BULLETINS

OF THE

Aerial Experiment Association

Bulletin No. XXXIII Issued MONDAY, FEB.22, 1909

MR. McCURDY'S COPY.

BEINN BHREAGH, NEAR BADDECK, NOVA SCOTIA

BULLETIN STAFF.

ALEXANDER GRAHAM BELL.................................Editor
GARDINER H. BELL.............................Assistant Editor
CHARLES R. COX.....................................Typewriter
MABEL B. McCURDY...............................Stenographer

Bulletins of the Aerial Experiment Association.

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Beinn Bhreagh, Near Baddeck, Nova Scotia.

Bulletin No. XXXIII----------Monday------------Feb. 22, 1909.

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EDITORIAL NOTES AND COMMENTS.

Langley Medal.

Feb. 17, 1909:- At a meeting of the Board of Regents of the Smithsonian Institution held Feb. 10, 1909, the following resolution, proposed by Senator Cabot Lodge was adopted:-

> RESOLVED: "That the Langley Medal be awarded to Wilbur and Orville Wright for advancing the science of Aerodromics in its application to Aviation by their successful investigations and demonstrations of the practicability of mechanical flight by man".

It was the sense of the Board that two medals should be struck off, one for each of the Brothers, and that each medal should bear both names. A.G.B.

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Baldwin's Lecture.

Feb. 18, 1909:- Mr. and Mrs. F.W. Baldwin left Beinn Bhreagh this afternoon for New York. Mr. Baldwin proposes to spend a day or two in New York at the Automobile and Motor Boat Show, and will then proceed to St. Catherines Ont. where he will lecture Feb. 25, before some private Club or Society with which he is connected. On Feb. 27, he will deliver, at the University of Toronto, a lecture on Aviation, a copy of which appears in this Bulletin. He will return to Beinn Bhreagh from Toronto via Montreal and Quebec. A.G.B.

Mauro, Cameron, Lewis & Massie to Bell.

To A. G. Bell,
Baddeck, N.S.

Washington, D.C., Feb. 11, 1909:- Complying with the directions contained in yours of the 2d inst., Mr. Cameron has had a consultation with Mr. C. J. Bell in regard to the question as to whether there should be a joint application in the names of all the members of the Aerial Experiment Association including Lieut. Selfridge, or make two applications, one in the name of Mr. F. W. Baldwin alone, and the other a joint application. Mr. Bell coincides with the view held by Mr. Cameron, that there should be two applications. Since Mr. Baldwin alone contributed the subject-matter of claims 1 to 11, and 13 to 16 inclusive, he is unquestionably the sole inventor thereof, and as this matter is clearly and easily segregable from the subject-matter of the other claims, the patent would unquestionably be stronger as a sole patent than it would be if included in the joint application.

Mr. Cameron has carefully considered your suggestions dated January 25th, 1909.

Concavo-convex in a lateral direction. We do not think that it would be wise to insert in the claims the limitation "in the lateral direction". We think it would be better to place in the body of the specification say after the word "employed" in the last line of page 3, something like the following:-

> "In some instances, this concave- convex form may be such that the supporting surfaces will be curved toward each other in a fore and aft direction, the upper surface having its upper side and the lower surface its lower side convex in a fore and aft direction. Preferably, however, the upper surface has its upper side convex and the lower surface its lower side convex in a direction from side to side, while said surfaces are approximately parallel along the lines where they would be cut by any vertical fore and aft plane".

With such a statement in the body of the specification it would be made clear that the inventor contemplated as an expression of his inventive idea the concave-convex supporting surfaces, whether the concavity extended in a lateral or a fore and aft direction, and the expression of the claims, such for example as claim I, is broad enough to include either of these forms. We think that your suggestion and discussion of this matter will thus have enabled us to materially broaden the specification.

<u>Specification, page 15, line 3</u>. Your criticism as to the "sole" function at this point is quite correct, and the word "sole" was left in from the old specification by an oversight.

Mr. Baldwin's suggestion for a broader claim than present claim 13 is a good one, though we fear that the claim is so broad that we will have difficulty in obtaining it. Nevertheless, we will make the effort.

<u>Claim 14</u>. The suggested correction to this claim is a good one, and will be made.

Claim 20. We do not think your first criticism of this claim is well founded. It simply amounts to a statement of the fact that there may be other rudders on horizontal axes than the ones you employ. Nevertheless, your rudders do turn on approximately horizontal axes, as shown in the drawings. Possibly we might adopt Mr. McCurdy's suggestion and insert the word "approximately" before "horizontal", though beyond all question, the claims would be so construed any way.

Generally speaking, and in its normal operation, the machine as a whole is intended to be approximately horizontal. Whether the machine is moving straight forward or whether it is rising, or whether it is descending, the medial line extending from side to side of the machine would be approximately horizontal, and in fact, the aim would be to so maintain it at all times. In any event, when the machine is stand-on the ground preparatory to a flight, it is undoubtedly the intention to have the medial line of the machine extending from side to side horizontal, and in this case the axes of the balancing rudders are approximately horizontal, as shown in the drawings.

Replying to the suggestion contained in the last paragraph of page 4, we feel that if claim 20 were amended as suggested, it would be responded to by a vertical rudder, since the axis of the vertical ruuder would be vertical, and such axis would be "at right angles to the said fore and aft medial line of the structure, and substantially radial thereto".

But this is old. Certainly it is old to have one rudder mounted on such an axis, though it may be new to have one on each side of the fore and aft medial line of the structure.

Referring to the first paragraph at the top of page 5 of your suggestions, the writer certainly had not grasped the idea that,

> "The essential idea involved is that the axis should be at right angles to the medial line of the structure and substantially radial thereto". (meaning the axes of the balancing rudders).

We should regard it as exceedingly dangerous to make any such statement, either in the specification or in any part of the record of the application, because this would be responded to by a vertical rudder. To place a rudder above the machine with its axis vertical and its surface vertical would appear to be merely to place the steering rudder above the machine rather than to the rear of the machine, as heretofore.

Claim 31. This claim can be easily changed to avoid the criticism you suggest, by using the word "member" instead of "part".

Claims 34 and 36. Mr. McCurdy's criticisms of these claims are sound, and they will be changed accordingly.

Claim 42. We think that this claim should be included in Mr. Baldwin's sole application. Read this claim in connection with claim 11, and it will be seen that it is but a broad and less specific statement of the structure defined in claim 11.

As soon as we receive your instructions as to whether you wish one or two applications prepared, we can speedily forward either the single or two applications for execution, as you may direct.

(Signed) Mauro, Cameron, Lewis & Massie.

Bell to Mauro, Cameron, Lewis & Massie.

To Mauro, Cameron, Lewis & Massie,
620 F Street, N.W.,
Washington, D.C.

Feb. 17, 1909:- Please go ahead with two applications as suggested.

(Signed) Graham Bell.

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SELFRIDGE MEMORIAL TABLET.

A Letter from Mrs. Bell to Mr. Curtiss.

Beinn Bhreagh, Feb. 13, 1909:- What I have had in mind all along for the Selfridge Memorial is something like the bronze bas-relief by St. Gaudens to Capt. Ellsworth and his first regiment of colored troops. It is let into the tall iron railings that separate Boston Common from the State Capitol.

I have hestitated to mention this, fearing that the funds in Lieut. Lahm's hands would not admit of anything so ambitious.

But when one comes to think of it the memorial would be not simply to Thomas Selfridge personally, but to him as marking a very great and stupendous historical event - the advent of the American Army on an entirely new sphere of action. It marks one of the greatest, if not the greatest, epoch in our Army; and looked at in this light it is certainly as well worthy of adequate commemoration as the enrollment of the first regiment of colored troops in the Army.

(Signed) Mabel G. Bell.

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AVIATION:- By F.W. Baldwin.

(A Lecture to be delivered by Mr. Baldwin at the University of Toronto, February 27, 1909).

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It is a matter of encouragement to the Art of Aviation and the cause of Aviation in Canada, that a great Canadian University should be giving some thought to the subject of flying-machines.

Only a few years ago intelligent people scoffed at the idea of flying, and a man needed a good deal of courage to profess his faith in its ultimate accomplishment. Repeated failures had given rise to most unreasonable prejudice. Sweeping criticisms had put the problem in a class with perpetual motion. Scientific men felt that it was an unsafe field in which to risk their reputations, and a popular feeling existed that flight involved some inherent impossibility and was in general a subject to be avoided.

It is difficult to realize how quickly all this has changed, but it is easy to see why it has changed. Flight has actually been accomplished. Machines a thousand times heavier than the air in which they are supported make long and successful voyages. The practicability of flight has been splendidly demonstrated. The world is at last convinced that flying is a reality.

Wilbur Wright, the American Aviator, on the 31st of Dec. 1908, remained in the air for two hours and 18 minutes and covered an official distance of 76 1/2 miles.

During this flight which is a record one for heavier-than-air machines, he showed clearly that he had perfect control and could steer up and down or make turns with the greatest ease.

Even more striking than this, though vastly easier of accomplishment, was the cross-country flight of Henri Farman on Oct. 30, 1908. He flew from Chalons to Rheims a distance of 17 miles in 20 minutes. The next day Louis Bleriot in a heavier-than-air machine of a different type, flew from Toury to Artenay over fences and houses and back again to the starting point. His average speed for this remarkable performance was 53 1/2 miles per hour.

Does it need more than this to convince the most skeptical that the development of the flying-machine marks a new era in the progress of the world.

It must be remembered that these are only experimental machines. Their commercial value is doubtful at present, but the speed at which they start is surely significant of what the near future may bring forth.

The first locomotive startled the world by traveling about 10 miles an hour, yet the aerodrome begins its career where the locomotive is to-day.

Perhaps it is not quite fair to say begins its career. Strictly speaking the flying-machine began its career long before it was able to fly, and a brief history of its early development is necessary in order to appreciate the long and tedious struggle of the mechanical fledgling before its wings and muscles were strong enough to support it.

We may pass without comment over the well worn legends which go back to mythology. These tales are but traditions which show how from time immemorial man has longed to fly.

The first authentic record dates back to Leonardo da Vinci. About 1492 he prepared a treatise on the flight of birds which shewed that he was a careful observer and gave more than a passing thought to the subject. The earliest technical designs we have for an apparatus to serve for personal flight I found among his notes made about 1500. His plan for wings is interesting inasmuch as he did not attempt simply to attach flaps to a man's arms. He realized from his study of Anatomy that the muscles of the arm were not suited for this purpose, and proposed to use the operator's legs for the down stroke of the wings. No experiments are recorded and it is doubtful if his apparatus was ever tried.

From this time on there were many attempts to imitate the flight of birds, and investigations were made from time to time by scientific men. Still nothing of importance was done until in about the year 1665 the Royal Society of Great Britain made experiments on the resistance a plane surface met with in falling, and the time it took to drop, if at the same time given a motion of translation. Sir Robert Hooke the great experimental physicist clearly appreciated that when moving, a plane surface met with greatly increased resistance to dropping and conversely if driven forward could be made to support itself. The results of these investigations seem to have been lost and with them some designs relating to flying which Sir Christopher Wren made and promised to submit to the Royal Society.

While these experiments at once suggested to us the aeroplane principle of flight, it is doubtful if the men of this time had in mind anything but wing-flapping devices. These were more or less hopeless without the aid of mechanical power and the theory was prevalent that man was not ordained by God to fly. As broken bones invariably accompanied these heavenward aspirations, there was abundant proof that this view was correct.

But while the superstition of the time did much to retard progress, by far the greatest setback Aviation received was the invention of the balloon in 1783 by the Montgolfier Brothers. This statement may seem paradoxical but nevertheless it is true. Public Attention was diverted from the efforts of the old school who still pinned their faith on heavier-than-air flight. The struggle to compete with the birds was given up until 1842. In this year Henson created a stir by patenting a machine which was in every way remarkable. It really looked as though it would fly, and the greatest interest was taken in his experiments.

Here we have the first attempt to imitate the soaring bird instead of the flapping bird, and this in itself was a big step in the right direction.

Henson's idea was to obtain support from a large aeroplane propelled by two aerial propellers of large diameter resembling small wind-mills. The power was to be supplied by a 30 horse-power steam engine.

While clumsy and unwieldy the design was a masterful conception of the successful machine of to-day. It did not fly, not so much because his reasoning was in error, but because he did not have the instrumentalities to work with. The steam engine of that day was far too heavy for the purpose. The form and construction of his supporting surfaces may have been crude, but looking back at his plans in the light of recent successes, it is perhaps the most remarkable machine ever contemplated, and shows a wonderful anticipation of the modern aerodrome. Had this genius been the possessor of the light and efficient motor of the present day, it is altogether likely that his large machine would have flown as his models did.

Henson and his friends were so sanguine of success that a large Company was formed known as the Aerial Transit Company. Their visions of crossing the Atlantic and the Sahara etc. were unfortunately never realized, and public attention turned once more to the less promising but easier solution of the matter - the balloon. So that for the next few years what is known as the lighter-than-air school held uninterrupted sway until in 1863 a Frenchman, Nadar, published his now famous manifesto upon Aerial Automotion. It appeared in all the newspapers of Europe and reawakened interest and promoted discussion.

In the most eloquent and dramatic style Nadar expressed the opinion that the chief obstruction in the way of navigating the air was the attention which had been given to balloons, and that in order to fly it was necessary to follow the laws of nature and to adhere to nature's plan - the bird - which is heavier than air.

His arguments were weakened by some too sweeping deductions, but nevertheless his dramatic appeal to men of science stimulated what may fairly be called the renaissance of the heavier-than-air school.

Three years later Francis Herbert Wenham read a very able paper on the subject of man-flight before the first meeting of the Aeronautical Society of Great Britain. After studying the flight of a flock of birds he came to the conclusion that the lifting effect of a large sustaining surface could be most economically obtained by arranging a number of small surfaces above each other in tiers. In 1866 he built a most ingenious glider upon this principle, and while his machine did not glide satisfactorily his happy idea of superposing surfaces was later taken advantage of, and he will always be remembered as a man who lived a long way ahead of his time.

Hopeless as seemed the struggle of these early pioneers their efforts effectually paved the way for the two great men who were simultaneously to demonstrate the feasibility of flight.

Otto Lilienthal, A German Engineer of great originality, and Sir Hiram Maxim attacked the problem in 1892 from entirely different sides. Both achieved success, which inspired other to take up the work, and the world was given two distinct lines of reasoning (each amply verified by experiment) which showed that heavier than air flight was within mans reach at that time.

Otto Lilienthal was born May 24, 1849 at Anklam, Pomerania. From his boyhood he was much interested in man-flight, and when only 13 years old began practical experiments with his brother Gustavus. Their first wings consisted of light flaps fastened to the arms. Being naturally enough afraid of the ridicule of their school fellows they made their experiments by night. Unsuccessful was were all their efforts to get started by running down hill, the ambition to fly never left Otto Lilienthal, and later when at College he took up the work again making careful measurements of the supporting power and resistance of birds' wings. In 1891 he built an apparatus later to be known as a glider.

It consisted of a large sustaining surface of about 150 sq. ft. arched in form like a huge wing. With this he made thousands of gliding descents, and became very expert in balancing his machine in the air.

He believed that the art of balancing in the wind must first be learned in this practical way, and showed first, that properly curved surfaces were much more efficient than flat ones, and second, that success was more likely to be obtained by first developing an efficient glider, and then applying power to it, than by attempting to build a complete power-driven machine as Maxim did.

Lilienthal met his death while experimenting with his glider in August 1896. Some claim that a guy wire which supported his wings gave way. Others that a gust of wind upset him, but however it happened this deplorable accident removed the man who did most to demonstrate that human flight was possible, who was the first in modern times to imitate the soaring birds with full-sized apparatus, and who was so well equipped in every way that he undoubtedly would have achieved final success had he lived.

Lilienthal's success was largely due to his novel attitude toward the problem and his exceptional ability to look upon the flight of birds from a true engineering standpoint.

The only research of this time in Aviation which stands comparison with Lilienthal's is that of Sir Hiram Maxim. He became interested in Aerial Locomotion as a mechanical problem and concluded that a balloon by its very nature was light and fragile - a mere bubble. He argued that even if it were possible to construct a motor to develop a hundred horse-power for every pound weight, it would still be impossible to navigate a balloon against a wind of more than a certain strength. The mere energy of the motor would crush the gas-bag against the pressure of the wind, deform it and so render it unmanageable.

Sir Hiram Maxim however, was not simply a destructive critic, and in condemning the balloon he was ready with a substitute. Like Nadar he believed that inasmuch as all things that fly are heavier than the air the problem must be solved by a machine which has a natural tendency to fall, and is only supported by the dynamic resistance of the air.

The principle upon which all heavier-than-air machines depend is that of a kite.

A kite as every schoolboy knows is supported by the wind while being held against it by a string. If there is no wind it can still be kept aloft by running with it because in this way an artificial wind is created.

Now the motor-driven machine is like the kite that is kept up by running, the running boy with his string being replaced by the motor and propellers which by driving it rapidly forward make the artificial supporting wind.

After carefully studying the power necessary to drive a large aeroplane through the air and the lift which would result from it, Maxim constructed what was practically a large power-driven kite. The steam engine which drove the propellers was one of the most interesting features of the whole apparatus, and as a marvel of lightness and power is still unsurpassed. The two screw propellers were 17 ft. 10 inches in diameter and under the full 300 horse-power of the engine exerted a steady push of over 2000 lbs.

The completed machine weighed about 8000 lbs. and had a supporting surface of approximately 4000 sq. ft. It was mounted on wheels which ran on two rails and had another set of rails arranged above to restrain the machine if it should lift from the track. The first trial of the machine was made some time in 1892. When released the flying-machine darted forward quickly acquiring the speed of an express train. At a speed of 36 miles an hour the wheels left the track; and, for the first time in the history of the world a heavier-than-air machine actually left the ground fully equipped with its own motive power and a crew of men.

The first great obstacle was thus overcome. Our fledgling had fluttered successfully. It was possible to make a machine light and efficient enough to support itself.

Control of it however was a very different matter, and Maxim's arrangement was not promising in this respect. It was woefully deficient in stability, and Sir Hiram did not attempt a free flight with his apparatus.

The wisdom of Lilienthal's plan now became still more obvious. It was one thing to build a machine with the requisite power to launch itself into the air, but quite another problem to keep it there. Safety is the all important necessity. A machine must be stable enough to give men an opportunity to become skilled in its management in the air. Practice alone can do this. It would take a man a long time to learn to row for example in a boat which upset at the first stroke of the oars. Since Maxim's experiment in 1892 the struggle has been for control and stability and the importance of Lilienthal's practical method of experiment was more than ever appreciated. Lieut. Pilcher, a talented young naval officer, realised this and took up Lilienthal's work in England. Also Mr. Octave Chanute the well known civil engineer began gliding experiments in America.

Pilcher met the same fate as Lilienthal before he arrived at the stage of installing a motor, but Dr. Chanute was successful in obtaining most useful information without an accident of any kind. He established a camp near Chicago on the shore of Lake Michigan where slopes suitable for gliding could be found. He and his assistants first built a glider similar to Lilienthal's but soon discarded it in favor of a much more stable and efficient truss form which has since become generally known as the Chanute type. The name of Lawrence Hargrave of Australia might also be associated with the development of the Chanute type as the basis of the double-decked Chanute Glider is really a Hargrave Box Kite.

Dr. Chanute gave to the world practical working data from which it was possible to build a successful power-driven machine. Still more than this by his kindly interest and generous advise he encouraged and directed the efforts of a younger generation some of whom were later to fulfil his most cherished hopes, the notable of these being the Wrights.

While Dr. Chanute was making his field experiments another man in America was laying the foundation of a new science. Prof. Langley, late Secretary of the Smithsonian Institution undertook to build a machine for the U.S. War Department. Previous to this he had made exhaustive laboratory experiments which established heavier-than-air flight as an exact science. To this he gave the name of Aerodromics from the Greek verb - aerodromeo - meaning to traverse air - to run in the air.

The most startling fact which he communicated to the world is now famous as "Langely's Law". In his book entitled "Experiments in Aerodynamics" published 1891 he says:-

> "These new experiments and theory also when reviewed in their light show that if, in such aerial motion, there be given a plane of fixed size and weight inclined at such an angle and moved forward at such a speed, that it shall be sustained in horizontal flight. Then the more rapid the motion is, the less will be the power required to support and advance it.
>
> This statement may seem so paradoxical that you may well wonder if you have rightfully understood it. To make the meaning quite clear let me repeat it in another form and say that these experiments show that a definite amount of power so expended at any constant rate will attain more economical results at high speeds than at low i.e., one horsepower thus employed will transport a larger weight at 20 miles an hour than at 10, a still larger at 40 miles than at 20, and so on with an increasing economy of power with each higher speed up to some remote limit not yet attained by experiment but probably represented by higher speeds than as yet have been reached in any other mode of transport".

In 1896 Prof. Langley obtained excellent results from a large model driven by an extremely light gasoline motor and proceeded to reproduce it on a scale large enough to carry a man. The mechanical difficulties involved in this apparently simple plan cannot be appreciated by one who has not attempted to do it.

However, the combination of Mr. Langley's perseverance and the engineering skill of Mr. Charles Manley, his able assistant, was not to be denied and in 1903 the full-sized machine was ready for trial. The quarter sized models had been successfully launched by a catapult apparatus which gave them the necessary initial velocity by literally throwing them into the air.

The plan was obviously a difficult one to adopt on the full-sized machine which weighed over 800 lbs., but Prof. Langley would not depart from his former plan and her it was that Prof. Langley's practical sense failed.

On both occasions on which a launching was attempted the aerodrome caught on the launching ways and was precipitated into the water. While uninjured by the plunge the machine was partially wrecked by the over zealous efforts of a tug-boat's crew to rescue it and although repaired was never again given another trial.

To the public Langley's aerodrome, nicknamed the "buzzard" was an absolute failure, but the truth of the matter is that it was never tried. The launching apparatus, it is true, did fail but not the aerodrome as this was never launched.

The difficulty Langley met with in increasing the dimensions of his successful model without sacrificing either lightness or strength revived an old argument against heavier-than-air flight.

As early as 1872 Helmholtz showed that, while a small model of a heavier-than-air machine might easily be made it was much more difficult to build a large one.

This view was generally accepted by scientific men but in 1891 Prof. Simon Newcomb in an article entitled "Is the Airship Coming" went so far as to say that, "The construction of an aerial vehicle which could carry even a single man requires the discovery of some new metal or some new force".

He pointed out that as the scale of the dimensions was increased the volume and hence the weight increased more rapidly than did the sustaining surfaces. To illustrate this important point consider a specific example.

Suppose a machine weighs one lb. and has a sustaining surface of one sq. ft. Now consider what happens when the dimensions are doubled. The length of the surface and the breadth of the surface both being doubled will give an area not twice but four times as great which would be four sq. ft. The weight however, depends upon all three dimensions, length, breadth, and thickness. If all these be doubled, as they are to increase the scale, the resultant weight will be eight times that of the half-sized model or 8 lbs. Thus the machine on the large scale, while it will have four times the surface of the smaller one, will weigh eight times as much.

The line of reasoning holds for similar designs in which the dimensions only are increased but it has been cleverly avoided by a system known as unit construction.

Dr. Alexander Graham Bell brought out this important principle and developed a unit system which is now well known as tetrahedral construction.

In this unique construction the law of the squares and cubes does not apply as an increase in weight simply increases the number of unit surfaces employed so that the weight must necessarily increase in the same proportion as does the surface. This principle is most important. Interpreted another way it means that an indefinitely large machine will fly equally as well as a small one provided the loads are properly distributed. Each unit cell in this system offers a certain resistance and carries a proportional load; so that if it is possible to make say 1000 of these units carry up a man and an engine it is possible to make 100,000 of them combined in one carry up a hundred men and a hundred engines always provided the men and the engines are not concentrated. Instead of attempting to increase the size of an artificial bird Dr. Bell proposes to combine a flock of artificial birds.

Recent progress in Aviation has been so rapid, and so many have been partially or wholly successful that it is impossible to do more than refer to some of the most notable achievements.

Orville and Wilbur Wright began gliding experiments in 1902 along the general lines laid down by Dr. Chanute. However they quickly developed original features and in their more mechanical principle of control made a great improvement.

Lilienthal, in his gliding experiments, had maintained equilibrium bu shifting the weight of his body. In an unsteady wind this method required a considerable amount of gymnastic skill.

The Wright Brothers adopted the principle suggested by Dr. Chanute of keeping the center of gravity fixed and maintaining equilibrium by changing the angle which their surfaces presented to the wind. The advantage of this system was immediately apparent. By it control was rendered much more certain and the manipulation more rapid.

The Wright Brothers worked persistently on their gliding experiments for three years and in 1905 felt themselves in a position to use power. How well they succeeded everybody knows. When their achievements were first made public many people discredited them because they chose to keep their hard earned secrets to themselves.

In March 1906 the Aero Club of America officially announced that the Wright Brothers had positively done what no other human being had ever before accomplished. On Sept. 26, 1905, they had flown a distance of 11 1/8 miles and on Oct. 5, 1905 they made a magnificent flight of 24 miles and came down only because of lack of fuel.

The Wright's motor-driven machine in 1905 we now know was made on exactly the same lines as their gliders. It weighed about 925 lbs. including the operator and was so strongly built that it was able to make landing at high speed without being strained or broken. Their object was to develop a machine of practical utility rather than a useless and extravagent toy.

While the Wright Brothers were practical enough to build their own machine, including the motor, they were scientific enough to make Laboratory experiments and to this rare ability to combine theory and practice they undoubtedly owe their success.

They realized from the first the intricate nature of the problem. In discussing their own work they aptly remarked that the best dividends on the labor invested invariably came from seeking more knowledge rather than more power.

While the results obtained by the Wright Brothers were more or less doubted in Europe, France began to take a great interest in the subject. Public spirited men offered prizes for heavier-than-air competition and the French Government encouraged inventors in a practical way.

Santos Dumont, already famous for his dirigible balloon was the first to respond.

He succeeded in making the first official free flight in a double-decked machine of rather clumsy design on the 21st of October 1906. The greatest enthusiasm was aroused by his success and more than fifty machines were built as a direct result of Santos Dumont's achievements. France immediately jumped into the lead and is still far ahead. While it is true that the United States have produced the greatest aviators, France builds ten machines to any other country's one.

In Oct. 1907 Dr. Alexander Graham Bell organized an Association to be known as the Aerial Experiment Association. The Association consisted of five members and had as its object the building and improvement of heavier-than-air machines.

Experiments were first made with a large tetrahedral kite at Dr. Bell's Summer Home in Nova Scotia. The late

Lieut. Selfridge went up in this man-lifting kite and it was hoped to get data as to the lift and what is technically called drift or resistance with a view to installing a motor and propellers to convert the kite into a free flying machine. The flight was entirely satisfactory but unfortunately the kite was wrecked by being pulled through the water after it had come down.

The Association then moved its headquarters to the engine works of Mr. G.H. Curtiss who was Executive head of the Association. Gliding experiments were commenced. For these gliding experiments the Association adopted the Chanute type, and obtained some useful information from it before building their first motor-driven machine. Selfridge's "Red Wing", as this machine was called (because the surfaces were wing-like and covered with red silk) was a distinct departure from the flat Chanute type.

The main supporting surfaces were bowed toward each other at the extremities and tapered from fore to aft like a bird's wing.

The machine was fitted with runners and tried on the ice of Lake Keuka. Although it was hardly expected that it would fly on first trial the machine left the ice after traveling about 200 ft. and made a very promising flight of 319 ft. The machine came down owing to the failure of a single surface tail but did it so gently that it was impossible to tell just when the runner struck the ice. This was the first public flight of a heavier-than-air machine in America and was a matter of great encouragement to the Aerial

Experiment Association. Upon a second trial, in attempting to fly her in windy weather the "Red Wing" was badly wrecked and the "White Wing" succeeded it.

The "White Wing" was an improvement on the "Red Wing" in having balancing rudders but she also was rather badly smashed and the Curtiss "June Bug" as the third machine was called, was really the first aerodrome built by the Association which made satisfactory flights.

Altogether this machine has made over a hundred flights varying in length from long jumps to sustained flights of 2 1/2 miles. On July 4th, 1908 she won the Scientific American Trophy for the first heavier-than-air machine to fly a kilometer (under test conditions).

Although the "June Bug" was still in commission the Association built a new machine, McCurdy's "Silver-Dart" which is equipped with a powerful water-cooled motor. The "Silver-Dart" made a flight of over a mile in Hammondsport, N.Y., and is now being used over the ice at Baddeck, Nova Scotia.

While it is absolutely impossible to get anything like an adequate idea of a flying-machine without seeing it, perhaps a few illustrations may give some impression of what an aerodrome looks like under way.

(Lantern Slides).

Few people realize what an important part sport is likely to play in the development of the practical flying-machine. Motor-car racing is directly responsible for the development of the light engine which makes flight possible, yet the men who raced motor-cars had no idea of developing the flying-machine. They raced for the pure joy of racing. These same men are already taking up the aerodrome, and the most useful lessons will undoubtedly be learned from the extreme racing machines in which comfort, and stability, if need be, are sacrificed to speed.

What form the passenger aerodrome of the future will take, and what it will be used for, no man can possibly foretell, but in view of the present possibilities how long are regions, heretofore inaccessible likely to remain unexplored? Such places as Thibet and the heat of Africa, for example, have so far resisted civilisation, not because white men couldn't live there but because they couldn't get there.

In the history of the world roads have hitherto gone, hand in hand with civilisation, and it is important for us to realize that the great universal highway above us is now open.

But while the flying-machine may cut down distances, and be of great value as a means of communication there is another significance which, though not nearly so broad as the spread of civilisation, comes home to us more forcibly. The big European Powers are spending vast sums of money annually upon aeronautics not as a missionary enterprise, nor in the interest of a sport.

France and Germany in particular, are alive to the fact that flying-machines may revolutionize the art of war. The struggle for the supremacy of the air has commenced in earnest. In this struggle the British Empire has a great deal at stake. England's insular security is threatened. The sea is no longer a barrier. Even in the present state of the Art a dirigible balloon like Count von Zeppelin's is a greater menace to London than two German Navies.

An impression seems to exist that a general agreement was made at the Hague Conference that explosives should not be dropped from dirigible balloons and flying-machines. As a matter of fact this proposal was made, but only one first class power agreed to it.

Military authorities agree that flying-machines or dirigible balloons could operate in almost perfect safety at the comparatively low altitude of a mile above the ground and from this height could drop explosives with great accuracy.

If this be the case, London could be destroyed and the combined navies of the world could not prevent it. A military training is hardly necessary to see that our bulwarks must be extended upwards, and our aerial fleet maintained at least upon a two power basis. A great sea-faring people should never be content to see other nations control the sea above us.

However apart from this use in warfare, flying-machines will be of inestimable value for scouting. Major Squier of the U.S. Signal Corps has drawn attention to this fact and pointed out two striking examples which illustrate how flying-machines will be used as the eyes of the Army.

If the United States Army or Navy had possessed a dirigible balloon or a flying-machine during the Spanish-American War the whereabouts of Cevera's fleet would quickly have been discovred.

The other example is still more striking:- The Japanese attack on 203 Meter Hill was one of the bloodiest contests the world has ever seen, yet the sole object of this great slaughter was to place two or three men at its summit to direct the fire of the Japanese siege guns upon the Russian fleet in the harbor of Port Arthur.

The usefulness of flying-machines in war ensures the continuous development of the Art of Aviation. The great military powers are afraid of the flying-machine, and the struggle to improve it must therefore go on. Self-protection demands more practical, more air-worthy and more efficient machines.

Flight has been accomplished. The flying-machine is actually here and no great Nation can afford to neglect it.

F.W.B.

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THE OUTLOOK ON AVIATION: By The Asst. Editor.

Foreign Aviation.

We have received the Bulletin of the Italian Aeronautical Society November 12, 1908. It contains, under the head of Aviation, descriptions of the following aerodromes:- Wright, Farman's triplane, Bleriot VIII, Bourdariet, Le Jeune, Zipfel, Kress and Demanest. Also are given descriptions and illustrations of the following light motors for aeronautical purposes. Gnome, Redbridge, Garbon-brille and Farcot.

It also contains a description of a new form of cannon which will send projectiles directly overhead. They use an ingenious plan of telling where a shot has been placed. The projectile emits a smoke which floats in the air in the path of the projectile. The cannon used is much like an ordinary cannon except that it has greater clearance from the ground and its wheels fold in toward each other and lock in this position.

The Grade Triplane:- Baron Pierre de Caters entered for the prize of 1 kilometer given by the Aero Club of Belgium, made at Brecht on the 20th of December, in his biplane constructed by the Voisin Brothers. Several flights in one of which he attained 111 m.

The Jorch Aeroplane:-An aeroplane, constructed by M. Hans Jorch, had flown 19 m at Mayence during the first part of January 1909.

<u>Spanish Aviation</u>:- The King of Spain has asked Capt. Kindelan to go to France and America in order to assist in experiments in Aviation. On this official mission Capt. Kindelan will be accompanied by one of his comrades.

An Aviation Society is being formed at Barcelone.

<u>The Aerial Touring Club of France</u>:- This Club which has been recently formed by the Touring Club of France, has just voted a grant of 100 francs in favor of the subscription opened by the Aeronautical Club, having as an object the offering of a prize to the aviator who will be the first to accomplish a distance of 100 kilometers from one town to another.

<u>The R.E.P. Aeroplane and the R.E.P. Motors</u>:- Among the most admirable stands at the Aeronautical Salon and the first thing which ought to be mentioned is the magnificent installation of the R.E.P. establishment.

Mr. Robert Esnault-Pelterie is without doubt the only French Aviator who has himself invented, calculated and constructed, by his own personal means and in the smallest details, machines which have taken the air the first time. Before inventing his definite models he had experimented with diverse types of biplanes and monoplanes. His debut, as aviator, dates back to 1903. Esnault-Pelterie is then, among his contemporary aviators, in age, the youngest, in profession, one of the eldest of aviators. After comparative trials the young aviator finally setteled on the monoplane type which he considered as superior, and capable of speed combined with suppleness and great stability.

<u>General Characteristics</u>:- The R.E.P. 2-bis embodies the characteristics of his former machines.

Its characteristics are:- Monoplane with a pair of supple wings which may be warped at the will of the operator. The rear supporting surface of the machine is made to act as a control. The starting device consists of two wheels in tandem under the body and a light wheel at the extremity of each wing.

The machine is 9 m 60 in breadth and 8 m in length. Its supporting surfaces: 420 kil. by 15 sq. m 175, that is, 26 kil. 600 in sq m.

<u>The Body</u>:- It is spindle-like, made of frames and tubes of steel of triangular construction, indeformable in every way (probably tetrahedral).

<u>The Wings</u>:- The greatest and most sought for quality of an aeroplane and one which sums it up more than anything else is the relation of its weight as compared to its dimensions. The R.E.P. 2-bis employs a most perfect surface.

The wings of the monoplane R.E.P. 2-bis are 9 m 60 in breadth. Their surface is 15 sq. m 75. The weight of the machine in flight being 420 kil. They are capable of lifting per sq. m 26 kil. 600 at a speed of 60 kilometers per hour. The wings are made up of united wood fibres breadthwise which join the two beams, one running along the cutting edge of each wing. These beams must be remarkably supple as also must be the whole construction of the wings in order to allow of warping.

Each wing is attached to the lower part of the running gear by means of stays. These stays also control the warping of the wings.

The Controls and the Tail:- The horizontal control is in the rear. It is of single surface and constitutes the tail of the machine. The vertical control is placed under the rear extremity of the frame. In shape and in relative position to the machine it is very like the rudder of a boat.

The operator is seated in the cock-pit. His body is well protected from the wind of advance as he is housed in on all sides.

The R.E.P. 2-bis Motor and the R.E.P. Propeller:- The motor of the monoplane R.E.P. 2-bis is of 30-35 H.P. and contains 7 cylinders. The weight of the R.E.P. motors, equipment complete but carrying no water, is remarkably light. The 20-25 H.P. weighs 53 kil. 500. The 30-35 H.P. weighs 68 kil. The 40-45 H.P. weighs 97 kil. Weight of the radiator 9-10 kil.

The propeller of the R.E.P. 2-bis monoplane is of metal containing four blades 2 meters in diameter.

The oil-tank contains 6 liters and the gasoline tank 40 liters which makes possible the continuous running of the engine for two hours.

The year 1909 seems to have opened with quite a number of aeroplane accidents in France.

The Antoinette monoplane, operated by Welferinger, after having made many successful flights at Issy, met with an accident early in February in which the right wing was badly damaged. A few days following this the Vendome monoplane, which was exhibited at the Salon at Paris, was wrecked at Bagatelle. We have a report from Issy that the Obre monoplane was completely wrecked after an unrecorded flight of no consequence.

Bleriot, on the other hand, seems to have been more fortunate. Though he has been making many flights with two machines he has had no serious accident of late.

On the 18th, 19th and 20th of January he made a number of successful flights with his monplane No.9. The dimensions of this machine are as follows:- 12 meters long, 10 meters wide with a surface of 25 sq. m. The motor is 50 H.P. with 16 cylinders and a radiator which neatly conforms to the body of the machine.

Bleriot also has a smaller monoplane No.11. This machine, though its weight is not materially less than the No. 9, has materially less surface. Thus it may be seen that it requires a greater speed in order to support itself. The dimensions are as follows:- 7 meters long, 7 meters broad with 15 meters of supporting surface. Its weight with operator on board is 250 kilos. It is driven by an Esnault-Pelterie 25 H.P. motor. Perhaps the most interesting characteristic of this machine is the warping of the front and the rear control for lateral stability.

Bleriot stated not long ago that his smaller machine, No. 9 is vastly more difficult to control than his larger machine.

It is stated in La Revue d'Aviation that MM Paul Tissandier, Alfred Leblanc, Delagrange, Garnier and Papeyre, and a number of Italian and Spanish Officers will be instructed by Wilbur Wright in the control of his machine. It also states that in case Orville Wright is recovered by April, Wilbur Wright will come to Fort Meyer to fill the conditions of the American contract and Orville Wright will continue his brother's work in France.

La Revue states that the new Society which has been formed for the sale of machines has already succeeded in selling fifteen Wright machines.

The activity in France in the way of Aviation is something to be envied. There are the Wrights with their biplane and the Voisin Brothers with their three types, the biplane and the triplane and the Goupy type, Boletoff, Farman, Moore-Brabazon, de Caters, Henry Fourneir, Goupy, the Vivinus and Zipfel, all experienced aviators, are daily making trials and are endeavoring to give the world a perfect aeroplane.

There is a report that Farman may install in his new machine an American engine, water-cooled 70 H.P.

Moore-Brabazon is at present stationed at Mourmelon where he has taken up again the trials of his biplane in company with Bagriel Voisin. The French seem to place great faith in Brabazon and La Revue predicts for him a great future.

The Goupy triplane has undergone a few changes. As it stands it contains 45 square meters of supporting surface.

Zipfel has gone to Germany where he will make experiments at the Tempelhof camp of manoeuvres near Berlin.

G.M.B.

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