing effects produced by gusts and eddies. By banking must be understood the angle at which an aircraft turns, and the sharper the turn the more pronounced will be the bank. In fact, so advanced is the art of piloting nowadays, and so highly developed are our wonderful steeds of the air, that it is quite a reasonable performance to "bank" an aeroplane absolutely vertically. Instead of making quite a mild

turn as would be done on a cycle the aeroplane will be seen to lean completely on its side with one wing tip facing directly downwards towards the earth and the other pointing immediately towards the sky. Whether warp or ailerons are used the same effect is produced, and in conjunction with these practices the rudder is also brought into play. For instance, we will agree that a pilot wishes to make a turn. Invariably the following movements will be enacted, although there can be exceptions according to circumstances.

Movement 1: The central control lever will be pushed very slightly forward. Movement 2: The rudder-bar, which is controlled by the feet and is mounted on a pivot, will be moved forward in the direction it is desired to turn. Movement 3: The central control lever is pushed to the same side in order to increase the bank and to assist the action of the rudder.

If the rudder has been too forcibly brought into play the warping lever is in that case hauled in the opposite direction to counteract rather than to assist the rudder, and the amount of movement is decided purely by "feeling" the behaviour of the machine. Affixed at the rear edges of the planes are small flaps known as ailerons, and these flaps, working on hinges, are connected with the central lever by means of wires running over pulleys. When this lever is pulled one way or the other in a sideway direction the flaps are turned up or down and bank the machine after the



A SHORT HORN MAURICE FARMAN BIPLANE

There is no front elevator to this craft

manner of warped wings. So in both cases the movement is the same, only in the latter method the side-way movement is not so stiff, simply because it is not essential to actually bend or warp the planes themselves. It has been said that by warping the wings they are apt to become distorted and in time affect the balance of the craft. Although there is possibly some truth in this, it is doubtful if the distortion occurs before a good deal of service has been extracted out of the machine. Monoplanes are almost universally manipulated by warping, and biplanes usually by ailerons, but this does not apply in every case.

Of the actual scientific phenomena a few points described non-technically may be of interest. Every plane surface is slightly curved, or to use the correct term "cambered." The camber of a plane is its curve. Thus, if you take a flat piece of cardboard or tin and slightly bend it so that it forms a part of a circle, there you have an excellent demonstration of what camber is. In an aeroplane the front edge of the plane itself is known as the leading edge and the rear is described as the trailing edge. The former is responsible for most of the lifting efficiency of the craft, for when it is passing through the fluid which we call air the front edge naturally has the least disturbed air for its special benefit. Directly it has entered a certain section of atmosphere, it disturbs the element over which the trailing edge immediately

has to pass, and so the latter cannot obtain so much support from air that consists of mixed currents as it would from air of an undisturbed nature.

These planes are then set at a given angle, and as they are forced forward by motor power the wind resistance causes them to lift into the air. The amount of lift required—or rather the angle at which it is desired to ascend—is regulated by means of the elevator which is worked by the central “joy stick” previously alluded to. By pulling this stick back, the elevator is raised, and the machine rises into the air. Pushing it forward, on the other hand, deflects the elevator, raises the tail, and so the machine is enabled to descend. Therefore by the controls of an aeroplane it is possible to direct the craft according to one’s desire, and it is surprising how easy it is to manage a heavier-than-air machine when once the art has been acquired.

It is strange that even at this present stage of development it is often believed by the uninitiated that should the engine of an aeroplane cease working the craft must at once crash to earth like a stone. That argument—albeit a false one—has been used by the prejudiced ever since man first flew, so that there can be no harm in once more contradicting the misleading assertion. True, an aeroplane must descend directly it loses its power, but it certainly does not crash to earth like a stone. If such were the case, where would many of our aviators be now? Only by

the power of gliding have many of our service pilots returned to the British lines safely with their observations and photographs, or from their bomb-dropping expeditions. Directly the engine stops the pilot pushes the nose of his machine earthwards and fixes his eyes on the spot he has chosen for landing. This is where the advantage of flying at a good altitude can readily be seen.

A glide to earth, with only the whistling noise of the wires in one's ears, is the most delightful sensation it is possible to experience. Nothing can excel it in any way. It makes one gladly wish that it were possible to affix wings at any moment to one's body and fly to the heart's content over God's beautiful earth. Man may well envy the birds their incomparable lives.

While on the subject of gliding it may be interesting to recall that a British pilot, Mr. Frederick Raynham, once ascended at Brooklands in an Avro biplane, rose to a good altitude, switched off his engine, and commenced one long glide which ended up quite neatly at the Hendon flying ground. The distance between these two aerodromes, as the crow flies, is approximately twenty miles. It is doubtful if a more delightful voyage could ever be experienced than this one continual floating on air, with no deafening noise from an engine, and with nothing to keep one company but the musical whistling of the wind through the many bracing wires which hold the structure together. The

propeller stops and the machine is temporarily transformed into a glider. The only way to prevent it turning turtle is to keep the nose or the foremost part well down so as to maintain the momentum as produced by the force of gravity. If for one moment the pilot were to flatten the machine out it would immediately lose its flying speed and then either turn over sideways or fall tail foremost. Such an occurrence taking place near the ground would be disastrous, for the pilot would have insufficient space to get the nose of the machine down again and so regain his momentum, but provided the craft happened to be at a fair altitude it would not be impossible to once again return to the normal path of flight. Gliding, itself, as a sport is unequalled, but it is accompanied by a reasonable amount of danger. I am alluding now to gliding with common or garden "gliders" such as were used in the early days of experimental aviation. A "glider" is expressly an aeroplane or a construction of planes fitted with no mechanical motive power. A small spanned glider can be built very economically, a reasonable sum for the outlay being about £10. They are launched sometimes on steel runners, and in other cases they are towed into the air. It is rather good fun, and where a gradual hillside slope can be found, there is a fine opportunity for sport and investigation. Some time before aviation became generally recognised as a universal problem I built, in company with a friend, two or three more or less successful gliders.



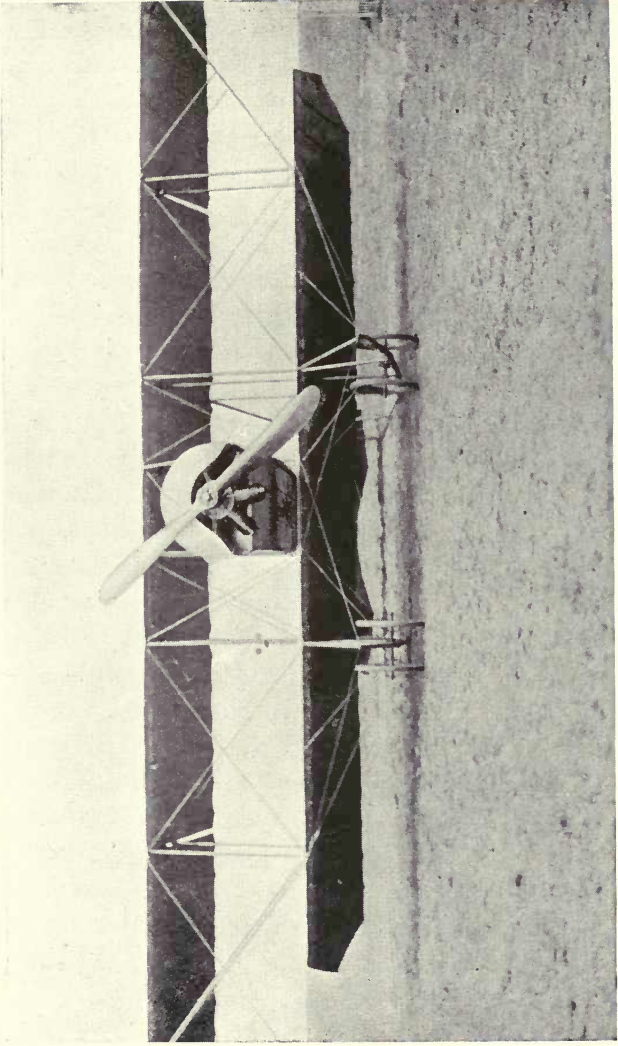
FREDERICK RAYNHAM

One, however, bore no resemblance whatever to the present-day aeroplane, or, in fact, to anything that has up to the moment ever taken the air, yet, strange to relate, this peculiar craft was the best glider I had ever flown. It was built on the line of a paper model which I had accidentally "discovered" whilst making various weird shapes out of a piece of paper and launching them in the air. It is really quite surprising what an extraordinary number of things can be gleaned from casual experiments of this sort, but I fear that if the reader makes a general habit of standing on the best drawing-room chairs and launching paper gliders, he will either be accused by his near relations of mental deficiency or compelled to re-cover the suite periodically. Still, I always found the air of the drawing-room particularly calm and just suitable for my experiments, and I took great care to have the key on the inside of the door. Such habits, though, do not earn for one the reputation of being an inventive genius, and I should not like to be compelled to record the exact nature of the remarks and opinions invariably loudly expressed by the said near relations.

Returning to the subject of controlling aeroplanes, it is interesting to compare the different methods of descent. When the Gnome engine is used the only way of coming down is by switching the engine alternately on and off with the nose of the craft always pointing earthwards. If a high wind is blowing the

engine is not switched off very considerably as it is advisable to have plenty of engine running when descending into a very strong wind, otherwise the craft is liable to be upset. When little engine power is used in coming down, that is, when the intervals between switching on and off are long, the descent must necessarily be made steeply so that the machine will not lose its flying speed. The less power used the greater must be the angle of descent.

Now, with many engines it is possible to "throttle down," or in reality decrease the number of revolutions made by the propeller. This has the effect of slowing up the craft, and consequently very fast machines may be landed at comparatively slow speeds. This is an exceedingly important matter, because when a machine lands at a high speed the length of the "run" after it has touched the ground is considerable. There is also another point which has to be allowed for—the ability of the pilot to land at rapid speeds. Just imagine a fast little scouting craft touching the earth at ninety miles an hour! There is a great deal of delicacy required in accomplishing the feat, and it is only an expert flyer who would possess such an exacting quality. It would be quite impossible for a machine of this description to land in a small field, for if it were to do so it would run on and on and on till, perhaps, it collided with a hedge, trees, or maybe a wall. If the ground happened to be at all rough the force of the impact on landing might be sufficient



CAUDRON BIPLANE

This machine is known as a " tractor " biplane, having the tractor screw in front of the planes

to turn the concern right over, and travelling at ninety miles an hour such an event would most certainly prove fatal for the luckless aviator. Therefore, the wider the speed range, the safer the machine. There are craft which can travel at ninety miles an hour and land at thirty-six miles an hour. Such craft are, of course, invaluable for alighting in small spaces. The Blériot machine can land extremely slowly, for the wing surface and the method of "sitting" these monoplanes down act as a very efficient air brake. No other machine is so efficient in this respect. The speed of descent on machines which rely solely on the switch is regulated purely by the angle at which the pilot decides to come down, and also upon the amount of engine used. Of course, the steeper the planing angle the faster will the craft travel, and, as already pointed out, the length of interval between switching on and off will also have some effect upon the speed. Sometimes a pilot of an aeroplane will intentionally "pancake" his mount in order to descend in limited space. This most peculiar term "pancake" requires some little explanation. It defines the action of an aeroplane which has been flattened out too early, as if it had already touched the ground. The machine then accomplishes its remaining distance to earth in a sitting posture, but such a practice is certainly not to be encouraged. The force of the impact is liable to break the landing chassis or "carriage," and in any case a few wires are bound to get broken, besides

putting a great strain on the whole structure. The "chassis" is the under part of the machine and consists of strong skids and several strengthened struts. In many cases the chassis is built up of steel to withstand the severe strain which it is sometimes called upon to bear. So, except in certain circumstances, the "pancaking" of aircraft is not an advisable method of landing, although that most astonishing of persons, the aviation pupil, usually makes up his mind to land fifty feet before it is necessary. That, however, has the advantage over landing too late with its resultant broken machine and, perhaps, broken neck.

"The man in the street" will now be able to grasp the one or two main points concerning the comparatively new mode of locomotion. Aeroplanes do not *fall* if by any chance they are deprived of their power, but in such circumstances they *do* have to descend. An airship, on the other hand, can be deprived of its motive power and yet still remain aloft, for its support is maintained by its huge envelope which is inflated with hydrogen gas. Aeroplanes do not fly like birds, although some are built on the bird-principle, inasmuch as they are designed with bird-shaped wings, but as mentioned earlier they resort to no wing flapping methods for the means of their propulsion. Lastly, the pilot is responsible for keeping an aeroplane on even keel and does not, as is the case with the motorist and his car, just jump in and manipulate

a few levers and gadgets with the result that the aeroplane flies off requiring no further attention. No! the pilot is part and parcel of his craft and upon him depends the neatness with which the dragon of the air is flown and the gracefulness with which the turns are made and landings effected. In short the flying of an aeroplane is an art and exemplifies in every way that much used and little understood phrase "the poetry of motion."

CHAPTER V

LEARNING TO FLY

To conduct an aeroplane at an altitude of 200 feet or so round the limits of an aerodrome is no difficult matter. In fact, I can imagine nothing easier when once the knack of flight has been acquired.

When a young man, or an old one for that matter, essays to learn to fly there are many little things he is apt to overlook in considering the best way to achieve his ambition. There are two main roads that will lead the prospective aviator to his cherished goal, flight, and these may be put down as follows: To build or purchase a machine and teach himself, or to join a school of flying and be taught by an instructor. The former is, of course, a very expensive way and may at once be put aside as impracticable, especially so when modern progress provides means whereby flying can be learned as easily and as safely as cycling or even bridge.

The latter method is, therefore, the better one, and I propose to give a few hints to the would-be airman who thinks of joining an instructional establishment. There are, as every one in the aviation world knows, flying schools and flying schools, just in the same manner as there are tutors and tutors. A very excel-

lent method of discovering whether a flying school be genuine or not is for the pupil to reside near the aerodrome a week or two before he actually wishes to commence his tuition and to pay regular visits to the ground, carefully watching the amount of work done by each school and the number of candidates passed for their certificates. In this way, too, he will soon pick up chance acquaintances who may be pupils themselves and he will easily gather some idea of the reliability of the various firms and whether by joining this or that school he will be receiving value for his money.

The standard charge for instruction in flying is now £100 (one hundred pounds), although before war so materially enhanced aviation in the eyes of the public it was usual for a reliable firm to charge £75 (seventy-five pounds). The fees nearly always include insurance against breakages and third party damage. However, with the ever-increasing demand for aviators for the Royal Flying Corps and the Royal Naval Air Service, schools became overcrowded, and in consequence the fee was raised by £25 in order to lessen the rush of students. Anent overcrowding, it is advisable to choose a school where the number of students is strictly limited so that continuous instruction is obtainable. For instance, where fifteen or twenty pupils were taken at a time, it would be possible for each individual to secure a certain amount of tuition morning and evening, weather conditions, of course, always

permitting, and thus these fifteen or twenty pupils would take but a short time comparatively to become sufficiently competent in order to fly the official tests. Now, let us take it that another school is open to accept as many as 100 students at one time, or even more if it could get them. After the first man has received his lesson, let us say, on Monday morning, there remain ninety-nine others to receive *their* first lesson. By the time, then, that the first man's turn comes round again a fortnight has probably elapsed, and he has more likely than not forgotten what he learned during his first flight, or in the case of single control machines, during his first "roll." Therefore he wastes many weeks in lounging round the aerodrome with nothing to do and all the day in which to do it, besides spending a considerable amount of money on keeping himself and providing amusement to wile away the time.

Some schools, on the other hand, insist on rushing all their pupils through at a most extraordinary rate, and some of the "pups," as students are called, have even complained that they have been learning too quickly! Where time is scarce, this system is a boon and a blessing, although it is not to be recommended to people who have six or eight weeks to spare. Officers home on leave for a short period usually avail themselves of this rapid tuition, and, of course, to those thus situated it is certainly encouraging to be able to secure a pilot's certificate in order to aid their

transfer to the Royal Flying Corps or the Royal Naval Air Service. However, if this quick tuition can be avoided so much the better, as that which is quickly learned is often as quickly forgotten.

Six or eight weeks may be considered a reasonable period to cover a course of lessons, for in this time a pupil can gain a thorough knowledge of the elements of flight, and he may also be able to pick up much useful information concerning aero engines. Not the least of advantages is familiarity with engines, for it often happens that a small trouble may be rectified in a space of five minutes or so by a pilot acquainted with his plant, whereas a man who could fly, but possessed no rudiments of engineering, would be at sea until help from outside sources arrived. And this, in war, might mean the capture of man and machine if through engine trouble a compulsory descent was made in enemy territory.

There are two systems generally employed in flying instruction. One is known as dual control and the other as single control. First, we will consider the former. Each machine is fitted with two seats, either side by side or tandem fashion, and each seat has attached a separate control lever and rudder-bar. The instructor occupies one and the pupil the other. Both sets of controls work simultaneously so that when the teacher moves the rudder-bar or the central lever the student feels the movement duplicated. The machine ascends to 1000 feet or so, and many flights

of this description are made before the instructor allows the pupil full control. When this is done it is, of course, also possible for the former to "feel" or notice any mistakes made by his charge, and so in many respects this system is an excellent one.

It has often been said that in learning to fly by dual control methods a pupil is unaware of the exact amount of flying he is actually doing, as he often imagines the instructor is working the lever, whereas the latter may be actually resting and merely leaving the piloting to the pupil, at the same time, of course, keeping a watchful eye upon what is happening. There is, to some extent, a little truth in this assertion, but this slight disadvantage is outweighed by many other points of more importance. If I may be allowed to express an unbiassed opinion, I certainly think the dual control method is the safer of the two under discussion. At least from what I have seen and experienced in school work I have always found it so.

The second system is that of single control. In some respects and for some temperaments it has its peculiar advantages.

The embryo aviator is seated in a single-seater aeroplane. He is alone. The engine is started and the machine commences to run over the ground. Directly its speed becomes too pronounced the pupil switches the engine off and so adjusts its progress to his liking. At first the path of the craft will be somewhat irregular like that of a bicycle bearing an amateur,

but with practice the pupil will become more competent and able to keep to a straighter course. The straighter the course, the faster his speed will become, until he is capable of running over the ground with his engine full on. This is aeronautically known as "rolling."

After this stage has been accomplished successfully small "hops" off the ground are made, until long straight flights can be flown and good even landings effected. These "straights," as they are called, are continued for some while, and when the young pilot feels sufficiently confident in himself or, perhaps, more correctly, when the instructor feels sufficiently competent in him he is allowed to attempt his first circuit flight. Perhaps this flight is the most exciting one of his tuition career, for there he is a couple of hundred feet high, alone, piloting a craft round the confines of the aerodrome for the first time. However, he is well on the way to completing his certificate tests, which he usually does after one or two circuits and "eights" with their necessary landings. These tests consist of the following flights:—

- A Two distance flights, consisting of, at least, 5 and kilometres (3 miles 185 yards) each in a closed
- B circuit, without touching ground or water; the distance to be measured as described below.
- C One altitude flight, during which a height of at least 100 metres (328 feet) above the point of departure must be attained; the descent to be

made from that height with the motor cut off. The landing must be made in view of the observers, without restarting the motor.

2. The candidate must be alone in the aircraft during the three tests.
3. Starting from and alighting on the water is only permitted in one of the distance flights, A or B.
4. The course on which the candidate accomplishes the tests A and B must be marked out by two posts or buoys situated not more than 500 metres (547 yards) apart.
5. The turns round the posts or buoys must be made alternately to the right and to the left, so that the flight will consist of an uninterrupted series of figures of 8.
6. The distance flown shall be reckoned as if in a straight line between the two posts or buoys.
7. The candidate before commencing the distance tests shall indicate an alighting point.
8. The alighting after the two distance flights in tests A and B shall be made:—
 - (a) By stopping the motor at or before the moment of touching the ground or water.
 - (b) By bringing the aircraft to rest not more than 50 metres (164 feet) from the point indicated previously by the candidate.
9. All alightings must be made in a normal manner, and the observers must indicate in the report the way in which they were made.

10. In the altitude flight, test C, the alighting may be made anywhere in sight of the observers. The descent from 100 metres must be made with the motor cut off. The motor must not be restarted till the aircraft has come to rest on the ground.
11. In the altitude flight, test C, a maximum reading aneroid must be carried on the aircraft, and on the candidate alighting, the observer must note the actual height attained as recorded by the aneroid and enter the same in his report.
12. It is not necessary for all the tests to be made on the same day.

The most difficult part of flying is not actually flight in the air, but the fine art of landing smoothly. Landing is no easy matter. It is easy to go up, but strange as it may seem it is not so easy to come down again. To judge the exact distance you happen to be from the earth requires much skill and more often than not an inborn gift achieves the desired result. Some pilots come to earth as lightly almost as a feather. Others bump most heavily as if to say, "Thank heavens I'm down," little caring how they get down so long as they descend somehow.

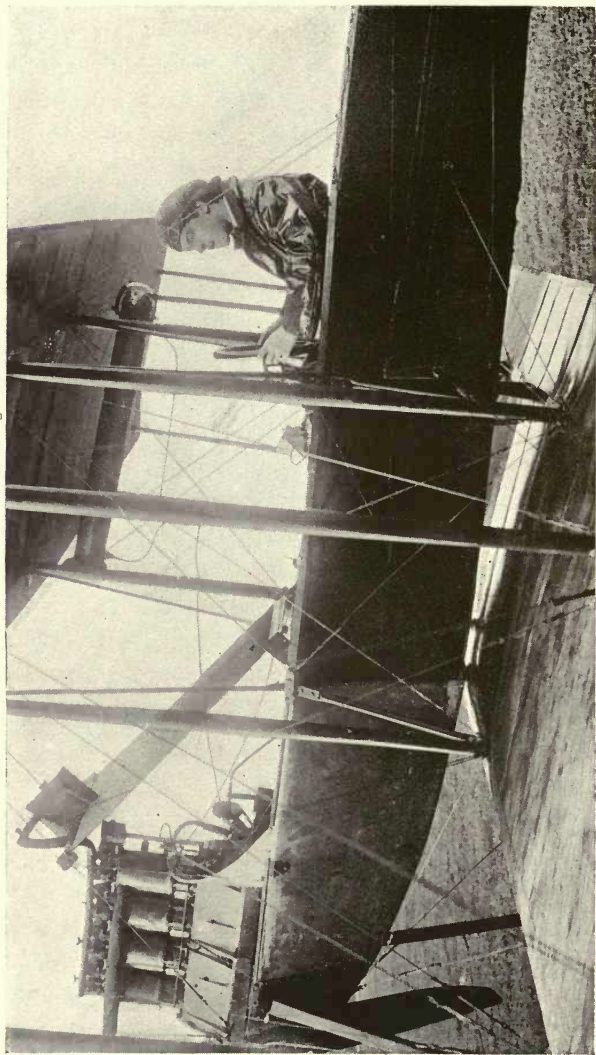
Practically nothing in the way of extra clothing is required during the hot weather for ordinary flying, although it is advisable to put a flying kit over one's clothes in order to keep them clean. Particularly does

this apply to the flying of some tractor machines. Burberrys of Haymarket make very efficient kits of their weatherproof cloths, the designs having been suggested by practical men who have had great experience of air work. In the winter the addition of good underclothing is very essential, and too much emphasis cannot be put on this point.

In tractor machines, too, where the draught is very pronounced, goggles are also desirable for long and short journeys, but in the "pusher" type travelling is generally more comfortable and short trips can be made without this protection for the eyes.

When a pupil essays to learn to fly there are many things which he must remember. Flying itself is not by any means difficult, as after a time it becomes instinctive, but the actual period spent in learning the art is usually tiring and monotonous. In the summer months the embryo must be up with the lark or even much earlier, for directly the sun begins to rise and the long shadows creep across the aerodrome the hangars are opened and the school machines are pulled out ready for their day's work. It is chilly, too, even on a summer's morning, as early as three o'clock. I remember when I was learning to fly myself the unsettled nights I used to spend. My alarm clock would be set for 2.45 a.m., a matter of fifteen minutes before the sun would peep through the eastern sky. Perhaps I would be dreaming dreams wherein I might be a veritable Gustav Hamel, flying here, there, and

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AN OLD TYPE AVRO BIPLANE
Note the exposed engine

everywhere, diving and climbing, and carrying out all sorts of evolutions possible only to the skilled masters of the air and to the dreamer of dreams. My alarm would go off and I would be rudely awakened from my erratic fancies only to realise that instead of being an accomplished master of the air I was but a mere pupil. I would switch the light on (almost crying "contact" as I did so, from force of habit in switching on the aeroplane motor, and also from quite unnecessary enthusiasm) and look with fuzzy eyes at the clock. A quarter to three, hang it! And how blows that evasive devil the wind? I would listen attentively, but not hear the rustle of the leaves or any noise up the chimney to tell me that the spirit of wind was abroad. With a firm effort I would—well, I had almost said spring, but it was hardly three o'clock in the morning remember—get out of bed, open the window and peer out, clad only in my pyjamas. My house, unfortunately, was situated in a very sad position for the accurate judgment of wind speeds, and it was with very great difficulty that I was able to decide whether the breeze aloft was sufficient to prevent an embryo aviator like myself from taking a lesson. Sometimes, however, by craning my neck out of the window and nearly accomplishing a nose dive to the balcony below, I could just manage to see a flag which had occasionally been unpatriotically left on its mast all night. By this I had to take my chances. At other times I would resort to a most

amusing procedure. Amusing inasmuch as it could not be very effective. Taking a large sheet of newspaper I would tear off pieces varying in size and cast them out of the window, carefully noting the direction and the manner in which they fell. Imagine, therefore, this remarkable early morning habit practised regularly by an elegant young man in mauve pyjamas, and with a shock of unnecessarily long hair falling in curious tangles about his neck. What a peculiar sight for any one who happened to be up early enough to see it, or for the many others just returning from their clubs! It was really quite astounding that the local policeman did not report me as mentally deficient, for the uncommon movements which I was wont to make might easily have encouraged suspicion. Here then was genuine evidence of my insanity apart from the fact that I was learning to fly! One or two of my neighbours began to learn of my extraordinary early morning adventures, and I felt extremely important when one or two of them made a special point of rising with the sun in order to see for themselves whether the quaint stories concerning the young man in the mauve pyjamas were really true. However, after I had decided that the weather was quite suitable for a beginner I hurriedly dressed, added a muffler and a coat, picked up my goggles and cap, took a long draw at a flask of cocoa, and then went out banging the door with sufficient force to awaken the whole household. For this I daily apologised on my return

to breakfast about nine or half-past. I had a quarter of a mile's walk to the garage of an hotel where I was wont to meet a friend with a car. It was not long then before we were well on our way to the aerodrome, a distance of about eight miles, for we usually travelled at something approaching fifty miles an hour in places as the roads were quite clear of traffic at that early hour of the morning. Policemen troubled us not at all. We either pulled up in time or trusted to our intentionally dusty number plates. Such was the spirit of youth and enthusiasm! What were "ten mile" limits to us at three o'clock in the morning? What were policemen to us but sleepy individuals like ourselves, only dressed ridiculously in an inartistic uniform decorated with more buttons than are really necessary to hold a jacket together? What did it matter if they waved for us to stop so long as we had passed them before they thought about it? Nothing mattered to us in those days. We were the new generation, the fledglings of an almost unknown age just feeling our wings which were to carry us—where?

Into this Universe, and *why* not knowing,
Nor *whence*, like water willy-nilly flowing;
And out of it as Wind along the waste,
I know not *whither*, willy-nilly blowing.

My companion of those delightful trips after passing for his certificate entered the Royal Naval Air Service and was destined to see much service as well as to render it. Little did we think in those days that we

should live to see what we have seen. Many of our other pupil acquaintances have since won fame and honour, while others have met their deaths in the one great cause. But to return to the conditions of the pupil's tuition period. After starting his practice early he works on until the heat of the sun becomes so intense as to prevent further school work. In the summer time the sun produces remarkable eddies, and it would be futile for any pupil to attempt to fly amongst them. That is one reason why the early hours of the morning and the later hours of the evening are always utilised for embryo students. In the cool of the evening with the sun setting serenely in the west, and the blue smoke from the chimneys and field fires rising gracefully towards the heavens and hardly moving from the perpendicular, then surely is the time for the beginner to take the air, and I can assure everybody that nothing could be more soulful and artistic than the setting of the sun as seen from an aeroplane on an evening like this. The sight of the rising sun as seen from the air is also one that should not be missed by the true artist, but even that does not excel the aerial evening sunset with its faintly twinkling stars gradually assuming brighter hues as the melancholy sun sinks lower and lower into the depths of the unseen. From nine o'clock in the morning the student is, therefore, free until about four or five in the afternoon. He can, however, spend some time in acquainting himself with the methods of

construction, and also with the many technicalities of an aeroplane engine, although it is inevitable that some sleep should be procured in the day when very early rising becomes a necessity. Nothing is more harmful to the flying student than fatigue, for he will be unable to assimilate the instructions given to him by his tutor as smartly as he should be able to do so. From my own personal experience of pupils I have always found that the man who has taken care of himself mentally and morally has generally made the best pilot in the long run, even though he may have incurred the ridicule of a large number of his fellow-students who were less disposed to take aviation seriously. Retiring to bed, let us say, at the hour of ten o'clock and rising again before three does not allow much time for sound sleep, and I have known of half-a-dozen cases of nervous breakdown caused, not by the flying itself, but merely through the imbecility of the sufferers in trying to burn the candle at both ends. My dear prospective pupils, I tell you once and for all it cannot be done, so if you intend to make yourself a decent all-round pilot you will have to pay some attention to your mode of living. Plenty of sleep, plenty of good wholesome food, with a certain amount of mental relaxation, will see you through all right. Mind you, this is not a new method of living *pro tem*. It will have to be carried out all the while you remain an aviator, that is, if you wish to be a competent man and preserve your life as long

as possible. It has been known to me personally that many pilots have lost their lives through inattention to these matters which may not at first seem of great importance, but nevertheless it is a true but sad fact that a few of our early pilots were wont to go the pace rather extensively. Sooner or later, however, it told upon their flying capabilities, and they either gave up aviation altogether or reformed to their one-time sensible existence. All of which may savour of preaching, but as the number of prospective flying men is now exceedingly large there can be no harm in pointing a friendly finger to the right road to success as an aviator.

In the winter months the hours of instruction are quite different, for the sun rises late, sets early, and in the daytime its power is somewhat feeble. Anyhow, it is not strong enough to set up such violent "bumps" as occur in the hotter months, but of course the weather is cold and very often windy. A cold frosty day is the best for school work. With frost there is generally no wind or what little there is is steady and the air is usually in good form. This reference to the air being in good form must sound strange to unaviatic ears, but it is a well-known fact that there is good air as well as bad air from a flyer's point of view. Sometimes the machine will "lift" or rise as easily as one could wish, while on other occasions great difficulty will be experienced in getting the craft to rise at all. There is a "sinking" sensation prevailing all the while, and on

such days the pupil cannot do very much. Strange as it may seem, too, it is often possible to tell whether the air is good or bad without actually going up at all. A kind of occult perception exists in the aviatic mind. I have very often felt that the air has been bad, and on interrogating pilots who have just previously flown their answers have helped to prove that my occult perception has never yet been at fault. May be I am more sensitive than most people, but I have come across plenty of aviators with a similar gift or whatever it may be called. The instinct apparent in realising flying conditions comes as naturally as the art of flying itself after a time, but its efficacy varies in different individuals. This extraordinary variation in the quality of the air opens out a new field of investigation for the scientist. It is said that the winter months offer greater advantages to the pupil because of the comparatively long flying hours available on frosty days, but in England, where the climate may be likened to the mind of a woman, it is doubtful if any general rule can be made. I have known some summers which have seen more flying than two winters put together, but then, on the other hand, I have also seen winters that could not be beaten for school work. However, it is a cold business in the cold months. Perhaps the flying ground is covered with snow, and there may be a dozen pupils waiting to go up for their lesson. If you are a student you must wait your turn, and if your turn happens to be

late on the list you must wait about for an hour or more before you are given any instruction. To go away with the intention of returning in an hour's time would be but to spoil your chances, for you might return just a moment too late and so miss your turn. Therefore, it can at once be seen that although early rising is not a necessity in the winter, the darker months have their disadvantages. Jack boots, fur-lined clothing, and plenty of woollen under-garments are the order of the day, and if you are not prepared to invest in these things, you must either suffer the accompanying discomfort or forfeit your desire to learn to fly. The chances of your doing the latter are small, especially if you have ever tasted the joys of the air.

During my connection with schools of flying, I have been asked perhaps three or four times daily to advise young men (and women, even) the best months to choose for the purpose of taking the elementary lessons in the more or less new art. I may say immediately that in England there are no best months at all, as the climate is so unsettled and irregular that to set out with the purpose of making a dogmatic statement of the most suitable periods for flying from a beginner's point of view would be to attempt a futile task. The January of one year is no criterion to the January of another year, at least not in England, so I fear that it would be impracticable for me to offer any advice on this extremely delicate matter. If I were to tell a pupil to start his lessons in April because March is

commonly known to be a windy month, and the particular March turned out to be a glorious month, for the main part calm and dignified, there would probably be some effort on the part of the said pupil to misinform me on some other subject of which he might possess a superior knowledge. Or he might even expect me to subscribe something towards his tuition fee, which from my point of view would be a case of misplaced ingratitude!

As a final word to flying-school pupils I would say: Don't argue with your instructor; his knowledge of flying is greater than yours. Don't attempt aerial tricks; other pupils require the use of the school machine, and your mother probably would be upset if compelled to attend an inquest. Don't blame your school for the bad weather; it is just as annoying to the instructor as it is to you. If you take a long time in picking up the rudiments of flying, it may be your own fault and may have no connection with the school's methods or teachers. Don't imagine that directly you secure your certificate a visit to the hatters is necessary in order to secure a size larger in head-gear; you are just an ordinary person even though you have passed the tests, and you still have a lot to learn.

If the pupil will only bear these few points in mind he should make good progress, become liked by his fellow-students and more particularly by his instructors, and finally he will add another excellent name to the noble profession of real sportsmen.

CHAPTER VI

AEROPLANING

A Woman's Point of View, by Mrs. Clarence Winchester

THE only way to appreciate the exact sensation one experiences in aviation is to take a flight oneself. As this may not be possible in so many cases, it may be found interesting, perhaps, if I give my own impressions of such an experience and of the exhilarating feeling derived from a flight through the air.

My first flight had to be an early journey, and I rose on that particular morning at something past four. My husband was to accompany me, so we motored from Brighton to the Shoreham aerodrome, reaching our destination in record time. The roads were clear at that hour and we could simply "let her rip."

Well, the sun was just rising by the time we reached the hangars, and a low-lying mist was very much in evidence. Aviators consider mist their most dangerous enemy, and I was wondering if my husband would change his mind about my flight and tell me that I had better wait. You see, I was so anxious for my new experience.

Aviators, at least all I have met, seem to me the most superstitious set of people living. They practically, all of them, rely on mascots in which they place their faith to deliver them from untold incidents.

But I am afraid they would not receive me into this category, for it was certainly impressed upon me that the day I had chosen for my flight was a—Friday!

Still, I am not superstitious, and so the day of the week made no difference to me. Therefore the shutters were pulled down and the machine was pushed on to the aerodrome ground. It seemed a large construction to me, this Henry Farman biplane, upon which I was to entrust my life. It was driven by a 50 h.p. engine, known as a Gnome rotary, and the noise seemed to me terrific, although I suppose it always does to the on-looker. However, I noted later that when in the air one soon forgets the roar of the machinery as one becomes absorbed in the beautiful scenery as witnessed from above, and while drinking in the life-giving air of the upper regions.

On the occasion of which I am writing my husband acted as pilot, sitting in front of me in order to control the machine. The propeller and means of locomotion were behind me, therefore there was very little interruption to my extensive view.

We raced away over the aerodrome, bumping a little where the ground was uneven, until suddenly the jolting ceased and the ground underneath began to pass by slower and slower. Thus it is one leaves *terra firma*. The higher one flies the less speed becomes apparent, although actually there may be no decrease in the speed at all. The mere slowing up is an illusion, owing to the fact that the objects one sees are far

away. A very cold draught flushed on my face and I was soon all aglow with the loveliest sensation imaginable. In front of me was my husband pushing a lever that way and hauling it this, which is the manner in which the aviator keeps his aeroplane properly balanced. Occasionally we would drop a few feet and then rise again. Occurrences of this sort are known as "bumps" and on a windy or hot day their description is justified.

If I were asked which part of the flight I enjoyed most, I should say at once the descent, although, of course, with the reservation that it unfortunately marks the termination of a truly delightful voyage. But really, the dive to earth is quite exciting in its way, followed by a sudden flattening out, and then another speed over the ground, this time back to the sheds.

There is no doubt about it, if you fly once you will want to fly again. Flying is an experience I would not have missed for the world, and I certainly advise all my lady readers to invest in a trip at least once. Of course, even now, some people think of the danger; but even admitting that the danger exists, it is quite a minimum amount considering the few accidents which occur in proportion to the countless number of flights being constantly taken. Anyway, for my part, whatever the risk is, I should consider it well worth while for the sake of the great pleasure received. Of course, it is only because I am a lady passenger that I talk about any risks at all. I am sure no one could

ever persuade an aviator to admit that flying is at all risky. But then nearly all flying men are good sportsmen (although there are exceptions to every rule), and most of them are much too sporting to admit of any risk even though they believed it really existed.

I will now tell you of quite an exciting little adventure in its own way which happened to me on another occasion when I was flying with my husband. I was, in fact, a wee bit frightened, but I don't think any one could have been otherwise if they had been in my position and belonged to the weaker sex. The day was quite calm; the time about four o'clock in the afternoon. Would I like a flight? Yes, I would. My advice to everybody is, don't refuse a flight when it is offered you, especially if you haven't got to pay for it. A passenger flight which is bought and paid for is never so enjoyable as a nice free "joy-ride." But, then, whoever thought of paying one's husband for a trip to the blue? Well, I climbed in "the old 'bus," as I called it, made myself as comfortable as space would allow, and sat patiently watching my pilot turning a petrol tap and switching the "contact" on and off. Exactly twenty minutes were wasted, as I thought, in repeating this tiring manœuvre. Then, just as I was about to suggest getting out (for I was fearfully stiff and irritable) the engine started up and we began to move across the ground faster and faster. Once or twice the engine misfired, but it worked all right a little later on, and we eventually reached about

1000 feet altitude. I simply love flying over the sea, so I shouted to my husband and pointed in the direction of the water. It was a glorious sight, shimmering and beautiful, and I felt very happy as the aeroplane crossed the border line and was soon flying miles out at sea—about seven or eight to be correct. We were by this time something over 2000 feet up. The engine had been running very sweetly all the time with the exception of the early part of the trip, but once again it commenced its antics and persisted in misfiring badly. Without hesitating a minute we turned in the direction of land as it might just be possible that she would “pick up” and get us back to the aerodrome safely. However, she missed so violently that our “dear old ’bus” looked very much like coming down in the sea, where she would probably sink in about three or four minutes! And what of the pilot and passenger? Well, we might sink too, although we could both swim. I pride myself on my swimming, but I was not particularly anxious to extricate myself from a sinking aeroplane and then swim about in flying kit until some boat came along to the rescue. I felt very anxious as we came nearer and nearer to the water, but soon my anxiety was relieved to hear the regular firing of the engine once again. So we climbed and climbed with the kind permission of the engine, and once more I settled down to enjoy myself. My husband must have felt so excited and pleased with the engine’s good behaviour in saving us from

a salt bath in the briny ocean that he began the most alarming capers on a machine which was intended for purely reasonable flying. Its flying at this moment was most unreasonable. The "banks" twisted my view of the sea and land so much that I should imagine alcoholic intoxication produced nothing compared with my then distorted vision. Then at last the climax came. A nice steep turn, just too much overbanked—and then a long, long sideslip which I thought was never coming to an end. Oh! what a nasty feeling I had inside me as we slid and slid through space for about 300 feet, and how delighted I felt when, after what seemed an eternity, my husband righted the machine and again we were travelling along serenely over the water as if nothing had happened. But that was not all. Our troubles were not yet passed. Our engine had not yet finished with us. She again started to misfire. My husband turned the petrol tap down so that a smaller quantity of petrol would flow into the engine, but in spite of all he did the thing wouldn't pick up. In fact, like the farmer's mare, she got "wusser and wusser" until she died right out altogether. There we were, some hundreds of feet up, with our engine stopped and nothing to do but to plane down over the sea towards the land. With no roar of an engine to interfere with us my husband and I could easily keep up a conversation; but how I longed for the monotonous drum of a healthy and powerful engine—the guarantee of a safe journey

over the sea, the hills and dales! Yet the one long almost silent glide was an enjoyable experience. I liked it, although I was exceedingly anxious.

“Do you think we shall reach the shore all right?” I questioned my husband.

“Oh! I expect so,” he answered, “but if not we must swim for it if necessary. That is, if we *can* swim with so much clothing on. We shall probably land in shallow water, so it won't be necessary.”

“But we shall get wet, very likely,” I suggested, with a woman's thoughtlessness. It was certain we should get wet unless the water was at least shallow enough to leave the body of the aeroplane clear.

“Get wet! Goodness me! You had better thank Heaven in advance that you won't get drowned!” cried my astonished husband, and just at this point it was plain that we should escape the necessity of “swimming for it.” In fact we even escaped getting so much as our shoes wet, for happily the biplane was approaching the land, and at a height of about twenty feet we passed the edge of the water and “pancaked” gently on to the shingle.

We got out, left the machine there as the tide was receding, made our way by foot back to the aerodrome, and replenished our interiors with a good meal. Subsequently, when the tide was far out, the machine was wheeled on to the sand and my husband flew it back, but not without another engine stoppage and an unexpected landing in a small field!

CHAPTER VII

HOW IT FEELS TO FLY

To analyse exactly the sensations of flight—and they are many—would occupy the whole life of a diligent nerve specialist. So many positions in the air are possible and so many different circumstances are responsible for those positions, that it is impossible to deal with any more than a few experiences enjoyed and suffered by the writer. Passenger-flying is the usual preliminary to actual piloting, although many aviators have started their career by first running the aeroplane over the ground, and by continual effort have flown at a height of a foot in a straight course, increasing their altitude by much practising.

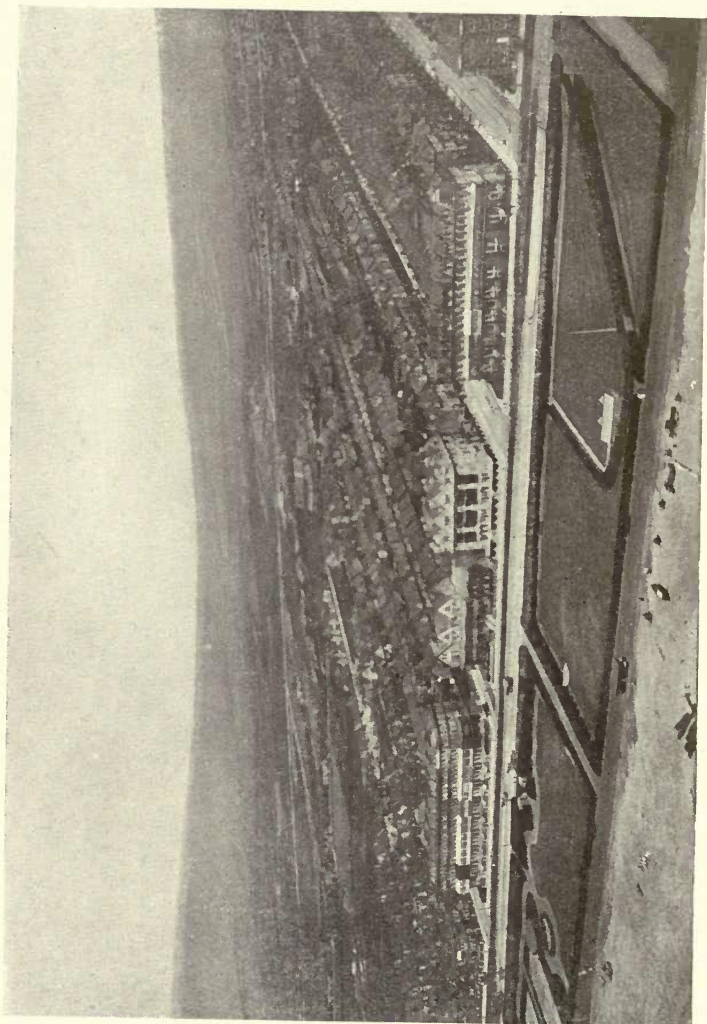
My own sensation of passenger-flying was one of extreme wonderment. I expected to see the earth beneath flash by as telegraph poles pass an express train; but I was disillusioned. The ground simply crawled by as I looked downward from 1000 feet or so, and I confess I was a trifle disappointed. It was as though one looked out of a fast-going train at a distant object. The higher we flew the slower appeared our speed, yet in reality we were travelling at fifty miles an hour or more. There was a terrible draught and a more terrible noise, and my experience was so

new to me that I became as excited as a child with a clockwork toy. I soon overcame my disappointment at the apparent lack of speed, and sat perfectly still to drink in the pleasure of looking at mother earth from a new and delightful point of view.

I watched the pilot moving his control levers, and I thought how nice it would be if I could control an aeroplane and subject it to my will as he did. Family considerations prevented my becoming a pilot there and then, so I had to content myself with flying as a passenger, which I did on every possible occasion; sometimes as often as three and four times a week.

At last I came to the conclusion that my seat was a very monotonous one. I had often taken a camera with me, and, with the exception of preventing myself from falling out whilst snapping pictures, I had very little to do. Once in saving myself I dropped a photographic slide, and incurred the wrath of the pilot for being so thoughtless about people on earth.

I would learn to fly myself. My family received the news with less joy than I had anticipated, and I fixed up definitely with a well-known aviator so that I could gain the certificate of the Fédération Aéronautique Internationale. I possessed a very sensitive nervous system and thought therefore that I should make a fairly competent pilot. Among my aeronautical acquaintances I find that the most daring aviators are those who have what is commonly called a nervy disposition. They are irritable, short-tempered



THE HOVE PUBLIC LAWNS, NEAR BRIGHTON
Taken by the author from a Farman biplane

men, argumentative, and full of electricity or vital force. They are not, as one might expect, hawk-eyed, with aquiline features and a strong, determined chin, denoting iron will-power. There are, of course, exceptions to every rule, and I do not pretend to write specifically.

When I first piloted an aeroplane alone I did so with no misgiving. My first impression was one of loneliness, and, as in the case of passenger-flying, one of wonderment. To think that if I pulled the control lever towards me this gigantic construction of wood and fabric would rise higher! It was a glorious and ecstatic feeling. The knowledge that I was balancing a huge biplane 500 feet up in the air made me feel joyful. When I first learned to balance myself on a bicycle I experienced the same sensation only in a lesser degree. The comparison is a splendid analogy. Then to turn! I banked the machine to the left—very slightly, for, remember, it was my first effort—and completed a wide circle. Candidly, I felt very proud. But I had not yet landed an aeroplane, the most difficult and dangerous part of flying. That was to come and I was rather unwilling to descend, partly owing to my joy at having flown alone, and partly because I had a little doubt as to whether I should do it safely and properly. Pushing the nose of the machine towards the earth at, I fear, a dreadful angle for a novice, I switched the engine on and off alternately, flattened out, and landed very successfully. They

were anxious moments, but once overcome, landing held no further worries for me. It was a long time before my instructor could convince me that I came down too steeply, as I thoroughly enjoyed the sensation of diving to the ground.

Imagine an aeroplane 5000 feet above ordinary civilisation. Below, a few clouds blot out parts of *terra firma*. Still further down a white mist hangs lazily, obscuring more ground; and houses appear as habitations for dolls. A terrible din from an 80 h.p. engine becomes a monotonous rolling in one's ears, and the woodwork of a huge biplane shakes from the vibration of the power plant. The sun is setting, throwing peculiar long-drawn shadows across the earth. Such were my surroundings some time after I had secured my flying certificate. Suddenly, without any warning, my engine stopped, and I was still climbing. I tried to get the nose of the machine down, but to no avail. The biplane stalled herself and fell over to one side. Fortunately I was strapped in, and I held tightly to my control lever. My mind reeled, and I thought all manner of things in such a short space of time. Could any one see my helplessness? Was any one aware of my tragedy? Had my terrible position been noticed?

A singing noise ran through my ears, and my head seemed to split. Then, without in the least surprising me, the speed of the descent decreased. The machine

rolled over and put her nose down as if to dive. I grasped the situation. I could save myself by dropping vertically for some distance to regain speed, for my engine had ceased entirely. Having fallen half the distance, I had plenty of space to my advantage, and I dived and dived. Gradually I pulled my lever back. Still more gradually did the machine answer its controls. My dive became less steep, and when about 900 feet from the ground, I was gliding at a natural angle and almost whistling with joy!

Although I am not brave, Fortune favoured me. A field lay below. It sloped gently away. I landed, rolled slowly into a hedge, and waited till some kind farm people arrived and invited me to have some tea. Tea, bad for the nerves? I think not. I was very glad of it!

One never feels exactly the same after such an experience as I have just described. Three days after the incident I became unwell and relinquished flying for a day or two, although on the intermittent days I had spent a great deal of time in the air. The fourth day I suffered from violent headaches, but a week afterwards I was as well as ever, and as keen on aviation as though nothing had occurred, although I often think of the incident and wonder if it will happen again. It is in that way one never feels exactly the same. The memory of such an event must always live as well as the knowledge of a possible recurrence.

Wonderment is the one word that best describes

the immediate impressions of flying on an ordinary receptive mind. The first passenger flight is marked by wonderment. A narrow escape is marked by wonderment. Perhaps it is possible to become accustomed to narrow escapes similarly as to passenger flights. That I cannot say. Wonderment can be divided into many divisions and sub-divisions, and it would take an expert psychologist to analyse correctly the numerous minute impressions stamped on the aviator's mind. For each incident there are two distinct general impressions; one made at the actual moment and another made after a few days' casual reflection. And usually they are opposed to each other, the former, as a rule, being one of astonishment, confidence, or calm resignation; the latter being one of fear, or something approaching fear, which may sound ludicrous to the lay mind.

Still, although I may have suffered, I have enjoyed much, and I would not have missed being an aviator for the world. It is a privilege of this new generation, and to those who would know the joys of the air more exactly I can but advise them to take just one flight. The rest will follow. They will want just one more, as I did, and then—well, they may become aviators one day.

CHAPTER VIII

TRICK FLYING

PERHAPS the essence of this chapter might reasonably have been included in the foregoing one, but I think a separate heading is perhaps advisable considering that in some quarters fancy flying is regarded as quite a thing apart from ordinary legitimate and sound practical flying. Still, however it may be considered in some quarters, there can be no shadow of doubt that in many ways fancy flying and exhibition work generally have done much to advance aviation and to arouse an apathetic public, previously alluded to, to the importance of the new arm of offence and defence. The circus flyers, as they have been inconsiderately called, are deserving of, at least, some gratitude, for they have brought home to the lay mind, and by practical ocular demonstration too, the fact that an aeroplane can be extricated from any tight position in which it may be thrown by gusts of wind provided that the pilot understands his machine, is flying sufficiently high, and will but remember to keep his head. That an aeroplane will fly in any and every conceivable position has been amply demonstrated time and again, but it must be definitely understood that it will only right itself with the aid

and quick forethought of the pilot. When an overturned aeroplane automatically rights itself, then indeed shall we have the lifeboat of the air, but, of course, what we really want is a machine that will not turn over at all, no matter how powerfully the wind may be blowing or how adverse the elements may be. Popularly, it was at one time supposed that if a gust of wind upset an aeroplane, the craft forthwith fell to the earth and, to give it the dramatic touch, killed the unlucky occupants. Hence aviation was at once voted a prohibitive pastime for those who valued their lives. Surprising, indeed, has been its progress since those pessimistic days, for the aeronautical profession has grown in comparison faster than any other existing profession could ever grow. There is no reason whatever why an aeroplane need be considered a dangerous means of locomotion, for, in truth, there is no more danger to be faced in accomplishing an aerial loop than there is in crossing a London street. In both instances you must go about the business in a proper manner, and in each case you have your life to consider. If you cross the street carelessly then you are bound to take risks and must necessarily put up with the consequences. The same applies to flying or, indeed, to anything where Fate can be tempted by throwing out the bait of carelessness. The comparison between flying and crossing the street may sound an exaggeration, but, believe me, it is not so by a very long way. Frankly,

I think continually crossing London streets on a busy day is one of the most nerve-racking occupations it is possible to imagine, and if it were not for the kind policeman a good many of us would now be living peacefully or otherwise in other spheres. Therefore, from the point of view of safety let me be an aviator rather than the follower of any calling which necessitates very frequent street crossing.

To loop the loop is not dangerous provided the machine is a good one and quite strong enough to take the extra strain involved. When looping the loop was first introduced the various machines which were used for the purpose were nearly all additionally strengthened, but at the present day machines are built so efficiently and strongly that any craft turned out by a responsible firm should be quite equal to looping and flying upside down without any fear of breakage. It is generally believed that the famous Adolphe Pégoud was the first aviator to demonstrate the possibility of looping the loop, but as a matter of fact the pioneer of the circus flying movement was a Russian soldier, who, by the way, suffered a term of imprisonment in consequence. He was charged with audacious flying on government machines! Certainly that was a case of national ingratitude, but it was not without a humorous aspect. Still, to Pégoud belongs the honour of first publicly demonstrating the actual safety of the aeroplane, and it was directly through him that other pilots summoned up sufficient

courage and self-confidence to attempt their first loops. You must well realise that although looping is in itself a simple accomplishment, the early loopers required quite a considerable amount of pluck to first make the attempt. Adolphe Pégoud went to Monsieur Louis Blériot and quietly put his scheme for the experiments before the famous cross-Channel flyer. Blériot was astonished at the aviator's sang-froid, and only after much hesitation would he give his permission for the proposed flights to take place on one of his machines—the widely-known Blériot monoplanes. For several days Pégoud practised suspending himself upside down in one of the machines which had been fixed in an inverted position on trestles, and in this way he gradually became more accustomed to the uncomfortable sensation experienced by any one who is so peculiarly constituted as to make a habit of hanging head downwards for several minutes at a time. Pégoud soon increased the length of time in which he could remain in this unenviable position, and suddenly he announced his intention to Blériot that he would risk the flights in the air. A monoplane was specially strengthened, and if I remember rightly the tail surface was increased. Extra bracing wires were fitted and some special straps were designed to prevent the pilot from falling out.

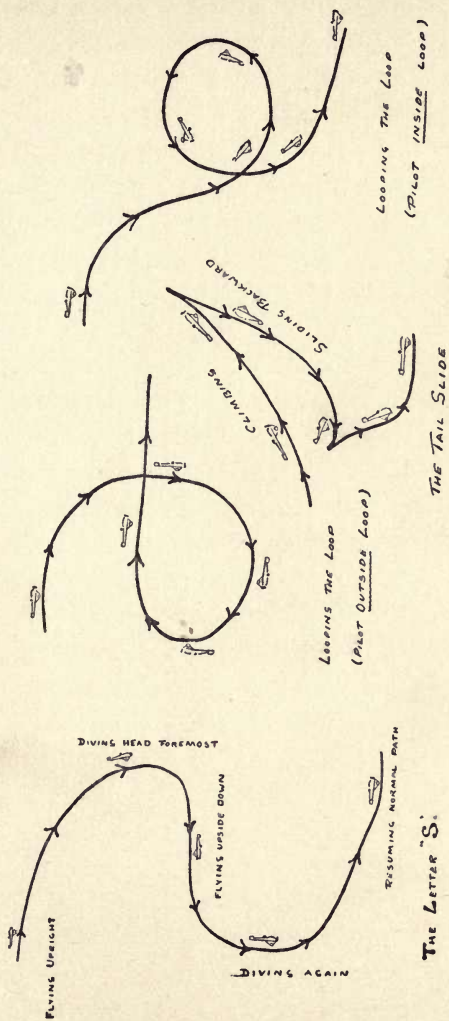
The day for the attempt arrived. A little group of people who were directly concerned gathered together at Buc in France, and not one member

of that little group felt absolutely certain that everything would go off without a hitch. But actually the experiments proceeded without any untoward happening, and the least concerned of all was the charming Pégoud himself. I say charming, because charming indeed was the man's personality, and I have no desire to meet any one nicer or with less self-conceit. Pégoud had much to be proud of, but in spite of the public clamour after the all-famous Pégoud the little Frenchman always remained the same cool, collected, and modest little man that he was. Little could he then foresee the wonderful revolution the seed of which he had actually sown in the world of aviation. The experiments proved that a pilot need not by any means despair if his craft is suddenly thrown upside down by gusts of wind. He must be flying at the time at a reasonable altitude; he must keep perfectly calm; and he must feel confidence both in his own powers and the powers of his machine. How valuable have these experiments been to those of our aviators who have been called upon to fly on active service! Many a flying man owes his life to the pioneers of looping the loop.

There are different kinds of aerial tricks, but the accompanying diagrams will give the reader some idea of what can be done on an aeroplane of the present day. It seems as if to advance still further were impossible, but the twentieth century has shown us that impossibilities do not exist, and, therefore, we cannot

say even now that the art of aviation will show us nothing new six months or a year hence.

There are two main systems of looping the loop. The two are distinguished in this way. In one the pilot is situated *inside* the loop (see diagram), and in the other he is situated *outside* (see diagram). The former example is most generally practised, and is perhaps the easier to accomplish, although neither is very difficult. Then there is a favourite trick known as "the tail slide." The late W. B. R. Moorhouse was the originator of this feat which was actually accomplished long before any one ever thought of looping. When Moorhouse told a few friends that he was going up to try this novel trick his solemn suggestion was received with some dismay. Quite rightly did everybody attempt to dissuade him from the then hazardous venture, but he persisted in carrying it out and so the friends were compelled to look on—and tremble. The "tail slide" consists of the following sequence of events. The aviator ascends to a fair altitude (once again note the importance of space), climbs his machine very steeply, and when at a very pronounced climbing angle he switches the motor power completely off. For a moment the aeroplane hovers in a hesitating manner, as if undecided as to its next movement, and after trembling for this brief space the craft slips backwards tail foremost. To all intents and purposes the aviator is flying backwards on a downward grade (see diagram). When the machine has thus slid for some



AERIAL EVOLUTIONS
 (A few everyday performances of an aviator)

distance the pilot manipulates his elevator to bring the tail up again, and this movement pushes the head or nose of the craft down and a landing is then made in the ordinary way. It is quite possible as a variation to this trick to force the machine on its side at the critical moment of hesitation—the moment when it reaches the top of the climb—and after falling for some distance sideways the nose can be put down and the ordinary descending angle can be maintained once more. None of these tricks offers any particular difficulty, and any pilot of reasonable ability and possessed of a reliable machine could carry them out. I do not say that every pilot would loop the loop, tail slide, or fly upside down to perfection, for there are degrees of skill in aviation as in any other profession. There is an art even in piloting an aeroplane, and the visible result depends upon the individual capacity of the artist, or, in this particular case, the pilot. If Oscar Wilde had lived in these advanced days of aerial navigation I feel sure he would have become an aviator. Already there have been many artists—some with the brush, some with the pen, and others with the strings or the lute—attracted to aviation, and to me this does not seem surprising when flying must primarily be considered one of the arts, albeit of quite recent inauguration. It is difficult to convince any one but an artist that Art has a rightful claim to flight, but eventually, when Art is more generally recognised as a daily necessity of life, it is

just possible that Flying, with a capital F, will be allotted its due place among the higher realms where Literature and Music are contentedly seated. Indeed, literally the art of flight already exists in the higher realms, but I hope that enviable position will soon be occupied figuratively as well.

It must be admitted, however, that Art is applied far too generally, as one of my critics made a special effort to point out to me, but the temperament that usually makes a first-class aviator is more often than not an artistic one at the bottom, even though the individual himself may not be aware of his artistry. There are men who are artists unconsciously just as there are men and women who are fools unconsciously. We all know the latter class, but few of us have the penetration to know the former.

The same critic who imagines I was unaware of the broadness of the term Art as applied in its Universal sense took me to task in his paper and said that flying was not a question of art but rather one of efficiency. Now, presumably, that critic knew nothing of flying and had possibly never been in an aeroplane. He certainly was unaware of the fact that flying is a very different thing from driving a motor-car, and I expect he was one of many people who think that the secret of flight is merely to know the various controls of an aeroplane regardless of balance. In any case I should think he had never heard of the poetry of motion, or of poetry as an art.

As to efficiency, I know personally of an organist and composer who is the very acme of efficiency, but in no way could he justly consider himself an artist, for he has no soul. That is quite apparent in his playing and his compositions. A true artist possesses a soul that feels every movement, every vibration of his particular art, and only those aviators who fly for the love of flight and can feel every movement of their craft instinctively can know how truly art applies to aviation. There are many inefficient men and women possessed of such sensitive souls, and they are more entitled to be called artists than many of the respected individuals who are efficient but soulless.

To some it may be of no importance whether aviation be labelled Art or Science, but to the man who can reap joy from the very poetry of motion it may prove an interesting study. Moreover, it may be the means of attracting those followers of the more legitimate art to the study of flying as another branch of their vocation. All this may not at first appear to have any connection with trick flying or looping the loop, but on closer investigation the connection becomes very real. I have seen hundreds of loops performed since the first inauguration of this method of amusing and instructing the public, and I have had as many opportunities of comparing the exhibitions of individual pilots. There need be no hesitation at all in awarding the chair of the supreme aerial artist to the late Gustav Hamel, who so unfortunately perished

in the North Sea. No one could equal him in the art of flying, and he was perhaps the most striking example of the proximity of aviation to Art. His loops were perfectly symmetrical, and I doubt if ever a fault could be detected in his numerous aerial manœuvres. Nothing could be more artistic than Hamel's looping displays, and when I directly questioned Hamel one day as to whether he considered flying an Art he replied to me in the affirmative. His testimony is worth noting if only because he was the supreme aviator. Nobody ever possessed more self-confidence than Hamel, and I fear it will be some considerable time before such another perfect air-artist will be discovered and given to the world.

Trick flying, therefore, is not dangerous. It has, in fact, been of use on war service, but to the embryo young pupil I would say, "Don't start trick flying with your school machine just because I tell you trick flying is not dangerous. Trick flying, or 'stunt' flying as it is colloquially called, can only be attempted with impunity by those aviators who have had some experience in the air and not by the new man who is not yet fully fledged."



GUSTAV HAMEL

CHAPTER IX

CROSS-COUNTRY FLYING

IN Chapter V. it was said that to conduct an aeroplane round the confines of an aerodrome was no difficult matter. That statement, although true in essence, may be misleading. To the uninitiated it possibly conveys the interpretation that flying as a general rule is mere child's play—a pastime or sport to be indulged in only by the feeble-minded and the mentally deficient. If that impression—perhaps a trifle exaggerated—has by any chance been conveyed, it may be as well to state at once that the impression is a totally wrong one and must be dispelled immediately. When first cross-country flying is attempted disillusion soon makes its appearance and the trusting flyer who thinks that the holding of a certificate certifies that he can fly anything anywhere soon climbs down both figuratively and literally, and, if he be a wise man, he will commence to learn to walk before he attempts to run. In short it is easy to fly, but it is far easier not to.

Ordinary aerodrome flying is a very different thing from piloting an aeroplane across country which is, perhaps, rugged, mountainous, overwhelmed with forests, or cut up into small fields interspersed with trees and hedges. Reference has already been made

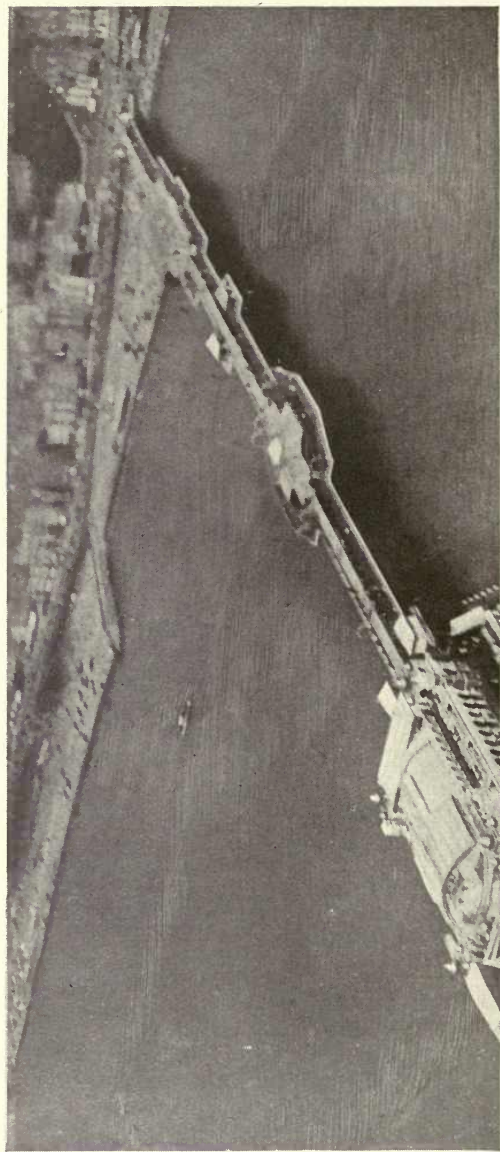
to the excellent training ground which England provides for the aviator, for this country could not by any stretch of the imagination be called flat. It consists, indeed, of every sort of obstacle it is possible to imagine from the flyer's standpoint, and this coupled with the most erratic climate makes it a very sound nest for the hatching of the competent human bird.

The one chief essential in flying across country is altitude. All pilots who travel from place to place by air usually maintain an altitude of 4000 feet or more. At this height they can feel perfectly safe and may well rest assured that if their engines stop they will have reasonable time at their disposal to choose a fairly decent landing place. The higher the altitude the safer the journey. It must be obvious, even to those unacquainted with anything aviatic, that a pilot flying, let us say, at only 200 feet, would have but very little time to spare to look for a landing ground if his engine suddenly failed him. His time would be fully occupied in the actual descent, and even if he did sight a suitable place it would most probably be out of his reach. He might be over a wood or, worse still, over houses, and a descent thereon would at least mean disaster for the machine if not for the unfortunate aviator. Therefore, the rule for all cross-country pilots is "fly high and the higher the better." Even over an ordinary flying ground low flying is an extremely dangerous habit. It is a most common one though and various aviators, experienced and other-

wise, make most astonishing turns while flying only a few feet off the ground. A side-slip would most certainly mean death or severe injury, so the game is not really worth the candle. It is likely, too, that the aviator might be flying over an enclosure packed full of onlookers, and a fall or even an ordinary descent on to a crowd of people would result in a dozen deaths or more, besides other casualties, and a moral set-back on exhibition flying. Being low down the pilot would have insufficient room to right his machine, and any efforts in that direction would at once be interfered with by mother earth.

So, although the man-in-the-street may persuade himself that he would prefer to fly, so to speak, with one leg on the ground, his preference would be for increased danger rather than for increased safety. A safe altitude for aerodrome work may be put at 200 or 300 feet, but that would not be nearly sufficient for the man who wishes to fly beyond aerodrome limits. Of course, to an extent, certain conditions alter some cases. There are exceptions to every rule even in aviation. For instance, I was once flying a Farman biplane from Shoreham to Eastbourne. There was a south-westerly breeze blowing and the sky was very much overcast. I rose about 800 feet, and even at this low altitude I found myself just entering the clouds. I was undecided as to whether I should go through them and fly in the sunlight above, or whether I should remain beneath them and reach my destination from

my intimate knowledge of the South Coast. I take, perhaps, undue pride in the fact that the south of England is as familiar to me from the air as each individual room of my home is when I am in it or away from it. There is some little consolation in seeing the ground, so I decided to keep just beneath the clouds so that I could watch the coast line beneath me. I pushed my way out to sea for some time in order to allow for the "drift" which I found very prominent and persevering. "Drift" is the side-way movement apparent in an aeroplane when it veers often considerably out of its course in spite of the fact that the nose of the craft is pointing all the while directly towards its destination. Even on a calm day this peculiar "drift" is met with. It has to be counteracted by the pilot, and much skill is required to make headway to a desired point accurately. I have known some pilots drift many miles out of their course, although, if the necessary instruments are carried, there is no reason why an aviator should go very far astray unless the "drift" is very considerable indeed. To return, however, to my journey to Eastbourne. When I decided to keep my craft this side of the clouds I did so with the risk of coming down into the sea, or of chancing a landing anywhere, if for any reason my engine went wrong, and so when I had passed the uninviting coastline between Shoreham and Brighton or even farther east, I felt to some degree more relieved. Still, when the



BRIGHTON PALACE PIER FROM ABOVE
Taken by Clarence Winchester

clouds are fairly universal and hang low it is excusable to fly at an altitude not exactly conducive to safety, but it must be borne in mind that the existence of an excuse does not by any means minimise the danger which is always prevalent when flying at a low altitude is concerned. As a matter of fact, on another occasion, when flying as a passenger with an aviator friend of mine over the very same country, *i.e.* from Shoreham to Brighton, the conditions were somewhat similar to those already described, and so perforce we were compelled to keep low. Our engine was not so considerate this time, for when we had just reached the east end of Brighton the motor completely stopped, and it was only by dint of good fortune that we were enabled to effect a landing on the cliffs which lie to the east of the town. Our landing place was not deliberately chosen, for there was no time to choose, but it was the only good one in the vicinity, and we accordingly felt very thankful for our good fortune. This particular occasion calls to my mind a very striking occurrence which I noticed when we passed over the edge of the cliff to the field beyond which was to be our landing place. At the moment of passing from the sea to the land we were suddenly shot many feet into the air by an exceedingly powerful draught. For the moment I was quite startled and could not think of anything which might cause such a noticeable "bump." When we had put the engine to rights and commenced our homeward journey the same strong bump again threw

our 'plane into the air at the moment of passing over the cliff's edge. Since that day I have spent many a long hour on various cliffs watching the sea-gulls and other birds flying about. If there has been any breeze blowing towards the cliff, I have noticed on every occasion without one single exception the same effect on the birds as had been previously noted on our machine. The explanation is this. When the wind blows towards the cliff it strikes the side and is immediately deflected in an upward direction. According to the strength of the wind so far does the upward current travel, although for some reason, which has yet to be explained, I have noticed this current in a minor degree on a calm and peaceful day. You can easily test this peculiar phenomenon for yourself by throwing a piece of paper over the side of the cliff. Even if there is no wind at all the paper or light substance will immediately ascend, and try as you will it will be practically impossible to get the paper to sink to the foot of the cliff. These experiments, although simple and apparently childish, are nevertheless very interesting, and I am afraid I have wiled away many moments in some sequestered spot by playing with pieces of paper, cut into various shapes and weighted with pieces of plasticine. In short, I am an enthusiast of the paper glider, for there is much to be learned from this apparently insignificant toy.

It is surprising when flying at a fairly reasonable altitude over wooded and broken country how

materially the contour of the ground and the conditions thereof affect the air above for several thousands of feet. Trees, tall chimneys, water, and even colours have a very pronounced effect upon the atmosphere, and it is often possible to foretell the exact conditions to be expected during a cross-country flight by studying the details of the country ahead as far as possible. It is possible to see a great many miles in advance on a clear day, and aeronautical maps usually give particulars of the condition of the earth's surface as well as of the usual prominent landmarks.

A very remarkable experience happened to me once during a flight from a south coast aerodrome. The fence which bounded the confines of the flying ground was successfully negotiated, but when only a short distance on the other side the engine misfired badly and the aeroplane began to lose altitude. There was insufficient room to make a turn, even a sharp one, in order to get back to the aerodrome, and it appeared evident that a descent would have to be made in the river that ran east of the ground. However, almost at the moment of touching the water the engine began to work properly again and the machine naturally felt more controllable. But, alas, it would not climb. Try as I would to induce it to go up the craft refused to ascend another inch. There seemed to be a kind of powerful suction exerting its influence above the water and the biplane was thereby prevented from lifting,

even in the smallest degree. So, for over half-a-mile the extraordinary altitude of six or seven feet was maintained. Where the river bank ceased and the land ran practically level with the surface of the water, I turned, and immediately I flew entirely over land I found the peculiar influence no longer apparent. It existed, therefore, solely over this particular stretch of water, and strange to relate this remarkable phenomenon was not by any means permanent, for other pilots, as well as myself, subsequently repeated the experiment a day or two later and nothing whatever was then noticed. The machines behaved reasonably and we had no difficulty in climbing quite rapidly. This particular incident is cited merely to show that the most unexpected things are likely to occur to an aviator. It appears that exceedingly strange and weird phenomena are likely to be met with, and that many exist and have yet to be discovered. Often it has occurred to me, where causes of fatal accidents have remained unsolved even by competent experts, that the deceased aviator may have been a victim to one of these peculiarities of the air which hitherto had not been experienced, or if it had been, the similar experience had remained in obscurity. Pilots dislike relating any uncommon occurrence, though it would be very advisable and a great help to many if a record could be kept of such new experiences as pilots thought worthy to report. There are many aviators who would be ready to assist in the compiling of such an interest-

ing and valuable log provided it were made a general custom. There is some fear that if only an isolated case is reported now and then the teller of the story will be accused of romancing, and this is but natural where the only evidence obtainable exists in the individual actually concerned. There is generally no one to prove his statements and, therefore, he is somewhat chary of relating any unusual experience he may encounter.

Mist and fog are the greatest enemies of airmen. These most dangerous of elements have been responsible for many accidents which in the majority of cases have proved fatal. Mist has been, and presumably always will be, the greatest bugbear of aviation.

Mr. Rowland Ding once told the author that he ascended in a new biplane up North and omitted to take with him a compass and an altimeter. The weather was quite fine at the start of the flight, but when over Barrow the aviator ran into an extraordinarily thick mist and could not tell in any way in what position his machine was flying. Thinking that by increasing his altitude he might avoid his unfortunate position he climbed as steeply as possible by pulling the elevator well back, but to no avail. Then the reverse tactics were tried. Down, down, down, he went, but still the mist seemed as thick as ever—then suddenly *terra firma* appeared but thirty feet below and the machine was still diving! The pilot, seeing the gravity of his position, at once pulled his elevator control lever back, flattened

out, and in spite of his difficult position made a splendid landing.

Fate played an important part in this particular descent, for on investigation there was no other place suitable for landing to be found for miles around. A hundred yards further on were houses and further back were woods and rugged land. So Mr. Ding had much to be thankful for when Providence directed the path of his machine to that convenient little spot.

Really a pilot has no business to run into mist at all. It is entirely his own fault if he does so, for in most cases, if not all, the approach of a thick fog or mist can be seen some distance ahead—at least far enough in advance to enable a landing to be made in safety before the inconvenient death-trap arrives. Sea mists can usually be seen approaching like a great white or grey wall. I have often watched them coming up in the English Channel, and sadly I confess that sometimes my common sense has not prevailed against my desire to fly, and in spite of the warning of the approaching great white wall I have gone up, more than once to anxiously wish I had stayed on the ground where I should have been far safer and much more comfortable.

There are many kinds of fogs; sea fogs, land fogs, black fogs, white fogs, war fogs, and the fog of matrimony. I have no intention of dealing with anything but climatic fogs here, so those readers who expect instructions on how to avoid war troubles or how to

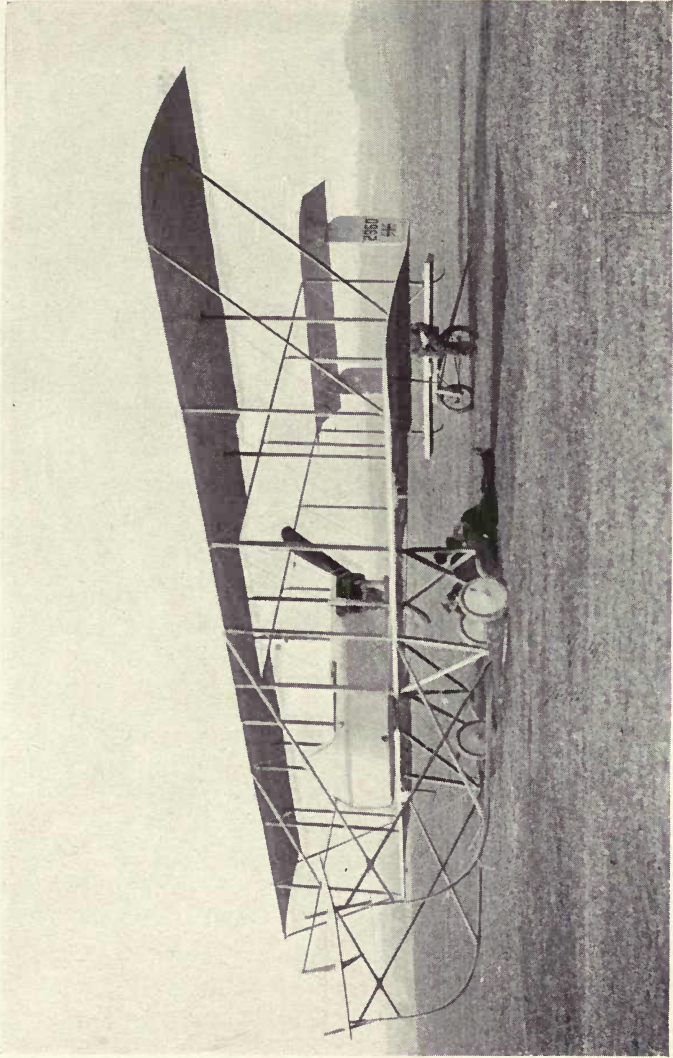
be happy though married will not realise their expectations. Needless to add, I boast that I am well qualified to deal with fogs as I am still alive after experiencing many foggy adventures both climatic and psychological. So I will relate at once a little about fogs and their connection with aeroplanes. Any aviator will agree with me that fogs are very cleverly allied to aircraft, either because aeroplanes attract the fogs, or fogs attract the aeroplanes. In this way the law of attraction is well fulfilled. It doesn't matter where you fly in this country you are fairly certain to find a fog hovering somewhere near. It reminds me of the association which seems so obviously to exist between flying grounds and the wind. Aerodromes are always to be found in the windiest districts, but why this should be so no aviator has yet had the courage to publicly explain. The thoughts of airmen on this subject after all are perhaps better left unprinted.

I was at Hendon with a well-known aviator some three years ago. He was quite young and flew a Blériot monoplane. Very often I accompanied him as passenger and many times we ran into fog and mist. Once we were flying towards Uxbridge, but when over Harrow (in spite of its distance above sea level) at an altitude of about 2500 feet we encountered an exceptionally dense fog. We could see nothing of the ground below, so we descended some distance. It was inadvisable to come down too much, for we had no altimeter with us and so could not tell our exact height.

It was an awkward situation, and no matter how we tried to escape, the fog still prevailed. Eventually we did make our way out into the sunshine again, but to our surprise we were not more than seventy-five feet from the ground, and what is more, we were travelling at about seventy miles an hour and making a bee-line for a tall chimney! How we came so low I could not tell, but the fact remains we were remarkably near destruction.

On another occasion a pilot, who is now a warrant officer in the Royal Flying Corps, asked me to accompany him as passenger on his Maurice Farman biplane. We started from Brooklands, intending to fly to Hendon, a distance of twenty miles. On our way there we reached a height of 5000 feet, but flew into some clouds. We came down and found ourselves over Windsor. After making our way at a low altitude for some time Fate again played us unkindly, for we soon lost ourselves in a thick yellow atmosphere. We finished up by returning to Brooklands as darkness approached, and we were fortunate in being able to land just before the night mists rose over the aerodrome.

Many flying men have unfortunately lost their lives owing to the exceedingly dangerous habit of flying through mist. One thing to be very vigorously impressed on the memory of the young pilot is never to attempt a landing if he cannot see the earth. The best course is to keep on flying, and if anything to ascend, as the chances are a hundred to one that the



A MAURICE FARMAN BIPLANE

The engine and propeller are behind the pilot. In these instances the craft comes under the category of the "pusher" type

danger will not last for more than a dozen miles or so. Mists are usually the products of the local climatic conditions and, therefore, they are comparatively small affairs. Nevertheless they are none the less dangerous and should be rigorously avoided on all occasions.

I will relate just one more episode to show how magnetic mists are to aeroplanes or *vice versa*. The incident occurred at Shoreham. I was flying a biplane about fifteen minutes before sunset. My height was about 500 feet; a land mist seemed to be rising, but I did not think it serious enough to interfere with me. However, I was mistaken. In ten minutes I was completely enveloped in the aviator's enemy. So methought to land. But alas! I could not find the aerodrome. Occasionally I caught a glimpse of a field or a hedge below, but not sufficient to determine my whereabouts. According to my compass I made a circuitous route, and although fully aware of the danger I was incurring by gradually reducing my height I was eventually enabled to effect a safe landing. The Norfolk suspension bridge gave me my bearings, but I confess I was somewhat astonished to find my machine almost touching the top of it!

There are, of course, many other difficult problems to be faced by aviators, but certainly the most difficult is fog or mist. One might just as well fly blindfolded as to attempt a cross-country journey in such an adverse element.

Another product of local conditions is the thunderstorm, and the same advice as that applied in connection with fog and mist must also be applied to this very undesirable climatic convulsion. The thunderstorm must also be eschewed. Twice I have been flying in a thunderstorm—one quite a serious one, and I very sincerely hope I shall never do so again. It is practically impossible to imagine the various powerful air currents encountered. The machine is tossed about; here, there, and everywhere lightning plays round the craft, and there is, of course, the risk of being struck. To keep the aeroplane on an even keel requires plenty of energy, for upward and downward currents are met with and are of such violence that it seems a very eternity before calmer atmospheres are again reached. These rising and descending currents extend sometimes for 200 or 300 feet, and a pilot may be hurtled headlong for such a distance or flung high into the air with just a minute chance of righting his machine. Maybe the downward current will reach as far as the earth, and if by any misfortune a craft happens to get into one of these terrible forces it will assuredly be dashed to pieces. However, it is usually possible to fly round a storm as it can be seen approaching some miles away. Thunderstorms, too, travel extremely slowly, and this favourable advantage will enable the aviator, if the storm appears to have a wide area, to turn tail and return to a flying ground as quickly as possible. To attempt to fly over it would

be sheer impertinence, for the sensations experienced above thunder clouds are of the most violent and unwelcome nature, and have frequently been responsible for aviation fatalities. The actual chances of being struck by lightning are small. Balloons have been struck on more than one occasion, but so far as I know the heavier-than-air machine has, up to the present, escaped this unwanted attention of Nature. There is nothing pleasant in being the centre of attraction for lightning. I have been flying an aeroplane, taking my wife as a passenger, when lightning has followed our craft for several miles, but neither of us has received this apparent affection with any glee, for to the pilot and to the passenger the different temperatures, the powerful air currents, and the general uncertainty of the aeroplane's course are all factors which amount sometimes to terrifying proportions. So if a pilot values his life he will never let himself be persuaded to encounter a storm "full on," so to speak, or if he does so I am more than certain that he will not be at all anxious to repeat the experience. It is more desirable to avoid storms than it is to avoid poison for, at least, in the latter case you have your choice and can die peacefully!

Another very uncomfortable business is flying on a rainy day. Not only is it uncomfortable; unless suitably protected by a wind screen or flying helmet, the aviator finds it very often particularly painful. The modern aeroplane, or perhaps the aeroplane which

is modern at the time of writing (Heaven knows what they will be capable of six months hence), can travel at anything up to 100 miles an hour or more. The fast gun-carrying machines are quite equal to such speeds, and these very fine craft are quite open in the front. The plane surfaces, the engine, the propeller, and the tanks are all situated well behind the pilot and the gunner, in order to allow free movement and a wide range for the gun. There is no protection whatever for the aviator and his passenger with the exception, perhaps, of a very small wind screen which deflects the rush of air over the heads of the occupants of the "nacelle," or more explicitly of the cockpit, in which the occupants are seated. Some of these "gun 'buses," as they are called, have no wind screen at all, as in many cases its presence slightly interferes with the free action of the gun, which to be efficient in war should be easily swivelled in almost any and every direction. Now, even when travelling in a motor-car at ordinary road speeds rain becomes very solid in effect upon exposed parts of the body, and more particularly upon the face. Air travel, which is probably seven or eight times faster than road travel, when undertaken in a heavy rain is the most injurious method of locomotion it is possible to engage in. Darting with the speed of an arrow through the falling drops they beat upon one's brow as if they were lumps of hot metal. It is no gentle patter, dear reader, such as you are wont to hear upon your window pane, but

a sound and very evident impact, and one which leaves its mark behind. Twice has my face been temporarily disfigured by huge lumps brought up consequent upon flying unprotected through the rain, and sometimes the process has become so alarmingly painful that the particular flight has had to be abandoned. Worse still, as can easily be imagined, are hail stones. So hard can the face be struck by this element of solidity that blood can be drawn and very serious trouble usually sets in as a result. Landing during a rainstorm is nearly as complicated as landing in a thick mist, for it is almost impossible to see the ground owing to the force with which the eyes are repeatedly and continuously struck. If goggles are worn they become quickly befogged, and so the result is practically the same—a faulty landing and, perhaps, a damaged machine. The rain-swept country which evaporates in the distance into a blurred nothingness is an interesting and strange sight, as, indeed, are all views seen from the new aspect brought into prominence by the modern method of locomotion. The earth as seen from an aeroplane is quite different from the earth as seen from a balloon, and this brings to mind an interesting fact which may with advantage be related. When an aeroplane is travelling in the air and with the wind (*i.e.* in the same direction as the course of the wind) it is propelled by its power *through* the air. The speed it travels relative to the air may be, let us say, ninety miles an hour, and, therefore, the occupants of the

craft receive in proportion a certain draught or wind resistance. In a balloon, which, of course, is not propelled by any mechanical means, the case is different. The inflated sphere travels, not *through* the air, but *with* it. Consequently there is no wind resistance at all felt by the occupants of a balloon although the balloon's speed *relative to the earth* may be considerable. Now, the speed of an aircraft *relative to the wind* and *relative to the earth* are also two very different things. Let me explain more fully. We will imagine that we have an aeroplane in front of us which is capable of flying at a maximum speed of eighty miles an hour. That speed is the speed *relative to the air*. On a windless day the aeroplane will travel at eighty miles an hour relative to the air and to the earth. But, if a wind is blowing, the speed of the craft *relative to the earth* at once alters. There is, let us imagine, a forty mile an hour wind blowing from due north. We ascend in our aeroplane and when at a sufficient height we put our craft on an even keel, turn round, and fly in the same direction as the wind is blowing. We are travelling then *relative to the earth* at a speed of 120 miles an hour, but *relative to the air* our craft is flying at its specified speed of eighty miles to the hour. If, on the other hand, we turn our aeroplane directly into the wind our speed at once decreases to eighty less forty miles per hour, which leaves a balance of forty miles per hour *relative to the earth*. Looking down from a balloon one gets a much clearer perception of

the earth's surface. There is no vibration, no wind resistance, no thundering noises from a powerful engine. Everything is still and soothing to the temperament, and one can peacefully enjoy a leisure hour or so without using any mental or physical energy. The balloon is there, supported by the gas which makes it a lighter-than-air craft, and there is no particular course for it to follow. Your craft must float wherever the wind listeth. To go up you must cast ballast. To descend you must pull the valve cord. But not so with the aeroplane. Here you have a craft which depends for its support upon the air itself and upon its means of propulsion. You must balance your craft continuously, and your mind must always be occupied. You cannot relax your attention, for at any moment the engine may stop and you will at once be confronted with the problem of an emergency landing. The noise of the engine, the vibration, and the unceasing wind resistance are all factors which alter your temperament. In short, you are a totally different person in each individual type of craft. Your outlook is, therefore, dissimilar, for it stands to reason that you cannot take such a calm and reserved view of the earth when you are travelling through the air by aeroplane as you can when you wander aimlessly across *terra firma* in the less exacting balloon. I do not by any means wish to convey the impression that the balloon takes first place in aerial locomotion. Far from it. It is merely my desire to explain more clearly the difference in view

points. Even your whole body is in a state of vibration whilst being transported through the air in an aeroplane, but, of course, the lighter-than-air balloon possesses no such means of imparting this vibration. Hence the view from the former is in a slight degree distorted—not merely by the vibration, but by the necessity of being always alert for the reception of any untoward happening. After all it is a purely psychological question, but that makes it none the less interesting. Even more so, in fact, if I may express a personal opinion.

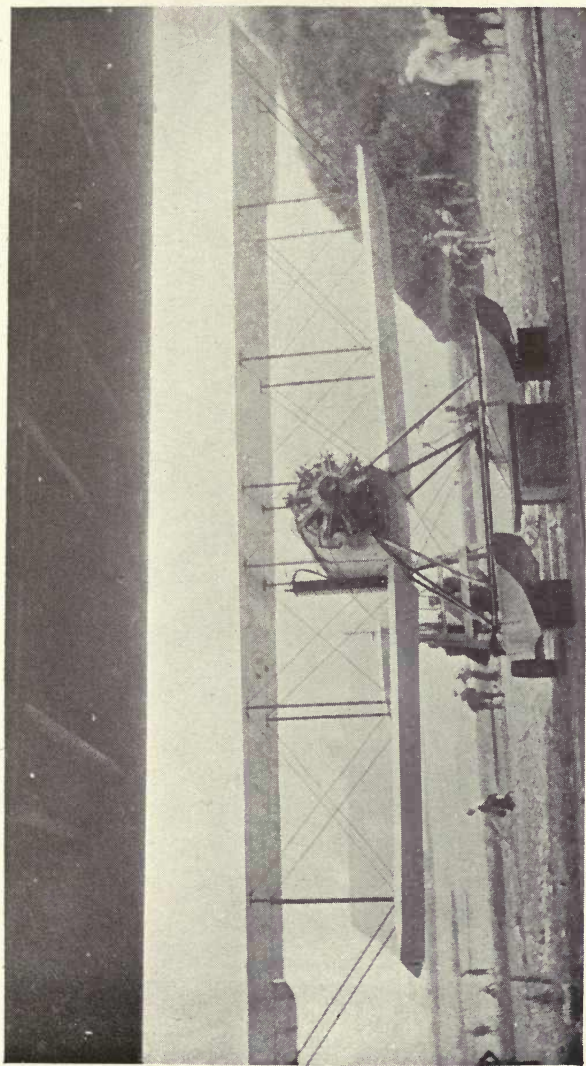
At the present day it is possible to fly in practically any wind. Its velocity matters little to the modern aviator provided he has the proper machine. Some machines are more suited to battle with rough wind, and these, besides being well powered, must be constructionally strong. Every gust increases the strain tenfold, and the construction must be equal to stand the sudden and often unexpected strain which the planes are very often called upon to bear.

CHAPTER X

THE SEAPLANE

It is well to remember that what one aeroplane will do another will not, and that each type is individually suited to some particular work. This also applies, as has already been explained, to the dirigible airship, which in many respects holds some advantages over the aeroplane and in other instances its disadvantages are plainly apparent. To say that the airship is a better craft than the aeroplane or *vice versa* would be impossible, as both are admirable for the class of work to which they are distinctively suited. There is one type of aircraft, however, which has not yet attained such a high place in aeronautics as its various brethren have, partly because the difficulties encountered have been and are really enormous, and partly because fewer constructors have devoted their attention to this particular branch. I am referring to the hydro-aeroplane. It may here be mentioned that the term "hydroplane," which has unfortunately been brought into fairly common use, is a totally erroneous application when it is intended to signify an aeroplane which alights on and rises from water. A hydroplane *does not* lift into the air at all, but is merely a flat-bottomed boat driven by an aerial screw. Therefore the word

hydroplane can never be associated with any kind of aircraft. This, by way of digression and to correct a most popular error. There are two distinct branches of hydro-aeroplane. They are the waterplane and the seaplane. The former may perhaps be considered the hydro-aeroplane proper and the latter is actually a flying boat—a seaworthy boat fitted with planes or wings. The waterplane is just an ordinary aeroplane, only instead of the customary wheels used on the land machine the water craft is fitted with floats. These floats are usually flat-surfaced elongated boxes, properly designed and stream-lined to ensure a minimum amount of resistance in the water and also in the air. There are generally two such floats in the front of the craft and one very small one placed just beneath the rudder and tail plane. Some floats, however, are not flat bottomed, but take the shape of the keel of a boat. A flat surface is subject to cause a considerable amount of suction, and consequently the machine takes longer to get off the water into the air. The waterplane or the machine with floats is essentially the craft for very calm water, such as lakes and a perfectly flat sea. On a rough sea they are practically useless. They ride irregularly over the waves, and if at the moment of landing a powerful wave strikes one of the floats, the whole machine is liable to be capsized or the floats torn completely off. In any case the aeroplane stands a good chance of sinking. From my own very limited experience of



BLACKBURN SEAPLANE

L Type 130 h.p. The propeller is not affixed

waterplanes on a rough sea I should be chary of repeating experiments with an insufficiently strong craft, for on one occasion I absorbed internally as large a volume of the English Channel as a confirmed drunkard could ever wish to absorb of frothy beer. Do not be misled by my reference to craft as insufficiently strong. To build a machine, which by nature of its element must be light as well as strong, is not a simple matter, especially when, as is well known, water is actually such a "solid" substance. You never realise how hard water is until you strike it with any force. Feeling is believing, and if any one believes with greater faith than I, then please may he step forward and declare his sincerity.

The flying boat is quite a different proposition. First and foremost it is essentially a boat. Secondly, it is a boat which flies—or should do. There have been many flying boats which have been boats all right, but when it has come to flying, well—perhaps I had better reserve my intended remarks. The flying boat is obviously better suited to the sea than is the ordinary waterplane, for being in itself a proper boat it is better able to plough through the waves, and is not subject to the vigorous tossing about which the flat-bottomed floats encourage in the other type of machine. Still, even though the flying boat is more suitable for ploughing rough surf, it has yet a long journey to travel before it reaches perfection. The naval aviator, who up to the present has done most of his work on land

machines, will eventually be compelled to make extensive use of the flying boat when that craft has reached the stage of evolution where it will no longer worry about sea conditions. There is this important difference in flying for sport and in flying for one's country. In the former case the pilot can choose his weather and place of starting, but in the latter instance the aviator has to fly at any time, in any weather, and from any place. The difficulties are accentuated in the case of the aviator who is compelled to pilot a flying boat compared with the pilot who takes charge of a land machine. Often on a reasonably calm day you will find the sea very rough, and although when once in the air a flying boat is a treat to handle, arising from and alighting on rough surf requires genuine skill of no mean order. In any case it is usually a very wet business at the best of times, and in the cold weather the task is not enviable. America has received the flying boat enthusiastically, not from a naval or military standpoint, but purely from the private individual's standpoint. The preponderance of large lakes has been responsible for this pleasant state of affairs, and the general business capacity of average wealthy American citizens has helped things along tremendously. Business men make a great habit of using the flying boat, and this private enterprise in America is a great contrast to the one-time apathetic view held by the average Englishman concerning anything aeronautical. But the main source of

revenue for the flying boat or seaplane will in future be the navy. The navy at the present moment—in fact any navy and any country—is not using the seaplane to the extent that one would have thought such a craft would be used. To begin with, the seaplane has not advanced enough. There is no denying that the seaplane is a very long way behind the land 'plane in a matter of all-round efficiency. But progress, albeit slow progress, is being made, and the main part of the navy's air work will eventually be done on the seaplane. These craft will actually be the eyes of the navy, for if attached to a battle fleet they would materially increase the present comparatively limited range. They will have to be carried on a special boat—a seaplane carrier—designed for its particular purpose and fitted up with machinery for immediate repairs, and having on board a good supply of spare parts, engines, and fittings for complete machines. These carriers would be armed against attack from above or beneath the water, and would in every way be efficient enough for the high-class work to which they would be totally restricted.

Do not imagine that range-finding would be the only duty to which seaplanes could be confined. Coast patrolling, bomb-dropping, and submarine locating would also come under the scope of the navy's duties, and accordingly the seaplane would be employed, although very little bomb-dropping need be done except in cases of combined attacks on submarines.

As to the different duties, each would be undertaken by a particular kind of machine, for in the case of the hydro-aeroplane or the flying boat there are as many distinct classes of craft as in the case of the ordinary land machine. Pushers, tractors, monoplanes, biplanes of all kinds and conditions have been converted into water craft, and there have been some machines, known as "amphibians," which have been able to alight either on land or water, according to the circumstances or according to the desire of the pilot. The wheels in amphibian machines are fitted on each side of the floats, and are connected with a lever in the pilot's cockpit so that they may be drawn up at will, leaving the floats perfectly clear to alight on water. Should an alighting on land be necessary or desired the wheels are lowered below the floats and the craft is at once transformed into a land machine, and is then as efficient as an ordinary aeroplane. One of the most notable machines of this description was the Caudron amphibian, but in this case the wheels, instead of being fixed to the sides of the floats, were let in the centre in order to offer a minimum amount of resistance when in the air, as the wheels were then drawn up and became entirely hidden from view. However, when in the water the resistance was not small and the craft experienced much difficulty in getting off the surface.

It will be apparent to the reader that essentially there is no great difference in the hydro-aeroplane and the aeroplane proper, although the former is not yet

by any means fully developed, while the latter is some considerable way along the high road to perfection, or if not to perfection to efficiency; and efficiency in the case of an island like England is as desirable a quality for the air service as for the service at sea. A navy cannot be said to exist or stand very much chance of existing without its "eyes" or aircraft, for in modern warfare we have been plainly shown that aircraft are the most important adjuncts to an up-to-date fighting force. In fact, a navy (no matter how strong in numbers) which was not supported by an adequate air fleet would be at a most serious disadvantage if it were called upon to combat with another sea power possessed of an aerial arm. In short, without the largest air fleet in the world England will no longer be able to preserve her hitherto much enjoyed and necessarily safe insularity. Therefore we must have aeroplanes—perhaps, nay necessarily, up to a number exceeding 10,000.

CHAPTER XI

THE AIRSHIP

A DIRIGIBLE airship is composed of an envelope, powerful engines, rudders, and elevators. It differs from the aeroplane both in principle and in appearance, and in many ways the lighter-than-air craft will seem to the uninitiated as different as cheese from chalk when it is compared with the smaller and more nimble heavier-than-air craft.

The various raids that have taken place over Britain naturally compel speculation concerning the actual capacity of the Zeppelin as to the amount of damage it is able to accomplish, its true speed range, the amount of explosives it can carry, and the heights to which it can ascend.

Before the European conflict it was comparatively easy to put down certain figures that would truthfully represent the above factors, and certainly the speed range and altitude capacity then compared very unfavourably with the same factors embodied in the aeroplane or heavier-than-air machine of the same period. Of course, it is quite obvious that a dirigible airship, being supported by gas lighter than air, possesses a number of advantages over the aeroplane which relies solely on the support of its engine or

engines and its plane surfaces. When the engine power of the latter stops for any reason or is exhausted through want of fuel a descent is compulsory, and the pilot is fortunate if he happen to be at a good altitude at the time of the stoppage so that he has sufficient time to choose a suitable landing place.

The dirigible, on the other hand, is not seriously affected by loss of power as its supporting gas bag is sufficient to keep the whole craft floating or hovering until the engine or engines have been put in working order again. In addition to the gas bag or envelope, the dirigible possesses sometimes as many as four and six engines, elevating surfaces, and considerable room for the transportation of bombs, guns, and the like. In aviation's slow but peaceful period before the war, the following points against the Zeppelin were raised:—

1. Lack of speed.
2. Enormous expense.
3. Difficult housing.
4. Incapability of reaching high altitudes.

There were, of course, many other minor objections, but the above four were considered the chief drawbacks of the dirigible airship. Some critics, therefore, argued that in warfare the gasbag would not stand one iota of a chance against an aeroplane when put to the test, and so the object of our discussion became an object of derision. In combat with an honourable enemy, with a foe that played the game of war fairly, the

limit of the Zeppelin would be very much restricted, but in the Anglo-German conflict the Hun has exhibited himself as an unscrupulous fiend, and we are compelled to discuss aerial warfare as used by an uncivilised nation and not even as it might be used by an uncivilised, but at least moral, community.

At the present moment a craft of the Zeppelin type is capable of a speed of at least sixty miles per hour with full load on board, and it is more than possible that the latest ship can approach something nearer, if not over, seventy miles per hour. Its attainable height under the same conditions is, to put it at the least, roughly about 12,000 feet. Three years ago such a vessel could travel only at a speed of fifty miles per hour and a height of 8000 feet was the most it could reach at one of the official tests in Germany. So in three years its velocity has increased by at least twenty miles an hour and its rising capacity by 4000 or 5000 feet. Comparatively this advance is rapid, and if the same rate of progress is still maintained it is not difficult to imagine the super-Dreadnought of the air ten years hence. Therefore, the possibility of the Zeppelin is no mere chimera, but a hard fact to be faced courageously. The policy of the State should be to build and experiment with enormous aircraft of this description. To build them in war time, as advocated by many unenlightened enthusiasts, would be absurd in the extreme; for one thing it is hardly the right moment to experiment with aircraft with which

we have had no experience whatever, and for another we could spend the money and time so employed on something that would give an earlier result. Under conditions of stress Germany can produce these craft on an average of about six weeks per head, whereas under ordinary peace conditions as many as nine months were occupied in completing a full-size airship.

Now the main point which concerns the building of a dirigible fleet is this: the aeroplane is now in its hundredth generation and the airship only in its tenth. In the ten generations of the latter the progress made has been very marked. Its speed, lifting capacity, and even housing convenience have all been improved upon, and are still being rapidly brought towards ultimate perfection. It has shown itself capable of avoiding destruction from anti-aircraft guns provided it be at a sufficiently high altitude. In the early days of flight the aeroplane advanced on a much smaller scale in the first ten generations of its existence than the airship has done in the same period of development. Yet suddenly the former leapt forward, and the biggest strides that have ever been made in any new science or art were then made in the following generations of the heavier-than-air machine. The fast scouting aeroplane of to-day can fly at over 100 miles an hour, the world's altitude record is held by a German who reached 26,000 feet, and the ease with which an aeroplane can usually be managed is indeed wonderful. This record height is not, of course, needed for

war work in the present era, but it goes to show exactly what an aeroplane can do after a hundred generations of experiment and practical development. So then, if an aeroplane can advance so much in that space of time, how much more will a Zeppelin advance in even a smaller number of generations? The first ten have certainly excelled all expectations scientifically, which leaves us to wonder the result of the ninety to come.

It has been shown that objections 1 and 4 have been and are being remedied, so there remain the questions of expense and the difficulty of housing. The first question to the private individual is naturally an important item, but as private enterprise is some little way ahead, at the present we are faced with expense from the point of view of the State only. This can be dismissed at once by the conclusion that no price is too high for the preservation of the nation's safety. Arising now is the supposed difficulty of housing. Airships sheds, being large, are very prone to aerial attack from enemy aircraft, and even though they may be guarded by anti-aircraft guns they can be severely damaged, as witness Flight-Commander Marix's raid on the Dusseldorf airship sheds in October of 1914 when a Zeppelin sheltered under its cover was completely destroyed by bombs. The difficulty of safely housing these huge craft is one that must sooner or later be solved and the expense would be considerable. The dirigible is now often housed entirely

underground. In the long run it saves time, money, and material, even though the initial cost of burrowing such sheds is exceedingly heavy.

The roofing is steel covered and bomb proof. The entrance is a long, gradual slope at an angle directly continued into the shed itself.

Now that aerial travel is becoming such a general mode of conveyance elaborate schemes of this description must of necessity be devised and carried out; for in ten years we may be astonished at the progress made by the art of flying and aircraft construction. So much so that it is more than possible that greater strides than are anticipated by the author will be made.

Zeppelins may come and Zeppelins may go without doing considerable damage, but it is necessary to remember that the Germans have stolen a march over us with these aerial Dreadnoughts, and if they push forward in the future the development of their aerial fleet as successfully as they have done in the past this country may find itself in a perilous position.

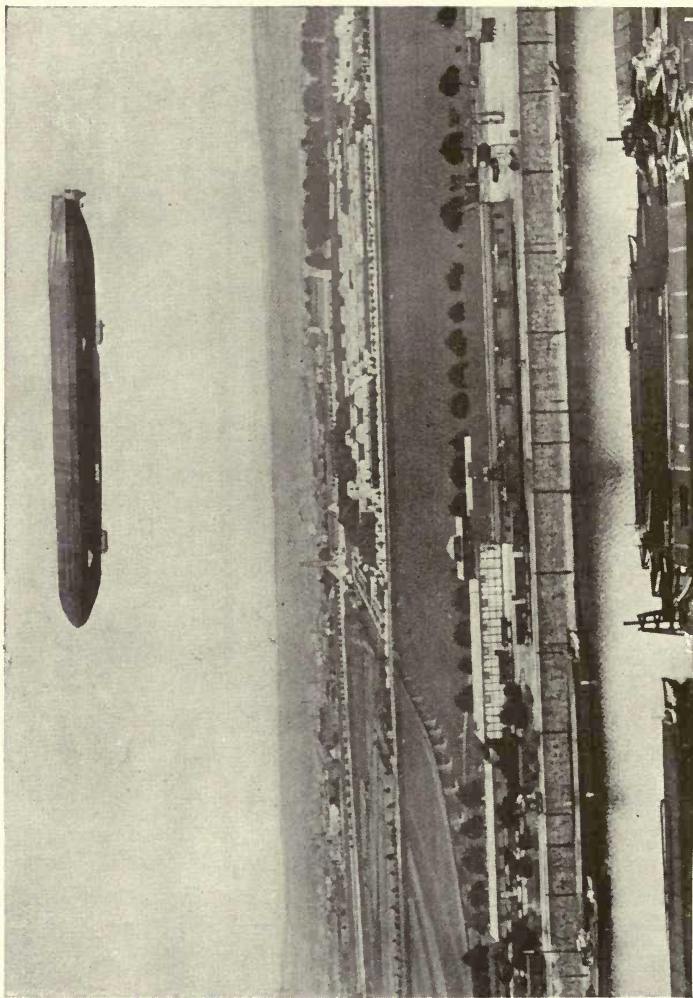
Retaliation has been advocated time and again in various publications as an effective precaution against raids by Zeppelins. Aerial attack upon non-combatants has become such a general practice by combating parties that neutral countries, ignoring these attacks entirely, seem to indicate that they consider such strategy quite legalised in modern warfare, because it has become so common and because it is quite a new type of warfare. There are some people in this country

even who are quite reconciled to these attacks by the absurd "All's fair in love and war" theory, and who consider that if one country retaliates with aerial bombardments on undefended towns of another country such a course would arrest air raids of that description altogether as soon as both countries found the course unbearable.

The alternative may not be simple, but it is certainly more than possible, and in some respects it has already been carried out in Paris, to the consternation of the Zeppelins. At all times arising from and alighting on the ground with an aeroplane at night is an exceedingly dangerous proposition, and many deaths have been brought about by the inability of pilots to land safely in the darkness, owing to the speed at which some aeroplanes land and to the difficulty invariably experienced in finding a landing place. Even pilots who are perfectly familiar with the contour of a particular aerodrome may meet with a fatal accident through bad judgment at night.

Yet it is to night flying by aeroplanes in this country that we must turn for safety. It is only by constant night flying in the form of patrols that we can guarantee ourselves immune from enemy air raids. It is only by a properly organised patrol that we can meet Zeppelins as we should meet them, face to face, if they would then give us the chance. It is very much to be doubted if they would.

The first essential to a patrol of this kind is an



By Courtesy of]

THE MAMMOTH ENEMY
"Somewhere", over Germany

[*"The Aeroplane"*]

adequate number of landing grounds situated on the outskirts of London at a given distance between each. Each ground must be supplied with hangars, petrol stores, and mechanics, and what is just as important special illuminating charts must be affixed to every ground. Without this latter precaution the inauguration of this system of dealing with Zeppelins would be doomed to failure. Actual night flying is no more dangerous than flying by day, but it cannot be too forcefully emphasised that landing even on an ordinary aerodrome is an exceedingly difficult procedure by night without the aid of lighting signs to indicate direction of ground wind, the actual position of the flying ground, etc.

It would be quite possible to let into the ground, under a grating, a large illuminated compass. Or it could be placed upon a hangar or put in any other position desired. The main issue is having the compass points N., S., E., and W. well illuminated, each point possessing a representative colour such as red, white, green, and blue. For example we will allot them as follows: North, red; south, white; east, green; west, blue.

Distributed round the aerodrome and suitably protected would exist 100 or so coloured lights of each description as above. Should a north wind be blowing the set of red lights would be switched on. As the pilot approached at a high altitude he would at once see the direction of the ground wind, and at the same

time he would be able to tell the exact contour of the aerodrome. He would, of course, carry an illuminated key to the lights, and as his altitude decreased he could gather from the illuminated compass the more exact position of the wind, *e.g.* N.N.E. or W.S.W., and thus with the aid of moderately powered searchlights he would be able to effect a safe landing.

It is an important thing to remember that an aeroplane must always land into the wind, and not travel with it, as should a landing be made under the latter conditions, accidents may occur through too much speed, or the wind may get under the elevator and consequently turn the machine on to its nose—a type of mishap which has killed many an able pilot. It is owing to this necessity that such precautions as suggested above must be made, and if each landing ground were so constructed the night patrol of London could be conducted with comparative safety.

This would be carried out in conjunction with the usual searchlights that are used for the anti-aircraft section, the people would be reassured, and it is very doubtful if enemy aircraft would attempt air raids on London any more.

When an airship arrives here at 6000 or 8000 feet or more it is quite hopeless for an aeroplane on the ground to attempt to give chase. In the first place, by the time a heavier-than-air machine reached the height of the gasbag the latter would be lost in the darkness many miles away, and it would be absolutely

fruitless to guess in which direction the Zeppelin had flown. If a constant patrol, as suggested, were kept up by fast gun-carrying machines, it would be quite feasible to foretell the demise of a German airship if she were so unwise as to attempt to enter the ring.

Many people will undoubtedly have qualms when they read of such a suggestion—a suggestion which means boldly indicating the actual position of London to the enemy! The illuminated grounds, they will argue, would be admirable landmarks for the bomb-droppers, and we should possibly be more effectively bombarded in our efforts to prevent the so-called terror by night.

Now, it is easy to understand such a criticism being put forward. Although we have had quite excellent experience in receiving explosives made in Germany, very few of us have had the temerity to put forward any solution of the problem or to consider it from all points of view. To the critic who says that such landing grounds would help rather than deter the enemy, it becomes necessary to put just one question. It is this. By darkening the streets have we succeeded in preventing any Zeppelin commander from finding London and its environs? Of course not. If the Germans want to find London they will find it, even though we turn every sign of a light right out and leave the Metropolis in pitch darkness. Suppressing flaring illumination has, of course, prevented the enemy from distinguishing any particular locality, but it is absolutely impossible to hide London altogether.

Therefore, a few illuminated flying grounds round the outskirts of London could not in any way be of assistance to an opposing country, and it is more than possible that if they knew they were to be met on their own level, they would hesitate and let discretion remain the better part of valour for all time. Londoners would then be free from the dangers of aerial bombardment by night and a hostile country would be compelled to turn its attentions elsewhere.

The three types of dirigible airships are "rigid," "semi-rigid," and "non-rigid." From experience the first kind has proved itself more useful than the last two. The Zeppelin is a proper example of the rigid type. It is built up on a firm framework of aluminium which is covered with fabric, and the frame or skeleton is divided into about a dozen or more compartments, all of which are filled with hydrogen gas. There are actually two main envelopes, one on the outside of the frame and one on the inside, and there is a space between the two which is occupied by air. The framework, as the name implies, is perfectly rigid, and even though the gas be let out the body still remains the same in that it cannot collapse owing to the rigid form of the skeleton which holds the fabric in its place. The value of the divisions can plainly be seen, and as time goes on no doubt additional means will be provided to safeguard these craft from the counter-attack of other aircraft.

If, for instance, a piece of shell or shrapnel strikes

the envelope of a Zeppelin there is no reason to suppose that the craft will at once burst into flames and fall to the earth like a stone. It may list to one side and it may lose altitude because the hydrogen in the particular compartments which have suffered will, of course, escape. In proportion, the airship will lose some of its support, but unless very seriously damaged there is no reason why it should not return to its base with comparative ease. The most fatal parts to hit are the engines, as if the means of propulsion are rendered *hors de combat* the huge gasbag must float aimlessly about according to the direction of the wind. Then naturally an enemy aeroplane would at once ascend to destroy the dirigible airship at the pilot's leisure, and that task under the circumstances would not be so very difficult as might at first be imagined. The necessity, therefore, of striking a fatal blow at the engines rather than at the envelope needs no emphasis, because in the case of an airship divided into compartments the chances of entirely destroying the craft by means of penetrating the gasbag are small. The case of the late Flight Sub-Lieutenant R. A. J. Warneford, R.N.A.S., was purely a matter of fate, and even though in all respects the results were very commendable, at least, so far as the destruction of the airship was concerned, bombing an airship from above is attended with very great risk by the attacking pilot should the bombs succeed in setting fire to the enemy craft. The explosion which necessarily follows disturbs

the air for a considerable radius, and if the aeroplane happens to be within reasonable distance of the airship it is almost certain to be upset and very probably damaged by flying debris and exploding bombs. Such was the case with Warneford's Morane monoplane, but being well up (I think above 6000 feet according to reports) he was able to right the machine. Attacks on airships by aeroplanes could be more safely carried out by gun-carrying biplanes or monoplanes, and by resorting to this method there would be more certainty of achieving the desired result. As explained in a previous chapter, dropping bombs on a stationary object is no easy matter, and it must be obvious therefore that dropping bombs on a moving object must be considerably more difficult. By using gun-carrying machines the risk of failure is smaller. Still, which ever method is adopted it is bound to meet with opposition from the airship itself, for all airships must be considered fighting arms. They carry guns, darts, and bombs, and in fact anything which is likely to be of use to them during their various missions.

Now we will come to the other kinds of airships—the semi-rigid and the non-rigid. The former are usually much smaller craft, and instead of being built up on a framework similar to the rigid type they are built in a kind of cradle or half frame. The lower half is, of course, always rigid, but the upper portion has no ribs whatever for its support and relies solely upon the gas for its evenness of shape. The non-rigid airship has no

framework whatsoever, and is merely nothing more or less than an elongated balloon filled with hydrogen gas in the usual way. This last class of dirigible is of no practical value in delivering attack or taking up aerial defensive, for the simple reason that in the event of a bullet piercing the envelope the whole thing would collapse without further ado. However, the non-rigid craft are very useful for coast patrolling and also for training purposes. They are of value in connection with coast work insomuch as they can hover about over the sea for the express object of discovering enemy submarines. An aeroplane must fly in circles if it desires to concentrate its attention on one particular spot and this necessitates much waste of energy, petrol, oil, etc. Still, the actual fighting airship is represented by the rigid dirigible which in every respect supersedes its sister craft the semi-rigid and the non-rigid. Its rigidity enables it to be handled more easily although its usual size is apt to make it appear cumbersome.

The effect of the weather upon the fabric is considerable if the machine is always left out in the open under way. German airships were at one time always moored in this way, so that when the wind veered in another direction the airship, being held fast by its nose on a central post, veered with the wind and escaped damage in consequence. Naturally there is a considerable amount of side resistance on a large dirigible, and if she happened to get across wind disaster would be

inevitable. Several ships have been destroyed in this way. The smaller ships have made use of revolving sheds so that entry or exit could be made without taking any of the risks incumbent with a side wind, but it would be a very difficult problem to erect revolving sheds for the latest dirigibles. As previously pointed out sheds have been constructed underground, and in some cases natural harbours have been found. For instance, two long hills running parallel to each other form a fine natural harbour, and there happen to be many such hills in this country. England should eventually find herself rich in such inexpensive positions as they are numerous, and to construct a shed between two hills is not nearly so expensive as burrowing right into the earth.

During the great European War it has been plainly seen that the airship (and indeed the aeroplane as well) has been trebled or quadrupled in value by the addition of wireless installations. Without "wireless" an airship would lose touch with its base, and it is conceivable that in consequence disaster might overtake the dirigible or perhaps the fleet for which the dirigible might be scouting. "Wireless," too, is of considerable assistance in acquainting an airship commander of weather conditions so that he may avoid any local storms or squalls on his return journey. Actually "wireless" is indispensable on aircraft, and few people understand the additional assistance it can render to all the ships that travel by the air. After a

long journey, however, the aluminium rivets employed in the construction of airships have to be replaced, as there would be a certain element of danger always present on a second long journey. With the intense vibration and the extraordinary strain always present the aluminium rivets wear almost beyond recognition, and very few people are aware of the fact that no identical Zeppelin has ever visited this country on two consecutive evenings. After one journey to England a Zeppelin requires overhauling. There was a time when the fabric was so porous that the hydrogen gas would escape quite rapidly and the envelope in those days required refilling every two or three weeks. This was naturally very expensive, but since the war has compelled many inventive minds along progressive lines, a fabric has been devised which now holds the gas so well that refilling need not be undertaken more frequently than every three or four months.

CHAPTER XII

THE AERO ENGINE

IF it had not been for the petrol engine the aeroplane as we see it to-day would be non-existent. The petrol engine made aviation possible, and aviation has done more to advance progress of the petrol engine than has any other branch of the engineering science. The obligation has been mutual. The great problem of the aeronautical experimenter has always been to extract from his engine a maximum of power with a minimum amount of weight. The petrol engine was the line which offered least resistance, and naturally the Wright brothers took advantage of it. They built a four-cylinder engine which drove a couple of propellers at very slow speeds, and thus their dreams of *sustained* flight at last came true. Their aero engine, however, was by no means perfect, and for one thing it was not particularly light. Still, it was as light as could be expected in those days, and it was, at least, one step up the stairs of progress. The advantages of light weight are very obvious. For instance, the lower the weight of the actual propulsive power the more fuel can be carried and in consequence longer journeys can be made. Or, unnecessary engine weight can be better dispensed with for the purpose of accommodat-

ing more passengers in its place. Hence the ambition of aeroplane engine builders has been to produce an efficient engine giving as much power with as little weight per brake horse power as possible. Note that I have said efficient, for there have been several very light engines put upon the market, but many have proved themselves useless by their inefficiency. That is the whole danger in attempting to produce a very light aero engine. The constructor *can* turn an extremely light engine out, but whether it will be suitable for air work is another question altogether. This is not to imply that aero engines are unduly heavy, considering the nature of their work. They are not, in fact. But even now—and one may consider that aero motors have advanced very rapidly indeed—there is still plenty of room for an efficient light engine developing a maximum amount of power for its minimum weight.

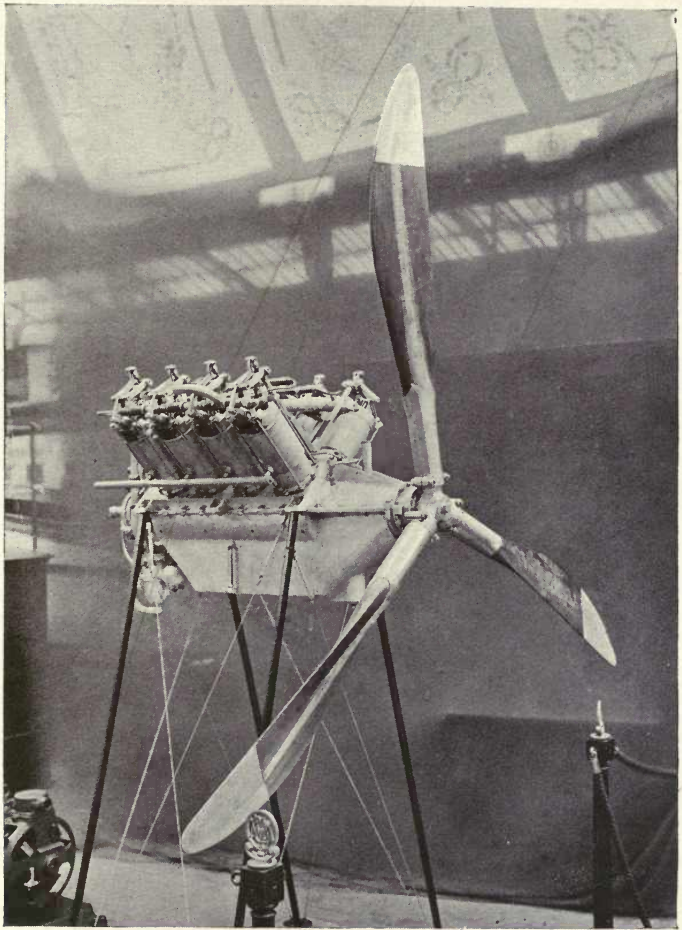
The English aero engine has not advanced so rapidly as its foreign competitors, but this has not been due so much to lack of scientific skill as to lack of encouragement received at the hands of the authorities in the early days of aviation. In fact, the whole aeronautical industry in this country has suffered from official starvation, and, considering this, the present general efficiency of the English product is something to be marvelled at. In Germany, in France, and in other countries the aeronautical industry not only received official encouragement, but also official

support, and to a great extent this must have had a pronounced effect upon the progress of the aero engine in those countries.

Although it is the custom of most folk to utter disparaging remarks concerning anything of British origin, it would be but to display extraordinary ignorance to make any untoward remarks concerning the British-built Green aero motor. There is something unique about this engine. The trend of modern engine manufacture in connection with aeronautics is certainly in the direction of increased power, and future developments may show that aeroplanes fitted with four engines of 500 h.p. each will be quite common or garden aircraft. The 2000 h.p. aeroplane is not so far off as many of us seem to imagine, so it may be useful to make some comment on the 300 h.p. Green—a plant which certainly augurs well for the future, in light of its present state of efficiency.

The cylinders are arranged in V form and number twelve, each being cast separately and machined both inside and out. In the very first Green engine produced, rubber rings were slipped into a groove at the base of the copper water jackets, these allowing for the varying expansion of copper and steel. Rubber rings make a perfectly reliable water-tight joint, although it may be doubted if these rings last as well as they might.

Induction is maintained by four reversible air funnels. These are changed according to which way



THE CURTISS AERO ENGINE AS EXHIBITED AT THE LAST
AERO SHOW

the engine is running. The crank chamber is kept thoroughly free by the two currents which also supply the forced induction. Two carburettors situated at each end are synchronised by a lever.

It is somewhat difficult to understand why an ordinary radiator is used on this engine when it could be put in the V section and so made more compact and decidedly neater. Still, that is a matter that can easily be altered on future productions, and there is no disadvantage to the ordinary radiator beyond ungainliness. One very decided factor about the Green is its adaptability to both types of aircraft—tractors and “pushers.” The former, as explained earlier in this book, has the tractor, commonly misnomered a propeller, in front, whilst the latter is actually propelled and has the correctly named propeller situated behind.

To alter the engine for either purpose is quite a short job. It takes not more than fifteen minutes at the most. The two magnetos, pumps, etc., are mounted as a single unit, all being removable by undoing four bolts, and the propeller bearing is also very easily transferable.

The weight per horse power is about three pounds, and the whole inclusive weight amounts to 970 pounds. It gives a normal speed of 1200 revolutions per minute and can be throttled down to only 160 revolutions.

Another very reliable engine of English manufacture is the Sunbeam-Coatalen water-cooled plant of 225

h.p. This also consists of twelve cylinders V shaped and cast in four sets of three each at sixty degrees on the crank chamber. A single camshaft actuates the valves on the inside of each row of cylinders and receives its lubrication by oil fed from the main, while this camshaft is housed in the top of the crank case.

A gear-driven pump is used for general lubrication. The oil tank feeds direct into this pump, which forces the oil into the main bearings, from whence it passes through the hollow crank shaft to the big end bearings. By the arrangement of the connecting rods the big ends are side by side on each crank throw, and in order to make this possible the opposed cylinders are staggered. Each row of cylinders is operated by a magneto. The reduction gear of 2-1 enables a large propeller to be fitted, and this can run at a small number of revolutions, yet giving at the same time wonderful efficiency. This engine, like the Green, is also designed for tractor or "pusher" aeroplanes, the thrust bearing being specially arranged to permit a propeller or tractor being used without altering the main purpose of the design.

The whole question of engine production for aircraft work is an exceedingly intricate one, but even though we are only now more or less in the experimental stage, the general advance in efficiency has been surprising to the motor as well as to the actual aeroplane industry.

Each individual part of an aero motor spells something approaching perfection.

The porous qualities of aluminium alloy are a great attraction to the engine maker. Several English firms as well as many Continental firms have tried aluminium alloy pistons, but all with the same result—breakage. This alloy will stand a general strain up to a certain point, but it cannot stand a sudden shock, so the advantages of its porous qualities are counteracted by its brittle tendencies, and breakages in the air, besides being disastrous to the engine, may endanger life and limb—a very important factor when really *expert* aviators are so scarce. It would certainly make an appreciable difference in weight, but this would not be recompensed by the extra risk and trouble incurred, so for the moment aluminium alloy must be put aside as unsuitable. There are, be it stated, other alloys undergoing experiments the results of which, I believe, have been to some extent more successful. Still, ordinary pistons can, if machined all over, be made much lighter than hitherto, and what is more important they will stand any sudden strain. The pistons of the famous Gnome engine have never been known to break if properly treated. This plant may, in fact, be considered the original aeroplane engine, for by it aviation has become what it is to-day. There can be no doubt that in the early days of flight the Gnome was unbeatable, and I doubt if even now there is a better engine for school work.

The 50 h.p. and 60 h.p. engines are ideal for this particularly strenuous work, for indeed a school machine is called upon to stand an extraordinary amount of wear and tear. One advantage about the Gnome engine is that its parts are so easily interchangeable, and this advantage has to be reckoned with when minutes of fine weather for instructional purposes are so very important to instructors in flying and to pupils.

The Gnome engine is and always has been essentially a light engine. It is, of course, air cooled and of the rotary type. In rotating, the crankshaft is perfectly stationary, whilst the cylinders and crank case revolve. This is quite a different system from that usually employed and enables a most perfect balance to be maintained, and at the same time a flywheel is not necessary. The decreased weight consequent upon the dispensing with the flywheel is an important consideration, for, as stated earlier, everything in the design of the aero engine must point in the direction of lightness.

The Gnome, however, from the point of view of fuel consumption, is exceedingly wasteful. Its petrol consumption is high, and it absolutely throws oil away—oil which has served no material purpose whatever. Therefore, for long journeys, it has to carry very large quantities of fuel, which add to the total weight of the flying concern and the efficiency is consequently further decreased.

WEIGHT PER B.H.P.

It has often been a source of wonder to the lay mind why aeroplane engines have no flywheel although the explanation to this is in itself very simple. In the early days, as a matter of fact, flywheels were actually fitted, and the 45 h.p. Anzani engine was one example. I believe it was the three-cylinder Anzani aero motor which was the first engine to dispense with a flywheel, although of this I cannot be certain. It is important—and too much stress cannot be laid on this point—in aeroplane manufacture that everything be reduced to a minimum amount of weight, although, be it strictly borne in mind, it is not usual to sacrifice safety for the advantage of lightness. Still, light weight is of prime importance, and it is quite surprising how by cutting out certain superfluous details quite a large weight figure can be considerably reduced.

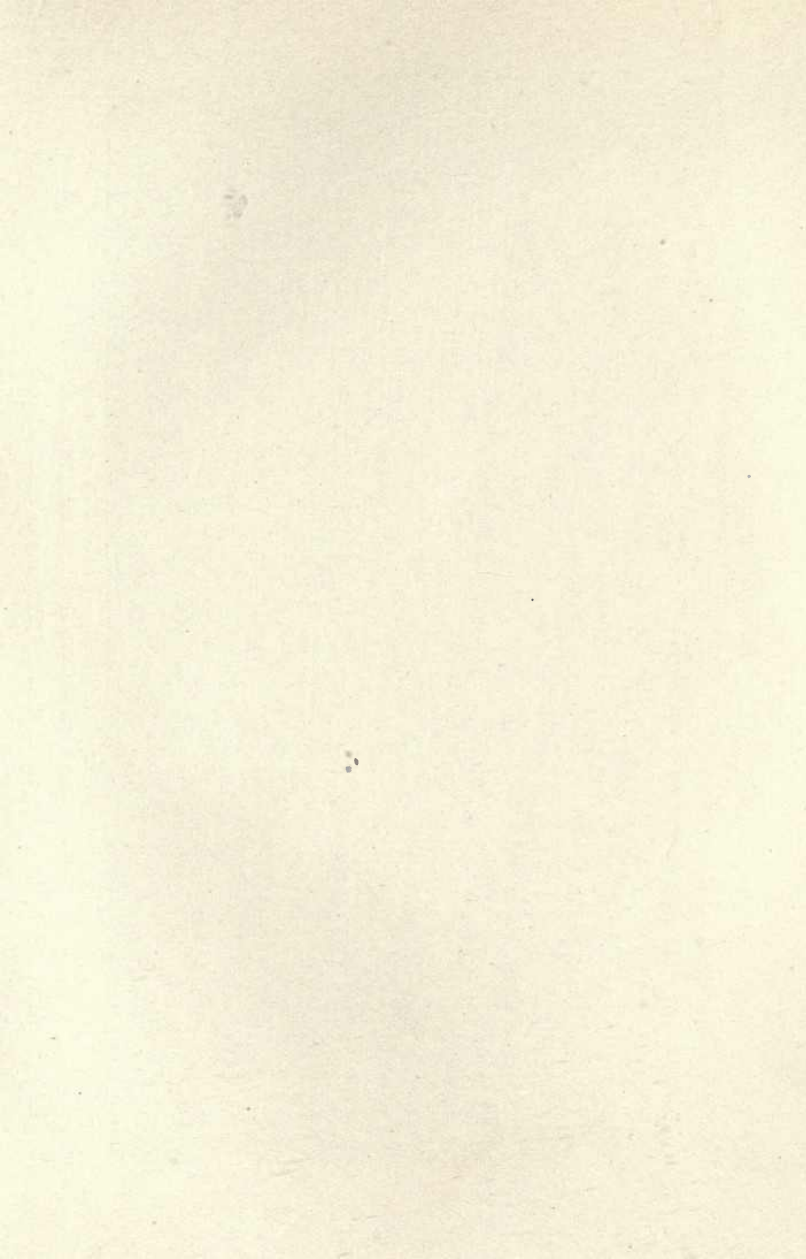
This necessity for weight reduction resulted in the demise of the flywheel, at least for air work, but in consequence of this more cylinders had to be introduced in order to ensure quite even running. As many as twenty cylinders are now used on some Anzani motors, but although weight was added in the form of cylinders it brought, of course, additional power, in consequence of which, comparatively, the weight per horse power was very much lowered. It may be interesting to compare the weight per horse power of one or two of the well-known engines of to-day and of yesterday.

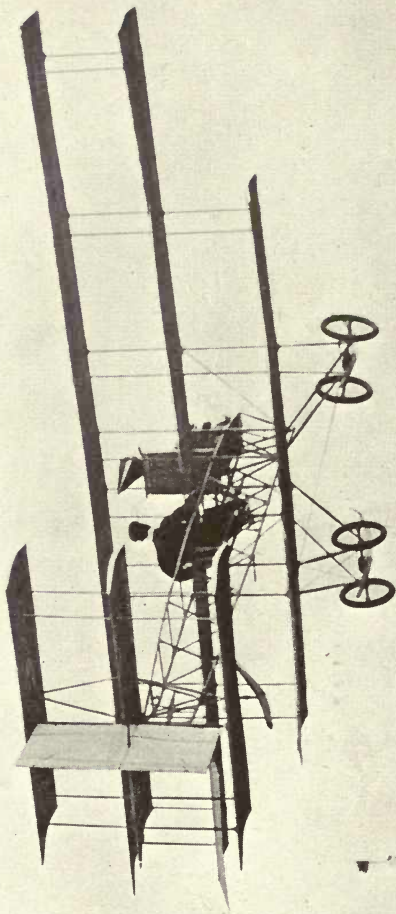
Very little is now heard of the Isaacson engine. It had a quaint little habit of blowing off cylinder heads, and this was most disconcerting to pilots when in the air. I had personal experience of the 60 h.p. Isaacson, and was once unfortunate enough to receive a piece of cylinder in my own head. Still, the fault could have been remedied, and considering the weight per horse power was only just over two pounds, the Isaacson engine should really take a foremost place to-day in the aviation world.

I have drawn up the following *approximate* table of universal aero engines and have chosen the best known, at the same time giving those of high or moderate power. Comparison is interesting:—

Make.	Horse power.	Cylinders.	Weight per b.h.p.
A.B.C. (English)	100-120	8	3 lb.
Anzani (French)	200	20	3 lb.
Argus (German)	150	4	4 lb.
Curtiss (American)	90	8	3½ lb.
Gnome rotary (French)	160	14	Just under 2 lb.
Isaacson radial (English)	65	7	Just over 2 lb.
Renault (French)	100	12	6¼ lb.
Le Rhone rotary (French)	160	18	2 lb.
Salmson radial (French)	280-320	9	3½ lb.
Sturtevant (American)	70	6	4 lb.
Sunbeam (English)	225	12	3 lb.

The 150 h.p. Sunbeam was quite a smart and reliable affair, but the new 'bus previously described promises even better. Of the former I can personally testify to sweet running and reliability, having flown many times in a Sunbeam-engined Maurice Farman biplane, but how I can remember pumping oil vigor-





THE PIONEER OF PRACTICAL ENGLISH AVIATION

A. V. Roe flying the 35 Green "Avro" Triplane at the Blackpool Meet, 1910

ously with a hand pump, which was not a very pleasant task when kept up for any length of time, I can assure you! In the 225 h.p. model, lubrication is forced by a very special gear-driven pump.

The 50 h.p. Gnome engine weighs per horse power about three pounds, but 8 horse-power is actually absorbed in rotating the engine itself. These engines require taking down after about every twelve or sixteen hours' running.

In a few years hence, as I previously stated, when weight reduction is brought to its absolute minimum there will be nothing strange in the sight of 2000 h.p. aeroplanes, or even machines with a greater engine capacity. This is where the biplane, having two lifting surfaces, and the triplane having three lifting surfaces, will show to advantage over the now almost obsolete monoplane. Four engines of 500 h.p. will be fitted, each having separate control, and the craft must be capable of flying with only one engine running. In fact, landing would have to be made with one engine only, and on touching earth this would be throttled down for slow taxi-ing over the ground. The multi-engined aeroplane is undoubtedly the machine for transport, for as weight is gradually diminished so will lifting capacity be increased. Triplanes and multiplanes should become very general, and although Mr. A. V. Roe in 1908 flew a triplane with *only 8 h.p.* little or nothing has been done to develop this type of machine. By having three planes one above the

other increased lift is maintained with a reduced span, and just as much efficiency in other directions is secured.

Referring again to different types of engines, it may be advisable to distinguish the three distinct classes—the stationary, the radial, and the rotary. The stationary engine, as is made clear by its designation, is a plant which is stationary, being fitted in the four longitudinal members which form the body of the aeroplane. This type of engine has either upright or V-shaped setting for cylinders. The radial engine is also stationary, but the formation of the cylinders is different from the other stationary plant. The cylinders are placed in a circle or radial form similar to the figures on the face of a clock and the cylinders do not revolve. The rotary engine, of which the Gnome is the leading type, has its cylinders in the same circular form, but, as already pointed out, these together with the crank case revolve round the stationary crankshaft.

CHAPTER XIII

THE FUTURE OF AIRCRAFT

THE war has been responsible for many miraculous changes. It has made some things and marred others. Among those folk in high places we find a few who have courage enough to express the view that the great European conflict is a blessing in disguise. Particularly do we find this so in the comparatively new art of aviation. And they are correct who maintain this view. Not only has the war proved a blessing in disguise to aeronautics, but it has actually been the means of saving the new science or art from being neglected by red tape on the part of the authorities and by disinterest on the part of the public. Not that there is no red tape still to be found among those who are connected with the various air departments. Far from it, but at any rate its power of binding us down to old conventions has been appreciably minimised. In the very early days of aviation, in spite of much criticism and even ridicule, there were only a few aviators in this country who made any large and continuous effort to bring home to the general public the future importance that aerial navigation would be bound to enjoy. Other than that the people of England had little opportunity of realising the future scope of

the aeroplane, until the war came along and brought with it the wonderfully successful application of aircraft to the cause of the Allies and also to the cause of the enemy. No one can deny that the aeroplane has proved its worth, and now in all seriousness this new mode of locomotion will have to be considered as applied to other things besides the grim business of war.

It would not be unnatural if men of commerce were attracted, at least, to consider the possibility of using the airways as suitable routes for the transportation of goods that require a rapid method of conveyance, such as stuffs of a perishable nature. Still, at the moment, or even after the war, although the progress of flight has been exceedingly rapid, the commercial uses of the aeroplane in this respect will be very limited. The enormous horse power and wing span required to lift heavy cargoes would be two of the chief disadvantages, and the expense of the former even initially and for subsequent maintenance would be so terribly high that it would be cheaper to use the ordinary methods of shipping and rail though at a greater expense of time.

Of course, by this it is not meant that the commercial uses of aircraft will always be so restricted, for progress is bound to be made in this direction and experiments will be carried out after the war with a view to development on commercial lines. The main point is that for the present and for some years to

come the man of commerce must rely upon his usual methods of transport, but the following generation may reap the benefit of the tests carried out by this generation, and so for the time being we can safely consider commercial transport by air not an impossible method, but rather an improbable one for a while. The commercial possibility is one that must not be overlooked, for although governments must always be well supplied with all kinds of aircraft—and in that way will the industry be kept alive—the demand by such governments is not to be calculated as an extreme incentive to progress in design. To begin with, the manufacturer has up to the present always held the field for efficiency, and government products have usually, although not always, been very far behind those of the private manufacturer. The private manufacturer has produced time and again exceptionally advanced work, but retrogression has been enforced by government experts and slide-rule theorists to the detriment of the whole industry, by going minutely over the manufacturer's goods and rejecting them on scientific grounds rather than on grounds of practical experience and common sense.

The margin between the military aeroplane and the commercial aeroplane must necessarily be a wide one. They are as far apart as the poles, and perfection in both is as difficult to reach. Cash expenditure matters little to a government if the outlay is intended for the preservation of peace or for the purpose of pro-

voking war. But in the case of the commercial aspect, cost is a very important factor indeed, and it will be cost which will determine the period in which we shall see the realisation of the aeroplane as a commercial proposition. Increased competition which is brought about by the many additions to the aeronautical industry during the war must eventually have some effect on the price of all kinds of aircraft, as it is well known that the prices now charged and which were charged before the war were to a great extent ridiculous considering the actual cost of production. Nor must it be imagined that the commercial aeroplane will be a type of craft which will embody perfection, for in many ways the new aeroplane must differ from the present accepted artistry of machines. It must differ as much as the motor lorry does from the graceful and artistic racing motor-car which disports itself round the Brooklands track for one purpose—speed. A transport aeroplane will need many qualities beyond speed. Indeed enormous speed will not be so essential as some of the other qualities, such as lifting capacity, etc. Passenger-carrying on a large scale does not necessarily require a speed of over eighty miles an hour—a speed which even now may be considered comparatively slow when one compares it with the 110 and the 120 mile an hour machines which are known to exist to-day.

The airship, too, should also develop on commercial lines, although here again the question of expense arises, and it is even more prominent in this instance

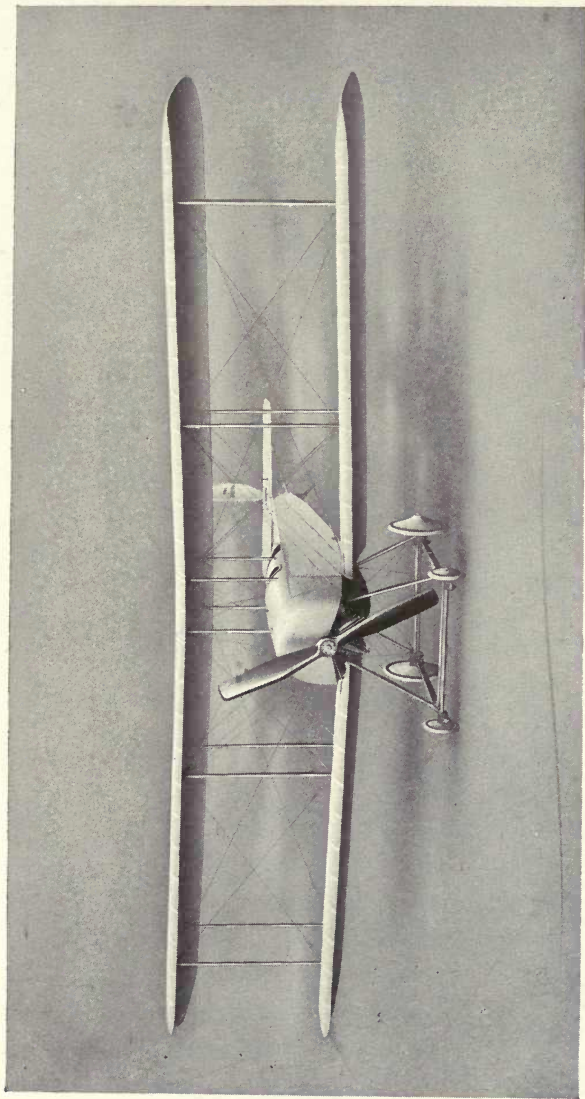
than in the case of the aeroplane. In the case of the dirigible there seems no reason why in time to come there should not be a trans-Atlantic airship service, and after all I should not be at all surprised if the airship is the first aircraft to travel *via* air from England to America.

But to revert to the aeroplane. The heavier-than-air machine can be put to another very definite and serviceable use beyond long-distance passenger-carrying. I refer to the transportation of urgent mails. A machine of 1000 h.p. should easily be capable of carrying about 7000 or 8000 lb. of mails, and this allowing for a journey of 200 or 300 miles. This would not at first be a paying proposition, but how many propositions are there which do pay from their commencement? With the afore-mentioned competition and consequently the cheaper production it should eventually be made to pay without any difficulty. The weather would have little or no effect upon the matter, for the reader has already seen that flying can be accomplished under almost any conditions. A descent at every 200 or 300 miles for the replenishing of fuel would be arranged at a delivery base, where mails would be disembarked and fresh mails taken aboard so that all the necessary attention could be made at one place. True, this sounds to the lay mind like a story of a romantic dreamer, but, nevertheless, who shall say it will not come true? Were there not critics of the steam engine, the steamboat,

the automobile, electricity, in fact of everything that has once been new? Nowadays, to say that anything is impossible in the way of scientific progress is to display ignorance, for in 1908 when Henry Farman and Wilbur Wright reached a height of eighty-two feet there were many misguided folk who clamoured, "What is the use of eighty-two feet as an altitude for aerial vehicles?" Comparatively that time is not so far away, and no doubt my readers will easily recall the ridicule which then attended the small attainments of pioneers. To show the rapid advance which the altitude record has made, I append a table giving the progress, record by record, from Farman's eighty-two feet up to Oelerich's 25,725 feet.

THE ADVANCE OF THE ALTITUDE RECORD FOR AEROPLANES

		Metres.	Feet.
Nov. 13, 1908,	Henry Farman	25	82
Nov. 13, 1908,	Wilbur Wright	25	82
Dec. 18, 1908,	Wilbur Wright	100	328
July 18, 1909,	Paulhan	150	492
Aug. 29, 1909,	Latham	155	508
Sept. 20, 1909,	Rougier	193	633
Oct. 18, 1909,	De Lambert	300	984
Dec. 1, 1909,	Latham	453	1,436
Jan. 7, 1910,	Latham	1,000	3,280
Jan. 12, 1910,	Paulhan	1,269	4,110
June 14, 1910,	Brookins	1,335	4,379
July 7, 1910,	Latham	1,384	4,539
July 7, 1910,	Olieslagers	1,720	5,642
July 10, 1910,	Brookins	1,900	6,237
Aug. 11, 1910,	Drexel	2,013	6,603
Aug. 29, 1910,	Morane	2,150	7,042
Sept. 3, 1910,	Morane	2,582	8,469
Sept. 8, 1910,	Chavez	2,587	8,484



BRISTOL TRACTOR BIPLANE

The engine is housed under a cowl and the tractor screw, often misnamed a propeller, is seen in front

			Metres.	Feet.
Oct.	1,	1910, Wijnmalen	2,780	9,118
Oct.	15,	1910, Drexel.	2,880	9,446
Oct.	13,	1910, Johnstone	2,960	9,600
Dec.	9,	1910, Legagneux	3,100	10,168
July	9,	1911, Loridan	3,200	10,496
Aug.	5,	1911, Capt. Felix	3,350	10,988
Sept.	4,	1911, Garros.	3,950	12,824
Sept.	6,	1911, Garros.	4,960	16,269
Sept.	17,	1912, Legagneux	5,450	18,000
Dec.	11,	1912, Garros	5,610	18,400
Mar.	11,	1913, Perreyon	5,880	19,290
Dec.	29,	1913, Legagneux	6,120	20,060
July	9,	1914, Linnekögl	6,600	21,653
July	14,	1914, Oelerich	7,850	25,725

The above table will immediately prove to the sceptic that nothing is impossible, and therefore it is perfectly evident that to decry any suggestion concerning aeronautical progress, or anything else for that matter, is an unwise and unsafe proceeding. The end of aeronautical development cannot be seen by any stretch of the imagination.

In the engine's prehistoric days—the days when an important-looking individual carried a red flag triumphantly before every road vehicle that ran on petrol or possessed sparking plugs and pistons—there were people who foretold that the doom of the motor-car would take place within five years. After experimenters tired of wasting money and time, they said, the automobile would die a natural death, and quite rightly too! There were similar people a year or so ago who made the same delightful inference concerning the aeroplane and airship. To-day their opinions

have been modified by the tempering effects of war conditions, although when peace is restored it is possible that they will break out again with their old cry. Let them take heed for the day of Aries is at hand. The sport of aeroplaning like the sport of motoring will spread to the sporting temperaments of Englishmen. The number of pilots now engaged in the services will possibly be retained on government work, but there will be a still greater number outside the army and navy desirous of promoting and carrying out the art of flying as a sport on similar lines to motoring. There is no reason whatever why aeroplaning as a sport should not be run on the same economical lines as motoring, and there is a great possibility of its being the cheaper of the two pastimes. The small low-powered single-seated biplane at the present moment can be built up very cheaply, and the cost is not much more for the extra power required to lift a passenger. The passenger-carrying sportsman's model would be constructed on "sociable" principles rather than on the tandem lines on which passenger aeroplanes are built at the present time. By "sociable" I mean where the pilot and passenger are seated side by side. Generally, they are placed tandem fashion, sometimes the pilot being situated behind the passenger and sometimes in front of him. There are and always have been "sociable" aeroplanes, but they number quite a minority.

Most of the large factories that now exist have

sprung up since the commencement of war operations to meet the immediate demand of the government. All kinds of motor and engineering firms are now building aeroplanes or fittings and spare parts, as well as engines. The fittings and spares are in consequence becoming more standardised. Standardisation means reduction in cost of manufacture, for larger quantities can be turned out and this means a reduction on retail prices. Large numbers of factories promise keen competition in the future, and this indicates that the price of aeroplanes will be remarkably low, comparatively. Nothing could be better for the cause of aviation. One of its great drawbacks has always been its initial expense and also the expense of upkeep. In the early days considerable risk was run, too, in regard to smashes, sometimes no small item in the account of costs, but now that such a large factor of safety exists in the heavier-than-air machine, there is no reason why single-seated and passenger-carrying biplanes should not be very extensively used in travelling from place to place. Such craft will eventually be priced as low as £300, and the cost of upkeep for a low-powered biplane will be about equal to what the average motorist now has to pay for the upkeep of his car. Possibly it will be less, for tyre expenditure in the case of the aeroplane is practically nothing, and as every motorist is aware in the case of the car it is a very formidable item. Of course, there is always the likelihood of small breakages occurring on landing,

but struts and other spares are so cheaply and easily made that expenditure in this respect would be very minute indeed. In fact the cost of upkeep for an aeroplane of the type under question might be taken as definitely less than the cost of upkeep for an average car. The man who is able to do odd jobs, such as carpentering, and is not afraid of turning up his shirt sleeves, will naturally possess a great advantage in the future days of the sporting aeroplane. The same applies in the motor world of to-day.

In considering the future of the aeroplane or of aircraft in general there is also to be taken into account the national point of view. For many months during the war general incompetency was very prominent in regard to the prevention of attacks made by enemy aircraft on this country. The incompetency was not to be found by any stretch of imagination in the rank and file of the air services, but rather at the head of affairs, for while the personnel of the R.F.C. and the R.N.A.S. was ready to do anything asked of it there were many stumbling-blocks to be found in certain staff officers who could have made a great difference in the organisation of the defence of England aeronautically if they had chosen to do so. This state of affairs naturally led up to the question of forming a Ministry of the Air. On this question opinion is very divided, but there seems to be a majority of outstanding points favourable to the formation of a special department for dealing with anything and everything aeronautical.

Now, the defence of London for some unapparent reason was at first placed in the hands of the Admiralty, which fact indicated that all aircraft and airmen employed in attacking hostile airships that attempted to bombard the capital or the coast would be connected with the navy. During one of the raids in September 1915 several Zeppelins visited this country and three aeroplanes were sent in chase from a certain flying ground. However, these machines belonged to the Royal Flying Corps and were essentially under military control, yet they were employed for the express purpose of attacking hostile airships, a danger which, according to the then existing arrangements, should have been met by the Admiralty. This is merely cited as an instance to show that some organisation is essential for the purpose of conducting the flying branch in a fit and proper manner.

It has been proved that by divided responsibility lack of success in purpose is produced, and in war time the definite accomplishment of purpose is a very desirable and necessary factor. At the expense of being accused of needless repetition, I will reiterate that it is not an unknown fact by any means that the art of flying has received very little encouragement from the people and the authorities in the past, and considering this scarcity of recognition our aviators have acted like sportsmen and progressed exceptionally well both before the war and particularly when the European crisis assumed such serious proportions. Still there is

plenty of room for improvement, and apparently one of the best ways, if not the best way, to bring about unity of purpose is to put the whole of matters aeronautical under one control—or in other words form a Ministry of Aviation.

Such a formation would be exposed to a certain amount of risk, for it so happens that many incompetent men have been given official positions where incompetency is the least desirable. In such delicate matters as are included in aviation—where perhaps the position of a wire means life or death to a pilot—it would be fatal to place the important positions which must necessarily be connected with an Air Ministry in the wrong hands.

France has actually taken the lead in some respects although not in full measures, but we may count upon her doing so to the fullest extent in a none too distant future.

With a strong man at the head of this new department—a man free from party bias, and a man who knows and has seen much of aviation and service conditions—with such a person to take the responsibility of the aerial defence of this country there should be little fear of England losing her present aerial supremacy, and there would be every possibility of maintaining an air strength of at least three to one compared with that of any other hostile or friendly country.

CHAPTER XIV

SOME TECHNICAL TERMS EXPLAINED

NATURALLY in a wide subject like aviation unfamiliar words are often met with by the uninitiated, and even though the layman has the energy to refer to his dictionary he may not reap any benefit from his labours, for even in some of the latest dictionaries a few aeronautical terms have been for some reason or other omitted.

First it may be advisable to describe the notable differences between various kinds of aircraft, for in these advanced days one still finds a great tendency among individuals, through the misguidance of the lay Press, to call an aeroplane an airship or *vice versa*. Therefore, the following descriptions are proffered in the hope that they may assist the man-in-the-street to call the right thing by the right name.

AEROPLANE

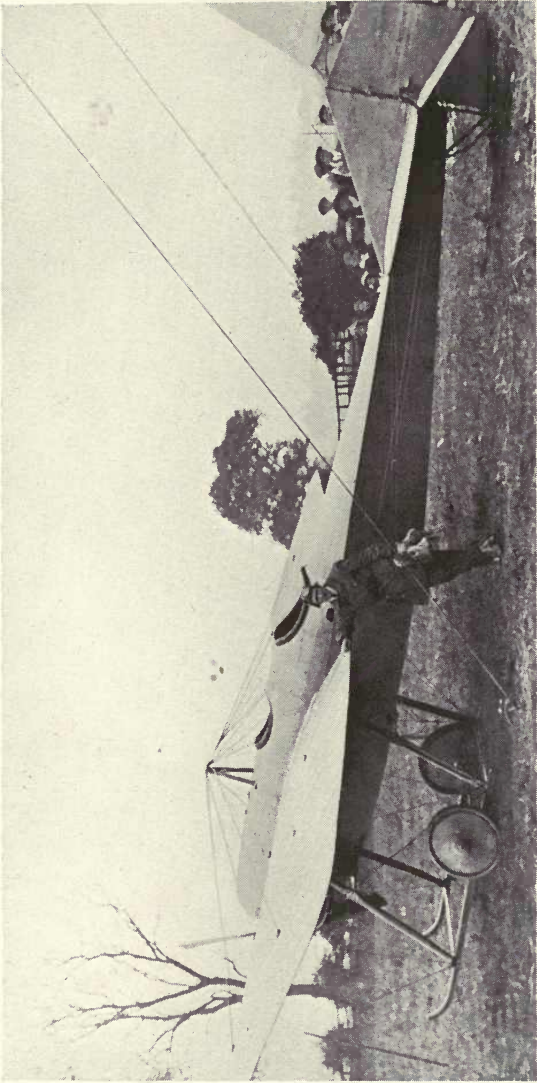
A craft which navigates the air by means of propulsion or by traction. It is not supported by gas, but in every sense it is a heavier-than-air machine. It usually consists of one or two main planes, which are rigid, one or more elevators and tail planes, as well as a rudder or rudders. With one main plane such a

craft is known as a monoplane. With two main planes the designation of biplane is given, and if there are three planes each fixed above the other it would form a triplane. Very few of these latter craft have been made. Attempts have been exerted to build a successful aeroplane with more than three main planes, and machines of this description would be known as quadrupleplanes in the case of four surfaces and multiplanes in the case of more than four. The most general types now in use are the monoplane and biplane, more particularly the latter. There has been an effort in certain quarters to alter the word aeroplane by substituting airplane as an alternative, but as aeroplane has become so standardised it is doubtful if such an alteration will be generally accepted.

DIRIGIBLE OR AIRSHIP

A cigar or fish-shaped balloon driven by engines and directed by means of elevators and rudders. Hydrogen gas is usually used for the purpose of inflation, and this enables the craft to remain more or less stationary in the air with its power-plant stopped. This is its chief advantage over the aeroplane or heavier-than-air machine, which latter has to descend by means of gliding in the event of engine failure.

There are rigid, semi-rigid, and non-rigid airships. The first are built up on a skeleton framework of wood



80 H.P. BLACKBURN MONOPLANE

and steel; the second consist of partly rigid framework; and the third have no rigid framework at all. The Zeppelin is a good example of the rigid type.

GLIDER

A glider consists of a construction of planes after the manner of the aeroplane, but in this case no engine is fitted. Flights, or more correctly speaking glides, are made by towing the craft or running with it down a gentle slope. In some gliding experiments rails or steel runners have been used and found fairly successful. Gliding is an excellent sport, albeit a somewhat dangerous one.

HELICOPTER

No successful helicopter machine has yet been built, although experiments have been and are still being carried out with this proposed type of aircraft. A helicopter is intended to rise vertically in the air without any forward movement at all. Propellers are mounted above the machine vertically, this with the object of lifting the craft directly upwards.

The above descriptions aptly show the difference between various types of craft upon which designs have generally been and are still being made. It now may be useful to give a few explanations of other terms used in the aviation world.

AILERONS

Ailerons are moving flaps attached to the trailing edge of each plane. They are controlled by a lever actuated by the pilot, and they are used for maintaining the lateral or side to side stability. In some cases lateral stability is maintained by the warp, *q.v.*

CAMBER

The camber of a plane surface is the maximum depth of the curve. All planes are curved in some degree, some largely, others only slightly. The diagram illustrates this more fully.

CHASSIS

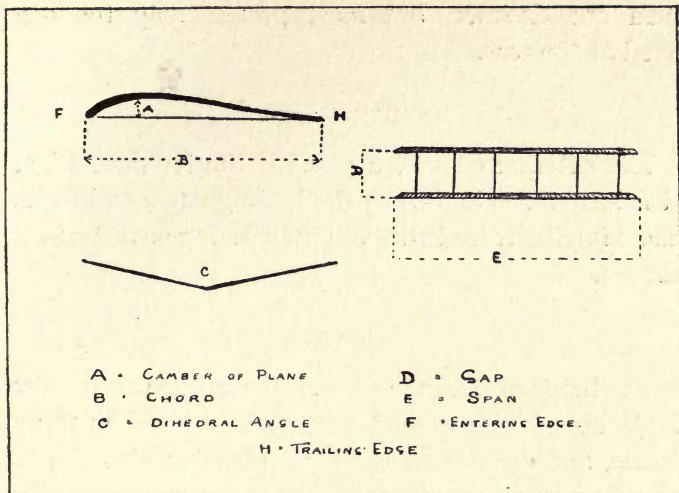
The chassis of an aeroplane is the undercarriage upon which the whole construction rests.

CHORD

The chord of a plane is the measurement in a straight line from the entering edge to the trailing edge. Illustrated in diagram.

DIHEDRAL ANGLE

A dihedral angle exists when the planes on each side of the machine are set in a wide "V" form perpendicularly. This is supposed to give increased stability and is employed in many modern aeroplanes. Illustrated in diagram.



DIAGRAMS EXPLAINING TECHNICAL TERMS

DRIFT

When a machine is going out of its direct course bodily it is said to drift. This is caused by various currents and winds. The best example of drift is to compare it with the same experience one meets with on seas and rivers when travelling in light boats. The effect of drift is counteracted by continuous use of the rudder

ELEVATOR

The elevator controls the longitudinal or fore and aft stability of an aircraft. It is worked by means of a lever held by the pilot. Some machines have more

than one elevator, but most possess only the one fixed at the rear.

ENTERING EDGE

The entering edge of a plane is the foremost edge. It is sometimes known as the leading edge, and as its name implies it leads the way in entering or disturbing the air.

FUSELAGE

The fuselage of an aeroplane is the body. It is usually built up of longitudinal members, covered over by fabric, and connecting the main plane or planes with the hind or tail part.

GAP

The distance between the top and bottom plane of a biplane or the distance between each plane of a triplane.

HANGAR

The hangar is now often called by the simple English name of shed, in which aeroplanes are housed.

PLANE

The planes or wings of an aeroplane are the main supporting surfaces. Correctly speaking, wing-surface is a term that cannot be used, for the principle of a

bird's wing is not essentially the same as that of an aeroplane's plane, except when the bird's pinions are outstretched stiffly for the purpose of gliding. Then and then only is the similarity of action apparent. Experiments have been made with wing-flapping craft, but with no success. In that case the term wing could be used.

PROPELLER

It is a common thing to hear the layman allude to the propeller of an aeroplane. Now actually a propeller is a propeller when it is situated behind the main planes and really propels the aircraft. As soon as it is put in front of the main plane surfaces it ceases to act as a propeller, as in its new sphere of activity it draws the aeroplane along and is then known as a tractor. Each use has its particular advantages and disadvantages.

PYLON

Pylons are numbered posts situated round the course of a flying ground and used for the purpose of air races. The closer the pilot turns on the outside of the pylons the greater his chance of winning the race.

RUDDER

Some machines are fitted with two rudders fixed in alignment. Others have only a single rudder. It is usually actuated by a bar known as the rudder-bar. This is worked by the pilot's feet and steers the machine

in conjunction with the warp or ailerons to right or left. In some craft steering is effected by rudders which are controlled by means of an ordinary steering wheel worked by the hands as on a motor-car. The type is, however, rare.

SPAN

The distance from one end of a plane to the other across the leading edge. In other words the width of an aeroplane.

VOL PLANÉ

A descent with the power plant cut off. It is often supposed that when the motor stops the pilot must needs consider himself already dead. This, as explained on another page, is not the case, for a descent *en vol plané* is a most delightful way of reaching earth.

VOL PIQUE

To dive perpendicularly downwards.

WARP

Warping has the same effect upon an aeroplane as have ailerons, only in the case of wing-warping the plane surfaces are actually warped or bent. The bending of the planes therefore produces identically the same result in turning or banking the machine as does the uplifting or depressing of ailerons or wing flaps.

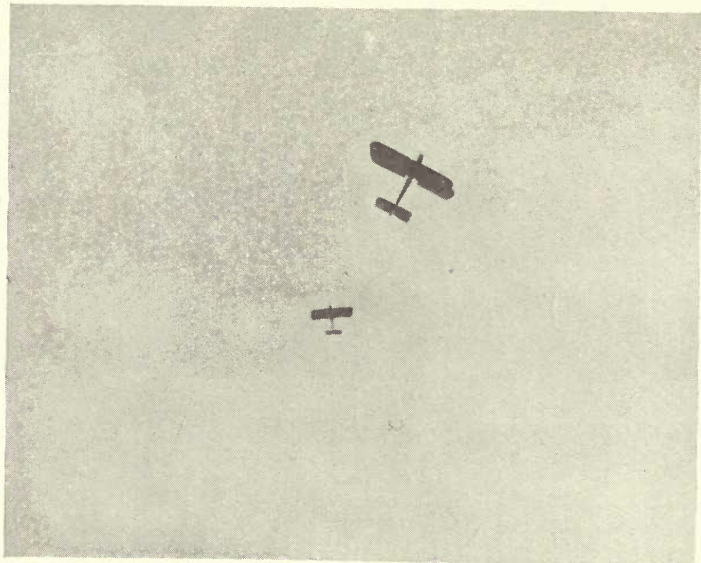
CHAPTER XV

FLYING MEN AND THEIR ADVENTURES

IN the following pages will be found the stories of those men who have used their art and employed their courage and fearlessness in furthering the cause for which the Allies have been so indefatigably fighting. It may, where the omission is noticed, be considered unjust to those brave fellows not to include their names, and this apparent neglect at once calls for an immediate explanation. Every one knows, or should know, that the tradition of the services is one of silence concerning individual valour, although the valour of a regiment may not be suppressed within a heaving bosom eager to free itself of stirring deeds accomplished by a particular regiment. The case of the individual is totally different. The really heroic officer of to-day and yesterday boasts not of his own prowess, but rather prefers his deed to pass unnoticed by the surging sea of men and women who are always eager to proclaim a hero. The honour of the individual is the honour of the regiment, and this same principle has been grafted into the majority of the members of the new air services. The tradition there is the same. For that reason the omission of many names has been partly intentional. In other respects

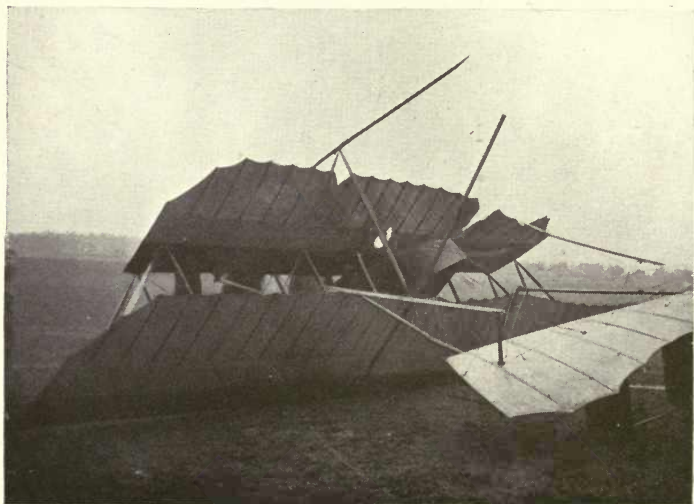
it has been of necessity, for there is always an outstanding difficulty in securing identification of any aerial exploits. The official communiqués are sparse in their reference to individuals, and this bears out the old tradition of the English service—to achieve duty, no more nor less, with no thought whatsoever of personal advertisement. For many of the stories I am indebted to the excellent weekly summaries of service aviation which have appeared in *Flight* and *The Aeroplane*, two most reputable and reliable organs of the aviation world. In a book of this nature it would be impossible to include every important and unimportant adventure, for the simple reason that the majority of them remain unrecorded. Some are inscribed on the hearts of those who have experienced the ordeals, others will never be told in this world, and others will not be known till after the war, when prisoners are released and the loved ones return to relate their adventures in their own restricted family circle. Perhaps that is the only audience which may rightly claim to hear the hero's tale from his own lips.

Some of the incidents given in these pages take the form of letters from officers at the front, and I make no apology for inserting these interesting documents, for many of them tell in plain, simple language of quiet and cool heroism of the "man up there" from whom so much is expected and realised. In the early days of the war, the aviator, although essentially safe at a good altitude, suffered considerably on descending



“ IN PURSUIT ”

Hold the photograph horizontally above the head



A PUPIL'S " ERROR OF JUDGMENT "

to lower levels from the continuous shooting which progressed vigorously from both sides. A very famous aviator told the correspondent of a morning paper (*The Morning Post*) that "they" (meaning friends and foes) "shoot a lot better than they used, of course, and shrapnel through your planes is quite sufficiently exciting, but it's nothing to what it was in the good old days when they couldn't shoot for nuts. Then every one had a pot at you, your own side just as often as the other, and any death was good enough for you when you landed. It was pitchforks most often, or any other handy agricultural instrument, and no matter in what unlikely spot you landed a burly French farmer was down on you the next instant, like some great spider out of the hedges, anxious to do his country a service by letting out your vital juice. They all seemed to consider the one safe course with anything so uncanny as an airman was to make an end to him first and inquire about him afterwards. Twice when I got shaken up on landing by a rough bit of plough I came to find a circle of scythes and billhooks round me, and no one the least concerned by the circumstance that I was upside down.

"The dear old French Territorial also felt in duty bound to have a shot at you, and the problem of how to get out of the air alive, in order to deliver your news, was, owing to the keenness of your friends to kill you, a problem that confronted you from the

moment your news had been acquired, and led you in a search for uninhabited places, or where there was nothing worse than a bull to gore you, till your petrol was almost out.

“ Now, of course, we are in clover. If you are a friend you're welcome, and if an enemy you don't amount to much. The magic glamour has been rubbed off our wings, and we are merely one of the few interesting objects left on the battlefield. I mean, we are about the only combatant left that you can watch being shot at, and whose fortunes you can follow from a quite safe distance with interest and amusement. It's easy to judge just how near the shrapnel comes to us, and our antics when a big shell opens an air hole under us appeal, I believe, even to men with no sense of humour. For the rest every one wishes now they had taken up such a safe line as flying while there was yet time.

“ A youngster, who had joined a Line regiment in the early days of the war . . . in charge of a machine-gun, was left by accident in the trenches when his battalion was withdrawn. . . . The boy had thus, as his earliest experience, a continuous spell of forty-three days in the trenches. . . . Sympathy for what he had endured sent him home on short leave, and when his week-end was over he realised that something unpleasant had happened to his nerves. ‘ I simply can't face the trenches again,’ he admitted. ‘ I can't get the sound of the bullets out of my head.’

“ He might have had more leave, but he asked instead to be transferred to the Flying Corps, and, having taken his certificate before the war, the transfer was granted him. He is now watching the Germans from a few thousand feet above them, and the change of air has worked just the relief required. He can still hear the bullets, but now they are beneath him, and as he explains it, ‘ You can always put her head up to get out of them, but you couldn’t do that in the trenches.’

“ Psychologically, aeroplaning on active service as a rest cure for shattered nerves may deserve consideration.”

An officer writes: “ The other day we were all about our daily business when we heard the sound of shots skywards. Now, sound of shell skyward is very common, as on any fine day one aeroplane or another is being shelled, and no one worries much about it. Shots mean a chance of something being hit, and is therefore exciting, while anti-aircraft shells are only exciting from the fact that they are more likely to hit you than the aeroplane.

“ Two aeroplanes were coming towards us, flying, I think, a little lower than usual. The pursued was a small monoplane, and the pursuer a very much larger biplane, and to our joy German and English respectively. I always thought a biplane was, as a rule, much slower than a monoplane, but the two seemed identical in speed. The German appeared to be about

100 yards at most from the English, judged by comparison of space between them and the length of the aeroplane. The 100 yards, as regards direction, was varying continually. The English aeroplane could only catch up the German by descending a bit, and if it tried to climb at all it lost distance horizontally.

“So we watched them going ding-dong at each other in a straight line for about ten miles, when they disappeared in the haze with the pursuer trying first one side, then the other, and then behind, but never over (I suppose because he could not get there, worse luck!). Each, as far as we could see or hear, blazed away with revolvers only, and it seemed rather amusing that by fighting so desperately to get each other down they were each, incidentally, doing their best to keep each other up, as neither English nor German anti-aircraft guns, though nicely within range, dared blaze away at them. They disappeared well over the German lines as close after ten miles of chase as they were after one. The result was, I believe, officially nil, but actually it gave a lot of excitement to many thousand onlookers.”

A N.C.O. of the R.A.M.C. (T.), writing from France, relates the following: “The weather has not been so fine during the last few days, so we have not had quite so many aeroplanes about. However, they always seem to be busy, and though one does not see many German machines, they occasionally pay us a visit. The other afternoon an Albatross came over,

flying quite low, something under 2000 feet, and she was absolutely blazed at by all sorts of fire for about a quarter of an hour. She kept going, however, and as far as I know was not once hit, and got away.

“ I always have a sort of fellow-feeling for these German chaps who come over our lines, and an inward hope that they may come through all right. One also feels that the men behind the anti-aircraft guns must have similar sympathies, but I suppose it is not the case. However, I have never seen a machine, English or German, hit yet, and the chief object of ‘ Archibald ’ (the anti-aircraft gun) seems to be to drive the hostile ’bus away by showing what he could do if the said hostile ’bus comes any nearer. Besides ‘ Archibald ’ we have got a very neat little machine-gun mounted on a car, which, when possible, runs along the road in pursuit of the invader with the gun popping away like an ancient Anzani engine.

“ One hesitates to think what would happen if the driver’s gaze became so transfixed on the prey that he failed to notice the neat eleven-foot ‘ Jack Johnson ’ hole in the road in front (jubilation of hostile airman and passenger!). I saw a couple of R.F.C. officers in a car the other day. They looked ‘ in the pink.’ ”

BALLOON *versus* AEROPLANE

One of the most thrilling and daring escapades that have ever fallen to the lot of man was an aerial raid

made by one of our aeroplanes over the dirigible shed which is situated at Ghent. The pilot started out in the afternoon armed with three large bombs, hand grenades, and a revolver. No passenger accompanied him. It was a calm, clear day, such as would enable him to accomplish his task without any atmospheric interference, and as he approached his objective he espied a captive balloon acting as an aerial guard. This did not disturb the aviator, though it was a trifle inconvenient, as the balloon contained two of the enemy whose ability at shooting was not to be laughed at. Shot and shell began to show its marked liking for English airmen, and so to give the Germans a taste of allied bombs the airman dropped the first of his supply. He was then over the balloon, and kept spiralling above it in order to prevent the occupants firing at him too enthusiastically. The second bomb was launched. Down, down it fell. The pilot gave up a sigh. Surely it had hit the balloon—and the Germans would go hurtling to death accompanied by the falling fragments of their captive craft! No longer was it captive, but in securing its freedom Death had shaken hands with it. But no! The bomb passed the spherical shape and missed it by yards, nay, by inches. Alas! the balloon was still a captive.

Seeing that he could do no further good for himself by stopping above the balloon he planed down underneath it. As he passed the two Germans hailed him with a volley of shot, and the pinkering of the bullets

through his planes resounded like so many taps on a drum. The airship shed lay below. By this time troops had been called out, but it was impossible to shoot at the Englishman from the ground for he was wise enough to keep in direct line of the enemy balloon. If he went, that should go too. He descended still further, and when at not more than 200 feet he released his last bomb over the mammoth airship shed. Down went the explosive and up went fragments of shed. The target was hit and the young English airman flew merrily away.

The following interesting account of aerial reconnaissance is taken from the letters of an officer of the Royal Flying Corps: "On the first day of the attack (on Neuve Chapelle) I was up doing a reconnaissance, but saw very little of the battle, as most of the time I was flying in a driving snowstorm and couldn't see the ground. After a bit my petrol pipe broke and my engine stopped, necessitating a forced landing.

"The morning of the second day of the attack I went by motor to one of the siege batteries to arrange with the C.O. about co-operating with us. The roads were crammed with troops marching up to the trenches, chiefly Indians, and batches of German prisoners being led back under guard, and long lines of horse ambulances filled with wounded, many of them very cheery despite their wounds, the happy possessors of German helmets and other trophies. The six-inch

siege battery I went to was in a regular nest of batteries, all keeping up a continuous bombardment of the Germans, by whom they were also being bombarded. The din was terrific. I got back in time for lunch and then did a reconnaissance with my observer over the battle.

“ I was flying a rotten old machine, with an engine that runs very badly and was missing from the time I left the ground. Under ordinary circumstances I should have landed again immediately, but it was an important reconnaissance, so I had to do it. The highest I could get the machine to was 4700 feet, and then as I flew towards the lines I could see our other machines up getting a hot time from ‘ Archie.’ They were flying between 7000 feet and 8000 feet, and as soon as I was in range the Germans opened on my machine, and then during the whole of the reconnaissance, which consisted of circling about a small area, they didn’t give me a moment’s peace, and I had shells bursting round my machine the whole time, simultaneously flashes of flame and loud bangs, sometimes on one side and then on the other, below the machine, above it, behind, and in front, and some of them bumped the machine about unpleasantly.

“ It was thoroughly uncomfortable. I twisted the machine about this way and that, made it side-slip outwards, and did everything I could to spoil their aim, but they kept me guessing the whole time. One shell exploded just in front, and I saw some bits of

things flying off the engine and thought the propeller was gone. I was very glad when the reconnaissance was over. On landing I found that the machine had been hit by rifle fire as well as by shrapnel.

“Yesterday I was up for over an hour trying to get in a reconnaissance, but there was mist from 400 feet up and from 3000 feet thick clouds in which I was awfully knocked about by bumps. After flying some time at a bit under 5000 feet I thought I was behind our lines and shut off the engine and glided down to 3000 feet, and when I could see the ground found I was well behind the German lines. They must have laughed when they saw the machine unsuspectingly appearing out of the clouds, and they greeted me with a tremendous fusillade of rifle fire and some ‘Archies’ that didn’t, however, come very near. I got into the clouds again as soon as I could, but had a warm time in doing so. They only succeeded in hitting the machine once or twice.

“ . . . I have just got down from just under two hours in the air, during which my observer was photographing German positions. As regards your question of the height at which practical observation can be done, given a clear day after the height of about 6000 feet is reached there is very little difference between that and 12,000 feet, and after the first 6000 feet it would take a very practised observer to tell if he were that height or double that height. One can see everything perfectly clearly. The other day one

of the observers took a lot of photos at 11,500 feet, thinking he was about 6000 feet, and they came out very clearly. I have not yet been higher than 8900 feet, as at present the engine of the machine that I am flying is not running well, but at that height one can see transport and troops perfectly clearly without field glasses."

It will be seen that the officer makes note of the violent bumps encountered in the clouds—phenomena which are always met with by any aircraft passing through cloudy regions.

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“ HE MADE HIS REPORT ”

These inspiring words were applied to the late W. B. R. Moorhouse in connection with the memorable deed which he bravely accomplished during the repeated raids on Courtrai. A higher type of heroism than that which dwelt in the soul of the real man Moorhouse could hardly be imagined, and his fine feat, which took place in April 1915, must go down to posterity as one of the bravest examples of endurance and courage ever performed.

The railway at Courtrai had to be destroyed and Moorhouse was chosen as the pilot to effect the destruction. He flew a biplane and was not accompanied by an observer. Spotting the junction at Courtrai he switched off his engine and descended to within 200

Small, faint markings or characters at the top right corner.



By Courtesy]

[J. Weston & Son, London

WILLIAM BARNARD RHODES-MOORHOUSE, V.C.

or 300 feet from the ground. Rifle and gun fire were very prominent, but in spite of this he threw a large bomb and hit the desired mark. Making all speed to ascend again he pushed the nose of his machine steeply skywards and climbed and climbed. A bullet struck the plucky fellow in the thigh, and although he realised that he must be fatally wounded he stuck to his post and flew back to the quarters of his squadron. Twice he practically fainted, but somehow managed to retain some sort of control over his craft. The distance back to the base was something like forty miles and, despite the overpowering fatigue through loss of blood, he landed the machine without damage, and in the words of the official eye-witness "he made his report," expiring some time afterwards in hospital.

W. B. R. Moorhouse was very well liked in the aviation world, and was of the true sporting type of flying man. He was the first aviator to deliberately switch his engine off while he was still climbing, and so accomplish what is known as a tail slide, and this daring experimental feat took place at Brooklands as the result of a bet.

WARNEFORD'S FAMOUS FEAT

The dull grey dawn of June 7, 1915, proved to be the last dawn that a particular German Zeppelin would see. In the eastern sky only a faint glimmer of light had pushed its way through the morning clouds,

and an enemy airship was making its way back to its temporary base in Belgium from where it carried out the murderous raids over England. Six thousand feet below twinkled a few lights, not yet extinguished from their nightly vigil, and further on lay the city of Ghent somewhat darkened, but withal visible. Further still, at an altitude of 3000 feet, flew two Morane monoplanes that by some good fortune were approaching in the direction of the dirigible. Neither could see the other for some time, until nearer and nearer the aircraft came, directed by the hand of Fate. A flame from the exhaust of the Zeppelin flashed out in the sky. The alert eyes of the aeroplanes' pilots missed nothing and Flight Sub-Lieutenant Warneford, pushing the nose of his machine skywards, felt the air for his prey.

The sky had brightened a little and the cigar-shaped airship stood out in silhouette form against the stronger light, Warneford the while climbing steeply to reach his objective. A huge flame burst out from the long gondola and shot belched forth. The English aviator was sighted, and the Germans lost no time elevating as fast as possible. But the little Morane monoplane only smiled. It climbed and climbed, eventually getting the upper hand, where it made small steeply banked turns over the gasbag.

The pilot loosened a bomb. It fell wide and the Zeppelin commander no doubt grinned broadly. Another bomb came hurtling through the air, this

time nearer to its target, and before the commander had time to grin again a third had crashed into the top of the envelope. A huge flame shot up, a loud explosion, and a little Morane monoplane was forced upside down with the pilot working vigorously to recover himself. The Zeppelin was falling, a mass of fire, and the commander grinned no more. Warneford righted his machine, but his engine ceased working, and landing in enemy territory he commenced to put his craft right. Meanwhile a party of Huns made rapid advance to the spot where the Englishman had landed, and it became fairly obvious that Warneford would be captured. Still, just as the enemy almost reached the machine, it sped over the ground, bounded into the air, and was away, amid showers of gun shot and open-mouthed astonishment from those below. Over the side peered the brave young Englishman, and in a moment of irrepressible joy he waved his hand as a token of departure and flew merrily away to his own lines.

SIXTY WARPLANES' EXPEDITION

The use of aircraft in very large numbers has been attended with very much success and joint action by fleets of aeroplanes has been responsible for a large amount of damage of military importance.

Imagine to yourself a calm moonlight night in the month of August. The stars shine faintly compared

with the fuller brilliance of the moon. They are in fact, like lesser geniuses, outshone by an all prominent and reigning light. The trees are still. The "Halt, who goes there?" of the sentry re-echoes on the barren stillness, and the password being given, that barren stillness reigns once again supreme. But its enthronement is soon disturbed. Like the hum of a thousand dragonflies the dull murmur of sixty aircraft engines catches the ear and the mind at once assumes the possibility of a raid on a grand scale. The stillness no longer exists. It cannot now appeal to the poetic sense for the dignity of silence is replaced by the dignity of the song of the engines of war. Sixty warplanes in joint action! 'Tis but a forecast of the future—600 warplanes in joint action! What shall mountains and seas avail a country then? Even now there are no longer partitions between country and country. Mountain and sea can offer no resistance to aircraft. The country with the most efficient aerial fleet can dominate the whole world.

Sixty warplanes! All bound for the Forest of Houthalst in Belgium where a large body of Germans is encamped. It is just before midnight when the sixty warplanes arrive over the forest and begin to drop their bombs on the military camp. The Germans are not feeling easy. Their guns soon exhibit that. The firing is good. Look! one of the Allied warplanes is hit and quivers for a moment, suspended in mid air. She turns over and commences to fall, not rapidly, into



REGINALD A. J. WARNEFORD

the forest 10,000 feet below. No wonder a hundred German gunners feel proud. Each one claims to have placed the lucky shot and each one burns with pride at having brought destruction on an Allied warplane. Destruction, did I say? A few moments more and the pride of the German gunners is humbled for the Allied machine rights itself—or by supreme skill the pilot manages to right it—and away she climbs, up, up, up once more to her fellow-raiders. Destruction? Not by a very long way. Shrapnel balls fly fast and furious. Other machines are hit but not destroyed. Bright flashes burst from the military camp. The Allied machines carry good bomb-throwers and the Forest of Houthalst shall not soon or easily forget this expedition. The enemy guns thunder louder and louder. The incendiary bombs drop faster and faster. Striking the earth they cast a flame eighty feet into the air and spread death and destruction as rapidly as the plague.

For over fifteen minutes this aerial battle ensues. Many of the aeroplanes return to their home for a fresh supply of bombs. Back they fly to the forest and restart their campaign against the German Station. The bombardment from the air continues for several hours in this way, but no German machine risks ascent with such overwhelming odds against it. So the Allies have it all their own way and press the attack to their uttermost. Damage to an enormous extent is accomplished, for munition factories which had been established in the forest are totally destroyed, being burnt

out by the incendiary bombs dropped upon and near the various temporary buildings.

Daybreak arrives. The dawn sends its long shadows over the scene of disaster and lays bare the realities of war. It reveals in all its horror the possibilities of aerial warfare, and the earth, saturated with blood and charred by fire, cries in agony at the blood-thirstiness of human nature.

But the allied machines and pilots are all safely called over at their base. That is the main issue; for after all, war is war.

Such was the scene of a great raid undertaken by sixty English, French, and Belgian aviators. It was but one instance of the many.

FALL OF 8000 FEET

An officer in France, writing home, says:—

“ First, as regards myself, or rather as regards the southern end of the British line in which I have the honour to burrow, German aeroplanes have a very thin time of it on our part of the line. One sees a dozen British for one German, and if one of theirs appears its life is either short or very harassed. Our anti-aircraft guns are decidedly better than the Germans’, and I have often seen their ‘ Archies ’ waste seventy or eighty shells in a few minutes, in clumps of four to six, without getting near our ‘ planes, whereas our guns have been decidedly successful.

“ The cleverest scrap I have seen was on September 30th. A very fast German biplane was touring over our lines, with its attention engaged by the close practice of our guns, when suddenly from behind the clouds a British aeroplane appeared and bore down on the German, which fired 150 rounds, as we found out afterwards, from its machine gun, but in vain, and our machine opened fire and riddled the German, almost severing one of its planes and killing both pilot and observer.

“ The aeroplane fell, both wings buckling, and came down within our lines after a drop of about 8000 feet, though even in such a shattered state the comparative slowness of its fall was noticeable. One wing was a long distance from the machine, and the bodies of those inside were unrecognisable, one being buried beneath the machine. One was glad that they had been killed by the bullets, especially as Hun aviators are generally good sportsmen.

“ The machine was regarded as a great prize, as it was of some wonderful new type, very fast and developing great horse-power. I gathered that its engines were a matter of great interest to our scientific experts. It was also an Iron Cross machine. There was a great rush for souvenirs, and some of our blithe Tommies were collared in the act of carrying off a machine gun as a souvenir!

“ Our pilots out here have not got a great opinion of the skill or courage of the German pilots, who never

attack them unless about three to one. One pilot described to me how he went a fifty-mile trip into German territory and his machine gun jammed at the start, and yet a big fast German machine followed him round at a safe distance, never interfering and sheering off if he fired at it with his pistol.

“The R.F.C. undoubtedly did great work before the big offensive, destroying all communications, and in some cases coming down to 300 feet to drop their bombs, but all agree that the Germans are wonderfully quick in repairing damage, for our men may drop bombs on a train, wrecking train and permanent way completely in the morning, and in the afternoon the trains are running as usual over that part of the line.

“I understand that the record for bullet-holes, a much-prized record, is held by a Captain L. who returned from one flight recently with over 300 holes, the previous record being 240 odd.

“The French pilots are of two sorts—those who dive to 300–500 feet and drop their bombs with beautiful precision, and those who stay at 9000 feet, drop their bombs, and trust to luck.

“I see that at the start of this letter I spoke of a few lines. Heaven preserve you when I write a good many! Life out here is a darned good mixture of a picnic and a gamble—at roulette, as you always lose in the end.”

LITTLE BY LITTLE

A Royal Flying Corps officer and his mechanic were compelled to alight about half a mile from Mons owing to a defective engine. It was the mechanic's job to put "the obstinate brute," as he called it, right. So he and the officer set to work. It was not long, however, before enemy shells began to fall in an adjoining field, much to the consternation of the two plucky men. Soon the shells fell 100 yards distant on each side of the machine, and this space soon gradually decreased yard by yard. Faster and faster worked the mechanic. Nearer and nearer fell the shells until the distance between the aeroplane and the excavations was not more than twenty yards. At last the engine showed some signs of returning to life, and the pilot took his seat and switched on. The mechanic swung the propeller and the engine performed its expected duty. The aeroplane moved forward, the mechanic scrambled on to its back, and then—bang! A shell had fallen at the rear of the craft, blowing part of the rudder and fuselage clean away. Of course, an aeroplane cannot possibly fly with no rudder and a damaged fuselage, so there were two courses left open to the men in the machine. They could either surrender themselves to the enemy or make for their own lines and take the accompanying risks. They felt disinclined—nay, they were both distinctly opposed to the former course—and, therefore, a decision in favour

of an attempt to return to their own lines was made. They fired their machine so that the remaining part of it could be of no use to the enemy and then they set about their formidable task. Under the cover of hedges they made some progress, but fearing that they would be seen they decided, on seeing an opportune recess in an ancient and almost dead tree, to take refuge therein and await patiently for darkness.

It was then about three hours after noon and the sun was due to set at something round seven o'clock, so a four hours' wait stared them in the face. Patiently they sat or rather half stood in the recess of the great tree trunk. Time did not fly on that occasion. The snail could have raced it and won by many lengths. Four o'clock saw them stiff through keeping in the same position, and that hour must have seemed an eternity to them. Half past four was just passed when suddenly the familiar drone of an aero-engine reached the ears of the men. The officer took out his glasses and scanned the heavens, but no machine was in sight. The drone became louder and louder, and eventually about 4000 feet up a biplane hove in sight. It was travelling fast and heading toward the German lines. Why it was flying so comparatively low was not apparent. It passed over the heads of the two soldiers and they soon forgot all about its advent. But that machine was destined to save their lives. Yet at that moment they were unaware of it and dismissed the event with a reference to the lucky devils up there

who possessed a machine with, at least, a rudder and a whole body.

At five o'clock, a spluttering noise was heard not a 100 feet above the tree in which the two men were hidden. The mechanic looked out, and there right enough was the identical machine which had passed over at 4000 feet but half an hour ago. The engine was misfiring. The craft was making for a field across yonder hedge, and a minute afterwards it was safely resting on terra firma.

The mechanic suggested to his officer that they should both go over to their new companion in difficulties, and so they made a dash for it and reached the machine. The pilot was an English R.F.C. officer of the same squadron as that of the stranded lieutenant and mechanic. His engine had given trouble in consequence of which he had turned round with the hope of reaching his lines, but he had only succeeded in getting so far.

The mechanic started on this second "obstinate brute" of an engine, while the two officers inspected the machine and counted the holes made by shrapnel. Somehow the Germans seemed to know where the craft had descended, for before five minutes had elapsed shells began to fall in close proximity to the machine, and the men once more began to feel uncomfortable even though unafraid.

The engine was tried once again and found to be in order, and so it was thought advisable to leave the

district immediately in case a party of Huns had been sent to find the machine. The shells ceased dropping, and this fact pointed to a party having been despatched by the enemy to search for the airmen. The machine was a single-seater scouting biplane, but with some difficulty the two officers and the mechanic packed themselves into it and the craft started off, dashing furiously across the field into the wind. The dash was not made a minute too soon, either, for the expected search party arrived on the scene just as the aeroplane left the ground. The Huns made a rapid fire upon the English biplane and several bullets passed through the planes and one managed to catch the mechanic's left arm. There happened to be one bomb left in the machine, and not to be outdone the pilot circled round once or twice quite low amid the firing which still went on vigorously and then—down went the bomb. As luck would have it, it fell somewhere near the little party of Huns, knocking one or two of them flat and astonishing the rest.

Half an hour afterwards the Englishmen were back at their base telling the incident to a friend of mine who has been good enough to relate the interesting story to me.

A MILE HIGH

The following passage is taken from the account communicated by an Eye-Witness present with General Headquarters:—

Sunday, the 20th, was also quiet. . . . There were two engagements in the air on this day. Near Roulers one of our machines on a reconnaissance duty encountered a hostile aeroplane, and after a machine-gun duel forced it to descend hurriedly to earth. A combat with machine guns at a height well over a mile above the earth's surface, though now not uncommon, may be considered to provide some excitement; but on the same day two other officers of the Royal Flying Corps had a still more exciting experience.

While reconnoitring over Poelcappelle at a height of about 4000 feet they engaged a large German biplane having a double fuselage, two engines, and a pair of propellers. The German machine at first circled round ours, shooting at it with a machine gun, but so far as is known not inflicting any damage. Then our observer fired about fifty rounds in return at under 200 yards' range. This had some effect, for the hostile biplane was seen to waver. After some more shots its engines stopped, and it nose-dived to a level of 2000 feet, where it flattened out its course, flying slowly and erratically.

Under a heavy fire from anti-aircraft guns down below our pilot turned towards our lines to complete his reconnaissance, when his machine was hit and he decided to make for home. But the petrol tank had been pierced, and as the aeroplane glided downwards on the slant, the petrol was set alight by the exhaust and ran blazing down to the front of the body of the aeroplane, which travelled on to the accompaniment

of the rattle of musketry as the unexpended rounds of machine-gun ammunition exploded in the heat and those in the pilot's loaded revolver went off.

The pilot, however, did not lose control, and the aeroplane proceeded steadily on its downward course. Before it reached the ground a large part of the framework had been destroyed, and even the hard wood blades of the propeller were so much burnt that the propeller ceased to revolve in the rush of air.

When the machine finally landed behind our lines both the officers were severely burnt, and the pilot, on climbing hurriedly out of the blazing wreck, tripped over a wire stay, fell, and sprained his knee.

The few still serviceable portions of the aeroplane were then salvaged and collected under the shrapnel fire of the German guns. As an example of a terse, unvarnished statement of fact, the last words of the pilot's official report of this adventure are worthy of quotation: "The whole of the nacelle (body) seemed to be in flames. We landed at W. 35 n P. 16 (Z Series 93 E.W. 1/35,500)."

EXCITING BATTLE IN MID-AIR!

An officer in the R.F.C. sent the following letter to the *Times*:—

"Yesterday, being the first fine day, I had instructions to go up in an F.E., with 'P' as observer, to take some photographs over ——. It was about the most

unpleasant job going, as the numerous woods about there are absolutely bristling with 'Archies' of no mean prowess, as I can testify, having had, perforce, to sample some of their wares on many a reconnaissance of late.

"It took us roughly an hour to get up to 9000 feet, which time we spent between —— and —— climbing, climbing, and climbing still. The air was pretty full of machines, it being the first fine day for some considerable time. We saw no Huns, though we afterwards heard that there were three hanging about behind their lines, and worrying a number of our fellows doing photography. Twenty to 12 found us east of ——, not far short of 10,000 feet up, and distinctly chilly.

"A biplane and a monoplane appeared east of us, the biplane leading, with ample evidence of being in a hurry, with the monoplane—which appeared to be one of our Morane type—overhauling it hands over fists. We were about 2500 feet above the 'buses,' and when within about a mile I got a glimpse of the monoplane's top wing. Black crosses on a white base. Good enough!

"Down went the F.E.'s nose almost vertically; 2000 feet we came down, while the air speed indicator went up to 160 M.P.H. and then stuck, not having been designed for the purpose of exceeding recognised limits. I expected the F.E. to fold up under the strain any moment, but she stood it like a rock. By this time the other two machines were almost vertically below us—the Hun had caught up the biplane and was

emptying his gun into it at fifty yards' range. It subsequently transpired that just at this moment he had put three bullets in the observer's arm and one through the main petrol tank, with the result that the precious fluid was pouring all over the pilot, observer, and fuselage.

"I started pulling the F.E. out of her nose dive about 200 feet above the Hun, as too sudden a shock would inevitably have crumpled her up. The consequence was that we found ourselves above and behind the unfortunate Teuton, and within twenty yards of him. To my mind he never saw us until we opened fire. Twenty rounds of lead were planted into the back of his neck, though apparently they did not hit him. He then turned his attention to us, turning left-handed and passing directly below us. This necessitated our getting on to a perpendicular bank and doing a complete circuit to see where he'd go to. The little beggar was describing circuits round us, while we did a sort of 'Inner Circle,' conducted, of course, with a perpendicular bank; but owing to the fact that our speed was so great and that we were doing complete turns in about twice the length of our machine, the centrifugal force was so great that 'P' couldn't hold the machine gun on its mounting; it swung down, and though the whole gun only weighs twenty-eight pounds, he he could not pull it up square.

"Things being at the moment distinctly unsatisfactory, we were not sorry to see the Hun head for

home. After him we went, both diving lustily, while 'P,' more familiarly known as 'Pongo,' gave him the rest of the drum—another twenty-eight rounds.

"I was beginning to get a little anxious, as we were getting very low and expecting 'Archie' to get us any minute, when we got him. A lucky shot found its billet and the pilot was no more. The evolutions that machine described falling 7000 feet, with no man at the wheel, were extraordinary, viewed from above—first wheels up, then right way again, a loop, several cartwheels, a nose dive, more loops, and several turns on to and off its back, sideways, until it was lost to sight almost on the ground. Good enough!

"By this time another F.E., a Bristol scout, and two Q.c.'s had arrived, but—fortunately for me—too late to claim a share in the *finale*. The next I remember doing was looking at my watch—12.45. The incident over, we started climbing again, as those infernal photographs had to be done. At this point the engine began to have a say in the matter, and one cylinder decided to strike. So homeward we wended our weary way. Quite an ovation on landing—the only person who wasn't cheery was the unfortunate observer of the Q.c., who entered into the commencement of the scrap. The satisfaction of knowing that the Johnny who'd pushed three holes into his right arm—considerately avoiding to touch the bone—had been properly 'straffed' didn't bear any weight.

"The Major was delighted, as it was the first machine

of this type to show up in this quarter. A number of Fokkisers, as the German Moranes are called, have been giving our machines a lot of trouble down south, and it is rather thought that this one may have been a picked pilot sent up to put some more heart into the other machines working in this sector of front. For his first appearance he had certainly done remarkably well, driving off three of our machines and wounding an observer. For speed and climb, he left our machines absolutely, so he was well out of the way.

“ I must say that he was the first German we have run across who put up anything like a real decent show, and our jubilation is tinged with regret at the loss of a very gallant fellow. So much for the episode itself.

“ We got back satisfactorily, to a late lunch, and soon after having entered up our report as to whether or not the machine was worth salving, were granted permission to go up to the wreckage. X and I, with a flight-sergeant from my flight and a mechanic, set out about four by car. . . . A walk of 500 yards brought us up to a line of trenches and dug-outs about 100 yards from the German trenches, though screened from those nearest us by a slight rise in between. That we were in unpleasant proximity was soon apparent, as the ‘ phew! phew!’ of the bullets came with most disturbing regularity. All the time star-shell magnesium flares went up and made you sit as still as a rock, as the least movement would give one away. But by now we had reached the wreckage.

“ As far as I gathered, viewed from the ground, the fall was full of excitement, and our troops for four miles along the lines had stood up and cheered to a man for several minutes on end. In fact, a few had said to the officer in command of the battalion—so he told us—that they all felt that it was worth four days’ discomfort to see it come down 7000 feet, as the engine was going all the time, and it only took thirty-five seconds to drop the best part of two miles. You can imagine the pace it was going when it hit the ground. Finishing its descent in a nose dive, as I said, with its engine going, it first struck the top of a dug-out. It would seem that fellows watching its descent and seeing its course to be headed towards them had taken refuge in a dug-out. The roof was built of trunks of trees of reassuring dimensions, covered with three feet of earth.

“ The impact was so great that owing to the weight of the engine it had gone slap through the roof and buried its nose into the bottom of the dug-out, leaving a portion of its tail outside, but the rest so telescoped as to occupy not more than a cubic yard. Remembering the fact that this type of machine has an all-steel frame, and that behind the pilot’s seat there is nothing of weight, it helps to emphasise what a colossal speed he must have been travelling. The four occupants of the dug-out were all wounded as a result, but none seriously.

“ Of what we saw in that dug-out, ten feet by twelve

feet, by the light of an electric torch through the smoke, the time being midnight and shells going off all round, I shall never forget as long as I live.

“As mementoes of a very gruesome occasion I have got two decoration ribbons which the observer was wearing—though no medals were found, one of the ribbons is that of the Iron Cross. I have also the magneto from the engine, and a pistol for firing coloured flares to range their anti-aircraft batteries on our machines, a portion of the fabric and plane—though the crosses from the wings had already been collared—and a few regimental buttons from his tunic, which we shared out to the mechanic and sergeant with us.”

FROZEN IN MID-AIR

The world-famed Russian Sikorsky biplanes have been of immense value to our brave Ally, and it was to one of these huge craft that the following exciting incident occurred.

The Sikorsky “Dreadnought,” as it was called, went out over the German lines on a scouting flight when the air was clear of enemy craft. The giant machine, which is most elaborately equipped in the way of war necessities, flew at about 8000 feet—an altitude which is not particularly immune from the anti-aircraft fire from below. For some unexplained reason the enemies’ anti-aircraft guns remained silent. Not one attempted

to shoot. Such luck was phenomenal, and the pilot of the Sikorsky imagined that the gods had specially favoured him. But he was soon to be disillusioned, for there in the distance arose three German scouting monoplanes, all fast, and all fitted with automatic guns. Rapidly they climbed to higher altitudes, all after the one prey—the Russian Sikorsky giant aeroplane. The Russian, however, continued his reconnaissance, and although in numbers the German arm was superior none of the monoplanes seemed very eager to engage in combat. The Sikorsky was well armed and opened the attack. The fire was returned, and the very first German shot made good, and one of the petrol tanks was pierced. Fortunately the tank was a reserve one and the petrol therein was not needed for the return journey. Thus encouraged the same German gunner ventured nearer, but his daring was probably the last exploit of its nature in which he would personally participate. The next moment his craft was diving headlong to earth. It was in flames, and something—it looked like a human body—fell out of it and fell, a separate ball of fire, a separate instance of the horror of war. There were still two Germans to be dealt with, though. They were careful after witnessing their brother take his fatal leap, but even so their fire was not by any means spasmodic. A perfect hail rattled through the planes of the Russian giant craft. Then ping! the main tank was hit. Ping! Another well-placed shot by the Germans and again

in the fuel tank. Petrol leaked out rapidly. The danger of fire and the risk of failing to return through exhaustion of petrol presented themselves before the crew of the Sikorsky. The observer knew as well as the pilot did that the tank must not empty itself, so standing up, outside of the cabin, he placed both hands tightly over the bullet holes and thus prevented a further leakage of fuel from the main tank.

The enemy made a special mark of the poor fellow, and a shrapnel ball grazed his leg. But he hung on in his perilous position thousands of feet above the earth. The cold was intense. The man was soon numbed almost to death. Presently he became entirely oblivious of his position. The dizzy height and the extreme temperature had affected him. How he managed to retain his hold over the tank was a miracle, for the machine swayed and turned steeply in its efforts to avoid the ceaseless fire from the other aeroplanes. But he did hang on although all to him was oblivion. He was still a good target for the Huns, but luckily he escaped their shots.

Nothing more could be done by the Russian machine, so the pilot headed for home with the observer still standing holding the tank. At last his energies gave way and he collapsed on to the lower plane where he lay until the huge craft landed at its base with the information for which it had been sent. The observer was later resuscitated, but it was some weeks ere he could leave hospital.

GRIM HUMOUR

This story, which would be a tragedy in the eyes of a German, might arouse the sense of humour in an Englishman were he to imagine himself the successful hero in the particular situation. In any case, there is undoubtedly a humorous touch to the story, although when the individual events were happening it is probable that the humour was not then apparent. Humour often manifests itself several hours late and, perhaps, it is as well, for if our hero in the following event had laughed at the wrong moment he might not have lived to tell the interesting little tale.

He was a French pilot, short in stature and brisk in manner. His bright eyes shone from his face like twinkling stars, and you could see in them a merry smile which told you that he might have "something up his sleeve," a little joke, perhaps, in which *you* might be the victim. He had already singled you out as his prey and that's why his bright eyes smiled upon you with an affability which came very near to being an overbearing affectation. It did not repulse you, though, as it would have done had it come from one of your own countrymen. Affectation in an Englishman brands him as an "impossible." In a Frenchman you tolerate it as a habit on special exhibition in honour of your individual presence. An Englishman affects to be natural, but a Frenchman can be naturally affected.

Adjutant Pierre T—— was sent up in the region of Mons to discover the exact position of the enemy batteries, but he had not been in the air for more than half-an-hour when a German Albatross took him to combat. Round and round circled the two machines, first here and then there, a dive of several hundred feet; another climb to higher spheres, side slips, and other tricks—all to avoid the shots of the opponent. Then the German gunner swiftly outclimbed the Frenchman, fired twenty-six rounds down on to the French biplane, and was fortunate enough to hit the engine, rendering it *hors de combat*. Adjutant Pierre T—— immediately steeply nose-dived and made a somewhat irregular landing in a wheatfield. The Albatross followed and landed about fifty yards distant. But the Adjutant was not to be taken prisoner so easily. His saving grace of humour did actually possess a saving element. He lay over the side of his biplane, imagined himself dead, and did all he could to look like it too! The German airman sauntered up and congratulated himself on having killed what was once a real live French aviator. He thought of iron crosses and all sorts of things, but just as he was swelling himself with what he considered justified pride, the Frenchman's revolver went bang and the German was then no longer in a position to think about iron crosses or swell with pride, unless there are iron crosses in the next world (which God forbid!) and bosoms can still swell when the spirit has departed.

Adjutant Pierre T—— then set about his engine, but it was damaged beyond repair. Still, he could not walk back. There was the German machine, true, but if he flew over the French lines in that he would probably be killed by his own countrymen or by the Allies. After setting fire to his own craft, however, he risked it, and eventually made a safe landing at the correct base though not before he had received an allied bullet in his arm and a good many through his plane. Still, as he said, it was worth it for a German Albatross.

SCARING THE ARABS

The *Melbourne Age* of July 14, 1915, prints the following letter from Captain T. W. White of the Australian Flying Corps, with the Indian Expeditionary Force:—

“ Our aeroplanes (we have two erected so far) are Maurice Farman biplanes, with no front elevator (called a shorthorn), and with one (called a longhorn). On Monday morning at dawn Major Reilly, on the shorthorn with Major Broke-Smith as observer, and Captain Petre on the longhorn, with Lieutenant Brown as observer, flew to a small island, on which there is an Arab mud village, about fifty miles by river and forty by aeroplane, and where we had sent four machines.

“ There they received orders to fly over the Turkish positions and reconnoitre. Major Reilly also took three bombs, which he intended to drop to try the new sighting arrangement he had made. As the whole

country is flooded for hundreds of square miles, the attack took the following form." (Here follows a general description of the action.)

"The aeroplanes collected some useful information about the Turkish position on Bahren Island and their positions farther north. Major Reilly also dropped his three bombs, but did no damage. Both machines returned to our camp about 4 p.m.

"I had my first experience of real active service on June 2nd. The Turks were holding a position about five miles north of the Arab town of Qurnah, which is situated at the junction of the Tigris and the Euphrates rivers, and which is supposed to be the site of the Garden of Eden. The British have held this town for about six months, although in April a large force of Turks, Kurds, and Arabs moved round them and threatened Basra. The force, numbering about 20,000, was defeated by a British and Indian force, the Turks losing 6000 and the British 2000. The bulk of the fighting fell to the — and — Regiments, which were almost wiped out. The average loss per regiment was greater, I believe, than at Neuve Chapelle.

"I asked to be allowed to go, and was detailed as observer with Major Reilly on the shorthorn machine, only one machine being sent. We left camp at half-past 4 a.m. The weather was fairly cold. It appeared as if we were flying over the ocean, as very little land is visible above the floods and the course of the Tigris can just be seen. Occasionally small islands are passed,

or date plantations deep with water. We flew high, as it would be very awkward in case of engine failure, and as the Arabs are not always friendly, so passed over the islands. After about thirty miles we could see the bombardment of Bahren Island, about twenty miles away.

“ We landed at — at 6.20, the trip taking an hour and three-quarters, which was very slow for forty miles, but we had a strong head wind. The machine has a dual control, and can be flown by either pilot or observer. I flew it for a great portion of the way. The machine is a new one to me, but I did pretty well.

“ On arrival we received orders to fly over the Turkish position and try to locate his guns at Bahren; also to mark in the entrenchments on the map, and also to try to locate a gun on the Turkish right, which had been replying, and was supposed to be concealed among some of the Arab villages. We started off, and passed close to Bahren. The shrapnel was bursting well over the trenches, and the larger shells were kicking up the dust. We flew on up the river, and came up with a large paddle-boat, with big lighters alongside, going north, and crowded with Turkish soldiers. There were crowds of mahalas (Arab sailing boats) and ballums (canoes), and several small steamers, and about five miles farther up another paddle-steamer, with lighters, and packed like the other. We flew over the town of Rotah, where large earthworks and gun emplacements had been made, and this, too, the Turks

were evacuating. We flew north as far as Sakricka, a little to the north of which is Ezra's tomb, about sixty miles north of Basra. In all the towns and from all the camps the Turks were embarking, and making north as fast as possible.

“ We started back and dropped a bomb at the first paddle-boat, and two at the second. They were blazing away at us all the time. I flew the machine while Major Reilly dropped the bombs, but, although they went close, they did not strike them. We were flying high, because we were so far into the enemy's country. Also the horizon was not distinct enough to use the bomb sight accurately, so that it was difficult to do any damage. We returned to ——. I wrote a message to say that the Turks were retiring northwards in all available boats, and had evacuated all their positions, also that there were no obstacles in the river to impede pursuit. This message, put in a tin, with streamers attached, Major Reilly threw out after we had volplaned down close to the gunboat on which was the General, but the tin caught on the struts by the streamers, so I wrote another, and this one I threw safely into the river, and it was picked up.

“ We then flew off to the west to try and locate the gun on the Turkish right. We flew low, and passed over many Arab island villages. The inhabitants are known as marsh Arabs, are very fierce, and mostly on the side of the Turks. In some of the small ones the people just scurried out of sight when they saw us,

but in most of them they fired at us. They use black powder in their cartridges, and we could see them through the glasses quite distinctly potting at us, but they are not the best of shots, and didn't even hit the machine. We could see no gun, as the Turks had evidently removed it, so returned to ——.

“ Altogether it was most interesting, and we had had a good day. Although we had not hit them, we had evidently helped to scare them, for when Captain Petre carried out a reconnaissance the following day they were not to be seen. I flew the machine back (forty miles) and got there in twenty-five minutes, but the wind was, if anything, favourable.”

LORAINÉ'S DEED OF DARING

Captain Robert Loraine of the Royal Flying Corps has seen as much active aerial service as any one could possibly wish for. The following incident took place about November 1915 and is indicative of what the Royal Flying Corps is called upon to achieve and risk day by day, summer and winter.

Loraine and his observer started out for the express purpose of making a reconnaissance over the German lines, but their journey was to prove much more exciting than they actually anticipated. About four miles off L—— they suddenly observed an enemy machine and at once moved the offensive. The occupants of both craft opened fire at one and the same time, and after

firing twenty-six rounds the English observer's gun jammed. Loraine continued to fire, but the same fate overtook his gun, and so the two men were left to the mercy of the Germans who blazed away for all they were worth at Loraine and his companion. The latter put one of the guns right and started on the Huns once more. Suddenly the German 'bus dived—and it kept on diving. So the English biplane dived after it. But there was no need. A flame leapt over the petrol tank of the Hun and all was over. The craft fell, a blazing furnace, and was no more. The Englishmen started off once more and soon espied another German 'plane. The observer was almost frozen, but a further attack was decided upon. The Boche turned to flee but it was too late, so he decided to take a sporting chance. The battle progressed for five minutes; then the chance was lost, for the pilot was hit and down went German number two. Loraine and his friend felt enthusiastic, but their enthusiasm decreased directly their engine petered out. They had to descend, of course, and pushing the craft in the direction of the English lines they eventually landed near the second fallen German aeroplane. The pilot was dead, the passenger severely injured. The *taube* had on board an old machine gun, a camera, a carbine, a pistol for firing coloured lights, a pair of binoculars and other goods which were at once commandeered.

The German observer was taken to hospital, and on making some recovery asked when he would be dealt



ROBERT LORAINÉ

with by our engines of torture. He understood, so the English observer says, that all prisoners were tortured on their recovery.

THE DOOM OF ZEPPELIN S30

The Central Air Station at I—— M—— had for three days enjoyed comparative quiet. German aircraft seemed very inactive. Only one or two Aviatiks had endeavoured to put in an appearance—and this in broad daylight—and they had been rapidly put to flight by sundry pilots of the English and French Air Corps. The anti-aircraft guns, too, had proved very effective, for two D.F.W. biplanes had been brought to earth, one pilot and observer being killed, and another pilot and observer being taken prisoners. Beyond these incidents nothing exciting had occurred at I—— and the inactivity of the German *fliegers* was taken as a reliable sign of future enthusiasm. Nobody doubted the soundness of the German aeroplane squadrons.

Snow was falling on the fourth day, falling so thickly as to blot out the hangars on the other side of the I—— aerodrome. But the weather made little or no difference to Flight Comptroller de V—— G——. All machines were to be in readiness, bombs were to be prepared and fixed, and quick-firing guns were to be placed on the gun-carrying biplanes. Nothing was to be left undone, nothing left to chance, for G—— expected everything and anything from the unscrupulous

Teutons. He expected, but he did not fear. *Avoir peur* was unknown to him. Like the British bull-dog, he watched unceasingly. Captain C—— L—— G——, R.F.C., was stationed at I——, with a squadron of shorthorned Maurice Farman biplanes, and the French and English were to make a combined defence or attack when opportunity offered.

As an aviator, L—— G—— had persevered with his work and had received rapid promotion. He had already been engaged in actual aerial warfare three times with marked success. It was fortunate for his country that the appeals of his mother and fiancée had left him unmoved in his early resolution to become an aviator. He loved his mother, but he loved his country and duty even more. So the fears of his dear ones were of no avail, and in consequence aviation gained a brave pioneer.

The fifth day arrived, but nothing happened. The Comptroller and Captain were getting impatient. The sixth day dawned. The snow had cleared, the sun shone, but the atmosphere was intensely cold. Already five machines were in the air, two fast Blériots and three Farmans. They were just trial trips to test the engines—all 80 h.p. The sharp crack of the power-plant sounded fascinatingly attractive. Captain L—— G—— came out of his quarters, listened attentively for a second or two, and returned looking well pleased, and seemingly satisfied with the machines aloft. He was a fine man, the Captain, a thorough sportsman,



LOUIS NOEL

and beloved of his subordinates. He was popular with all, lieutenants, sub-lieutenants, and mechanics.

When the telephone bell rang in the Captain's private room it was just eight in the morning. He answered the ring himself.

“ Who's there?—Hello! ”

The speaker answered in French.

“ I'm speaking from Compiègne, monsieur. Six German aeroplanes have just passed over here, monsieur le Capitaine, and were flying in the direction of Paris. No bombs were dropped and the machines were kept at a great altitude. There is also a Zeppelin following them. That is all, monsieur.”

“ All right—we are prepared for them. We shall endeavour to drive the enemy back *via* Compiègne, so have your anti-aircrafts ready.”

The Captain rang off, hurried to the French Commander, explained matters, and within five minutes the two Blériot monoplanes and the three Farman biplanes were circling upwards to look for their German prey. Captain L— G— went up in a Sopwith tabloid scouting biplane—the fastest of the squadron. He soon outclimbed his confrères, and then made off in the direction of Compiègne, steadily climbing all the way. He had only three small bombs with him and two revolvers, and as his machine dashed through space at ninety miles an hour, he began to think out his plan of campaign.

But he did not think for long. Actions were soon

much more imperative than thoughts. In the distance he espied the gigantic form of an airship making towards him, and above it—some thousand feet or more—two Fokker monoplanes.

The ground below looked wonderfully green and peaceful, but the air suddenly became agitated with the feeling of strife. The atmosphere was rent with the engines of war.

The Captain rose still higher, but as he did so the two monoplanes appeared to rapidly advance, leaving the Zeppelin behind. Evidently he was sighted.

The great dirigible shut off her engines and hovered silently and still; the Fokker machines and the Sopwith came nearer and nearer.

But the German aeroplanes had no speed compared with the English biplane, and could not ascend so rapidly. Captain L—— G—— pushed his machine up to the uttermost, and soon gained the ascendancy; he then noticed yet another German aeroplane above him. It appeared to come from nowhere. Shots were fired from it down to the Captain and his machine, but without hitting either.

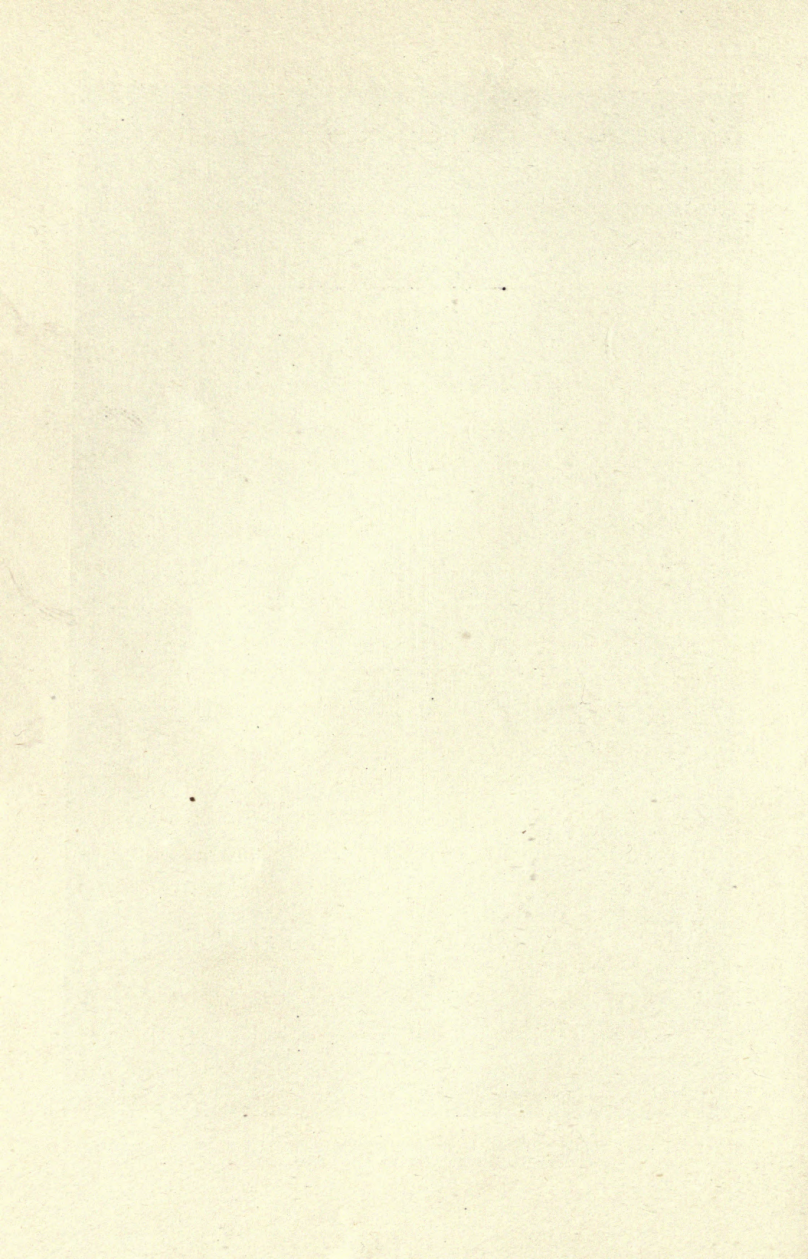
Next a bomb fell past within two feet of the end of his planes, whilst bullets continually whizzed by him.

These were exciting moments. The young airman literally flirted with death and withal enjoyed his flirtation.

In the meantime, the Zeppelin had turned and was fleeing fast, for its commander had seen the other



NOEL PEMBERTON-BILLING, M.P.



British and French aeroplanes coming up behind the Sopwith.

The brave aviator had saved his bombs and ammunition, and now decided to pursue the airship. It had gained a good start, and had turned towards Soissons, where it eventually arrived and dropped bombs. The church was set in flames, and the public hall shattered to pieces. Meanwhile the aeroplanes that had attacked L— G— were well occupied in saving themselves from destruction by the remaining British Blériots and Farmans.

The Captain pressed on and on, until at last he caught the Zeppelin up, but she was already some way over the German lines. She descended low to draw the Sopwith into the gunfire of the enemy. But the plan failed. The Captain released one bomb in an effort to hit the Zeppelin, and thereby destroy her. The bomb missed its mark, and fell somewhere outside of Crouy. A second one was released. The pilot watched it fall towards its objective, but, alas! it also missed, though only by a dozen feet. He circled again once or twice, and decided to go down to the cigar-shaped airship and risk the ground fire.

A neat spiral with the engine throttled down brought him almost level with his opponent. He descended a little further and flew close by the carriage of the aircraft. No guns were then fired from the ground for fear of hitting the German S30, but from the airship itself bullets came fast and furious.

The aeroplane pilot whipped out his revolver and fired in rapid succession at the inmates of the cabin. Two fell, but the airship kept her nose pushing forward.

Should he make a third attempt on the gas-bag?

The Captain answered himself in the affirmative, and no sooner had he made his decision than he started climbing above the Zeppelin again.

He had reached 200 feet above the top and flew in circles over it. This time he made very sure aim. Releasing his last bomb, he watched it fall. Down, down, down it dropped. Then a great flame—a crash—the huge machine exploded—curled up—and the débris fell to earth.

The bomb had done its work, and below the skeleton of the Zeppelin was a seething mass of flames. The Captain had won. He made off for the Allies' lines immediately; but the boom of the guns and the screech of shells followed him. His top plane was riddled with bullets, and his petrol was low.

Ping! A bullet struck his oil-tank, ricocheted on to the pilot. It entered his back, the machine swerved, stalled itself slightly, but the Captain subsequently regained control. He was losing blood rapidly, but he held on to the levers. His engine was misfiring badly, owing to the lack of fuel, and his altitude was decreasing. At last the engine stopped altogether. He pushed the nose down and began to look for a suitable landing place. There is a preponderance of trees in the valley of the Aisne, and landing looked difficult. But

he kept his machine gliding towards the British and French lines. He was about 100 feet over Courmelles, near the road to Paris, when suddenly he felt all his strength leaving him. He clutched hard at the lever, but retained his hold for only a second or so. Then, with sheer exhaustion, he let go and swooned back into his seat. The little biplane continued to glide some distance, and then, without any warning, turned over and crashed to earth with its human cargo.



RICHARD THOMAS GATES

INDEX TO PILOTS' PHOTOGRAPHS

NOEL PEMBERTON BILLING.—Learned to fly in one day as result of a wager. Bought machine specially to learn and won £500 on the bet. Built several machines, some of which flew, others of which did not. The Pemberton Billing scouting biplane was very fast and efficient. This pilot held squadron-commander's post in R.N.A.S., but resigned in order to put up for Parliament. Returned as Air Member for East Herts, 1916.

LOUIS BLÉRIOT.—On July 25, 1909, flew Channel and thereby won fame and fortune. Well known as manufacturer of celebrated Blériot monoplane. Was born at Cambrai July 1, 1872, and after completing education, built up successful searchlight and lamp business. The first aviator in the world to hold an official certificate issued by the Fédération Aéronautique Internationale.

SAMUEL FRANKLIN CODY.—Certified on June 7, 1910. Built many large biplanes, and previously constructed successful man-lifting kites which were used by the military authorities. Won many prizes including British Empire Michelin Cups 1 and 2 and the Royal

Aero Club silver medal. First pilot to secure "Superior" certificate. Killed on Cody biplane August 7, 1913.

RICHARD THOMAS GATES.—Started life in very small way, and by dint of hard work and pushfulness worked his steps to the top of the ladder. Fought in South African War as private and won honorary lieutenancy. Several years acted as honorary secretary to the Divorce Law Reform, and wrote pamphlets on questions affecting that issue. Director of the London Aerodrome since its inauguration, and one of its ablest workers. Killed on September 14, 1914, as result of misjudged landing after successful flight in dark.

GUSTAV HAMEL.—A Scandinavian by birth and the cleverest exponent of flying that ever lived. Learned to fly at Pau and secured French certificate on a Morane monoplane in February of 1911. First aerial postman, carrying mails from London to Windsor. Many times commanded to fly before Royalty. Made trip from Dover to Cologne in three hours, flying through rain, snow, and thunderstorms. On May 20, 1914, he was lost in the North Sea and has never since been seen. That he was a German spy was quite unfounded, and the rumour has given unnecessary pain to his relatives.

BENTFIELD CHARLES HUCKS.—Well-known exhibition pilot. Qualified for certificate on Blackburn



BENTFIELD CHARLES HUCKS

monoplane on May 30, 1911. Looped the loop on Blériot monoplane and gave exhibitions all over the country, and previously flew for the Blackburn Aeroplane Company, Leeds. Entered Royal Flying Corps and later promoted captain.

ROBERT LORAINE.—The "Aviator." Flew across the Irish Channel from England to Ireland in 1910. For this feat the Royal Aero Club awarded him silver medal. He first flew in France on Farman biplane, upon which craft he took his certificate. Wounded seriously whilst flying over German lines in November 1914, but miraculously recovered. Promoted captain, Royal Flying Corps. Is an actor of some note.

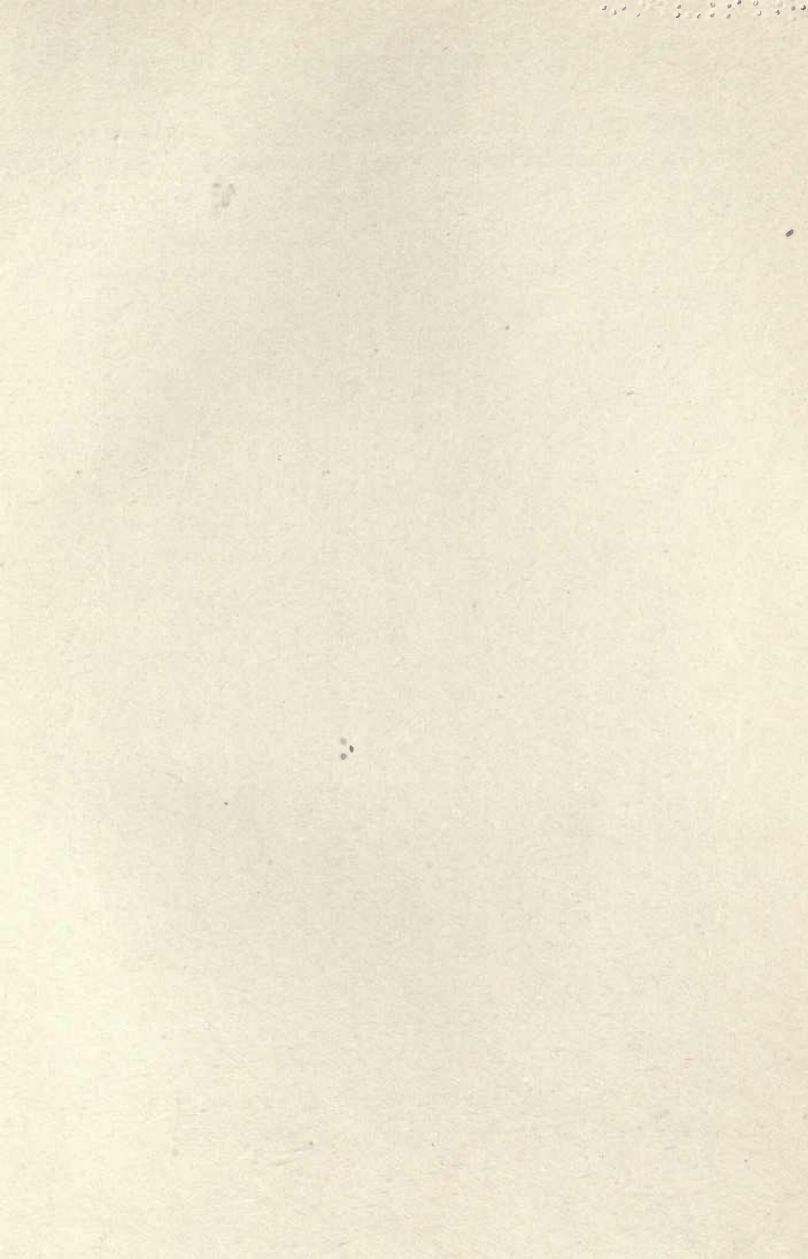
WILLIAM BARNARD RHODES MOORHOUSE.—Built monoplane in conjunction with Mr. Radley in 1909. The Radley-Moorhouse monoplane flew well for the period. Toured England and United States with his partner, and in 1911 took his certificate at Huntingdon on a Blériot monoplane. First pilot in the world to "tail slide" deliberately. Competed in Aerial Derby in 1912, finishing third. Entered R.F.C., and died from wounds received whilst flying over Courtrai. Awarded V.C.

LOUIS NOEL.—Studied first at the Polytechnique, acted as mechanic to Maurice Ducrocq at Brooklands

where he commenced learning to fly. After a few lessons from his employer he joined the Avro School. Passed "brevet" tests on Henry Farman biplane on August 17, 1911, and in 1912 joined Grahame-White at Hendon where he became chief instructor. Flew at St. Moritz and took part in the "Wake-up, England!" campaign. Now in French flying corps and possessor of the Medaille Militaire, Croix de Guerre, and the Russian Cross of St. George.

FREDERICK RAYNHAM.—Expert "Avro" pilot. Passed for certificate on 35 h.p. Green engined Avro biplane in May 1911. Became instructor at Avro School. Joined Sopwith firm and tested all its productions. Flew many other types, but is best known as an Avro pilot. Had serious accident at Brooklands after looping the loop. The tail of his machine broke and the craft fell 600 feet.

ALLIOT VERDON ROE.—England's pioneer. Built small triplane and made his first flight as early as June 1908. First man to develop the "tractor" type of machine, and now the controller of the famous Avro aeroplane works. The machines are noted throughout the world. Succeeded in getting machine to fly with only 8 h.p. Built first hydro-aeroplane to rise from and alight on water. Early career adventurous and included prospecting in the wilds, marine engineering, and inventing improvements for railways.





CHARLES RUMNEY SAMSON

CHARLES RUMNEY SAMSON.—Wing Commander R.N.A.S. Organiser of many successful air raids over enemy country. Learned to fly on short biplane and passed the necessary tests for pilot's certificate on August 25, 1911. It is said that a price was placed upon the commander's head by the enemy, but whether there is any truth in this suggestion is another matter.

REGINALD A. J. WARNEFORD.—Joined the Sportsman's Battalion in 1915, and in February of the same year transferred to the R.N.A.S. Became famous by destroying a Zeppelin single-handed by dropping bombs thereon. For this feat H.M. the King awarded him the Victoria Cross. Killed shortly after this memorable feat whilst testing a new biplane in France.

CLAUDE GRAHAME-WHITE.—Took certificate at Pau on a Blériot monoplane. First became known in an aeronautical connection on competing for London-Manchester prize. Made two plucky attempts, but beaten by Paulhan. In company with Richard T. Gates founded the London Aerodrome. For some time Flight-Commander, R.N.A.S., but resigned. Now Director of the Grahame-White Aviation Company, Limited.

CLARENCE ARTHUR CHARLES WINCHESTER.—First trained for the Church, but owing to figuring in sensational court case in 1908, abandoned this course.

Became connected with provincial journal; one of the first laymen to inaugurate special feature of aviation in newspapers; left staff of paper to experiment with gliders and to make flights with various aviators for the purpose of making collection of aerial photographs. Undertook investigations for important London paper in connection with treatment received by lunatics in asylums. Toured with Hall Caine's son, Derwent Hall Caine, in *The Prodigal Son*. Became associated with the Pashley brothers at Shoreham, where he flew Farman biplanes and the Pashley pusher biplane. Acted as secretary and pilot to School of Flying at Hendon. Well known as a contributor of articles, poems, and stories to the lay and technical Press. On outbreak of war offered services to the Government. The offer was not accepted however.

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