BULLETINS

OF THE

Aerial Experiment Association

Bulletin No~~XXII~~ Issued ~~MONDAY, DEC. 7,~~ 1908

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.

BULLETIN NO. XXII ISSUED MONDAY DEC. 7, 1908

Beinn Bhreagh, Near Baddeck, Nova Scotia.

TABLE OF CONTENTS.

TABLE OF CONTENTS (CONTINUED).

ILLUSTRATIONS.

ILLUSTRATIONS CONTINUED.

-----------oOo-----------

EDITORIAL NOTES AND COMMENTS.

Baldwin's Experiments.

Nov. 20, 1908:- A conference was held in the headquarters building this afternoon to consider the general results obtained with hydro-surfaces on the Dhonnas Beag.

The best results so far as efficiency is concerned were obtained in experiments made October 28, 1908, in towing experiments, when the lift was 12.9 times the pull (see Bulletin XVIII p.29). The later arrangements of hydro-surfaces have not proved to be so good. It was therefore determined to use again the arrangement of hydro-surfaces used on Oct. 28 and multiply observations. Should the average result again yield an efficiency exceeding 10 we will accept this arrangement of hydroplanes as satisfactory and develop other points. It is not our object at the present time to get the best possible form and arrangement of hydro-surfaces. We might spend our whole lives upon this point and our descendants would still improve upon our results. Let us be satisfied with an arrangement that works and then leave alone the question of the character of the hydro-surfaces to be employed and consider other points. The most important being a satisfactory arrangement to secure stability when the boat rises from the water.

The stability seemed to be good when three sets of the reefing hydro-surfaces shown in Bulletin No.XX p.37 were used, but I find no record of the experiments which were

probably made between Nov. 10 and 13. The stability was good and the lift poor, whereas in experiments made Oct. 28 the stability was poor and the lift good.

Let us then try the hydro-surfaces used Oct. 28 with the arrangement of reefing surfaces which gave good stability Of course the question of stability will be more easily met when the center of gravity is brought lower down by placing the engine and man inside the boat instead of above it.

In the meantime it is obvious that the general principle involved is to secure in the water an extended base of support. This suggests three sets of hydro-surfaces well separated from one another forming the corners of a triangular base of support. A.G.B.

November 27, 1908:- The experiments made Nov. 23 have demonstrated the superior efficiency of the hydro-surfaces employed Oct. 28 (Bulletin XVIII, p.30) and in order to improve the stability it was proposed to use three sets of such surfaces instead of two, the two rear sets to be placed one on each side of the boat. Practical difficulties, however, present themselves in making this arrangement and before doing so it has been decided to test what element in the combination shown Bulletin XVIII, p.30, produces the great efficiency.

There are three points involved.(1) The surfaces do not present a straight edge at right angles to the line of advance, but are bent backwards so as to form a blunt V, presenting cutting edges. (2) The supports are not vertical but are sloped backwards. (3) The surfaces are not flat but curved

from fore to aft.

Mr. Baldwin thinks that the most convenient shape for the proposed arrangement of three sets would be to have the surfaces present a straight edge at right angles to the line of advance and to have the supports vertical. A set of hydro-surfaces has now been made of this character in which the surfaces are curved from fore to aft. Another similar set has been made with flat surfaces. A comparison of the results of these two will show whether there is any advantage in using curved surfaces over flat.

If the curved surfaces do not give us the efficiency of the surfaces shown in Bulletin XVIII, p.30, then we must conclude that the good efficiency of the latter was due either to the cutting edges, or to the sloped back supports; and another set of straight edged curved surfaces will have to be made with sloped back supports to bring out the point. We wish to test the relative efficiencies of combinations differing in only one element. A.G.B.

November 28, 1908:- Experiments made this morning with the surfaces presenting a straight edge at right angles to the line of advance and with the supports vertical. The efficiency turns out to be quite as great as with hydro-surfaces employed Oct. 28 (Bulletin XVIII, p.30). Indeed in the first experiment it was greater, 14.55. In experiment 3, 12.88; experiment 4, 11.17.

The following points seem to have been demonstrated. The good results of the old curved cutting-edged hydro-surfaces seem not to have been due to the wedge shaped form of

construction, for the straight edged form used to-day did as well or better. Nor were they due to the raking back of the supports, for the supports were vertical to-day and gave at least as good results.

The single point remaining now to be demonstrated is whether the curvature of the blades used Oct. 28, Bulletin XVIII, p.30, was the cause of their superior efficiency. The arrangement used to-day had curved blades and we have a duplicate set with flat blades. The next experiments will show whether a hydro-curve is or is not superior to a hydroplane.

A.G.B.

December 1, 1908:- The experiments with flat blades made this morning gave an efficiency of only 5.6, whereas the efficiency of the hydro-curves used Nov. 28 were 14.58, 12.86, and 11.17. The evidence indicates that the hydro-curves are more efficient than the hydroplanes.

In order to be perfectly sure of the result another experiment with the hydro-curves was made this afternoon. Efficiencies 10.51, 13.22.

It has therefore been satisfactorily demonstrated that the great efficiency of the hydro-surfaces used Oct. 28, Bulletin XVIII, p.30, was due to the curvature of the blades and not to the sloping back of the supports or to the cutting edges.

It has also been demonstrated that three sets of hydro-surfaces so arranged as to form a triangular base of support are quite satisfactory so far as stability goes. It is noteworthy that in the last experiments made the two sets well

separated laterally were in front instead of behind.

HAMMONDSPORT EXPERIMENTS.

December 3, 1908:- Mr. Curtiss seems to be still bravely struggling with the difficulties of the new engine. He has been meeting with encouraging successes and exasperating delays, but it is obvious that as a result we are going to have finally an engine that will be worth something to the art of Aviation. An engine that will not break down in five or ten minutes and leave the aviator stranded ---- where!!!

He is apparently finding out the weak points of every part of the apparatus in turn; and at last when every difficulty seems to have been conquered and the engine is installed upon the Loon the c-c-c---------- cylinder blows its head off into the air.

We can all understand and sympathise with these mishaps. The only criticism I have to offer is that our Hammondsport members seem inclined to report only their successes and look upon accidents as failures instead of experiences to be profited by. What we want to know from Hammondsport is the answer to the question "What are you doing". We want to know what you are doing. We want to know your experiences in full. Silence does not give us any information. A report of a success does not give us the opportunity of helping. Everything should be reported as it occurs with the double object of recording what happens and giving the distant members a chance to co-operate in the development of what is going on and the correction of defects.

The delay in completing the new engine affects us all for it is needed at Beinn Bhreagh as much as at Hammondsport. We all have confidence in Curtiss, however, and feel sure that out of his troubles will come triumph and a better and more reliable engine than we have ever had before. Go ahead Curtiss and don't get too blue. Your letter of Nov. 24 sounds like a wail. Baldwin has had his ups and downs too, but he is on top to-day - so will you be too. Go ahead and good luck to you. A.G.B.

HAMMONDSPORT WORK:

Telegrams from Members.

Curtiss to Bell.

Hammondsport, N.Y., Nov. 22, 1908:- Experiments delayed by cylinder breaking and other insignificant though exasperating troubles. Am writing.

(Signed) G.H. Curtiss.

McCurdy to Bell.

Hammondsport, N.Y., Nov. 28, 1908:- Loon made two miles with and against five mile wind in four minutes twenty-six seconds. Lift very marked, but not sufficient to take the air. Engine and transmission fine. Will install in Silver-Dart to-morrow and have first trial.

(Signed) J.A.D. McCurdy.

McCurdy to Bell.

Hammondsport, N.Y. Nov. 29, 1908:- Tried Loon this afternoon. Made speed calculated at 20 miles an hour. Boats lifted considerably but propeller shaft sheared before Loon took to the air. An early trial to-morrow will decide the question.

(Signed) J.A.D. McCurdy.

LETTERS FROM MEMBERS.

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

Hammondsport, N.Y., Nov. 17, 1908:- I enclose a clipping which strikes me as very humorous; it is certainly not very flattering to Mr. Baldwin or any of us, and the part about making flights between five o'clock and sun down on summer evenings is not so much of a joke after all. Just now we miss those calms very much. We have been ready several times but haven't had anywhere near a calm in the last ten days.

Both machines are all ready and we are waiting for an opportunity to show what we can do. We have some new methods for attaching the propellers. With our more powerful engine and bigger propellers the old methods proved inadequate. We have also made a solid aluminum propeller cast of a soft alloy, and while it is somewhat heavier than wood, it will take the place of a balance wheel. We shall try it out on the 30 H.P. eight cylinder we are just finishing.

Capt. Baldwin is now with us having finished exhibition work for the season. He expects to build an airship for the Glidden Syndicate before Spring.

(Signed) G.H. Curtiss.

Curtiss to Dr. and Mrs. Bell.

To Dr. and Mrs. Bell,
Baddeck, N.S.

Raymondsport, N.Y., Nov. 24, 1908:-I got somewhat discouraged Sunday and wired you about our troubles. I have not written before as we had nothing good to report. Most people don't like excuses.

On November 19 we had the "Loon" in the water and ready to start, as shown by enclosed print. The part extending through the surface above is the radiator. Everything was fine until just about to give the word "go" when a cylinder blew off. It was a flaw in the casting. I was in a boat with the big camera to get a good picture of her under way. I snapped this just after the accident happened. The cylinder may be seen out of place. The other picture shows the disheartened crowd pushing the "Loon" back to the shed. It is mounted on a two wheel cart made especially for it.

An interesting fact in connection with these experiments is that the boats are covered with rubber cloth and have not leaked at all. Would you care for these two pictures in shape for the Bulletin; if so, wire and we will get them ready.

A duplicate cylinder was immediately fitted and preparations made for another trial. This was last Saturday. While testing, a wire broke; this caused a little delay and some water, probably from the radiator, got on the distributor causing the secondary spark to "wander" and not distribute properly. This, of course, made the engine skip. We

worked on this until dark but were unable to dry the distributor or get it running without skipping. We also had some trouble from water getting in the cylinders due to our using a valve dome purchased of the Franklin people, which was done to save time. These domes fasten on by two studs, the draw of which pulls the metal in the cylinder head out of round and caused the leak.

After our troubles Saturday we held council and decided not to make another attempt until this trouble was eliminated by new valves, which were being made and which will go into the engine to-night. We are running 22 hours a day on this work. At one time, some days ago, there was just one man in the whole machine shop who was not working on this engine. Ordinarily, however, but a few men can work on it at a time. This, of course, was during its construction.

There has been plenty of time to make the changes we are now making, but we did not know at the time they were needed, the engine having run all right, the accidents happening only when we went to make a trial. John suggested yesterday we put a heavy automobile engine in the "Silver-Dart" and see what we could do. The regular engine, however, will be ready before this could be accomplished.

We have read so much of the Wrights and others flying, not to mention the fact that we should have been through here long ago, that we are getting very uneasy.

I don't like to write this letter any better than you like to read it, and here is hoping that our next report will be more encouraging. (Signed) G.H. Curtiss.

McCurdy to Bell.

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

Hammondsport, N.Y., Nov. 25, 1908:- Mr. Karl Dientsbach was down in Hammondsport for a few days last week and while here read me an article, which he wrote for a German Aeronautical Magazine, on the work of the Aerial Experiment Association.

I thought it a remarkably good account and perhaps it is the only account of our work from the organizing day till the present time that has been written by an outsider, and what is still more the facts and reasoning stated are correct. I made a few corrections of facts. and had him translate it for me, and it is this article which I enclose. Perhaps we might incorporate it in our Bulletin.

Just received the latest number XX. The photographs are exceptionally good. I don't think you know how much we all appreciate your efforts to have these Bulletins assembled like a Swiss watch. They are certainly fine and will be invaluable in time.

We have not written up a detailed description of the experiment to be tried on the water with the "Loon" because we thought it would sound better after we had tried it out. I have made notes of all the changes made in its construction in my note book with the dates attached. Won't it be fine if, it proves a success. I think that if we can manage to maintain a constant push of 250-300 lbs. we will do the trick. Mr. Curtiss thinks that to-morrow will see the engine as he wants it and if all goes well the "Loon" will make its debut.

That will only be a matter of a few hours and then the engine will go right up the Valley, to be installed in the "Silver-Dart".

Please understand that no time has been lost in the "Loon" experiment. It was simply made ready in spare time while we had nothing to do except wait for the completion of the engine.

If all goes well with the Silver-Dart, I suppose we will fly her for about a week or more and do you think it would be possible to work in a second trial for the Scientific American Trophy. We can tell at once if we have any chance and the fact of trying for the Trophy would not keep us here any longer than we otherwise would stay.

Mr. Post assures us that we can have a trial whenever we wish and I am sure that he will do all he can for us. Please let me know at once what you think about it, so that we can have a date set as soon as we all are sure that we can fly the 25 kilos. or more. Did you ever receive the big batch of mounted photographs I sent you long ago.

(Signed) J.A.D. McCurdy.

Curtiss to Bell.

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

Hammondsport, N.Y., Nov. 27, 1908:- We have Bulletin No.XX, and I wish to compliment you as the Editor. This issue is, I believe, the greatest yet. Should like to comment, however, on your article on Hammondsport experiments. p.3, in which you have taken the weight of the power plant at 365 pounds, and call attention to the fact that 110 pounds for gasoline and oil would cover an extremely large supply. For experimental work the weight of 15 or 20 pounds would be sufficient for the fuel. The weight of the engine has also been reduced and the chain transmission added without increasing the weight of these parts. It is safe, therefore, to figure the entire power plant under 300 pounds, and I believe we will get a push from the propeller of 350 or more. The alterations on the engine have been completed and it is in the "Loon" ready for trial. We are looking for a quiet afternoon to-day.

(Signed) G.H. Curtiss.

BEIDEN BEOBACH EXPERIMENTS REPORTED BY ASST. EDITOR.

Experiments with the "Get-Away" and model of Drome No. 5.

Nov. 27, 1906:-Half-sized model of drome No.5 was flown over the water, being launched from the "Get-Away" which was towed by the Gauldrie. This is the first time the "Get-Away" has been used.

There was quite a stiff breeze about 18 miles an hour, and the Gauldrie had all she could do to keep headway while the experiments were being carried on.

The model of No.5 rose nicely from the "Get-Away" when the tilting arms were lifted. In addition to her own weight the kite carried up a piece of lead on her nose, a sea anchor, three floats, and an auxiliary line which was taken on board the "Get-Away" for the purpose of landing her on same. The days experiments went with the precision of clock-work and after making the following observations, the kite was landed without accident on the "Get-Away".

OBSERVATIONS.

Wind	18.15	miles per hour.
	20.05	miles per hour.
	16.50	miles per hour.
3 Obs.	54.70	
Average	18.23	miles per hour.

Altitude.	Pull
25	70
26	100
28	80
32	130
19	120
24	90
23	70
27	110

(over)

Altitude	Pull
22	130
28	110
25	100
23	90
27	120
28	56
14 Obs 357	170
Average 25.5	80
	70
	60
	18 Obs. 1756 lbs.
	Average 97.6 lbs.
	or 44310 gms.

WEIGHT.

Whole structure with 3 floats.....56 lbs. or 25424 gms...
Flying line (wet).....4230 gms.
Dangling line.....940 gms.
Lead on nose.....382 gms.
Sea anchor.....390 gms.
Two keel sticks to be added to weight of Kites...90 gms.
Total.....31456 gms.

Model of drome No. 5 contains 738 cells.
Total surface.....40 sq. meters.
Ratio.....786 gms. per sq. meter.
Efficiency.....1.265.

G.H.B.

(approved) A.G.B.

BALDWIN'S EXPERIMENTS WITH THE DHONNAS BEAG.

Nov. 16, 1908:-Mr. Baldwin has had three sets of new hydro-surfaces made. The uprights have a series of holes bored in them for the attachment of the blades so that he can take out or put in blades at different distances apart as desired.

In experiments to-day three of these surfaces were used in each set. The Dhonnas Beag was propelled by a four-bladed propeller two meters in diameter and 30° angle at the tip, covered with nainsook and varnished with shellac. It was driven indirectly by gearing 3-1.

Mr. Baldwin reports that the boat lifted with some indications of speed but no records have been preserved. G.H.B.

Nov. 18, 1908:-The Dhonnas Beag was tried to-day with the same outfit used Nov. 16 excepting that the hydro-surfaces employed consisted of a set of five blades placed under the the boat in the bow and two sets, one to port and one to starboard of three blades each placed a little abaft of abeam.

These hydro-surfaces are not cut back to reduce resistance but present a cutting edge perpendicular to the line of advance and set at an angle of 5°.

The boat lifted more astern by the bow. The four-bladed propeller seemed to give a better push than the two two-bladed propellers driven in opposite directions but the torque was quite noticeable. G.H.B.

Nov. 19, 1908:- The Dhonnas Beag was taken out to-day with the same equipment as in experiments Nov. 18, but it was not long after the engine started that the chain parted. Mr. Baldwin thought that the parting of the chain was due to the fact that the engine was somewhat loose on the engine bed. This ended the experiments for the day. G.H.B.

Nov. 20, 1908:-The Dhonnas Beag was tried to-day with the same equipment used in experiments Nov. 19.

Exp. 1. The boat came out high in the bow. Speed.

100 m in 32 sec. down
100 m in 33 sec. up
200 m in 65 sec.

The torque was very noticeable in that the starboard outrigger was forced under the water. The boat tended to turn to the right. This turning action had to be neutralized by steering hard to port with the boat's rudder.

Exp. 2. The Dhonnas Beag was then towed by the Skidoo with the engine on board but without a man. The boat still lifted high in the bow. Half way down the course Bedwin got aboard the Dhonnas Beag and the pull was found to be 95 lbs. There was ice in the harbor near the shed. G.H.B.

Nov. 21, 1908:-Two new propellers revolving in opposite directions have just been completed. They are 15° at tip, 6 1/2' diameter geared at 8 to 20. They gave a steady thrust of 100 lbs., maximum thrust 110 lbs. G.H.B.

Nov. 23, 1908:-Mr. Baldwin not having been able to produce results with his hydro-surfaces at all comparable to those obtained Oct. 27 and 28, it was determined to repeat the old experiments to-day.

On Oct. 27 his hydro-surfaces gave an efficiency of 14 l.e. they supported 14 times the pull of the towing-line but as it was believed that there must be something wrong with the spring balance employed the experiments were not noted in detail in the Bulletin (No. XVIII p.28). On Oct. 28, 1908, Bulletin XVIII, p.29, the experiments were repeated with a new spring balance, the accuracy of which was tested before employing it in the experiments. In this case the efficiencies obtained were:- Exp. 1,10.96; Exp. 2, 12.9; Exp. 3, 12.16. The arrangement of hydro-surfaces employed is shown in Bulletin XVIII, p.30, and the same arrangement was used this morning.

Exp. 1 The Dhonnas Beag without its engine or propeller was towed by the Skidoo. Starting from the Aerodrome shed the boat was towed down the harbor and out into Baddeck Bay as far as the Laboratory wharf and then cruised about Baddeck Bay in open water. The water was smooth, there was no wind either way. Mr. Baldwin thinks that the boat must have been towed at least three miles with the dynamometer under constant observation. He reports the pull as perfectly steady at 40 lbs. when the boat was clear of the water and well balanced. The lateral stability was defective and when she leaned over so that one of the outrigger floats touched the water she skewed around to one side and the pull went up to a maximum

of 35 lbs. John MacLean was on board and by leaning over to the high side was able to restore the equilibrium when the pull at once became steady at 25 lbs, the boat being completely out of the water supported upon her hydro-surfaces. The boat weighed 165 lbs., man 135, total 300 lbs.

As a general result a pull of 25 lbs. lifted 300 lbs. so that the efficiency was 12, thus verifying the results formerly obtained with the same arrangement. While in the harbor the speed was measured at two points. First observation gave 100m in 30 sec; second observation 300 m in 92 sec.

Exp. 2. The hydro-surfaces used in experiments November 18 were then substituted for the old set referred to above in Exp. 1, but there were five blades in the bow set and each of the after sets had four, making a total of 13 blades each having an area of 60 sq. inches giving a toal area of 780 sq. inches. The area of the blades used in experiment 1 was 816 sq. in. The Dhonnas Beag was towed by the Skidoo with Baldwin on board making a speed of 100 m in 32 sec. down. Boat weighed 160 lbs; Baldwin 185 lbs total 345 lbs, and the pull was 60 lbs. yielding an efficiency of 5.75. The boat came clear of the water.

Exp. 3. At lower end of course Bedwin got aboard D.B. with Baldwin. The D.B. did not come out of the water and the pull registered from 90 to 100 lbs.

Exp. 4 The rear planes were set at a less angle and the pull came down to 70 lbs.

Weight.

Baldwin.....185
Bedwin.....155
Boat.....160
Total.....500 lbs.
Pull.....70 lbs.

Remarks:- Boat did not clear herself.

Exp. 5 D.B. was dry-docked and three sets of hydro-surfaces were used as before only the number of blades was changed making a set of four blades in the bow and two sets of four blades each, one to port and one to starboard. Making in all 12 blades giving an area of 720 sq. in.

WEIGHT.

Baldwin.....185
Boat.....160
Total.....345 lbs.

Pull.....50 lbs.
Time 100 m in 31 sec. down.

Efficiency 6.9

Remarks:- Boat cleared herself.

Exp. 6. Bedwin then got aboard with Baldwin.

WEIGHT.

Baldwin.....185
Bedwin.....155
Boat.....160
Total.....500 lbs.

Pull.....60 lbs.

Boat did not clear herself.

Exp. 7. Baldwin then got aboard Skidoo and left Bedwin on D.B.

WEIGHT.

Bedwin.....155
Boat.....160
Total.....315 lbs.

Pull.....43 lbs.

Efficiency 7.32

Remarks:- Boat cleared herself.

GENERAL REMARKS.

It is obvious that the hydro-surfaces employed in experiment I are more efficient than those in experiment 2 and more efficient than the reefing hydro-surfaces employed Nov. 7 (Bulletin XX, pp36-37). In fact they are the most efficient that have yet been produced and are perfectly satisfactory so far as lift is concerned. They are deficient however in stability and this is probably due to their arrangement (see Bulletin XVIII, p.30).

On the other hand the reefing hydro-surfaces (see Bulletin XX, p. 37) when arranged with one set at the bow and two sets aft about under the center of gravity one on either side of the boat seemed to possess stability without great lift suggesting the idea that the lack of stability noted in experiment I might be remedied by employing three sets of the most efficient hydro-surfaces copying the arrangement employed with the reefing hydro-surfaces.

Having obtained hydro-surfaces that are satisfactory in lifting power the idea is to let well enough alone and instead of spending too much time upon trying to improve the good lifting power obtained tackle the question of stability.

G.H.B.

(Approved).F.W.B.

Nov. 28, 1908:-The following were the conditions of to-day's experiments. Three sets of straight-edged hydro-curves 3 ft. by 3 1/8 in. with three vertical supports in each. The curvature was one in fifteen at 1/3 from leading edge. Two sets

in front set 4 ft. 9 1/2 in. from bow. The third and single set placed at the rear 4 ft. 6 in. from the stern. Each set contained two superposed surfaces set at an angle of 5° making a total of 6 surfaces. The wieght of the boat with surfaces attached was 146 lbs. Throughout the day's experiments the Dhonnas Beag was towed by the Skidoo.

Exp. 1. Boat.....146 lbs. Pull.....20 lbs.
J. MacLean.....145 lbs.
Total.....291 lbs.

Efficiency 14.55

Remarks:- The Dhonnas Beag rose out of the water on her hydro-curves. The stability was good.

Exp. 2. Boat.....146 lbs. Pull.....70 lbs.
MacDonald.....189 Time 100 m in 29 sec.
MacLean.....145
Total.....480 lbs.

Efficiency 6.86

Remarks:- The Dhonnas Beag rose well clear of water the stability being good. Boat did not lift as high out of the water as in Experiment 1.

Exp. 3. Boat.....146 lbs. Pull.....26 lbs.
MacDonald.....189 Time 100 m in 30 sec.
Total.....335 lbs.

Efficiency 12.88

Remarks:- Dhonnas Beag rose out of water the stability being good.

Exp. 4 Boat.....146 lbs. Pull..... 301bs.
MacDonald..189 Time 100 m in 30 sec.
Total.....335

Efficiency 11.17

Remarks:- The Dhonnas Beag rose well out of the water, the stability being good. On returning to the wharf eel-grass was found on the hydro-surfaces.

Exp 5 The above experiments were reported by Mr. Baldwin. An experiment was then made with the Dhonnas Beag propelled by her own motive power and mounted on hydro-surfaces with same arrangement as in above experiments. Two double-bladed propellers rotating in opposite directions were used driven by Curtiss No.2 engine, Mr. Baldwin being aboard. The Dhonnas Beag came well clear of the water rising perhaps 1 1/2 ft. from the surface. She also had good port and starboard as well as fore and aft stability. She had hardly gathered speed when the deck near the forward hydro-surfaces smashed. Baldwin immediately shut off power and Dhonnas Beag was towed safely to the wharf after a most successful day of experiments. G.H.B.

Nov. 30, 1908:- The Skidoo not being available and the Gauldrie being overhauled, we could not try flat surfaces so tested one of the new propellers.

Propeller:- 88 in. diameter; 22 1/2 degrees at tip; solid construction; weight with shaft 31 lbs; chain drive; geared 3to 1; maximum pull 125 lbs; steady pull 120 lbs. The driving chain snapped before pull could be noted and above results were obtained after repairs had been made. Second chain also gave way soon after making observations. G.H.B.

Dec. 1, 1908:-Mr. Baldwin reports experiments this morning with the D.B. in which hydroplanes instead of hydro-curves were used. Two sets in front and one in rear the arrangement being the same as that of the hydro-curves used Nov. 28. Both on Nov. 28 and to-day vertical supports were employed instead of sloped-back supports. In each set there were two blades vertically above one another separated by a space of six inches, so that the only difference between the arrangement used Nov. 28, and to-day was that the surfaces used Nov. 28, were curved blades whereas thise used to-day were flat. The object of this morning's experiment was to ascertain whether the great efficiency noted Nov. 28 was due to the curvature of the surfaces. The D.B. provided with flat surfaces was towed down the harbor to-day by the Gauldrie making a speed of 100 m in 33 sec. There was considerable slush ice in the harbor, and the boat was taken out into the Bay so as to have clear water. The D.B. has been repaired since her accident Nov. 28 and weighed 155 lbs.

Exp. 1 Boat.....155 lbs. Pull.....52.9
J. MacLean....142.5
Total.....297.5

Efficiency 5.6

Remarks:- The above experiment was made with the D.B. well clear of the water. The efficiency with the hydro-planes is very much less than with the hydro-curves. Efficiency with hydro-curves obtained Nov. 28 were Exp.1, 14.55; Exp.3, 12.88; Exp.4, 11.17; efficiency with hydroplanes obtained to-day 5.62

Exp. 2. In order to test the matter throughly the hydro-curves used Nov. 28 were replaced upon the D.B. and experiments

repeated this afternoon with the following results.

Exp. 2. Boat.....155 Pull.....28.3
J. MacLean....142.5 Time 100 m in 30 sec.
Total.....297.5 Time 100 m in 31 sec.

Efficiency 10.51

Remarks:- The Dhonnas Beag was tried this afternoon with the hydro-curves used Nov. 28 towed by the Gauldrie.

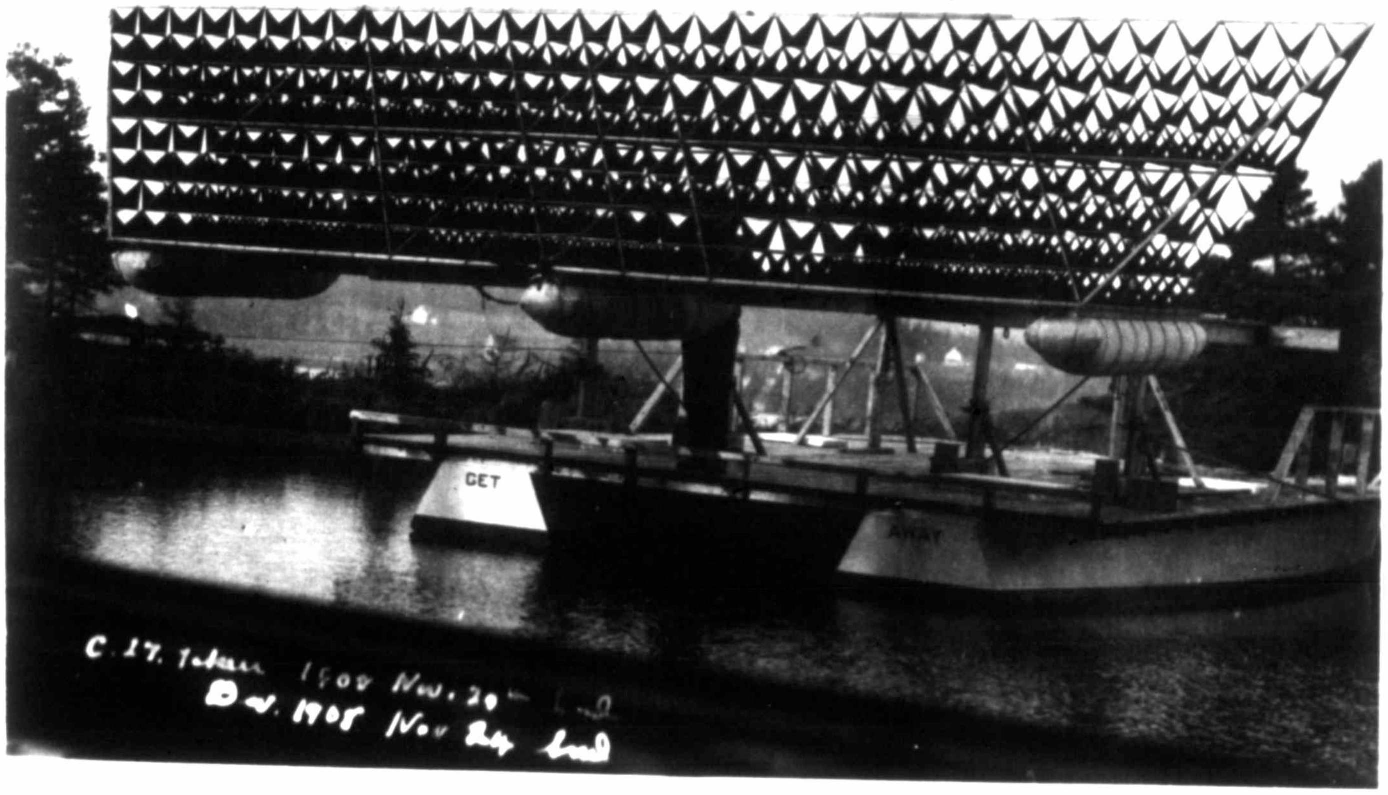
Exp. 3. Boat.....155 Pull.....22.5
J. MacLean....142.5
Total.....297.5

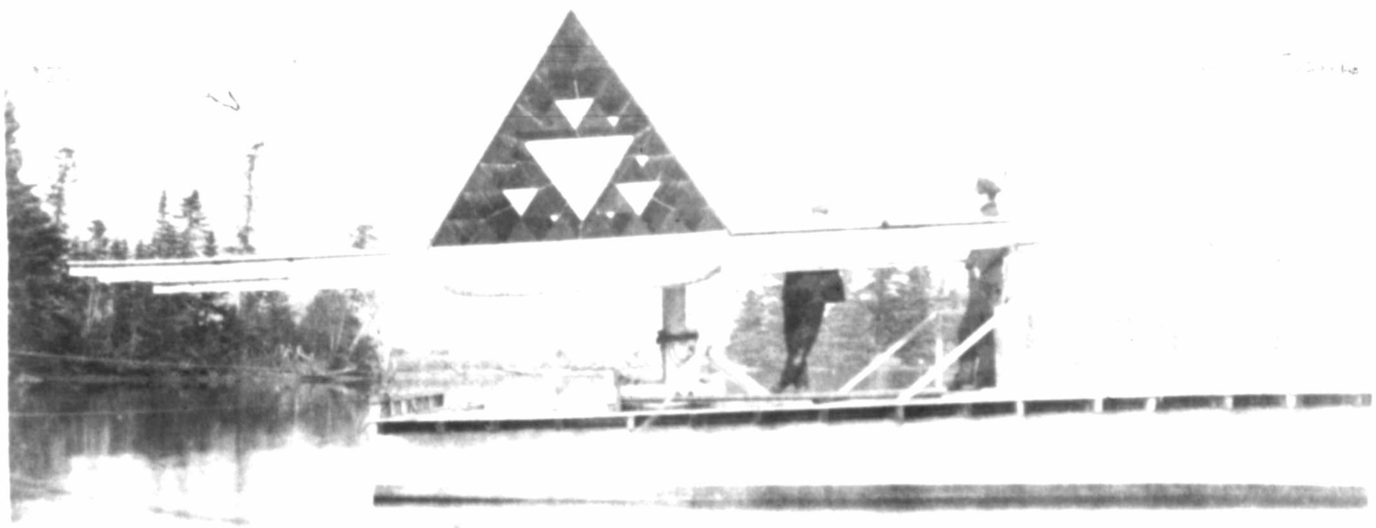
Efficiency 13.22

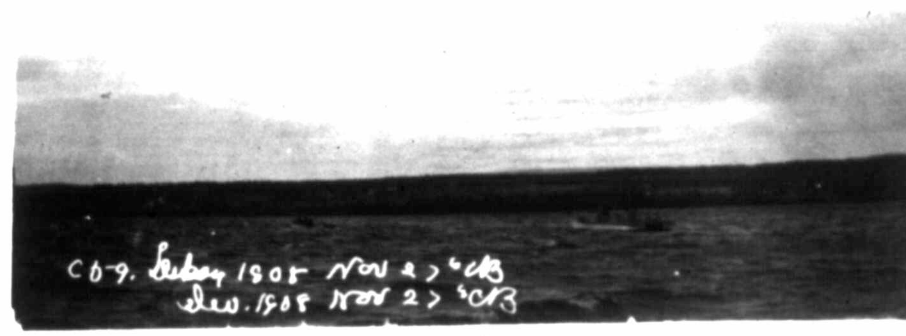
Remarks:- Coming back from the Bay the above observations were made with the boat completely out of water supported on her hydro-curves.

As a general result of these experiments it can no longer be doubted that the hydro-curves are more efficient than the hydroplanes.

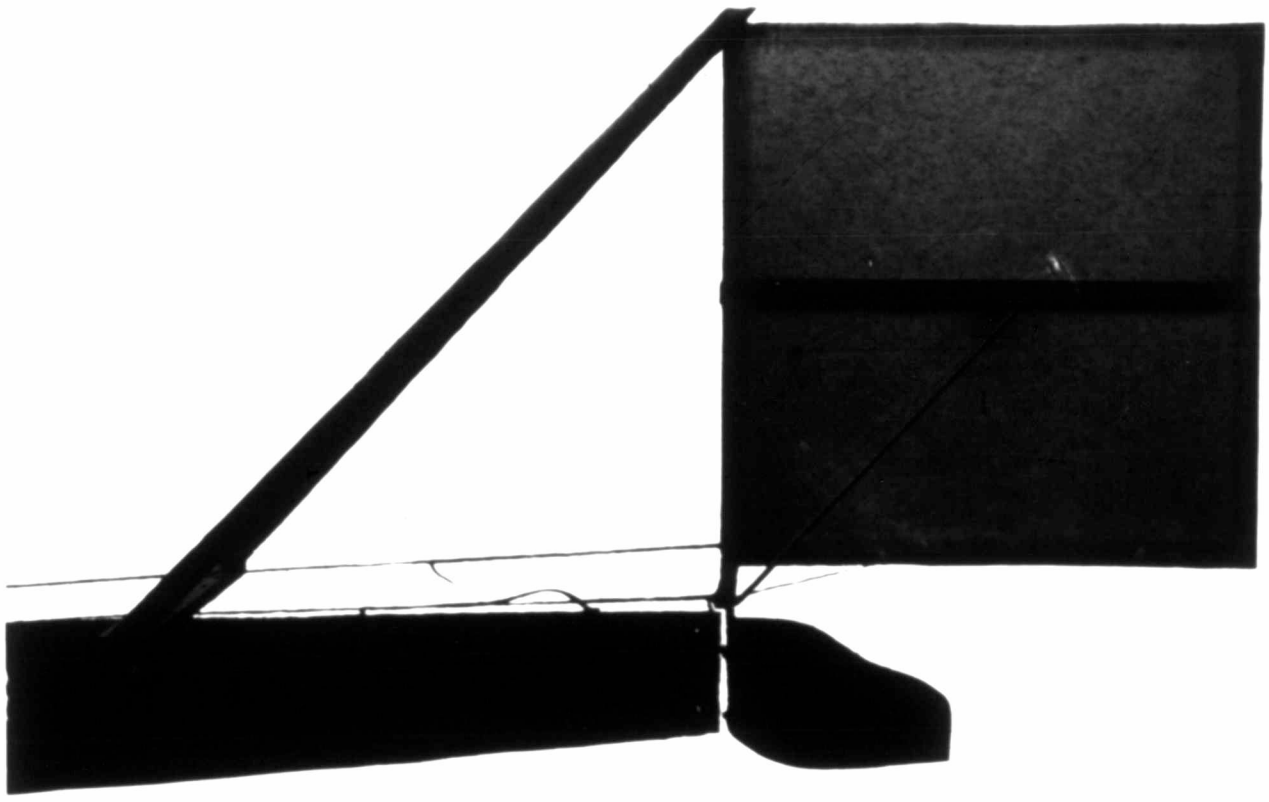
Exp. 4. An experiment was then made to ascertain the lowest speed at which the hydro-curves would support the Dhonnas Beag out of water. When Gauldrie was 100 m in 38 sec. the boat was supported; upon slowing down to 100 m in 40 sec. the boat was still supported out of water. This was the lowest speed attempted. The average pull was from 40 to 45 lbs. This ended the experiments for the day. When the boat was taken out of the water some eel-grass was found upon the blades. G.H.B. (approved) F.W.B.

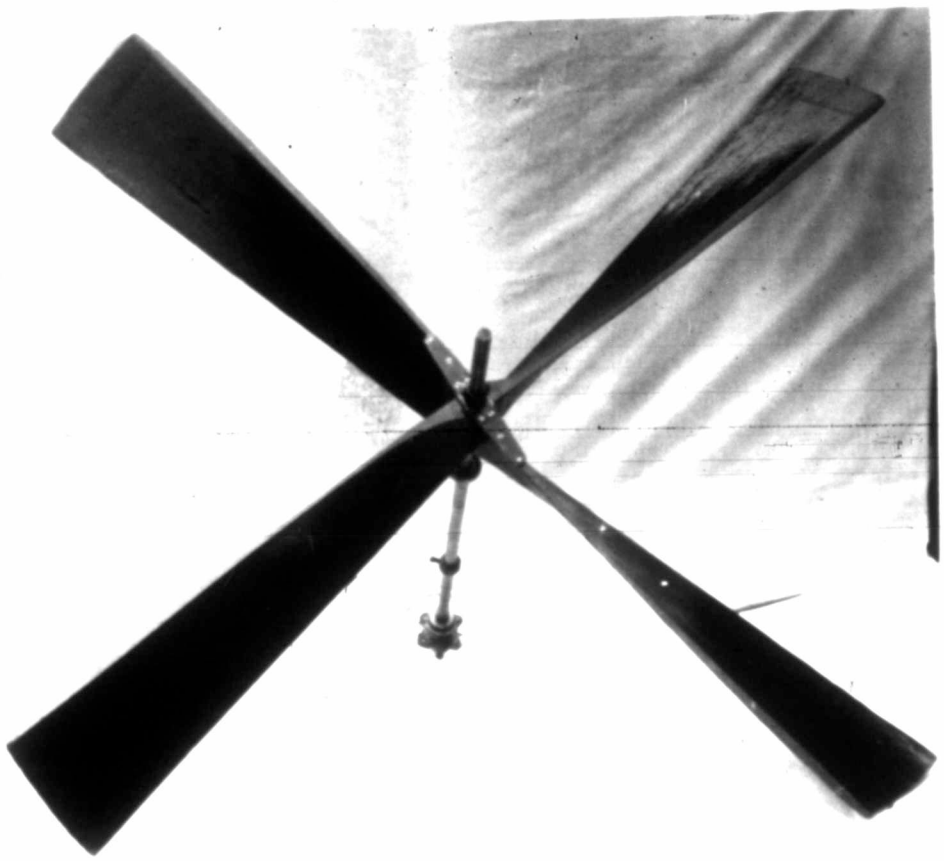

GET
C. 17.
1908 Nov. 20
1908 Nov

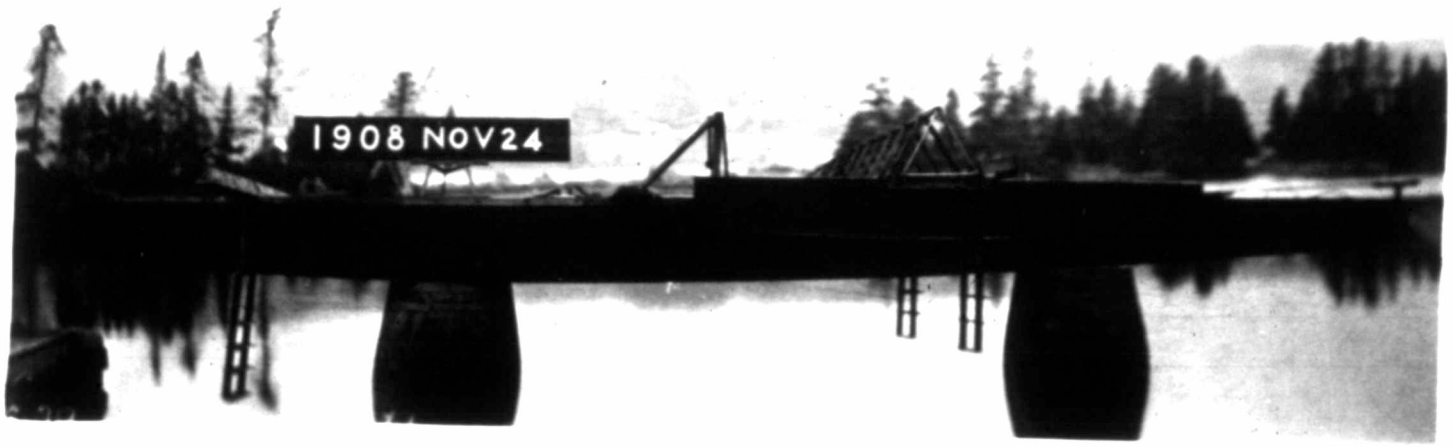


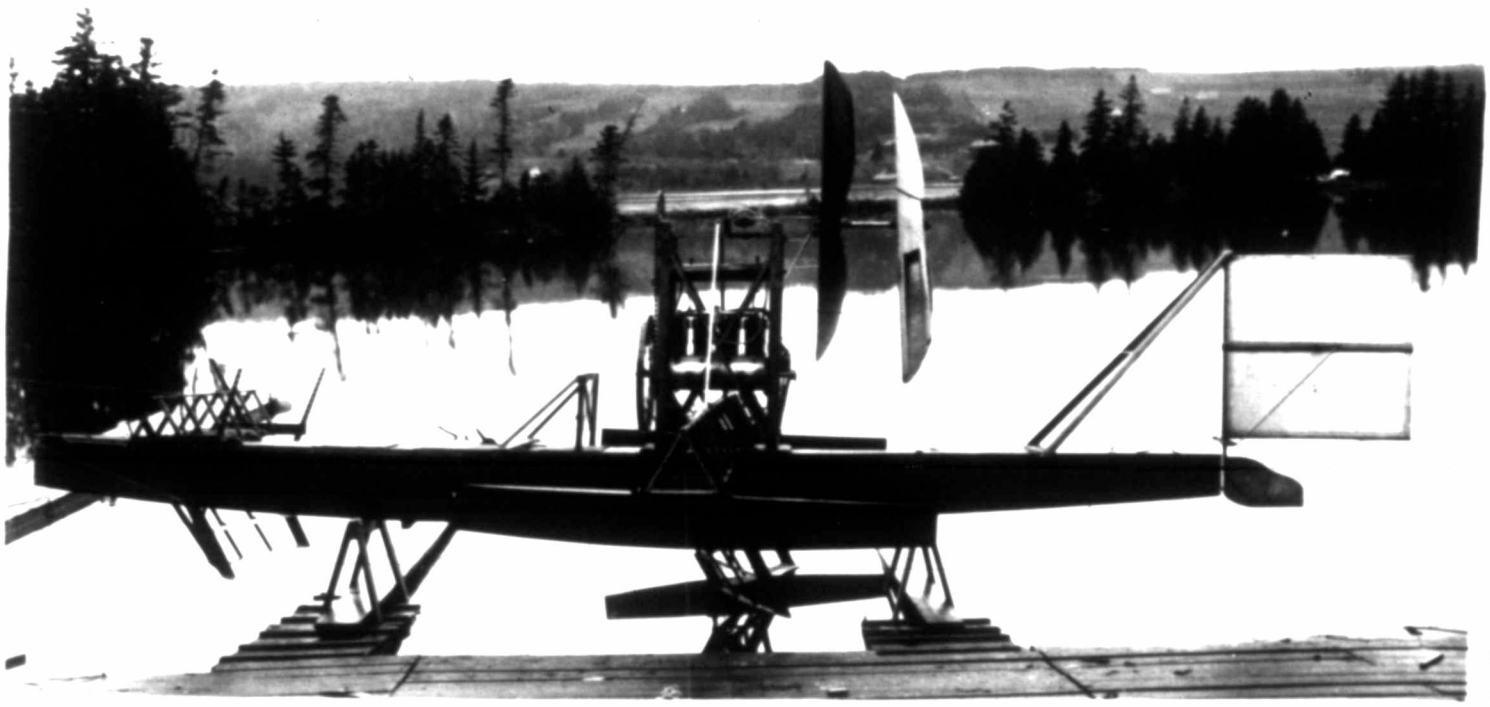


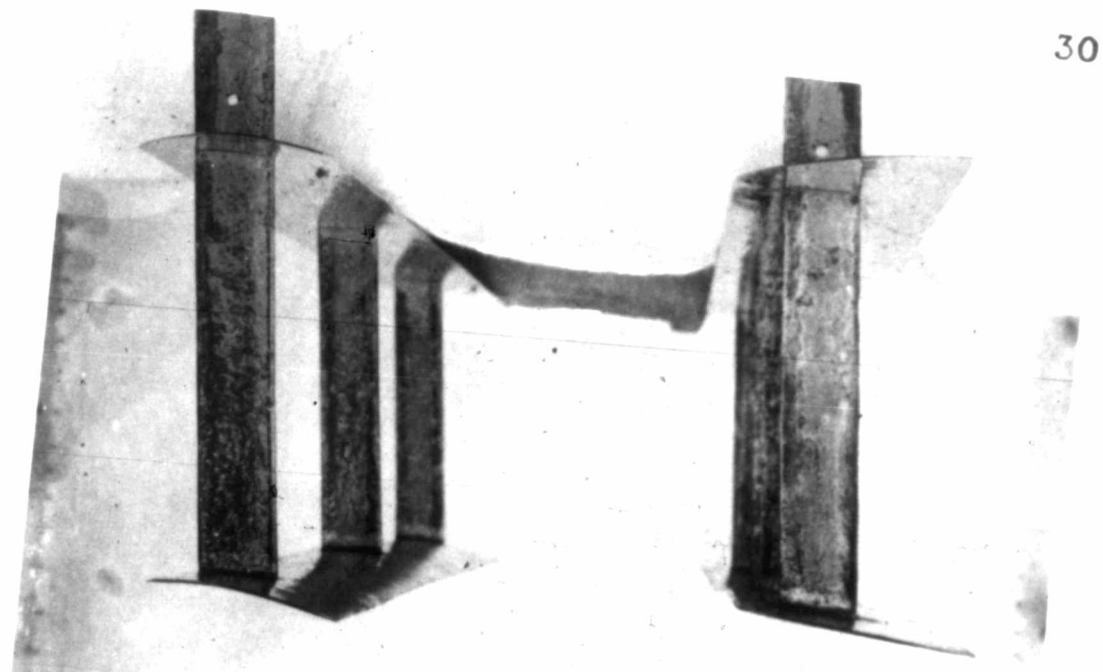

C60. Taken

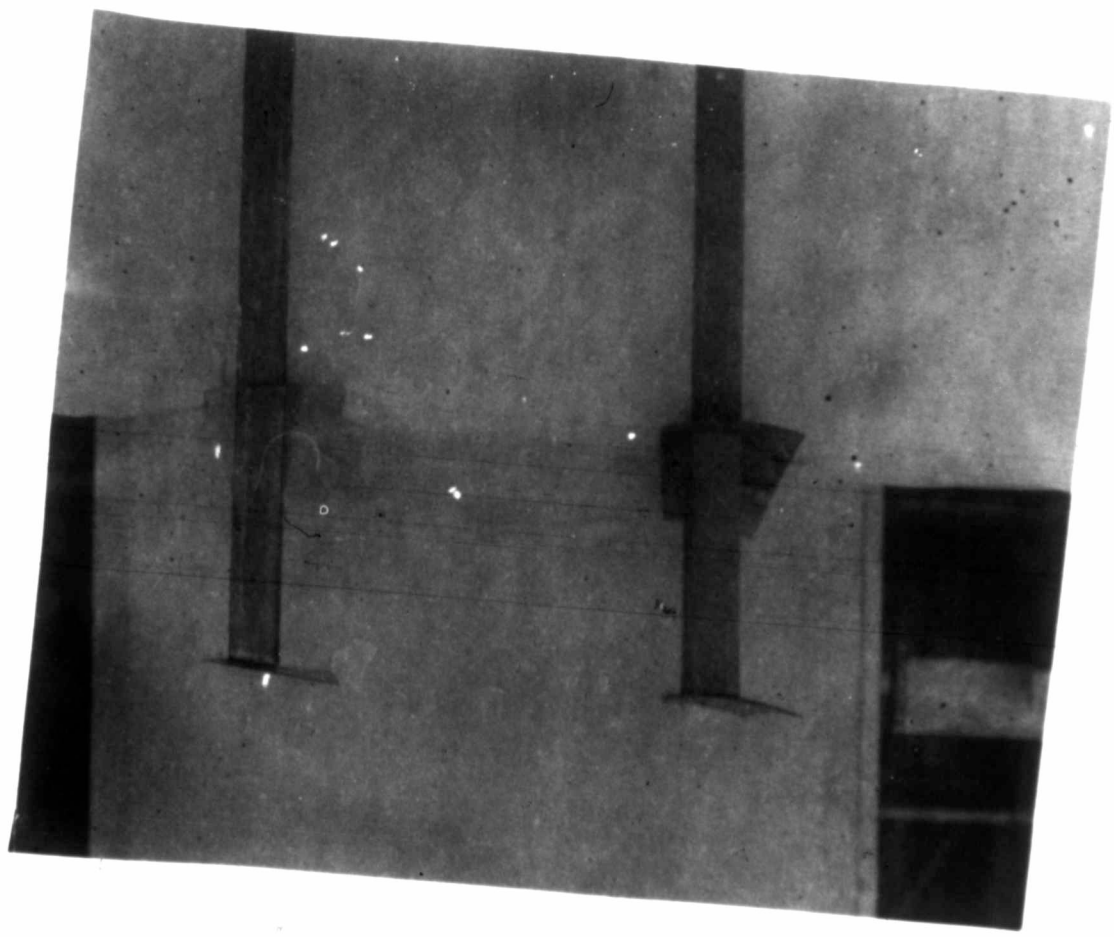





1908 NOV24








1
2
3
4

THE WORDS "AEROPLANE" AND "AERODROME":
By Gardiner H. Bell.

Just as the art of Aviation is new, so are the terms we use in application to the art. There seems to be some question as to the technical application of a number of these words. Let us first take up the question as to the use of the word "aeroplane". Mauro, Cameron, Lewis & Massie in relation to patent matters, have used the word "aeroplane" in reference to the Hammondsport machines. The question immediately arises, are the Hammondsport machines aeroplanes? It is true that they are universally known as such but technically have we any right to use the word "aeroplane" when we are speaking of heavier-than-air machines whose supporting surfaces are not planes but curves?

We must admit that the following sentences quoted from Patent matters do not sound technical to say the least.

> "In a flying machine the combination of a pair of superposed aeroplanes spaced farthest apart at their central positions and gradually approaching each other towards their lateral edge portions etc.". and again
>
> "In a flying machine the combination of a plurality of concave-convex aeroplanes united with the concave surfaces toward each other etc".

In the above sentences the composer has used the word "aeroplane" in speaking of the curved portions which constitute the supporting surfaces. Perhaps this brings the point home more clearly than when the machine as a whole is termed "aeroplane".

Then there is the word "aerodrome", sometimes used in speaking of the machine; sometimes in speaking of the shed in which the machine is housed; and sometimes in connection with the imaginary track on which the machine travels. It is an easy matter to trace the origin of each of the above applications of the word and it may be said that there is something to argue in favor of each.

However it may be, one thing is certain; that in order to converse intelligibly on the subject of Aviation we must cut our technical words down to one and only one meaning. I think most of us will agree that the following sentence would be somewhat misleading.

> "The doors of the Aerodrome were opened and the aerodrome was wheeled over to the Aerodrome".

G.H.B.

Mauro, Cameron, Lewis & Massie to Bell.

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

Washington, D.C., Nov. 24, 1908:- We are in receipt of your Editorial Notes and Comments under date of Nov. 18, 1908, in which you criticise the use of the expression "aeroplane having a concave and a convex surface". It is true, as you state, that a plane cannot have a concave and a convex surface but we are not talking of planes but aeroplanes, two very different things. It is true that a plane cannot have a concave and a convex surface, and it is equally true that an aeroplane can have such a concave and convex surface.

There is a clearly defined distinction between a geometrical plane and an "aeroplane". This latter term is not confined to a structure which would fall within the definition of a geometrical plane. It is defined in the dictionaries as a flying machine having supporting surfaces or wings, and in this sense it refers to the entire machine. Thus, we would speak of Wright's machine as an aeroplane, and just as surely the June Bug is an aeroplane.

The term "aeroplane" also has a more specific meaning, that is, the supporting surface in that class of machines broadly designated as aeroplanes. You will recall that we have the authority of the Wright Brothers (who are certainly entitled to be regarded as authorities in this art) for the use of the term in this sense.

Referring to your suggestion that there should be some statement or definition in the specification as to the

meaning of the term "aeroplane" if we employ it, we should not object to this, but, unless it is absolutely called for, we think it undesirable, because some infringer might manage to evade the definition and thus escape the charge of infringing the claims.

The law requires that the specification of the patent shall be couched in such clear, concise and exact terms, as will enable one skilled in the art to make, construct and use the device. Now, we will venture the assertion that there is not a flying machine man in the world who would not call your machine an "aeroplane", and who could not, from the description which is embodied in the specification submitted, construct and use the machine, and who would not perfectly understand the term "aeroplane" as employed therein.

Mr. Cameron carefully considered this very question when drawing the specification and deliberately adopted the term "aeroplane" because, in his judgment, there was no other expression known to the art which would as fully and completely describe the structure to one skilled in the art as the term "aeroplane".

The term "aero-surface" suggested by you does not appear to us to be as apt as the term "aeroplane". It is a coined word, it has no known and well defined meaning in the art, and would necessarily require definition in the specification in order to fix accurately the meaning which was to be given to it in the specification. On the other hand, "aeroplane" has a well defined fixed meaning in the art, as is readily understood by all.

We beg that you will recognise that there is no personal pride involved at all in the above suggestions. We are interested, as we know you are, only in getting the most apt expressions and the strongest patent possible under the circumstances, and we shall be most happy to make any changes or to adopt any descriptive terms which appear, after full discussion, to be the best. We are satisfied, however, that the criticisms suggested in your Editorial Notes of the use of the word "aeroplane" are not well founded from a patent standpoint, and that the suggested substitute is more undesirable than the term already employed.

(Signed) Mauro, Cameron, Lewis & Massie.

Bell to Mauro, Cameron, Lewis & Massie.

To Mauro, Cameron, Lewis & Massie,
Washington, D.C.

Baddeck, N.S. Dec. 4, 1908:- Your note of Nov. 24 received. I am glad to know that my criticisms relating to the use of the word "aeroplane" are not well founded from a patent standpoint.

There are other points of view, however, and your letter is suggestive of a new conundrum.

"When - oh when - is a plane not a plane?

Answer: When it is an Aeroplane!!!

according to Messrs. Mauro, Cameron, Lewis & Massie! This may perhaps not be appreciated as a joke in the patent office but I can assure you it sounded very like one to me when I first read it in your letter!

Seriously, the whole matter of terminology requires looking into. Mr. Cameron must not for one moment suppose that my criticisms in any way reflected personally upon him. He is of course not responsible for the absurd terminology employed by the Public; and he has only followed, in the specification, the ordinary usage of the day.

I expect to arrive in Washington on the 14th of December and to remain there until the 18th and would like to have a conference with Mr. Cameron concerning the specification during my visit there. I must say that the whole specification impresses me with the feeling that it has been prepared with great care and thought, and it will be a pleasure to look it over with Mr. Cameron himself.

(Signed) Alexander Graham BeLL.

THE OUTLOOK ON AVIATION: By the Asst. Editor.

The November Number of "aeronautics" has at last arrived. It describes, in this issue, the Herring aeroplane. It also contains an article on "The Increased Lifting Effect of Curved Aeroplanes" by Edward W. Smith. There is given quite a detailed account of the aeronautical meet at Morris Park.

NEWSPAPERS.

For the first time on record the Wright aeroplane was operated solely by a stranger, M. le Comte de Lambert on Nov. 23. It is reported that a few days later Wright brought his machine to the ground, describing a spiral path, and lighted without accident. There is a report that Wright intends flying with two men besides himself.

A Russian by the name of Beleteff is having constructed by the Voisin Bros., a triplane which seems to be arousing considerable attention. It is to be driven by a 100 H.P. Panhard engine and is built, as nearly as can be judged by a very poor accompanying illustration, to resemble the form of a bird. The machine is 33 ft. in length, its wings measure 21 ft. from tip to tip.

There has been a split in the French Aero Club in the form of a League Nationale Avienne which in a few weeks obtained five thousand supporters and considerable sums in prize money. As a result of the split the Marquis de Dion and M. Archdeacon have resigned from the Mother Club.

On November 6 Lieuts. Lamb and Winter and Holland

Forbes made a successful trip to Annapolis, M.D., in the Government dirigible. It is intended to make a flight to Baltimore in the near future.

The Aero Club of the United Kingdom has decided to present to the Wright Bros. its gold medal, at a dinner to be given in honor of Wilbur Wright in London before the end of the year.

Baden-Powell seems to be of the opinion that not enough attention has been paid to head resistance throughout the construction of the Wright machine. He also doubts that the system of warping the planes is an important feature in navigating the machine.

Fournier, a Frenchman, is working on a biplane in this country. The machine is to be driven by a 50 H.P. four-cylinder gasoline engine.

The word "Drome" seems to have been excepted by the public, and especially as applied to the Harmondsport machines.

An armoured automobile designed to destroy airships is under construction at Berlin. Its armament consists of a rapid fire 5 centimeter gun capable of discharging 24 times a minute.

A school of flight has been started in Belgium. An ingenious apparatus for teaching pupils in actual flight is used. It consists of a "captive aeroplane" which is towed through the air by a long cable winding round a drum.

New York Herald, Nov. 23, 1908:-Two brothers by the name of Gemma living in Norvera, have invented an aeroplanes which

from its planes they call an "aerocurve".

Paris, Sunday:-The Auto Aero Committee of the Auto Club of France has decided to organize a grand prize for Aviators. The prize will be competed for in 1908 and its value will be about $40,000.00

The Russian Government is looking into the Wright machine.

FRANCE.

It has been figured that the total duration of Wilbur Wright's flights up to October 7, inclusive, amounted to 11 hourse, 32 minutes. Up to Oct. 10, twenty-six persons have been carried, including three women and a boy. In the 2 hour 7 minute flight of September 28, Wilbur Wright won the Commission d'Aviation prize of 5000 francs, open till September 30, for a closed circuit flight of 5 kilometers.

WRIGHT.

On the 9th of October, he made six flights of about 4 minutes, average, with Lazare Weiller, Baron Deutsch and Engineer Berheim as passengers.

On October 10 Wilbur Wright carried Paul Painleve for 1 hour, 9 minutes, 45 seconds. The official distance was 55 kilometers, but considering the curves, it must have been about 80 kilometers. There was no wind blowing; the flight ended after dark, having been delayed on account of the mending of a wire stay, made necessary by a false start. It was the third long passenger flight, having been preceded by one of 55 minutes, 37 seconds, and one of 1 hour, 4 minutes 26 seconds.

The Weiller syndicate has conceded that the flights have fulfilled conditions and have paid the first instalment of 250,000 francs to Wright.

On Oct. 15 two flights were made of 1 minute, 38 sec. and 2 minutes, 35 seconds, carrying first Mercanti and second Rene Gasnier, who was in the Gordon Bennett race from St. Louis last year. Wright stopped his motor when at a height of 60 ft. and made a smooth glide to earth.

On Oct. 21 Wilbur Wright made a flight of 6 minutes, 40 seconds, covering 17 kilometers in a strong wind. On Oct. 23 he made another flight of 2 minutes and 30 seconds, following which were flights carrying a passenger of 3 minutes, 17 seconds; 4 minutes, 58 seconds, and 3 minutes, 2 seconds.

On Oct. 28 Count de Lambert began his lessons as an apprentice-aviator. For his first lesson he had three flights of 12, 8, and 15 minutes. On the following day the master and pupil made three more, 7 minutes, 5 seconds; 17 minutes, 34 seconds, and 19 minutes, 25 seconds respectively.

On Oct. 30 one of the connecting rods of the motor broke and smashed through the crank case, while the machine was in mid-air. The descent, however, was made without trouble. In a recent interview Wilbur Wright stated that the success of his machine was especially due to the high efficiency of its propellers, and that light motors were not essential and flight could as well be attained with a steam engine. He claims 70 per cent efficiency for his propellers.

FARMAN.

On Sept. 30, in competition for the Aero Club 5000 franc prize, Farman accomplished a flight of 35 minutes, 36 seconds, covering 34 kilometers. On Oct. 2 he succeeded in remaining in the air 44 minutes 32 seconds, covering 42 kilometers at Chalons. On Sept. 28 Farman made another long flight, and again another of about a mile with M. Painleve aboard. Following these, for the first time in the history of aviation a flying machine traveled from one town to another. Leaving the plains of Chalons on Sept. 30, no stop was made until he descended just outside Rheims, a distance of 27 kilometers, 20 minutes later. His course took him over the houses and trees and the photographs of the flight bear witness.

BLERIOT.

On Oct. 2 the Bleriot VIII made a flight of 4 minutes. On Oct. 22 Bleriot tried for the "high prize" and accomplished a flight of 6 minutes, 40 seconds in a gusty wind. On the following day another attempt was made, but the motor stopped on account of too much gas feeding, and in landing the machine was damaged. On Oct. 30 still another attempt was made, but the motor again stopped. The next day, after a short flight in the morning, he set off in the afternoon for Artenay a small village, and 9 miles were covered before landing. After a few necessary repairs the monoplane started back, but had to stop once on the way.

PELTERIE.

The Pelterie Aeroplane, No. 2 has just been finished on the general lines of No. 1.

ENGLAND.

Mr. Moore-Brabazon has received the triplane he ordered fro the Voisin Brothers, and will soon start experimenting with it. It is provided with a regular make of automobile motor, the Metallurique.

The Daily mail has offered a new prize of $2500 to a gasless machine which flies over the English Channel in either direction. The least width is 21 1/2 miles.

The Aero Club of the United Kingdom has elected the Brothers Wright to honorary membership and presented their gold medal for 1908 to them.

The British Army's first aerodrome , which had such successful trials, unfortunately met with disaster recently and is now a total wreck. When twenty feet or so above the earth it suddenly swooped and struck the ground with some force.

GERMANY.

On Oct. 24 the overhauled Zeppelin I the first fully successful representative of its type, was sailed for the first time. With all the improvements incorperated in it, after the experiences with the illfated No.4, it has proven a wonderful success. Prince Henry of Prussia made a very extended trip of seven hours on Oct. 27, being so delighted by his experiences that he continued many hours longer than

expected.

On November 7 the Crown Prince of Germany shared his experience. By the decision of Gen. von Einem, the Minister of War, the Zeppelin ship has been bought by the War Office. The National subscription for the construction of Zeppelin's airships totals nearly seven million francs.

SPAIN.

At the park of Guadelajasa, Capt. Kindelan and Mr. Torres Querdo are testing a small dirigible of 950 cubic meters. It has two 34 H.P. motors, driving two propellers of 1.5 meters diameter placed at both sides of the car.

ITALY.

The new Italian war dirigible has undergone its first trials very successfully over Lake Bracciano, with Major Morris, Capt. Crocco and Ricaldoni and a mechanic. It is constructed on scientific lines by Major Morris. The envelope possessed a fish-like form of least resistance.

AUSTRIA.

The Wels-Etrich monoplane is nearly completed, driven by a 24 H.P. Antoinette motor, with a single traction screw.

BELGIUM.

In the newly-opened exposition for arts and crafts at Brussels is seen an ornithopter of M. de la Haulit, furnished with a motor of 100 H.P., of only 800 lbs. total weight a propeller for dirigibles by Mr. Kluytmans that is placed in the center of the car, and an aeroplane model by a Mr. Koch, with improved stabilizing devices.

NOTES FROM NATURE.

The following notes from "Nature" may be of interest.

Nature, Nov. 12, 1908:-On Nov. 6 an inaugural meeting of the Aeroplane Club was held in London, when it was decided to form a club devoted to the development of aerial navigation by machines heavier-than-air. A small provisional committee was appointed to submit to the Club the names of gentlemen for service on a general committee.

The Paris correspondent of the Times reports that M. Barthou, the French Minister of Public Works, announced in the Senate on Nov. 5 that the sum of 4000 l. is to be devoted by this Deaprtment to the encouragement of aerial locomotion. From the same source we learn that the International Sporting Club of Monaco has offered the sum of 4000 l to be competed for at an international aeronautical meeting to be held at Monaco from January 24 to March 24, 1909. The length of the course will be about six miles. The first prize will be 3000 l., the second 600 l., and the third 40 l.

AERO CLUB OF AMERICA.

At a meeting of the Aero Club of America, the following resolution was unanimously passed:-

"RESOLVED that the Club offer to take charge of funds for the erection of a monument in memory of Lieut. Selfridge and ask the members so inclined to contribute".

A unanimous resolution was passed by the Aero Club of America to give Wilbur and Orville Wright suitable gold medals. It is proposed that these medals be handed to the Wrights at a banquet to be given by said Club.

INVENTOR	TYPE	H.P.	MOTOR	No. OF PROPELLERS	No. OF BLADES IN EACH	DIAMETER OF PROPELLER IN M.	PITCH IN M.	
reguet	Gyropl	40	Antoinette	2	4	7.85		
Koechlin-Pischof	Monopl	20	Duteil & Chalmers	1	2	*1.65	1.	*also 1.55
Koechlin-Pischof	Monopl	15	Duteil & Chalmers	1	2			
Dufaux	Bipl	100	Dufaux	2	2	2.8		
Bleriot VIII	Monopl	50	Antoinette	1	4	2.2	1.3	
Bleriot IX	Monopl	75	?	1	4	2.1	1.3	
Bleriot	Monopl	24	Antoinette	1	2	1.6	0.98	
Bertin	Helicopt	120	Bertin	1	2	2.2		
Auffm-Ordt	Monopl	35	R.E.P.	1	2	2.5		
Blanc	Monopl	35	R.E.P.	1	2	2.	1.2	
Roesch-Seux		50		2	2	2.	1.2	
Cornu	Helicopt	24	Antoinette	2	2	6.	2.7	
Kapferer	Monopl	35	R.E.P.	1	2	2.1	1.3	
Kapferer	Bipl	20-25	Buchet	1	2	1.6	1.	
Farman I	Bipl	50	Antoinette	1	2	*6.89	*3.61	*feet
Farman I-bis	Bipl		Antoinette					
Farman II	Bipl	35	Renault	1	2	2.5		
Farman II	Bipl	50	Antoinette	1	2	2.1	1.1	

In August, 1908, Farman gave E.L. Jones diameter as 2.3; pitch 1.4

INVENTOR	TYPE	H.P.	MOTOR	NO. OF PROPELLERS	NO. OF BLADES IN EACH.	DIAMETER OF PROPELLER IN M.	PITCH IN M.
Vaniman	Tripl	70-80	Antoinette	2			
Bonnet-Labranche	Bipl	70-80	S.A.C.A.A.	1	2		
Hughes	Tripl	10	Hughes	1		1.5	
Hervieux	Monopl	18-24					
Gasnier	Bipl	40	Antoinette			2.2	
Goupy	Tripl		Renault	1	2	2.3	1.4
R.E.P. I	Monopl	25	R.E.P.	1			
R.E.P. II	Monopl	35	R.E.P.	1	4		
R.E.P. II-bis	Monopl		R.E.P.	1	4		
Santos Dumont 14-bis	Bipl			1	2	2.0	1.0
Santos Dumont No.IX	Monopl	20	Duteil & Chalmers	1	2	1.35	
Santos Dumont 14	Bipl	50	Antoinette	1	2		
Santos Dumont 20	Monopl	24	Antoinette	1	2		
Santos Dumont	Bipl	100	Antoinette	1	2	2.05	1.7
Detable	Monopl	2	Herdtle-Bruneau				
French Military	Tripl						
Caters	Tripl						
English	Bipl	50	Antoinette	2	2		

INVENTOR	TYPE	H.P.	MOTOR	No. OF PROPELLERS	No. OF BLADES IN EACH	DIAMETER OF PROPELLER IN M.	PITCH IN M.
Delagrange	Bipl	50	Antoinette	2	2	2.1	1.05
Delagrange	Bipl	50-60	Antoinette	1	2		
Kllehammer	Bipl	18		1	2		
Kllehammer	Tripl	30	Kllehammer	1	2		
Gilbert	Monopl						
Ætrich-Wels III	Monopl			1		1.5	
Coanda	Bipl	50	Antoinette	1			
de la Vaulx	Monopl	40		2	2	2.0	2.2
Gastambide I	Monopl	50	Antoinette	1	2	2.0	1.3
Gastambide II	Monopl	50	Antoinette	1	2		
Gastambide III	Monopl			1	2		
Vuia	Monopl	24	Antoinette	1	2	1.85	1.0
Witzig-liore-Dutil-leul	Part mono part bipl	50	Renault	2	2	3.0	2.5
Fritzche							
Ferbe Wind Wagon	Wind Wagon	12/16	Pengeot	1	2	1.85	1.8
Ferber IX	Bipl	50	Antoinette	1	2	2.2	1.1
Zens	Bipl	50	Antoinette	1	2	2.0	Variable
Zens	Bipl	50	Antoinette	1	2	2.05	1.0
Pischoff	Monopl	35		1		2.0	

INVENTOR	TYPE	H.P.	MOTOR	No. OF PROPELLERS	No. OF BLADES IN EACH	DIAMETER OF PROPELLER IN M	PITCH IN M
Pischoff	Bipl	25	Anzani	1	2		
Antoinette	Monopl	100	Antoinette	1	2	2.5	
			AMERICA.				
Red Wing	Bipl	40	Curtiss	1	2	6'2"	4'
White Wing	Bipl	40	Curtiss	1	2		
June Bug	Bipl	40	Curtiss	1	2	5.5' 6'	4'2" 4'
Silver-Dart?+	Bipl	50	Curtiss	1	2	8'	17-15°
Kimball	Helicopt	50	K & C	20	4	4'	1/2'
Luyties	Helicopt	20		2	4	35'	upper 12° lower 13°
Williams	Helicop	40	Curtiss	2	2		
Williams (CW)	Monopl						
Zerbe	Monopl	40	Curtiss				
Heinfeld							
Wright	Bipl	25	Wright	2	2	2.5	also given as 2.8

----------oOo----------