Journal by Alexander Graham Bell, from July 2, 1909, to November 24, 1909

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This is OK Obtaining Power from the Swiss rays by A. G. Bell. A RADIATION Solar MOTOR.

July 2, 1909 :—I have been recalling to mind the remarkable effects produced by radiophonic receivers containing lamp black, soot, or carbon in the a fine state of subdivision and the possibility of applying the results to a motor worked by radiant energy the Swiss rays .

If we put into an empty bottle a few spoonfuls of dry soot and concentrate a beam of sunlight upon the soot by means of a lense the following effects are observed. The moment the focus falls upon the soot a gushing sound is heard from the bottle and if a lighted candle be held near the mouth of the bottle the flame is blown away showing that the heating of the soot has heated the air in the bottle causing some of it to be expelled suddenly.

If we hold the hand in the path of the beam of light the moment the shadow falls upon the soot a sucking sound is heard from the bottle and the flame of the candle shows an in-draught.

These effects occur so suddenly that when the beam of light is rendered i n termittent, by passing it through holes in a rapidly rotating disc of opaque material, distinct noises are perceived every time the light is let on and every time it is cut off, so that b B y increasing the rotation of the disc we obtain a musical tone from the bottle which continues to rise in pitch as the rate of interruption is increased. Clear musical tones are perceived even when the interruptions occur more than 100 times per second — showing that even at this rapid rate 2 2 alternate expansion and contraction of the air within the bottle takes place in accordance with the interruption s of the light.

The thought has often occurred that it might be well to enquire what power could be produced by the expansion and contraction of confined air in such a case.

I propose, therefore, to construct a simple apparatus to investigate this point , modelled upon one of my radiophonic receivers.

A shallow circular space is to be turned out of a block of glass brass. In this space will be placed a sheet of wire gauze coated with lamp black and the whole interior of the brass cavity will also be smoked. Then a diaphragm of glass will be arranged to cover the shallow recess like a telephone diaphragm and a cover screwed on, as in the case of the telephone, so as to hermetically seal the space.

If the air within the space is heated it will cause the glass diaphragm to bulge up to a certain extent and with a certain force. To what extent? And with what force?

In order to determine this point the apparatus will be placed with the glass diaphragm horizontally and above , and a A lever of brass will then be attached at one end to the edge of the cover , the other end projecting several centimeters beyond the opposite side of the diaphragm , and a projection upon the lever will rest upon the center of the glass diaphragm and . and the The free end of the lever will be loaded with the a weight. The movement of the glass diaphragm 3 3 will be magnified by the free end of the lver so that its amplitude may be calculated lever that and the weight lifted by the free end of the lver it will be a measure of the weight that could be lifted by the diaphragm.

In operating the apparatus a beam of sunlight will be concentrated upon the lamp blac k ed wire gauze. This will be completed The gauge The air in contact with it will then become heated and cause the expansion of the air within the cavity. From the action of this apparatus we may be able to determine whether any useful power could be generated in this way.

The only trouble One difficult in this connection is that glass is rather opaque to the dark rays of heat , so that we will utilize chiefly only have the heating effect of the luminous rays. The dark heat rays being absorbed by the lense, and the glass difference, and doubly absorbed by the glass in any ordinary mirror hit many lightning to different the suns rays the . In our ordinary glass mirror with a reflecting & the twice to the a the glass once on its way to the falling and a second time after reflecting from surface. Consequently great absorption takes place of the very rays world be most effective for our proposal on the invisible dark rays of heat.

If we substitute for the glass diaphragm a diaphragm of ebonite or hard rubber; and for the lense a silvered could have reflector with the reflecting surface outside we produce no marked absorption of the dark heat rays. I discovered many years ago the diathermancy of hard rubber . While hard rubber in thins shuts is It is quite remarkably transpar a ent to the dark rays of heat , but we here we lose, the heating effect of the luminous rays , for it for hard rubber is practically opaque to light. (Cutting to the as end of the).

Perhaps a sheet of mica might be better than glass , and better than hard rubber , for it is transparent to both sorts of rays , or at least, it It is at all events transparent to light , and allows the transmission of the dark rays of heat to a much greater degree than galss glass . A glass fire screen cuts off the heat of an open fire; but the mica window of a stove allows the heat to pass. A.G.B.

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LABORATORY INSTRUCTIONS

Ju ly 5/09 :1. Have instructed Mr. Bedwin to fill in Cygnet II T he The large empty spaces on either side of the body of Cygnet II are to be filled in with large tetrahedral cells of fish-shaped material.

2. A large portion of the Oionos Kite white Oionos kite has survived the recent disaster. and I have instructed Mr. Bedwin to provide it remains available for experiments, will be provided with a keel stick and repair it with so that we may make another attempt to ascertain the efficiency of an Oionos kite flown upside down.

3. I have instructed Mr. Bedwin to make an apparatus to test the sucking-power of the wind upon a tube held with one end pointing the same way the wind blows. To measure vacuum effect & wind. A fine glass tube is to be bent at right angles one arm will be arranged vertically and form the axis of a wind vane. The other arm to have a vane attached to it. The action of the windupon the vane, will turn the open end of the pipe away from the wind so that it will point in the same direction with the wind and the action of the wind should cause air to be sucked out of the tube. The lower end of the pipe forming the axis of the tube is to be placed ina vessel of water and the partial vacuum created within the tube can be measured by the elevation of the water in the tube.

4. I have instructed Mr. Bedwin to make a A pipe of balloon silk is to be made large enough to round the enclose a man's body. which this will be tied round the waist and under the arm pits for the purpose of making a waterproof envelope round the body to contain the aqueous vapour evaporated from the body in perspiration 5 2 a perspiration or from damp clothes within the waterproof envelope. A.G.B.

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INTERESTING ITEMS CULLED FROM THE NEWSPAPERS AND MAGAZINES.

July 5, 1909: — From the Scientific American I learn that an inventor proposes a new form of scratching post for cattle. When the animal rubs against it the pressure squeezes out a linement or healing lotion, soothing to the irritated skin, and sure death on ticks and other parasites. There is really a good idea here. The creatures rub and press the affected part for relief, and the pressure can certainly be made to cause the exudation of a healing or soothing fluid right on the affected part, without be ng wasted upon other parts.

India rubber under tensile strength contracts strongly when its temperature is raised. Professor Sylvanus PL Thompson proposes to utilize this in a thermal engine. Sc. Am. June 19, 1909, p 455.

A starting device for a syphon is shown in Sc. Am June 19 p 464. For example — One end of a syphon is placed in a jar of milk but the syphon is not started b y sucking the other end with the mouth. A rubber cap is fitted over the mouth of the vessel and by pressing this down with the fingers sufficient air pressure is produced within the jar to cause the liquid to rise to the upper bend of the syphon and thus start it acting.

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2 The gyroscopic compass of Doctor Anshuetz-haempfe is declared to be “a brilliant success”. The German Government has decided to abolish magnetic compasses from Warships and adopt the gyroscopic compass.

A 9 lb. wheel, rotated 21000 times per minute by an electric motor, is fitted with a compass card in a holder of mercury. After it has run for about two hours it is set in the direction of the mathematical meridian, which position it keeps unchanged, unaffected by iron or steel in its neighborhood or by the rolling or vibration of the vessel. (Sc. Am. June 5, p 419). This appears to me to be one of the most brilliant discoveries of the 20th Century. If indeed it is not the most important yet made.

Marconi found in 1902 that wireless signals were perceived at night at three times the distance they were in the daytime. Sunlight affects the transmission. (SC. Am. June 5, p 422).

A common cause of indigestion is too much salt. (Sc. Am. May 15, p 367).

We can now obtain drinking cups of parafine for one cent. The cup is thrown away after using. These cups are now being employed instead of a common drinking cup in public places. (Sc. Am. May 15, p 367).

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3 Ice goblets are now made for iced drinks. Instead of putting ice in the liquid the liquid is put in the ice. The cups are provided with paper covers by which they are held. (Sc. Am. May 15, p 374). A.G.B.

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The Condensation of Water By A. G. Bell CONDENSING WATER FROM THE BREATH. Experiments & AG Bell

July 5, 1909 :— Mr. Bedwin reported that after several days trial of the apparatus for condensing water by the heat of the sun a mere trace of moisture was found at the bottom of the submerged jar. I had intended that a bottle with a long narrow neck should have been used but he employed a jar with a wide mouth. The indications are not promising for condensation in quantity without a current of air.

Air, charged with aqueous vapour, should have a motion of translation into the condenser. A much greater amount of water was condensed by breathing into a cool tumbler in a few minutes than several days of operation of the apparatus tried by Bedwin in which there was no current of air.

July 3, 1909:— Last Saturday, July 3, Mr. Bedwin supplied me today with a glass tube having an internal diameter of 2 cm plugged at one end with a rubber cork. This tube was 4 feet long.

A finer tube also 4 feet long and having an interior diameter of 5 mm was slipped inside the larger tube, the upper end being bent at about right angles to facilitate being placed in the mouth. Upon blowing th r ough the fine tube the breath passed down to within about 10 cm of the bottom of the larger tube and then the inner tube-and escaped up the larger tube. Condensation was immediately observed and water began to collect in the bottom of the large tube.

I took these tubes to the Houseboat on Saturday and 10 2 made a number of experiments with them. I shall only here record the results.

After breathing into the fine tube for half an hour the depth of water at the bottom was 2.6 cm from which I calculate a condensation of 15.6 cu. cm. per hour

(2) Upon covering the outer tube with a damp wash cloth the condensation amounted to 16.8 cu. cm per hour.

(3) The large tube was then provided with a water jacket by being placed inside a brass tube having an internal diameter of 10 cm closed at the bottom and filled with cold water. Condensation, determined from a half hour experiment 17.4 cu. cm. per hr.

(4) Experiment 3 repeated with cold salt water in the water jacket and the brass tube placed in a bucket of cold water. In this experiment I breathed into the inner glass tube for one hour and found fresh water filling the lower part of the larger glass tube to a depth of 8 cm from which I calculate a condensation of 24 cu. cm per hour.

The quantity of water condensed in these experiments was much greater than anticipated and indicate to my mind the importance of a current of air.

(5) An empty Poland water bottle was floated in a bucket of cold water with its neck resting on the edge of the bucket. I then inserted the fine glass tube and breathed through it into the bottle.

Result :— 18 cu. cm of water per hour.

(6) I floated upon cold water contained in a bucket, a porcelain lined iron frying pan In a bucket containing cold water , I floated a frying pan of enamelled iron ware, covered over with a porcelain plate. I then inserted the fine a glass tube under one edge 11 3 of the plate and breathed into the frying pan through the tube for one hour.

Result: — Under side of porcelain porcelain plate dry without any signs of condensation s upon it. The bottom of the pan was wet and considerable water had condensed. Poured it into the 2 cm glass tube for measurement and found depth 3.6 cm. from which I calculate a condensation of 11 cu. cm per hour.

All T hese results are very encouraging and show indicate that with proper apparatus a very considerable amount of water may be recovered from the breath.

They also seem to indicate that the moisture charged air should be bodily translated have a motion & translation into the cool receiver . to condense.

There could be no difficulty in continuing such an experiments for hours. I found that I could read a book all the time and the process of breathing out through the mouth and in through the nose was as easy as smoking a pipe. It is simply the reverse action.

It would really be worth while determining how much recoverable moisture there is in the breath. It can hardly be possible that in these experiments with the crude apparatus employed I obtained more than a fraction of the water that could might could be recovered with proper apparatus . with better apparatus

At 50 cu. cm per hour the result of 10 hours breathing would yield 500 grams of water, 46 grams more than a pound. One pound of water per day would go a long way to support life. July 10 , 1909:— Experiments made July 3, 4, and 10 show that we can obtain from

20 to 25 cabin automotive of water per hour with the crudest apparatus. Simply breathe through or tube into a bottle floating on cold water. AGB sup 34

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4 AMOUNT OF WATER LOST BY PERSPIRATION.

9 Considering water from , and from water vapor the evaporation the evaporation from damp clothes. 14

July 3, 1909:— I have, on several occassions, made experiments in the summer time to gain an idea of how much water is lost by perspiration. I weighed myself without clothes, then dressed warmly and walked up the mountain, round the Crown road and back again. I then undressed, dried myself amount only recollection, off, and found that I weighed 3 ½ lbs. less than when I started.

The result varied on different dates but was rarely less than three pounds, and it is obvious that we lose several pounds every day from water evaporating from the body. If any considerable fraction of this water could be recovered by condensation the amount saved would contribute very materially to prolonging life when lost on the ocean without drinking water. It is probable, however, that when a person suffers from thirst the evaporation from the body is very much less than when he is well supplied with water.

But even though we should neglect the normal perspiration of the body as a source of water supply, it would be easy to provide means whereby the avaporation from damp clothes wet with salt water should be carried off and condensed. In this case we would have an external source of water supply, the body merely being used as a heater.

To give definiteness to the conception suppose a man clothed only in his under garments and let these be wet with salt water. The heat of his body will cause evaporation. ? S team will rise from it. This steam 13 5 Dear Ma. Ross: contains onlyfresh water which, if condensed, could be used for drinking purposes.

Well, let him put on over his wet under garments an oil skin coat or at least a cover of water proof material and over this he can put on any other clothes he chooses. Now the space between his wet under-garments and the oil skin coat is filled with water vapour and if a tube were inserted into this space the water vapour could be sucked out and discharged into a cool condenser. All that is necessary is that there should be a current of air to transfer the water vapour into the condenser. and the problem is limited to the simple one of making that current of air. The water vapour could either be sucked out or blown out. For example air admitted into the space round his body would tend to blow out the water-proof jacket if it was tied tightly around the waist and under the arm pit t s and this would cause the delivery of the vapour into a pipe leading to the condenser.

Or, if suction is employed the same effect could be produced without the necessity of t y ing the clothes One means that suggests itself is to prolong the exit pipe from the condenser and hold it away from the wind and the action of the wind would drag air out of the exit pipe and out of the condenser which & its place would be supplied by aqueous the moist air from between the clothing by atmospheric pressure.

This might not perhaps create a sufficient draught for the purpose — especially when there is no wind!

Another method would be to take a tub or bucket 14 6 filled with water and held upside down in the sea. Then if the upturned bucket be lifted partly out of the water the water in the bucket will be at a higher level than the water outside. If now we bore a fine hole in the bottom of the bucket the level of the water inside will fall causing a suction of air into the bucket through the hole. If the exit pipe of the condenser be placed in this hole air will be drawn out of the condenser until the water inside the bucket is at the same level as that outside. The process can then be repeated.

Another method would be to cause the waves to work a pair of bellows after the manner of an experiment made many years ago at Beinn Bhreagh.

There can be no doubt that simple apparatus could be made for the purpose of creating the necessary current power of this , to be worked by the hands or feet ; but all this would be more complicated than an automatic apparatus. The best automatic arrangement would be to utilize the wind. If the action of the individual himself is required the simplest arrangement would be to let the man himself create the necessary current of air by blowing or breathing through a tube. A. G. B. This current & air could be admitted to the space between the damp under-clothes & oilskin jacket and cause ? the discharge the into the of the moisture laden air into a tube leading to the condenser, which might consist of an empty bottle floating on to cold sea-water ? in a or in a bucket. AGB

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Want picture of this Kite. EXPERIMENTS.

Experiments with half sized model of Cygnet II

July 6, 1909:— Experiments were made this afternoon on Baddeck Bay with a half-sized model of the Cygnet II, a practice flight with the Get-Away in tow of the Gauldrie. Indent & close up. This The kite consisted of 738 winged cells. Surface 40 sq. m Weight 60 lbs. or 27240 gms. Flying weight of structure 681 gms. per square meter oblique. ¶ Two lines were attached the F used, the F lying line attached to the front edge of the structure +100 & Kids. was It was 95 meters long and weighed ten 4540 gms pounds. A B ow line attached + 200 cw was also used 100 meters long and weighing 11 4994 gms. lbs.

These lines brought the total weight of kite & up to 81 lbs. or 36774 gms. Flying weight 919 gms

Kite 60 lbs.

Flying line 10 lbs.

Bow line 11 lbs.

Total 81 lbs. or 36774 gms.

This brought the flying weight up to 919 gms. per sq. m oblique.

Experiment 14 — The kite was placed upon the Get-Away which was towed out into Baddeck Bay against the wind by the Gauldrie. The kite was raised by the flying line with the bow line slack. Relative wind Wind, relatively to the kite, 17.6 mph.

17.6 to 17.6 alt Roel

Pull Alt.

30 lbs. 7°

30 lbs. 7°

30 lbs. 6°

35 lbs. 7°

35 lbs. 7°

35 lbs. 10°

30 lbs. 9°

30 lbs. 10°

35 lbs. 10°

30 lbs. 10°

Summation 320 lbs. 83°

Average 32.0 lbs. 8°.3

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2 The kite was then lowered on to the Get-Away without injury.

Experiment 2:— The bow line was then taken off to reduce the weight carried by the kite in the hope of getting higher altitude readings. This brought the weight of the kite & apparatus to 70 lbs. or 31780 gms. Flying weight 794.5 gms. per sq. m.

The kite was easily raised and the following observations were then made:—

Exp. 2 Relative Wind 14.25 M.p.h. to w 14.25 mph alt Ruel

Pull Alt.

40 lbs. 12°

35 lbs. 9°

45 lbs. 8°

45 lbs. 10°

60 lbs. 12°

75 lbs. 18°

50 lbs. 18°

55 lbs. 17°

60 lbs. 16°

60 lbs. 18°

Summation 525 lbs. 138°

Average 52.5 lbs. 13°.8

The Gauldrie was then stopped, the flying line let out and the kite allowed to fall into the water. It fell very gently and rested upon its floats which consisted of two distended tubes of soft rubber. A sea anchor had been provided connecting of a weighted of -cloth this which filled with water and kept held the head down Facing, the wind. . The K ite floated well and lighted so gently that the cells were not even wet. The flying line passed near or over the Get-Away and was caught by the men on board. It was not necessary, therefore, to send a small boat to the kite. It was pulled in gently by the flying line up to the stern of the Get-Away. The tilting arms were lowered and the kite was taken safely on board. without a 17 3 stick broken or a cell wet.

This is the first time that the Get-Away has been employed in recovering a kite from the water.

TO TEST VACUUM PRODUCED BY WIND.

July 6 Experiment 3:—A glass tube about 1 cm diameter was bent at right angles; one arm was held vertically in a vessel of water and the other arm was provided with a vane of aluminum as a wind vane. The whole arrangement was taken on board the Gauldrie which went full speed against the wind in the Bay. The anemometer registering 19 mph.

The water level in the vertical tube did not seem to be affected.

When Mr. Bedwin blew across the open end of the tube the water rose about 6 cm. The wind vane was then held at right angles to the wind so that the wind blew across the open end of the tube. A slight rise in the water level of about 1 cm. was observed.

Then several straight tubes were tried held vertically in the tumbler. In all cases the water rose slightly In the tube of finest diameter the water rose about 1 cm. and in the larger tubes it rose to a less elevation. It is doubt therefore doubtful whether the effect was due to the wind or to capillary action. More probably the latter . glass attracts waters & raises its and where in .

Condensing Water from the breath.

July 6 Experiment 4: :—An experiment was made this evening to ascertain the amount of moisture that can be condensed from the breath. A glass tube 4 ft. long and having an internal diameter of 2 cm. was plugged at one end with a rubber stopper. Another glass tube, also 4 ft. long but bent at about right angles at a point 12 cm. from one end, was placed inside the larger tube. The whole arrangement, 18 4 rubber stopper down, was placed inside a brass tube more than a meter in length and about 10 cm. in diameter. The brass tube was then filled up with broken ice. Cold water was then poured in and finally a handful of salt to make a freezing mixture.

Douglas McCurdy and I then took turns in breathing into the inner glass tube. The experiment lasted for one-half hour and resulted in a collection of water at the bottom of the 2 cm. tube having a depth of 3 cm. This yields a rate of condensation of about 18 cu. cm. per hour.

This is about the same rate obtained at the House-Boat without any freezing mixture, and probably represents pretty fairly the amount of moisture that can be condensed from the breath in ordinary gentle breathing.

It may be well to ascertain whether the amount can be increased by rapid breathing or blowing.

Mr. Bedwin has fitted a rubber stopper to the end of a 12 ft. aluminum pipe of considerable diameter. It should be possible with this arrangement to get the maximum condensation possible. A.G.B.

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1909, July 8 Thursday At Beinn Bhreagh.

July 7, 1909 :—Have instructed Mr. Bedwin to make a bridge of tetrahedral cells to be flown upside down for the purpose of ascertaining the relative efficiencies of winged cells flown right side up and upside down. The bridge is to be provided with a tail, as in the case of an Oionos structure. A.G.B.

Sc. Am. May 29 p 403 Dr. Davenport says "two parents with clear blue eyes and yellow or flaxen hair can have children only of the same type no matter what the grand-parental characteristics were: That dark-eyed and dark-haired, curly-haired parents may have children like themselves, but also of the less developed condition.".

D ry soot in test tube stopped by rubber cork through which passes fine glass tube forming a mercury ga ra u ge.

Try test tube of slight capacity — and bottle of larger capacity.

A series of glass vessels containing soot or lamp black terminating in fi ? n e noggles turned at right angles.

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2 Concentrate a beam of sunlight by means of a large lense (or concave reflector) so that the focal point comes upon the soot in A. The intense heat will cause the expulsion of a jet of air thus turning the wheel as shown by arrow-head bringing B up to the focal point. Result:— Should not the wheel be thrown into continuous rotation? I assume that the cooling process will be much slower than the heating process so that the indraught into A

as it cools will not retard the rotation as much as the heating process accelerates it. Could make a sort of Turbine out of this. A will be cool by the time it returns to the focal point.

If cooling is as a rapid as heating process — this would not work unless valves could be employed — and two outlet no gg zz les be provided for each receiver — one on either side — one opening to pressure from within the other to pressure from without.

A solid plate could be provided for jet to re-act against where focal point comes — and no plates in positions where there would be an in-draught. No reciprocating motions — a pure turbine action. Reciprocating action confined to the air in each chamber. Alternate expansion and contraction is a reciprocal process — analagous to the too and fro motion of a piston — but there would be less 22 3 objection to this on account of the less mass moved backwards and forwards.

Colored gases like Iodine, are very sensitive to radiant energy.

Feel sure that all the power of a steam-engine can be developed by powerful heat generated in the cylinder itself. We have at command (1) radiant energy focused through the transparent wall of a cylinder — and (2) electrical energy sending rendering a solid incandescent in the cylinder.

The electrical method always available — not dependent upon the sun's rays.

Reservoir bellows of organ. Intermittent action of small bellows converted into continu ous action in reservoir bellows. Could not intermittent action of small receivers cause continuous compression in a larger receiver.

A.G.B.

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Discussion reported by M. B. McC Sec.

The changes that have improved the efficiency and & handling have by no means improved the stability of the mean the omission of a finest tail, and the obstacle of under it more unstable in the fore and aft direction, & the omission of vertical surfaces, has safeguard against instability the stability & the as a whole now depends exclusively upon the skill of two

I don't think it sake to make an aerodrome that A.G.B. won't fly as a kite. I mean the model of which won't fly as a kite.

McC. Bet you a dollar the Silver Dart won't fly as a kite and yet she is safe enough as an aerodrome.

A.G.B :—That's just where I differ from him you—I don't think her safe. h H er equilibrium depends upon the skill of the aviator and not upon the machine ; and that is my objection to all the aerodrome of that type or of simil i ar type like theWright Bros. Machines

Bedwin:— What about the monoplanes then?

A.G.B.— I h ave the same objection to the monoplanes.

Bedwin: — Don't you think the Silver Dart would fly as a kite with a tail behind her?

A.G.B. :— Not a bit of its Not a bit of it. The tail would certainly improve its longitudinal stability but it lacks lateral stability. Once tipped a little on one side it would tend to slide down hill to sideways towards the ground.

Bedwin:— Woudn't a vertical surface cure that?

A.G.B. :) Vertical surface would greatly improve it but it is very difficult to get anything satisfactory out of a single celled Hargrave box kite and it would practically be that. The vertical surfaces would certainly prevent the her thing from sliding down as quickly to one side as if they were omitted altogether : —

An Oionos kite, if not loaded often in the middle, sometimes turns over on its one side , but it has not the no tendency to dive down that always as a kite of the Silver dust would do. way an Oionos kite, when tiffed over from some cause or other, actually continue s s flying on its side on account of the large amount until the disturbing have disapproved when it gradually rights itself again. This may he due to the cause amount of resolved vertical surface. What would I consider it the Oionos a safer form than the Hammondsport type of machine.

The Kite of pure tetrahedral construction come out in such marked contrast 24 2 to all the other forms I know of in as possessing good lateral stability that I consider it very important to that we should study the conditions required to give it such a kite efficient engine power. This, however, must be experimental work and should constitute the main work of the Laboratory This should constitute out & too main problems before the Laboratory this summer. the Laboratory this summer.

The Oionos form with a horizontal tail seems to me, although somewhat imperfect in lateral stability, to be superior in that respect to the Hammondsport type of structure , and to give promise of greater lifting power and with less head resistance. It would however require be advisable I think to use lateral rudders at least at first to control make sure of the lateral stability , and a fixed horizontal tail to secure equilibrium in the fore and aft direction. Later, when the aviator gains experience, the time could be omitted if deemed desirable in the interests & speed.

McC: — With a double surface machine without any verticals, what is going to cause it to upset laterally as a pure flying machine not as a kite?

A.G.B.: — A hundred things. For example, a squall of wind on one side may cause it to tip slightly from the horizontal position ; and when tipped , from whatever cause , gravity tends to make it slide down ill sideways.

McC :—But it would also tend to right it because the centre of pressure that way would cause it to advance towards the down end.

A.G.B. :—Not gravity, but momentum the horizontal component of its motion. Gravity simply tends to bring it down and it is only when it has horizontal momentum that but when, in falling, it has acquired horizontal as well as vertical motion the horizontal component & its motion leads to a lateral & the center & pressure. Then it would commence to rise up again. The whole machine would then tend to fall with an oscillat ing motion. now note & then, the other — a dangerous We are talking here, of course, of the natural automatic actions. Of course, by the action of moveable rudders the skill of the operator comes into play . When we use lateral rudders them the skill & the aviator course into play to neutralize the dangerous tendencies. My objection to the type comes of machine arises from the fact that safety depends so exclusively upon skill. Witness what happened to a Wright machine when 25 3 the Italian aviator lost consciousness.

Continued on next page

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4 discussion continued

July 8, 1909: McC. — It is impossible when a machine is flown as a kite to subject it to the side action of a wind because necessarily the kite flies in the eye of the wind so we don't know how that would act; whereas in a free machine the conditions are different.

The kite is subjected also to side gusts from squalls , bus as McCurdy remarked it is not subjected to the side A.G.B. action of the a continuous wind , but it is the If sudden gusts that however are the chief disturbing elements.

The momentum of the kite would keep it from going McC. the most, of the kite in a continuous wind it would be overcome.

I think a free flying machine would be more stable A.G.B. than a kite in gusts because it possesses momentum whereas the momentum of a kite is nil l . At least it has no momentum relatively to the earth.

The momentum of a kite is relative to the wind to Bed. the same extent w t h a t the momentum is a free flying machine is relative to the wind I should think.

A.G.B. It may be so ; but I have a suspicion that it is not.

I don't t hink it is. I think that the velocity of a flying machine is always along the line of its advance. McC. Whereas in the case of a kite its velocity in one instant is in a certain in direction and if a squall comes from another direction, it is in that direction the direction & its velocity relatively to the air is changed.

Bed. I was speaking of steady wind.

It is like taking Cygnet II and flying up it from McC. one end.

A.G.B The momentum of a heavy body moving , so that say with a velocity of 20 miles an hour is very different from the momentum 27 5 of a lighter body , say the wind , moving at the same A.G.B. velocity.

The pressure on the surfaces would be the same, Bed. would it not?

Yes, the pressure on the surfaces would be the same. I am extremely doubtful whether the pressure on the surfaces is the only source of support in a free flying machine and am inclined to think that the momentum of the machine is itself a source of support. ¶It is gravity that is the great obstacle A.G.B. to flight ; and the constant of acceleration of gravity is only 32 ft. per second or 21.8 miles per hour (I think about 21 miles an hour). And I imagine that a flying machine whose velocity exceeds the constant of acceleration of gravity has , in its surplus velocity and momentum , a source of support against gravity quite independently of the Aerial Pressure. so that i I f you can get a speed of 40 miles an hour , as you do with the Silver Dart , almost anything would fly — Mr. Bedwin says a barn door for instance. The supporting surface s in such a case become sources of retardation of the machine can be supported in the air at a lower velocity and the thing would fly better with out such surfaces. them, or at all events with less surface. A stone flies very well without supporting surfaces at all when it has considerable sufficient velocity.

It is always coming down though. Gravity always McC. acts at right angles to your push.

AGB I don't think it is always coming down. Support you fire a bullet up at an angle with the horizon, one the vertical element of its motion is directly opposed to gravity and the bullet is not, as a matter of fact, falling in respect to the earth only until its upward tendency to motion is less than the downward motion tendency due to gravity. ¶One would naturally suppose 28 6 that the body of a crew would bob up and down with each motion of its wings , but if the propelling forc e re -acts serve to be applied A.G.B. upwards at an angle & we can easily see how the body may be actually performing a horizontal motion pursuing a strictly horizontal , as it is seem to be doing in actual flight , as a resultant of the upward & downward tendencies the wind much upwards say forward angle. The downward pull & gravity the vertical components & the leaving the horizontal component .

It seems to me we are getting off the subject if , into deep water, and of four subject, if indeed, we had any subject to start with.

I would like to make a suggestion. That is that we know practically what weight we want to support , and we know practically that velocities we can get , hence we know McC. about how much material we want, how much cloth we want , etc., and if we don't decide what how the exact design of the structure we want etc. , and then we can at all events get the materials right away. It takes such a long time to get the , and they should be ordered now.

[Mr. Bedwin has

[It must that

N.B. [It was finally agreed that Mr. Bedwin should order at once a sufficient amount & fish-shaped street material, and of sail-cloth like that on the Baddeck No 1, to complete the proposed Aerodrome of the Oionos model type without waiting for the completion & the plans. This aerodrome will be discussed to lift the Query out of the water, or to lift or truck with wheels or may be upon later on preferred . M.M.McC.]

Mr. Bedwin has also been requested to build a half-sized model & the proposed aerodrome so that its flying qualities as a kite may be tested by experiment. M.B.McC.]

29

1909, July 10 Saturday At Beinn Bhreagh. TRIPS OF THE GAULDRIE

July 10, 1909: — I find from Mr. Byrnes that the present hours of the Gauldrie are in-convenient for a large number of people who commence work on Beinn Bhreagh at 7 a.m. and leave at 6 p.m. and we have therefore been discussing how to arrange the trips of the Gauldrie so as to be convenient for everybody.

We have decided that, in addition to the present trips, the Gauldrie will make two other trips in the morning and evening.

Morning trips: — 1. Leave Beinn Bhreagh Central Wharf at 6:20 a.m. returning leave Baddeck 6:40 a.m. to bring over persons who commence work here at seven.

2. Leave Beinn Bhreagh 7 a.m. to take mail and passengers to the Steamer Blue Hill returning leave Baddeck 7:40 a.m. to bring over persons who commence work on Beinn Bhreagh at 8 a.m.

For the convenience of the whole estate these trips will be from and to the Central Wharf alone.

Evening trips: — 1. Leave Central Wharf at 5:15 p.m. returning immediately.

2. Leave Beinn Bhreagh 6:15 p.m. returning immediately upon the receipt of the mail.

These will be the regular trips of the Gauldrie leaving it free from 8 a.m. to 5 p.m. for the use of the family or for other purposes as arranged by Mr. Byrnes.

30

FORMAL BULLETINS FOR BEINN BHREAGH.

July 13, 1909: —I am still uncertain as to the details of the proposed formal Bulletins for Beinn Bhreagh. Knowing the amount of labor involved I hesitate to begin until I have well considered the details of the plan.

In the days of the A.E.S. an absolute necessity existed for the appearance of the Bulletin in order to secure records of experiments, thoughts, discussions, etc. Until we had the A.E.A. Bulletin we had no satisfactory record of what was done by the associated and the work of the Association during the pre-bulletin period remains today practically a blank.

Now that we have to deal with my Laboratory alone and my own experiments, thoughts, etc. the same necessity does not exist for a formal bulletin.My note books are sufficiently full to afford at any time a record of what is being accomplished in the Laboratory and what is proposed. These records,however, however, existing as they do in what might be more properly called “Scribbling Books”, are not in good form for permanent preservation and examination by others. It might be a good plan to get out a bulletin putting in permanent form and in readable form a sort of summary of what is being done in the Laboratory, and of the various thoughts and suggestions made by me or by others which would seem worthy of being recorded in more dignified form than is possible in a scribbling book.

31

2 Of course the scribbled notes are of more value as a record, and as evidence of reduction to practice and I preserve them all; but they are of a private character not suitable to be submitted to others. It would be well, on my own account, and on account of the Laboratory to supplement with these by proper t ly written descriptions of important points illustrated by diagrams and photographs in a book that should be intended to place before others the work of the Laboratory etc. and to give expression to thoughts and investigations of various kinds in a form suitable for publication should the time ever come for printing such records.

Whether it would be wise for me to fetter myself by attempting to issue a regular weekly bulletin are is very uncertain. I am inclined to think that I should prepare these notes as the spirit moves me very much on the line of my “Dictated Notes”. Only the matter should be more carefully prepared with the view of possible publication. These notes should be paged consecutively and ultimately be bound up into a volume. A sufficient number of copies should be made to secure preservation.

My idea is now not to issue a periodical but a book. I would simply contribute material from time to time upon all the various subjects that interest me. It would not be a record of everything that is done in the Laboratory but an account suitable for publication of completed work and of thoughts. The experiments noted should not be given with the detail necessary for a record but should be in the nature of a general summary in completed language 32 3 giving the results rather than details and referring, where advisable or necessary, to my private note books for the details.

I think that three copies will be sufficient to secure preservation, if kept in three different places to avoid the possibility of destruction by fire. One original and two carbon copies. The original can be press-copied which will secure a fourth copy.

I will therefore ask Miss McCurdy to provide three black portfolios for the three copies; and a special letter presscopy book for the letter press copy.

The only other thing to do, to give it a name. I am inclined to think that a modest title would be “The Beinn Bhreagh Notes”. Miss McCurdy suggests “Beinn Bhreagh News”. We can put down a number of titles for consideration. How about “Thoughts and E xperiments”, “Beinn Bhreagh Journal”. A.G.B.

33

1909, July 14 Wednesday At Beinn Bhreagh. ITEMS FROM HOME NOTES.

July 9, 1909:— Mrs. Gilbert H. Grosvenor had a little boy baby born here this afternoon at Beinn Bhreagh Hall, Friday, July 9, 1909, somewhere about three o'clock in the afternoon.

At the invitation of the Canadian Aerodrome Company a large number of persons came over from Baddeck this afternoon (July 9) to see the new aerodrome which is to be crated to-morrow for Petewawa. This is the first aerodrome of exclusively Canadian manufacture. Mr. Douglas McCurdy presided very gracefully, explained the new points about the machine, and answered questions. The company then adjourned to Mr. Baldwin's Bungalow, where afternoon tea was served by Mrs. Frost, and Miss Georgina McCurdy.

July 9, 1909: — Subjects for expansion:—

1. Cygnet II and experiments with pure tetrahedral construction.

2. Oionos construction and experiments relating thereto.

3. Work of Canadian Aerodrome Company.

4. Experiments with hydro-surfaces.

5. Hydrogen-vacuum balloons.

6. Power from radiant light and heat.

7. Power from electric heaters.

8. Power from atmospheric pressure.

9. Distillation of water at low temperatures.

10. Sanitary methods of disposing of sewage matter.

34

2 July 10, 1909: — New time table completed for regular trips of the Gauldrie to and from Baddeck.

July 11, 1909: —Condensing water from the breath. Experiments were made to-day (Sunday) at House-Beat. A bottle was floated in a bucket of cold water with the neck resting on the edge of the bucket. I then breathed A glass tube was then arranged with one end in the floating bottle and the other end in my mouth and experiments were made to ascertain the amount of water obtained by forcible blowing, by gentle breathing, and by rapid breathing but not with force.

To determine these three points three bottles were used and the water preserved for measurement at the Laboratory.

The following were the results—

1. Forcible blowing. Total time consumed one hour, thirty minutes. Amount of water condensed 33 gms. Rate of condensation 22 gms. per hour.

2. Gentle breathing at natural rate. Total time one hour. Water condensed 14 gms. Rate 14 gms. per hour.

3. Rapid breathing., but not blowing. Time one hour. Water condensed 20 gms. Rate 20 gms. per hour. I tasted the water in these—cases and found it to be fresh, and pure and good with no taste whatever. A.G.B.

July 12, 1909: —

Hon. A. C. Ross came to Beinn Bhreagh this afternoon and conferred with Mrs. Bell about water supply for Baddeck.

35

3 EXPERIMENTS JULY 10, 1909.

OIONOS KITE UPSIDE DOWN.

July 10, 1909: — Mr. Bedwin made experiments to-day on the kite field with the Oionos kite flown upside down.

Conditions:— Weight 13118 gms. No details given concerning flying lines used or their weights. This kite has horizontal surfaces equal to 6.2500 sq. m. horizontal and oblique surfaces equivalent to 8.0161 sq. m. oblique. The flying line was attached at a point +50 cm. FL BL 250 —

Exp. 1 w 9.92 mph Exp. 2 w 12.45 mph. Exp. 3 w 12.85 mph. Exp. 4 w 11.5 mph Pull Alt. Pull Alt. Pull Alt. Pull Alt 40 23 20 17 40 22 24 24 10 22 30 20 32 26 16 20 10 19 10 19 50

27 8 16 20 17 40 30 40 17 15 12 24 31 40 19 10 9 26 27 24 19 30 12 24 27 40 15 30 13 8 17 8 12 40 17 40 29 50 19 20 16 32 27 40 24 225 160 316 263 270 185

Bedwin's Notes: — Exp. 1. Kite acted very uneasily sailing from side to side quite a lot. Exp. 2. Kite came down after third reading. Exp. 3. Had to nurse kite several times to keep it in the air. Exp. 4. After this series was completed another reading obtained:— Pull 24, alt. 20. After this kite came down of itself and the experiments were discontinued.

36

4 Experiments made July 12 1909.

OIONOS KITE FLOWN UPSIDE DOWN.

July 12, 1909: —Mr. Bedwin made experiments to-day with the Oionos kite flown upside down, on the kite field.

Conditions: — Kite weighed 13118 gms. Horizontal surface 6.2500 sq. m. (horiz.), oblique surface 8.0161 sq. m. (oblique). A single line was used attached at a point +50 cm.

In the first experiment kite was flown by Manilla rope 100 m. long weighing 4852 gms. FL BL C50

Exp. 1 w 11.50 mph.

Pull Alt.

40 21

50 24

20 25

40 21

10 22

8 14

16 12

21 10

30 17

<u>40 17</u>

275 183

The Manilla rope was thought to be too heavy for the light wind, so kite was taken down and a flying line was substituted of small white chord 100 m. long weighing 1053 gms. and attached at +50 cm. (See Over)

37

FL <u>BL</u> C50 37

Exp. 2 w 12.90 mph. Exp. 3 w 9.40 mph Exp. 4 w 10.50 mph Exp. 5 w 12.40 mph Pull Alt Pull Alt Pull Alt. Pull Alt. 30 29 20 33 40 34 30 30 50 34 35 36 30 36 50 38 50 35 40 37 30 35 20 34 20 36 30 37 25 37 20 37 35 37 45 35 35 39 40 36 20 37 50 38 40 39 30 40 35 36 35 37 35 36 20 36 50 34 45 36 40 38 50 37 40 32 40 34 45 35 45 36 45 35 30 32 30 35 40 35 375 345 370 355 350 364 345 359 Exp. 6 w 11.00 mph Exp. 7 w 1.40 mph Exp. 8 w 13.10 mph Exp. 9 w 11.20 mph. Pull Alt. Pull Alt. Pull Alt. Pull Alt. 30 35 40 35 24 34 40 37 40 36 32 34 30 30 35 33 45 32 30 36 40 30 30 35 40 30 40 30 45 19 40 36 20 33 24 30 40 25 24 36 30 32 40 34 50 32 30 33 50 30 35 35 40 31 30 31 40 31 30 38 30 30 30 33 30 32 40 40 40 32 40 35 30 30 35 30 45 30 45 30 355 321 346 342 384 293 344 339 Exp. 10 w 11.30 mph Exp. 11 w 10.50 mph. Pull Alt. Pull Alt. 40 40 40 30 40 36 45 34 35 36 24 32 40 35 30 30 40 32 30 31 45 34 40 37 40 33 24 36 24 32 45 32 16 31 30 31 45 34 45 33 365 343 353 326

For Summary tables see over

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6 July 12 1909: —

SUMMARY OF EXPERIMENTS 2 — 11.

Exp. Wind Pull Alt. 2 12.90 37.5 34.5 3 9.40 37.0 35.5 4 10.50 35.0 36.4 5 12.40 34.5 35.9 6 11.00 35.5 32.1 7 10.40 34.6 34.2 8 13.10 38.4 29.3 9 11.20 34.4 33.9 10 11.30 36.5 34.3 11 10.50 35.3 32.6 Summation 112.70 358.7 338.7 Average 11.27 mph 35.87lbs. 33°.871lbs.

In the above summary each reading of pull and altitude is the mean of 10 observations. In calculating the average each reading has been considered as a single observation. Each reading of wind is taken upon a single observation; each reading of pull and alt. is the mean of 10 observations so that in the case of the average of the whole the readings of pull and altitude represent the mean of a hundred observations; the reading of wind, the average of 10.

Weight lifted.

Kite 28.9 lbs.

Flying line 2.5 lbs.

Vertical pull 20.1 lbs.

Total Lift 51.5 lbs.

Drift 29.8 lbs.

Efficiency = 51.5 29.8 = 1.7

39

7 Flying weight:— It is difficult to ascertain the flying weight of an Oionos structure because some of the surfaces are horizontal and some oblique. In this case we have

6.2500 sq. m. of horizontal surface, and 8.0161 sq. m. of oblique surface making a total amount of nainsook used on the surfaces of 14.2661 sq. m.

Considering the oblique surfaces as equivalent in supporting power to their horizontal projection the 8.0161 sq. m. oblique are equivalent to 4.6250 sq. m. horizontal. In this manner estimating the total surface on the horizontal plan and on the oblique plan we reach the following results.

SURFACE.

(On horizontal plan)

Horizontal surfaces = 6.2500 sq. m. horiz.

Oblique surfaces = = 4.6250 sq. m. horiz.

Total 10.8750 sg. m. horiz.

(On oblique plan).

Horizontal surfaces = 10.8332 sq. m. oblique

Oblique surfaces = 8.0161 sq. m. oblique.

Total 18.8493 sq. m. oblique

FLYING WEIGHT.

The flying weight of the kite structure alone without the flying rope is, on the horizontal and oblique plan, as follows:— 40

8 (On horizontal plan)

Weight of kite 13118 gms.

Surface 10.9 sq. m. horizontal

Ratio 1203 gms. per sq. m. horizontal

(On oblique plan)

Weight of kite 13118 gms.

Surface 18.8 sq. m. oblique

Ratio 698 gms. per sq. m. oblique.

The total lift, including weight of kite, flying line and the vertical pull of the flying line, in an average wind of 11.27 mph, amounted to 51.5 lbs. or 23296 gms. The total surface of the kite amounted to 18.8 sq. m. oblique, so that the total weight lifted in an 11 mile breeze amounted to 1237 gms. per sq. m. oblique.

If the weight lifted increases as the square of the wind velocity then if we double our wind velocity the weight lifted would be fourfold. That is:— Should the wind velocity be 22.54 mph the total weight lifted should amount to 4948 gms. per sq. m. oblique, which is about 1 lb. per sq. ft. oblique. A.G.B.

The Drift also should increase as the sq. of the wind velocity so that at 22.54 mph the drift should be 119.2 lbs. In actual practice it would probably be much less than this because the kite could fly at a higher angle of altitude. A.G.B.

41

9 Experiments made July 12, 1909.

HALF-SIZED MODEL OF CYGNET II.

July 12, 1909: — A practice flight was made this afternoon with a half-sized model of the Cygnet II on Baddeck Bay. Mr. Bedwin in charge. The kite was placed upon the Get-Away which was towed against the wind by the meter boat Gauldrie.

Conditions: — The kite is composed of 738 winged cells forming a hollow bridge. There are 32 cells on the top layer. There are eight layers of cells the lowest having 25 cells from side to side and 8 cells from fore to aft. Weight of kite 27240 gms. (60 lbs. oblique. Surface 40 sq. m. oblique. It was flown by two lines. The flying line of Manilla rope, attached at point +100 (the front edge of the structure) was 100 meters long and weighed 4852 gms. (10.7) lbs.). The bow line, attached at point +200, was 105 m long and weighed 5290 gms. (11.7 lbs.).

When the Gauldrie was fairly in position in the middle of the Bay and going directly against the wind the tilting arms of the Get-Away were lifted and the kite at once took the air. The following experiments were then made:—

Flying line 4.85219 5.29019 (See over)

42

10 1909, July 14 Wednesday At Beinn Bhreagh.

(Experiments July 12 with half-sized model of Cygnet II).

Exp. 1 w 17.10 mph Exp. 2 w 15.60 mph Exp. 3 w 15.16 mph Exp. 4 w 17.00 mph. Pull Alt. Pull Alt. Pull Alt. Pull Alt. 75 18 65 15 70 15 75 17 70 16 70 16 70 14 70 15 70 15 65 16 70 15 70 15 65 17 60 15 65 15 75 16 70 16 70 15 70 15 70 17 75 15 70 15 70 14 70 16 75 15 70 16 75 16 65 15 70 15 75 14 75 17 65 14 75 16 70 14 75 16 60 15 60 15 70 16 70 16 65 15 705 158 685 152 710 153 685 155 Exp. 5 w 16.25 mph Exp. 6 w 17.50 mph Exp. 7 w 16.40 mph Exp. 8 w 17.60 mph Pull Alt. Pull Alt. Pull Alt. Pull Alt. 60 16 70 17 65 15 65 17 65 14 70 15 60 16 60 15 70 15 75 16 70 15 65 13 75 15 70 14 65 15 60 14 75 16 65 15 70 16 60 14 70 16 65 16 70 15 65 13 75 17 65 14 75 16 60 14 75 15 60 14 75 14 75 15 70 16 60 15 70 14 65 15 70 17 60 14 65 14 75 15 705 157 660 150 685 150 650 145 Exp. 9 w 18.00 mph. Exp. 10 w 16.25 mph Pull Alt. Pull Alt. 75 15 50 12 75 15 50 11 70 14 55 11 70

14 45 10 70 15 60 10 65 15 55 12 70 14 50 11 60 14 50 11 55 15 55 11 55 13 45 10 565 144 515 109

Note by Bedwin:— Kite brought down on Get-Away arms direct. Nothing broken. Not a hitch in the whole experiment.

(Summary see over)

43

11 In the following summary each reading of pull and altitude represents the mean of 10 observations.

SUMMARY

Exp. Wind Pull Alt. 1 17.10 70.5 15.8 2 15.60 68.5 15.2 3 15.16 71.0 15.3 4 17.00 68.5 15.5 5 16.25 70.5 15.7 6 17.50 66.0 15.0 7 16.40 68.5 15.0 8 17.60 65.0 14.5 9 18.00 66.5 14.4 10 16.25 51.5 10.9 Summation 166.86 666.5 147.3 Average 16.69 mph 66.65 lbs. 14°.73

WEIGHT LIFTED.

Kite 60.0 lbs.

Flying line 10.7 lbs.

Bow line 11.65 lbs.

Vertical pull 17.35 lbs.

Total Lift 99.7 lbs.

D

Drift 64.7 lbs.

Efficiency = 99.7 -64.7 = 1.54

The kite lifted a total weight of 99.7 lbs. or 452638 gms. including kite structure, flying line, bow line, and the vertical pull of the flying line. The surface was 39.9 sq. m. oblique. Thus the weight lifted was 1134 gms. per sq. m. oblique at wind velocity 16.69 mph A.G.B.

44

1909, July 15 Thursday At Beinn Bhreagh Experiments July 13 with Oionos kite upside down.

July 13, 1909: — The white upside down Oionos kite was taken out on the Bay to-day and flown from the Get-Away in tow of the Gauldrie. Kite weighed 13118 gms. (28.89 lbs.) Flying line of Manilla rope attached to +50 cm. was 100 m. long and weighed 4852 gms. (10.7 lbs.). A bow line was also used attached at +150 cm. 103 M . long weighed 1085 gms. (2.4 lbs.).

Kite had 6.2500 sq. m. of horizontal surface; and 8.0161 sq. m. of oblique surface. Total surface equivalent to 10.8750 sq. m. horizontal, or 18.8493 sq. m. oblique.

The object of the experiments was to ascertain the efficiency of the Oionos structure in a wind of higher velocity than that which could be obtained upon the kite field. Out on the Bay we could obtain a resultant wind equal to the true wind plus the velocity of the Gauldrie.

It was my intention that there should have been no differences between the equipment for the experiments made July 12 and those made July 13 so that the only difference in the com b b ination tried should be the velocity of the wind element. Mr. Bedwin, however, fearing that the light line used July 12 would be too weak to support the strains with a higher wind velocity used a Manilla rope weighing 10.7 lbs. and also a bow line weighing 2.4 lbs. thus increasing the weight of the lines used from 2.5 lbs. (July 12 to 13.1 lbs. July 13. The conditions July 13 were thus 45 2 materially different from those July 12 in other respects than the wind velocity and the experiments will have to be repeated at some future time with exactly the same conditions as on July 12 in order to get the effect, upon the efficiency of a kite, of the wind velocity alone.

Experiments with Oionos kite upside down, July 13. FL BL 250 C150

Exp. 1 w 13.95 mph Exp. 2 w 22.18 mph Exp. 3 w 21.85 mph. Exp. 4 w 18.10 mph. Pull Alt. Pull Alt. Pull Alt. Pull Alt. 35 21 40 23 30 18 30 13 45 21 40 22 35 19 30 15 35 20 45 19 30 18 25 14 30 21 35 22 30 17 20 14 35 22 40 21 30 16 25 15 45 22 40 22 25 15 20 13 40 22 40 21 25 14 20 13 40 22 40 22 30 12 20 12 30 22 35 18 30 13 25 11 35 21 35 20 25 14 220 13 370 214 390 210 290 156 235 133 Exp. 5 w 18.60 mph. Exp. 6 w 18.25 mph. Exp. 7 w 19.20 mph. Exp. 8 w 19.40 mph. Pull Alt. Pull Alt. Pull Alt. Pull Alt. 20 12 20 12 25 16 20 15 25 13 25 14 30 15 20 14 25 14 25 16 25 14 30 15 20 14 20 14 25 14 20 15 25 13 20 14 25 15 25 14 20 14 25 14 20 14 25 14 25 14 25 13 20 15 20 15 25 14 20 12 25 14 25 15 25 15 20 14 20 15 20 14 25 14 20 15 25 15 20 15 235 137 220 138 240 147 225 146 Exp. 9 w 19.00 mph. Exp. 10 w 19.40 mph. Pull Alt. Pull Alt. 25 15 25 15 25 14 20 15 20 13 25 16 25 15 25 15 20 14 25 14 20 14 20 13 25 15 25 14 20 14 20 13 25 14 25 12 130 25 14 142 230 20 12 139

Bedwin reports pull and altitude as remarkably steady; the variations of pull being apparently chiefly due to the motion of the motor boat Gauldrie on the rough water of the Bay.

(Summary, see over)

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SUMMARY

Exp. Wind Pull Alt. 1 13.95 37.0 21.4 2 22.18 39.0 21.0 3 21.85 29.0 15.6 4 18.10 23.5 13.3 5 m18.60 23.5 13.7 6 18.25 22.0 13.8 7 19.20 24.0 14.7 8 19.40 22.5 14.6 9 19.00 23.0 14.2 10 19.40 23.0 13.9 Summation 189.93 266.5 156.2 Average 18.99 mph 26.65 lbs. 15°.62

Estimate of Efficiency

Sin..276 Vert. 7.3416 lbs

Alt. 16° Pull 26.6 lbs.

Ces..961 horiz. 25.5626 lbs

Weight Lifted

Weight of kite 28.89 lbs.

Weight of flying line 10.70 lbs.

Weight of bow line 2.40 lbs.

Vertical pull 7.34 lbs.

Lift 49.33 lbs.

Drift 25.56 lbs.

Efficiency = 49.3 25.6 = 1.9

The efficiency determined July 12 was 1.7 with an average wind velocity of 11 . 27 mph. Efficiency determined July 13 was 1.9 with wind of practically 19 mph. Thus the efficiency was greater in the greater wind but this result is complicated by the greatly increased weight of flying line used. It need hardly be said that 13.1 lbs. weight of rope placed further forward than the center of surface must have considerably affected the position of the center of gravity of the kite bringing it further forward in 47 4 experiments July 13 than in July 12. The displacement must have been considerable because the lead of the flying line employed equalled nearly one-half of the total weight of the kite.

From my general recollection of past experiments I should say that the efficiency of a kite is affected by the position of the center of gravity, by the point of attachment of the flying line, and by the wind velocity. and altitude.

In determining the effect of any one of these elements the other elements of the combination should be retained unchanged. See U.E.A Bulletin VIII for conclusion experiments.

Baldwin thought that by ascertaining the drift when the flying line was attached at the extreme end of the bow we would ascertain approximately the push necessary in a propeller to sustain the kite as a free flying machine; but, if my recollection is correct, the efficiency of a kite increases as the point of attachment of the line is made further and further back in the kite until the central point of the kite is reached when the efficiency would equal the lift, Drift at this point being zero. AG.B.

Baldwin's idea seemed to be to get such a condition that the Lift element represented by the vertical pull of the flying line, should equal zero so that the total Lift should equal the weight of the kite and attachments. Considering then the weight of the kite and attachments as the weight of a free flying machine the pull of the flying line would represent the push of the propeller.

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5 I am inclined to think, however, that as the efficiency of the whole combination increases with the altitude we would obtain a better idea of the propeller thrust required by taking high altitude readings and then calculating the drift. It is the drift element that corresponds to the thrust of the propeller.

When a kite flies at a low altitude so that the wind can hardly support it the kite surfaces are very much inclined to the horizon. As the wind increases in strength the kite rises to a higher altitude and the kite surfaces become less inclined to the horizon taking nearly a horizontal position as the angle of altitude approaches 90°.

Take extreme cases kite line horizontal, kite surfaces tend to be vertical. Kite line vertical, kite surfaces tend to become horizontal. The more nearly the kite surfaces become horizontal the greater is the lift as compared with the drift. That is, the efficiency is greater.

I have been much troubled at the difficulty of measuring the inclination of the kite surfaces to the horizon; but when I come to think of the matter it is practically immaterial to do this for the kite will ascend to a position of balance and the angular altitude tells the whole tale. A.G.B.

High altitude readings more important than low.

We have made numerous observations of an Oionos kite flown right side up. The result of one set of observations gave an efficiency of 2.7 (A.E.A. Bul. XXX, p 18), another an efficiency of 2.4 (A.E.A. Bul. XXXIV, p 18)

49

6 The July 12 experiments with an Oionos structure upside down yielded an efficiency of 1.7 and the experiments of July 13 an efficiency of 1.9.

The indications are that the Oionos form is more efficient with the larger surfaces above (right side up) than with the large surfaces below (upside down). From which it follows that in the double Oionos form, which we are proposing to use in the Oionos aerodrome, the upper half of the structure would be less efficient than the lower half; and it becomes a point of consideration as to whether it would not be better to stick to the regular form. That is, if we use a triplane, would it not be better to make the highest plane the largest, the lowest plane the smallest and the intermediate plane, intermediate.

We also propose to use upon the new aerodrome aero-curves instead of aero-planes. We have made a few experiments with an Oionos kite having aero-curves which seem to justify this departure. With a very crudely constructed apparatus of this kind we obtained an efficiency of 3.1 (A.E.A. bul. XXXVII, p. 7). This result, however, was determined from only three series of observations and with low wind velocities. I think we should ma d k e another model and multiply observations upon it.

One result, which is of significance, if it can be relied upon from so few observations, is the importance of taking a high altitude. In Bulletin XXXVII page 8, the observations are grouped into three classes. Those in 50 7 which the altitudes observed were between 20° – 29°, 30°–39°, 40°–49°. The following were the results:—

Grouped altitudes Efficiencies

20°–29° 2.7

30°–39° 3.0

40°–49° 3.3

This seems to be an experimental proof that the efficiency increases with the angular altitude of flight; but the observations are altogether too few to render the result reliable.

I think we should construct a model of the Oionos aerodrome we are proposing to make and fly it as a kite so as to test its efficiency. We have two old models of double Oionos kites and although they are of small size I think we better put them in condition for flight and see whether we can make any satisfactory determinations of efficiency.

I think also that we should make another model of the regular Oionos form with curved surfaces and multiply experiments upon them. A.G.B.

51

Objections to the use of a vertical rudder at the rear and for overcoming them.
DOUBLE RUDDERS.

July 15, 1909: — In the Hammondsport type of machine a single, vertical rudder appears at the rear forming a vertical tail. I see one or two objectives to this:— and for overcoming them.

There are some objection to this.

I Suppose we wish to steer to starboard and put the helm in the proper position. Let the machine turn in a wide curve so as to completely reverse its path. The center of the machine, and every portion of the machine for that matter, has described a semicircle in the air. The semicircle described by a point on the starboard wing is necessarily of smaller diameter than the semicircle described by the corresponding point on the port wing. Hence the velocity of translation of the starboard wing is less than that of the port wing and the supporting power of the starboard wing during the turn is therefore less than that of the port wing. It follows from this that in turning to starboard the machine tends to tip down on the starboard side while making the turn. because that side receives less support from the air than the other side.

While the machine is So long as the machine remain's horizontal the vertical rudder at the rear is vertical ; but when the machine tips down on the starboard side while making is the turn , the rudder at the rear is no longer vertical but is tilted obliquely to starboard. The chlm being turned to starboard then tends to steer the None is then a vertical component in its steering actions. It steers downwards as well as to one side. The head of the machine turns down as well as to the right. This diving tendency , induced during a turn, seems to me to be indicate one of the causes involved in making to the manifestation of a machine difficult to during a turn. At the very moment when the starboard wing loses some of its supporting power the head of the machine is steered downwards, inducing a dive. which can only be obtained by the manipulation of the other to be pressure the

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2 1909, July 15 Thursday At Beinn Bhreagh.

2. Another objection 1 to the vertical rudder as arranged in all our machines is that it is theonly vertical surface in the whole machine (at least with the exception of the struts which are centrally arranged) and that it appears at one end of the machine far out from the body of the machine. It follows from this that should the machine be struck by A a side gust or a side wind, the wind, acting upon the vertical tail (excentrically to the machine) tends to swerve it out of its course, acting upon he (which is for removed from the tends to turn the machine round, (like a weather) with its tail away from the wind — thus interferring with horizontal steering, and tendency to make the machine sincere to our side from its course.

A similar effect, but of a constant instead of fluctuating character, would be produced by a quartering wind.

I notice that in the Wrights' machine there is a vertical surface at the front control ; and I can readily see that this arrangement meets the second this objection by having providing so that the machine may be likened to a weather with two vertical views our end, each neutralizing the turning action much distributing side winds a balancing vertical surface away out in front so that a side gust would tend to turn the rear of the machine in one way and the head of the machine in the other and a balance would result. So also a quartering wind would act equally on the front and the rear and produce no deflection of the machine out of its course.

It would not, however, obviate the first objection ; for, in making a turn, the vertical rudder at the rear would still induce a dive , which could only be obviated by the manipulation of the other controls to preserve the equilibrium.

But suppose the front vertical surface, the balance for the rear rudder, should itself be moveable, should itself be a vertical rudder moved simultaneously with the 53 3 rear rudder in making a turn all the objections noted above would vanish. For example:— Suppose we steer to starboard with both front and rear rudders simultaneously; then, while making the turn, the machine will tip to starboard and the two vertical rudders will produce a certain amount of vertical steering. The rear rudder tends to steer the head down but the front rudder steers the head up and the two together balance one another's vertical steering. They co-operate in their horizontal steering and oppose one another's vertical steering. Thus obviating my first objection. The vertical surfaces also balance one another when the machine is struck by a side gust or by a quartering wind.

P. S. July 16, 1909. In my notes concerning the actions of double rudders, July 15, I have fallen into the error of assuming that the front vertical rudder would would neutralize the action of the seen rudder in producing a dive when the machine turns to the right or the left. Reflection convinced me that this would not be so. If the two rudders co-operate in horizontal steering they would also co-operate in producing the diving effect. The only advantage of the proposed double rudders therefore, would be to neutralize the deflecting active of side gusts or quartering winds; and for this proposal a fined vertical surface in front, as in the Wright's machine would serve every purpose. I could I am inclined to think that the Silver-Dart, and Baddeck We might be improved by adopting this plan, although I am aware that Douglas McCurdy is in the opinion that the vertical surfaces of the strut in the front control of Baddeck Mr I me sufficient for the purpose. AGB

On second thoughts I am inclined to think that the front rudder also would produce a dive and thus co-operate with the rear rudder instead of opposing its action.

I think this matter should be fully discussed. A. G. B.

Reflection N. B. My conception, the action & the two

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1909, July 16 Friday At Beinn Bhreagh.

DOUBLE RUDDERS.

July 16, 1909 :— In my notes on double rudders July 15 I have fallen into the error of assuming that a front rudder would neutralize the action of a rear rudder in causing a dive when machine turns to right or left. The two rudders would co-operate in whatever effects they produce instead of opposing each others action. The only advantage of the proposed double rudders therefore is, to neutralize the deflecting effect of side gusts or quartering winds; and for this purpose a fixed vertical surface in front as in the Wright machine would serve every purpose.

Simplication of Controls.

July 16: — At the present time we employ four different rudders on our machines: (1). A horizontal rudder in front for vertical steering known as “The front control.”, (2) A steering vertical rudder in the rear for horizontal steering known as “The helm”, or “Vertical rudder” , (3) A starboard ba lancing and 3, 4, balancing two balancing rudders control one located at the starboard & the other on the part end of the wing-piece rudder and (4) a port balancing rudder at the starboard and port ends of the wing piece. ¶ This leads to the aviator having three different kinds of steering to attend to simultaneously : (Vertical, horizontal, and balancing steering), with three different kinds of instrumentalities to operate: (Horizontal, vertical, and balancing rudders) .

It should be possible to reduce very greatly the number of instrumentalities required and hence give the aviator more simple apparatus with less to attend to.

I think that the balancing rudders alone could be made to fulfil the functions of vertical and horizontal steering. ¶ If not then a universal joint rudder might be 55 2 made to combine the functions of vertical and horizontal steering.

Suppose that our balancing rudders were hinged upon the back edge of the wing piece at either end, believed. We instead of extending beyond the wing piece with the axis nearly as far forward as the front edge. Then, these balancing rudders would project behind and be, to all intents and purposes, tails. Our machine, instead of having one centrally arranged horizontal tail , as in the case of a bird, would have two tails, one at either extremity of the wing piece , leaving the central portion of the machine at the rear the machine free f or the propeller without anything behind it. I am here consisting the machine, for the moment as without front control, or vertical rudder, only the two control rudders projecting out behind like tails. ¶ Now if these two horizontal tails are made separately moveable , so that we can move both up or both down at the same time, or move one up and one down simultaneously, or move one up or down without the other or both up or both down in different degrees , would not these rudders alone be capable of performing all the functions of all our present rudders. For example:— Consider the following cases:—

1. Move bothup or both down and we steer the machine up or down. Thus fulfilling the function of the front control.

2. Move one up and the other down in equal degrees and we produce a balancing action without swerving to the right or left, thus fulfilling the present function of our balancing rudders.

3. Move one up without disturbing the other. This introduces a resistance to advance at one end of the wing piece and not at the other causing the machine to turn to 56 3 the side of greater resistance , thus fulfilling the function of the vertical rudder but without the objection of causing a dive: For the elevation of the rear of the rudder will cause an upward, not a downward, movement of the head of the machine. So that the wing, making the curve of shorter radius will have a an additional support greater supporting angle than the other during the turn and thus neutralize the loss of support due to less velocity of translation. McCurdy is inclined to think that the elevation of this rear the rear-end of the balancing rudder would produce a greater depression of this end of the wing piece instead of without steering the head up. If this is so the depression of the rear end of the vertical

rudder, instead of it's rudder instead of its elevation would produce the reverse effect . an elevation of the end of the wing piece without steering the head down.

If these lateral rudders should be in front of the wing piece at the ends consider another case:— Let the lateral rudders without of behind them they would act as front controls instead of as tails . and T here could be no doubt, I think, that in this case the depression of the rear end of one of the lateral rudders would not only introduce resistance to advance at that end or turn but would also produce a lift upon the retarded end of the wing piece, and a steering action upwards of the head of the machine.

If placed behind the wing piece instead of in front the depression of the rear part of a lateral rudder, while it might produce a lift at the end of the wing piece would also operate tend to steer the head down.

I think the action of hypothetical lateral rudders should be fully discussed. If they can be made to do the work of all our present rudders the operation would be much 57 4 simplified. We would need only two levers. One for each of the lateral rudders, each worked by one hand.

McCurdy has a prejudice in favor of a steering wheel combined with a pushing and pulling arrangement for operating the front control and such an arrangement has worked well in the Drome Silver-Dart and the other Hammondsport machines.

On the other hand I have a prejudice against any form of steering lever or handle or wheel which comes directly in front of the aviator and near to him ;— F f or the reason to that any sudden stoppage of the machine, for example by contact with the ground in a header or fast landing, , would cause the aviator to be thrown violently against the steering device. I would prefer , that the aviator should have nothing solid closely in front of him against which he could be thrown, or at least nothing more solid than a net whose elasticity would save him from shock by distributing the points of contact over his whole body instead of at one part alone. or a few alone . and Baldwin again has a prejudice in favor of having the moveable parts in front of the Aviator as much as possible so that he can have them make onstant observation

There is another point that might be considered: There is a plan that is perhaps work a moments thought Instead of having our lateral rudders at the extreme ends of the wing piece and immediately behind suppose they should be in front of the wing piece on either side of placed near the middle of the machine, and in front, was on either to . center of the machine. they would thus constitute two separate Thus constituting two front controls , instead of one; one on either side of the aviator, with a space between like the space between the shafts of a buzzy — where safety devices could be arrange if drained next, re or through in the event of a bad landing could reach terraforma in the shortest possible time. He might not desire this & yet might not be able to help it. He would have the consolation at all events that he would yet be thrown into the debris of his machine. This arrangement would have the advantage of placing the rudders within view of the aviator, a rather important matter; and would have the further advantage of being 58 5 closer to the steering devices leading to shorter, and therefore stronger and more reliable, connecting pieces.

A. G. B.

He would and be to be slashed by knife-edged guy wires, in front of , hammered by his sterring wheel in a delicate part & his anatomy, shaffed and by the jazzed edges of broken on pipes.

He would have an pull without — and be need not have even this if he utilizes the space in front

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1909, July 17 Saturday At Beinn Bhreagh.

Simplification of Controls

July 17, 1909 I think one of the most important subjects for discussion should be the simplification of our various controls by a reduction in the number of moving parts required and in the number of levers or steering devices to be manipulated.

The two lateral rudders now employed , or rather the four lateral rudders, for there are two at each end of the wing piece, are not supporting surfaces ; for they are retained normally in the horizontal position. If these lateral rudders should be removed entirely, their place might be occupied by fixed supporting surfaces forming a continuation of the main supporting surfaces. In this way we would secure a great increase in the total lift of the machine without increase of size.

We sacrifice supporting surface and what do we gain? Simply the power of re-establishing the lateral equilibrium when from any cause, it is disturbed. That is, the lateral rudders are only used at exceptional times. when the emergency arises of a tip to one side that might prove disastrous if not immediately corrected. They are really emergency provisions and play no necessary part in the normal operation of the machine . excepting

Now, if we could provide balancing rudders, not at all connected with the wing piece, we would save, for purposes of support, the surface now occupied by our lateral controls. These balancing rudders are placed at the ends of the wing piece for mere convenience and not from necessity. We know perfectly well that, but for the 60 2 awkwardness of the arrangement the balancing rudders might be placed vertically above and below the center of the machine. In such an arrangement the surfaces of the rudders would be normally vertical instead of horizontal and they would resemble two flags on flagstaffs projecting above and projecting below. By moving the upper rudder to one side and the lower rudder to the opposite side, a turning movement of the machine would be created around its longitudinal axis and this is all we do with our present arrangement.

Why would not the vertical arrangement be equally practicable? Simply and purely because the lower projecting flag pole would interfere s with starting or landing.

The thought then occurs, why not omit the lower projecting flag pole and leave the upper one alone ? We are so accustomed to consider the turning forces as applied at the opposite sides of a circle that we forget that a single point of application of our turning force would be equally efficacious. At least it would be efficacious , whether equally so is another question.

I would like to consider the point whether an arrangement like our present vertical rudder placed, like a flag, on a pole of suitable length, above the center of the wing piece, would not, alone, serve for balancing purposes. If it was placed behind the center of pressure to any material degree, then, when turned to starboard, it would steer the machine to starboard. If placed in front of the center, to any material degree, a similar motion of the sudden the would steer the machine to the opposite or port side 61 3 Now there is between these positions a neutral position in which the rudder would not steer the machine to either side and yet would be efficacious to produce the balancing movement desired.

The balancing rudder, centrally arranged, upon a flagpole projecting above the machine, would look like a flag and could indeed be painted as a flag to show the nationality of the machine. I could fly the Stars and Stripes and leave the Union Jack to Baldwin and McCurdy unless indeed we could show the inter-national character of our aerodrome by exhibiting the Stars and Stripes on one side and the Union Jack on the other. A.G.B.

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1909, July 19 Monday At Beinn Bhreagh.

DIMENSIONS OF NEW OIONOS AERODROME .

July 17, 1909 :—

I have been calculating the probable weight of a double Oionos structure under various dimensions. Would submit for discussion a structure composed of cells having a side of 1.5 m. or nearly 5 ft. (4.87 ft.). Then the main plane would be 7 cells long and the upper and lower planes 6 cells each. Main plane 2 cells deep from fore to aft, upper and lower planes 1 cell deep, Total surfaces of the three planes. Main plane 10.5 × 3 = 31.5 sq.m horizontal. Upper plane 0 × 1.5 = 13.5 sq. m. horizontal. Lower plane 9 × 1.5 = 13.5 sq. m. horizontal.

Total horizontal surface 58.5 sq. m. (horizontal)

The oblique surfaces consist of 14 hexagonal surfaces having a side of 1.5 m. each hexagon consisting of 6 equilateral triangles having a side of 1.5 m. Thus total oblique surface consists of 14 × 6 = 84 triangles having a side of 1.5 m. I calculate that the area of an equilateral triangle, having a side of 1.5 m., equals 0.97 sq. m. Therefore total oblique surface equals 84 × .97 = 81.48 sq. m. say 81.5 sq. m. Total cloth surface needed would be as follows:—

Horizontal surfaces 58.5 sq. m.

Oblique surfaces 8 1.5 sq. m.

Total cloth surface 140.0 sq. m.

If we arrange our surfaces as in the Baddeck No. 1 glove fashion, we will require twice this amount of cloth, or 280 sq. m.

We better order this amount of stuff at least if we 63 2 decide upon the above dimensions.

This would be equivalent to a strip 187 m. long and 1.5 m. wide or say 200 m. long and 1.5 m. wide.

In round numbers this would be about 650 ft. × 5. These figures will give Mr. Bedwin some idea of the amount of sail cloth to be ordered.

FISH-SHAPED MATERIAL

I have calculated the amount of fish-shaped material required for the construction of an Oionos aerodrome composed of cells having a side of 1.5 m. and with the main plane 7 cells × 2 cells.

Horizontal strut material = 112.5 m. long

Oblique 666 strut material = 168 m. long

Total strut material = 280.5 m. long.

It would be well then for Mr. Bedwin to provide at least 300 m. length of fish-shaped material.

SURFACE AND WEIGHT.

Total amount of horizontal surface 58.5 sq. m. (horizontal) Total amount of oblique surface 81.5 sq. m. (oblique): which is equivalent to a horizontal projection of 48 sq. m. horizontal.

Horizontals 58. sq. m. horiz.

Obliques 48. sq. m. horiz.

Total surface 106 sq. m. horiz.

say 100 sq. m. horiz.

At 5000 gms. per sq. m. (1 lb. per sq. ft.) this should support a total weight of 500 kilogms. or 1100 lbs.

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3 The total weight of the planes, if made of the heaviest No. 3 fish-shaped material, would weigh 65 kg. (143 lbs.) and the sail cloth (doubled) would weigh 33 kg. or 73 lbs.

Frame of wing piece 143 lbs. maximum

Sail cloth 73 lbs. doubled

Power plant 400 lbs.

Man 150 lbs.

Controls, Chassis, wheels etc. 334 lbs.

Total 1100 lbs.

This weight corresponds to a flying weight of 5 Kg. per sq. m. or 1 lb. per sq. fr. This is only about one-half the flying weight of the new aerodrome Baddeck No. 1.

The oblique surfaces are credited with the supporting power of their horizontal projection. As we know, however, that the supporting power is not as great as this the real supporting surface would be somewhat less than that calculated and the flying weight greater upon the total weight assumed. A.G.B.

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1909, July 21 Wednesday At Beinn Bhreah.

6 July 20, 1909: — An old red double-Oionos kite was flown today over Baddeck Bay towed by Mr. Bedwin's motor boat “The Swerm”. A row boat was towed by the Swerm by a long line, and the kite was released from the row boat. The row boat was then dropped, and the Swerm proceeded up Baddeck Bay with the kite in the air as far as the Little Bra d'Or Lake about midway between Washabuct, Beinn Bhreagh and Kidston's Island. Two

series of obseevations of altitude and pull were made; and Bedwin succeeded in landing the kite safely on the stern of the Swerm without allowing it to drop in the water. The kite was provided with a flat tail set at an angle of about 5°. Kite weighed 3099 gms. (6.8 lbs.). A flying line of white cord 100 m. long was used which weighed 1053 gms. (2.3 lbs.) Line attached +25 cm.

Experiments with Double Oionos Kite. July 20, 1909

Exp. 1 Exp. 2 wind 16.40 mph. wind 16.45 mph. Pull Alt. Pull Alt. 8 24 18 26 8 31 16 29 10 27 16 27 12 25 14 26 12 27 16 29 14 26 16 28 8 26 14 27 16 29 16 28 16 22 16 26 14 26 16 28 Summation 118 263 158 274 Average 11.8 lbs. 26°.3 15.8 lbs 27°.4 71 7 Exp. Wind Pull Alt. 1 16.40 11.8 26°.3 2 16.45 15.8 27°.4 Summation 32.8 27.6 53.7 Average 16.4 mph. 13.8 lbs. 26°.8

Alt. 27°, Sin .454, Cos. .891; Pull 13.8, Vert. 6.3, Hor. 12.3.

Weight of kite 6.8 lbs.

Flying line 2.3 lbs.

Vertical Pull 6.3 lbs.

Lift 15.4 lbs.

Drift 12.3 lbs.

Efficiency = 15.4 12.3 = 1.25

This kite shows very poor efficiency for an Oionos structure. It is a double Oionos kite but its efficiency is less than that of kite A which is of pure tetrahedral construction. At altitude 27° efficiency of double Oionos 1.25. Whereas kite A at angle 27° gave efficiency of ¼

We must be very sure that the double Oionos form will give us good efficiency before adopting it in the new tetrahedral aerodrome. The kite used in these experiments contained oblique surfaces which extended above the upper horizontal surface and below the lower horizontal surface. We do not propose to use such oblique surfaces in the new aerodrome. It might be well, therefore, to remove these surfaces from one of our double Oionos kites and see what change this makes in the efficiency of the kite. I have given instructions to have the long keel stick with protruding tail removed and the tail placed at the rear of 72 8 the middle horizontal surface and attached to it. Some tetrahedral empty frame work will be fitted for the support of the keel stick as in my old Oionos kites. With this arrangement there will be no necessity to load the kite with lead as in the present case. The protruding keel stick alone will be sufficient to cause a slight head heaviness. On account of the long protruding tail a load of lead had to be placed at the extreme bow of the present arrangement. A.G.B.

July 21, 1909 :— Douglas McCurdy left for Petewawa this morning. A.G.B.

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1909, July 22 Thursday At Beinn Bhreagh.

6 The difference of altitude does not in this case seem to make any material difference in the efficiency.

In the case of Kite A the efficiency increased with the altitude.

Kite A was of full tetrahedral construction, kite C of hollow construction. It is probable that the interior cells, present in Kite A and absent in Kite C, may account for the difference. Supposing that some of the interior cells in front of them so of Kite A were shielded by the action of cells in front of them so that they constituted chiefly a dead load to be carried by the kite instead of contributing in an equitable manner to their own lift, they would also by their drag contribute unduly to the drift element of the kite. Thus reducing the efficiency by increasing the drift. The drift element is greatest with the lower altitudes so that, upon this assumption, the drag of the inefficient cells would reduce the efficiency more with the lower than the higher altitudes. This would account for the effects observed upon the assumption that with structures containing only efficient cells the efficiency of the kite as a whole would be the same at all altitudes.

In comparing the curves of efficiency for the kites A and C derived from observations in Bulletin IV it is obvious that the efficiency of kite A was greater than that of kite C at every angle of altitude noted where ten or more observations were averaged. While there was a small rise of efficiency with increasing altitude in the 79 7 case of kite C, it was so small that substantially the efficiency was the same at all the altitudes noted.

In the case of kite A a regular progressive rise of efficiency occurred with increasing angles of altitude.

So far as the observations tabulated in Bulletin IV are concerned kite A of full construction was more efficient that kite C of hollow construction. It would be well to study all the observations taken with these typical kites.

We have in Bulletin VIII, pp 22–33 a record of experiments with kites A, C and D; but as the records were so voluminous only the summaries and averages have been noted in the Bulletin. In my Home Notes for August 23, 1908, p 170, I find the following memorandum relating to these:—

“The detailed observations, however, will be preserved here (Beinn Bhreagh) so that they may be accessible to members of the A.E.A. when desired.”

I have not yet succeeded in finding the original records but they undoubtedly exist. There were more than a thousand instrumental observations (1176) of wind velocity, altitude and pull. Wind 156, altitude 560, pull 560. Total 1176 observations. The original records must be hunted up.

It is important that the original records should be thoroughly analyzed for it was as a result of these experiments that the hollow form of construction was adopted in the Cygnet II as preferable to the full form used in Cygnet I under the impression that the hollow form typified 80 8 by kites C and D were more efficient than kites of full construction typified by kites A.

But it certainly appears from the experiments noted in Bulletin IV pp 6–32 that the efficiency of kite A of full construction was greater than that of kite C of hollow construction at every angle of altitude. It would be well to read carefully the report by Baldwin upon the efficiency of these kites and the remarks by F. W. Baldwin and A.G. Bell upon the bearing of the experiments upon the construction of Drome No. 5 (Cygnet II) in Bulletin VIII pp 33–40.

A.G.B.

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1 1909, July 23 Friday At Beinn Bhreagh.

LABORATORY STAFF.

July 20, 1909 :— Mr. William F. Bedwin, Superintendent of Beinn Bhreagh Laboratory, reports the following men on the Laboratory staff:—

A. Ross, Machinist

J. MacLean, Blacksmith

W. Stewart, Carpenter

N. McFarlane, Carpenter

A. MacKillop, Carpenter

J. McNeil, Photographer.

EVENTS ON BEINN — BHREAGH . July 1–22 1909 July 1–July 22 1909.

return & Mr. & Mrs. Bell:— 1909:—

July 1, Thursday :— I arrived at Beinn Bhreagh from Europe accompanied by Mrs. Bell and her maid, Christine McLennan. Mr. & Mrs. A. G. Bell, accompanied & Christine McLennon returned from Europe , Beinn Bhreagh Thursday July 1.

July 2, Friday :— I Mr. Bell visited the Aerodrome Factory of McCurdy and Baldwin and saw their aerodrome first aerodrome, Baddeck No. I, in a nearly finished condition. Also which was approaching completion. He also inspected Beinn Bhreagh Laboratory and saw the fro?? Cygnet II which has now been arranged to be flown as a kite.

Aerodrome for Baddeck :—

July 6, Tuesday 1909: :— A.G. Bell, Douglas McCurdy and WM. F. Bedwin inspected , from the Gauldrie , the flat meadow land bordering the Lake beyond Baddeck and Kidston's Island , with the object of determining whether it could be used as a practice ground for trying out aerodromes. We They came to the conclusion that there was ample room for trial flights there; and that it would be advisable to make arrangements with the owners of the land for its use as an a A aerodrome Park at for Baddeck.

A birth at Beinn Bhreagh Hall

July 9, Friday 1909 :—Born at Beinn Bhreagh Hall at about 3 p.m. a son to Mr. and Mrs. Gilbert H. Grosvenor. Dr. Macdonald & Baddeck was in attendance with Miss a training nurse from Washington D.C.

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2 1909, July 23 Friday At Beinn Bhreagh.

The child has since been named Alexander Graham Bell Grosvenor. In order He will be called “Alec” for short in order to distinguish him from his cousin Alexander Graham Bell Fairchild, he will be called Alec for short, while Mrs. Fairchild's boy is distinguished by Sandy. who is known as “Sandy” . Alec Grosvenor is the first baby child born at Beinn Bhreagh Hall.

Baddeck citizen visit the Aerodrome factories Alexander Baddeck Alexander Baddeck No I

July 9 —Friday :— At the invitation of the Canadian Aerodrom e Company a large number of persons people came over from Baddeck (July 9) and visited the Aerodrome factory. Mr. Douglas McCurdy presided upon the occasion and influenced the construction of the new Aerodrome and exhibited the New Aerodrome that has just been completed by the by the company — the first built by them. company

He stated that this was the first Aerodrome of exclusively Canadian Manufacture and that it had been made by Baddeck men. For this reason the Company had given the people & Baddeck the opportunity of seeing it before its departure for Petewawa where it will be fitted with an engine. To work the plane & its origin the machine will be officially known as the “ Baddeck no 1 ”. Mr. Douglas McCurdy presided upon the occasion and exhibited to the gathering the new aerodrome the frist manufactured by the Company. since called, “Baddeck No. I”, which ha d just been completed , with the exception of the engine which is at Petewawa. for the device is at Petewawa This is the first aerodrome of exclusively Canadian manufacture. (The engine for the new aerodrome is at Petewawa) & Mr. McCurdy thought that the people of Badeck would like to see the machine before its departure for Petewawa to where it will be fitted with an engine.

After the exhibition the Company adjourned to Mrs. Baldwin's Bungalow where afternoon tea was presided over by Mrs. Frost, sister of Mr. Douglas McCurdy, and by Miss Georgina McCurdy.

3 The child has since been named Alexander Graham Bell Grosvenor. In order to distinguish him from his cousin Alexander Graham Bell Fairchild, he will be called Alec for short while Mrs. Fairchild's boy is distinguished by Sandy. Alec is the first baby born at Bein Bhreagh Hall.

Water supply for Baddeck

July 12, Monday: — Hon. A. C. Ross visited Beinn Bhreagh to consult with Mrs. Bell about the use of her property at Crowdis Mountain as a source of water supply for Baddeck. The following is a copy of the Correspondence between Mrs. Bell and Mr. Ross concerning the matter which culminated (July 12) in an arrangement satisfactory to both:—

Mrs. Bell to Ross.

July 3, 1909: —Mr. Bell has told me of your conversation with him on board the Steamer Blue Hill about your new project for bringing water into the town of Baddeck from my Crowdis Mountain property. It is no longer proposed, I understand, that the town itself should undertake the work; but that a Water Company should be organized for the purpose.

When the proposition was first brought publicly to the attention of the people of Baddeck that the town itself should bring in this water, I offered in the event of the plan being adopted, to present my Crowdis Mountain Property to the town as a free gift for the benefit of the people; but the offer was not accepted. I may say that I am no longer willing to repeat this offer either to the town, or to a Water Company.

I had supposed that the whole plan for utilizing this source of water supply had been abandoned; and I have therefore been forming other plans for the utilization of the water power in a commercial way.

I shall be glad, however, to hold these plans in abeyance until I know more definitely what your plans may be.

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4 I would, of course, be glad to co-operate in any movement to bring water to the people of Baddeck; and I shall be willing to consider, in a liberal spirit, any proposition, from your proposed Company looking to the utilization of my Crowdis Mountain Property for this purpose.

(Signed) Mabel G. Bell

Ross to Mrs. Bell.

July 7, 1909: — In reply to your favor of July 3rd I beg to say:

Dr. Bell, in writing me last year in connection with the above, intimated that he thought, in the event of the town of Baddeck not availing themselves of your very generous offer to make them a gift of your Crowdis Mountain Property providing that the people of the town established a water system for the town, you would consider favorably conveying this property to me at a nominal sum if I undertook the formation of a Company to supply the town of Baddeck with a water system for domestic and fire purposes.

The town (as you are aware) declined to undertake the installation of a gravitation water system of their own, but expended some money in trying to get a supply by borings in rear of the town, which proved a failure. The water Committee then requested me to organize a Company to supply the town with a good water system.

With this end in view I have been getting data as to cost and possible revenue.

My son, George (who is an engineer) is now making a preliminary survey, and I hope to be able on Monday next to submit some plans and figures re this proposal for the consideration of yourself and Dr. Bell, with a view of securing your co-operation in supplying the people of Baddeck with a much needed good water system.

(Signed) A. C. Ross.

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5 Ross to Mrs. Bell.

July 12, 1909:— THE CROWDIS MOUNTAIN PROPERTY. I beg to make you the following proposition on behalf of the water Company which I am organizing to supply the town of Baddeck with water for domestic and other purposes.

If you will convey the above property, including the water source and falls, to a Company to be known and in—coporated as "The Baddeck Water Company", I will undertake, for the Company, to deliver to you 20% of the stock of proposed Company fully paid and un—assessible, and any amount of first mortgage bonds of the Company at $95.00 on the hundred. These bonds to bear interest at 5%, and be for a term of twenty years.

The Company will further undertake to preserve the forests on the said property.

They will also erect a suitable public drinking fountain at their own expense, at any place in the town that you may indicate, and connect the said fountain with the proposed water system.

(Signed) A. C. Ross.

Mrs. Bell to Ross.

July 12, 1909:—I beg to accept the proposition contained in your letter of even date, with these modifications:—

1. That the consideration of 20% of the stock of the Company in fully paid up and unassessible shares, together with the right to subscribe for any amount of first mortgage

bonds of the Company at $95.00 the hundred, proposed to be given me, shall instead be assigned to the town of Baddeck, as I do not wish to even appear to make money out of its necessities.

2. That the forests shall not merely be kept uninjured, but that a good road be maintained, and the public allowed free access to the mountain as a public park, under suitable restrictions for the safety of the Company's property.

3. That these conditions, of a free public fountain, and the maintainance of the forests be made binding 86 6 upon the Company and its successors for ever. Failure to comply with which shall entail forfeiture of the property to me or my heirs-at-law.

(Signed)Mabel G. Bell.

Mr. Ross stated that this would be satisfactory to him, and that he would have legal papers drawn up to have the property transferred to the Company in accordance with Mrs. Bell's plans.

Arrival of Mrs. Fairchild and family

July 16, Friday :— Mrs. David Fairchild arrived at Beinn Bhreagh accompanied by her son Alexander Graham Bell Fairchild (Sand y ie) and her daughter Barbara Latterok Fairchild (a baby in arms). Also accompanied by Miss McRae, a trained nurse from Washington, D. C. and by her maid Miss Anna Urquhart of Washington D. C. Nova Scotia

A long flight by Curtiss

July 16 Friday:— A telegram was received from Mr. Glenn H. Curtiss to the following effect:— announcing a long flight in his new Aerodrome:—

Curtiss to Bell.

Mineola, July 16 :— First long flight this morning. Fifteen miles. Everything fine.

(Signed) G. H. Curtiss.

A reply was immediately send to the following effect:—

Bell to Curtiss .

Baddeck, July 16: — Heartiest congratulations from all. Hope this means the Scientific American Trophy for you.. Baldwin and McCurdy will soon try to rival your achievement in their new aerodrome “Baddeck No. I” which has been sent to Petewawa.

(Signed) Graham Bell.

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7 Expected arrival of a Shetland Pony from England

July 19, Monday:—John McDermid is on his way to Halifax to receive a Shetland Pony which Mrs. Bell purchased in London and which is expected to arrive in Halifax July 20 by Steamship Shenandoah.

McCurdy leaves for Petewawa

July 21, Wednesday :— Mr. J.A. Douglas McCurdy left Beinn Bhreagh for Petewawa. Wednesday Morning July 21.

Arrival of students from Princeton University

July 21, Wed.: — In the afternoon A party of students from Princeton University arrived at Beinn Bhreagh on Wed. afternoon (July 21) in the Yawl “A.J. McCosh”, (the name of a former president of Princeton University) . This Yawl has been presented by the students of Princeton University to Dr. Grenfell of Labrador to be used by him in his work there and it is being taken to Labrador by a party of students. I understand T here are seven persons on board, (probably not all students) . Five of them, all Princeton students, took dinner at Beinn Bhreagh, (July 21). Their names, as recorded in Mrs. Bell's Visitor's List are as follow s :—

Paul G. Tomlinson, of Elizabeth, N.J.

Ethan Flagg Butler, of Washington, D. C.

H. P. Townsend, of Washington, D. C.

Andre L. Causse, Jr., of Raleigh, N.C.

Hugh K. Gilmore, of Washington, D. C.

July 22, Thursday :—The Princeton students visited the Tetrahedral Tower on the top of the mountain early in the morning accompanied by their dog, a Gordon setter, named “Lady”. The dog followed them up the se steps to the very top of the Tower, but required a little assistance in coming down again. In the afternoon the students visited Beinn 88
8 Bhreagh Laboratory under the charge of where they were received by Mr. Bedwin, Superintendent who explained the work and they also visited the Aerodrome Factory of the Canadian Aerodrome Company under the charge of Mr. Ingraham. where Mr Ingraham took charge them and explained the work of the Company. In the evening after dinner the students came up to visited Beinn Bhreagh Hall and played for a gave of billiards.

Experiments at Beinn Bhreagh (A partial list & experiment) made between July, 1 and July 22, 1907) Partial list of of Experiments at Beinn Breagh. of EXPERIMENTS July 1–22, 1909.

<u>July 3, Saturday</u> :— 1. Condensing water from the breath. Experiments made at the house-boat July 3. Experiments were made by Mr. Bell at the Houseboat in condensing water from the breath.

July 4. Sunday:— Mr. Bell continued his experiments at the house at on the condensation of water from the breath.

<u>July 6, Tuesday:</u> — Mr. Bedwin conducted a P ractice flight with on the Baddeck Bay with a half-sized model of Cygnet II . (July 6) on Baddeck Bay July 6 which was let off from the Get Away, and towed by the Gauldrie The Kite July 6

<u>July 10, Saturday</u> :— White Oionos Kite flown upside down at the Kite field July 10. Mr. Bedwin made experiments upon the kite field with a white Oionos kite flown upside down.

<u>July 11, Sunday</u> :— Condensing water from the breath: Experiments continued at the houseboat July, 11. Mr. Bell continued his experiments at the Houseboat on the condensation of water from the breath.

<u>July 12, Monday:</u> — White Oionos Kite flown upside down. Experiments continued on the Kite field July 12. Mr. Bedwin continued his experiments on the kite field with the white Oionos kite flown upside down.

¶ Practice Flight on Baddeck Bay with model, of Cygnet II on Baddeck Bay July 12. Mr. Bedwin also had another practice flight on Baddeck Bay with the half-sized model of Cygnet II.

<u>July 13, Tuesday</u> :— Mr. Bedwin conducted a practices flight on Baddeck Bay with the white Oionos kite White Oionos Kite tried on the Bay. July 13 Kite was flown upside down and towed by the Gauldrie on Baddeck Bay July 13.

July 20, Tuesday :— Double Oionos Kite & red silk tried on the Bay July 20 the Kite was Towed flown & towed by W. Bedwin's motor boat “Swerm”. July 20 on Baddeck Bay July 20 Mr. Bedwin conducted a trial flight on Baddeck Bay with an old double Oionos kite having surfaces of red silk towed by his motor boat “Swerm” as the Gauldrie 89 9 was out of commission at the time.

Mr. Byrnes conducted experiment at the Aerodrome Company's headquarters relating to the S anitary disposal of sewage matter by cremation. Burns at Experiment at the Crematory, July, 20.

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10 EXPERIMENTS RELATING TO THE SANITARY DISPOSAL OF SEWAGE MATTER July 20, 1909.

Reported by G—C. Byrnes.

July 20, 1909:— The experimental Crematory was in use from July 10 to July 20, a period of ten days.

An examination of the contents by Dr. Bell and myself, July 20, before lighting fire, showed very little dessication owing possibly to too constant use. There was no . ¶Upon lighting fire we found that dry brush as fuel burned too rapidly the whole amount burning in about 20 minutes, and not entirely consuming the deposits which remained smouldering for an hour or two.

A later examination showed the mass to be burned to an inoffensive black ash, except ing a very small center, thus showing that a slower fire would have consumed the whole.

There appeared to be were no flies around the fire-pit t , although no fly screeens fly-screen have not yet been provided. Possibly the place is too dark for them.

Under present conditions I recommend burning out once a week.

(Signed) C. C. Byrnes.

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Introductory THOUGHTS CONCERNING BULLETIN.

Beinn Bhreagh July 23, 1959.

July 23, 1909 :— Now that Mr. F. W. Baldwin and Mr. Douglas McCurdy are at Petewawa and will probably be absent from Beinn Bhreagh for an indefinite period I cannot possibly get their assistance in Laboratory matters unless we have some form of Bulletin to keep them in touch with Laboratory work. At the same time I am unwilling to fetter myself by undertaking regular issues of a Bulletin, and have therefore decided to start a book to be entitled to start a Record book which will be issued, a few pages at a time, as convenient to me. The book to be known as “The Beinn Bhreagh Recorder”. as it is intended to form a at once & thinks Vol. I will be commenced within a few days. I propose to be limited to Lab work alone— have seven typewritten copies made at once, typewrite, in multiple form, a few pages from time to time , after papers will be issued from a few will be done at a time which will be numbered consecutively, and distributed occasionally to those persons we decide upon who will agree to file to the heads and before upon BB. Estate including, the Lab. and Aerodrome Co. — T he se pages sent will be filed in a portfolio ; so that used that when a sufficient number of pages have been collected , together they may will be bound up in a volume for permanent preservation. Each page will bear, at the top, the date at which it has been typewritten, and this will may be taken as the date of issue issuance of that page , although, it may not be sent to heads of until more time afterwards subsequently. .

I do not propose to limit myself to a record of Laboratory work but intend to include events and occurrences on Beinn Bhreagh estate, and items of interest to the people on the estate. Also to include thoughts and discussions on various subjects. — as well as the experiments.

The principal object will be to secure a record of what goes on on the estate and the movements of people connected with the estate, Beinn Bhreagh .In fact this will be as its name implies — the Beinn Bhreagh Recorder. A. G. B.

Alexander Graham Bell, Editor .

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July 23, 1909. Mr. W. F. Bedwin, Supt. B. B. Laboratory. Dear Mr. Bedwin:

I enclose a list of photographs wanted for "The Beinn Bhreagh Recorder".

Want five Velox x c opies of the following of Bulletin size. See that we have a good supply of Velox paper for the purpose:—

1. A page giving good photograph or photographs of the half-sized Cygnet model. Specially want to show the hollow space in the center.

2. Full page illustrating the white Oionos kite which was flown upside down.

3. Photograph showing the tubes used for condensing water from the breath. Want a photo showing apparatus in operation with a man blowing into it.

4. Photograph of a man breathing through a tube into an empty bottle floating in a bucket of water. The bottle — not the man.

Yours sincerely,

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Beinn Bhreagh, near Baddeck, COPY Nova Scotia. July 20, 1909. Mr. Charles J. Bell, Trustee Aerial Experiment Association, Washington, D. C. Dear Mr. Bell:

Allow me to report the present status of the two applications for Letters Patent on the work of the Aerial Experiment Association. One of these applications is in the name of Mr. F. W. Baldwin as inventor; and the other is a joint application in the names of all the members of the A.E.A.

Baldwin Application :— I have already forwarded to you a copy of a letter from Mr. Cameron dated June 30 in which he says:—

“The Examiner expressed the opinion that the case (Baldwin Application) was in condition for allowance, but told the writer that it would probably be a long time before the case would be passed to issue, as it was sure to be involved in a complicated interference along what he termed ‘side issues’, and that the interference could not be declared even until the other cases had been treated and were placed in condition for the declaration of the interference. He laid his hand on a large pile of cases and said that there were a great many of them, probably fifty”. etc.

Joint Application :— I enclose a copy of a note from Messrs. Mauro, Cameron, Lewis & Massie, dated July 12, 1909, which will show you the present status of the Joint Application. You will observe that the following claims are allowed viz, 2,15,16,18,20 and 21. I enclose a copy of these claims in order that you may see what they are. The other claims have been 94 2 rejected upon various grounds, chiefly French and British Patents; and it is somewhat noteworthy that the rejection is not based upon the Wright Brothers' Patent showing pretty clearly that our Joint Application does not conflict with that Patent.

Messrs. Mauro, Cameron, Lewis and Massie say, in reference to the claims that have been allowed without opposition:—

“These allowed claims, as you will see, are very broad and go to the fundamental principles of the invention”.

In reference to the rejected claims they say:—

“We have not as yet taken up the references cited for study, and therefore cannot undertake to say how effective they are against the claims”.

They conclude as follows:—

“The gratifying thing is that we have the claims on what we regard as the most important features allowed, and these, together with what are allowed in the Baldwin application, if we do not get too completely tied up in an interference, will giveus very good protection on the invention as a whole”.

While I am glad to be of assistance to the Aerial Experiment Association by assuming for the present the cost of applying for these patents, I must say that I am considerably disturbed by the prospect of interferences arising and do not think that I should be called upon alone to shoulder the expenses of interferences.

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3 Is it not time that we should take up the consideration of forming a commercial organization representing the interests of the members of the A.E.A. to relieve me from the expenses of probable interferences.

Messrs. Mauro, Cameron, Lewis & Massie seem to think that the claims already allowed, if carried through to issuance, will give us very good protection on the invention as a whole. Under these circumstances it would seem to be a pity to give up the struggle for good patents so long as there is any prospect of obtaining them. I am perfectly willing to go on with the normal expenses of the application but cannot undertake alone the expenses incurred in defending interferences. Can you not see your way to some plan to relieve me in such a contingency. A company should be formed for the purpose or an attempt be made to sell the interests of the A.E.A. to some existing company.

I shall be very glad if you can give me the benefit of your advice in this matter.

Yours sincerely,

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COPY Washington, D. C., July 12, 1909. Dr. Alexander Graham Bell, Beinn Bhreagh, Near Baddeck, Nova Scotia. Dear Sir:—

Replying to yours of the 7th inst., asking for news of the joint application, we have to say that this application has been pretty severely rejected, but the following claims are allowed, viz., 2,15,16,18,20 and 21. These allowed claims, as you will see, are very broad and go to the fundamental principles of the invention.

The rejections are based on the following French patents, viz., Dodek, No. 362,201, Ferber, No. 380,073, and Liurette, No. 380,492, and on British patent to Chappell, No. 21,923 of 1907. The interesting point in the rejection is that there is no reference made to the Wright patent, except to say that there is no invention in operating levers or cords by the body of the operator to effect the lateral balance, in view of the British patent to Chappell and the Wright patent 821,393. Claims 19,22 and 23 are rejected on U. S. patent to Wondra, No. 876,125.

We have not as yet taken up the references cited for study, and therefore cannot undertake to say how effective they are against the claims.

The gratifying thing is that we have the claims on what we regard as the most important features allowed, and these, together with what are allowed in the Baldwin application, if we do not get too completely tied up in an interference, will give us very good protection on the invention as 97 2 a whole. Mr. Cameron expects to start on his vacation on the 30th inst., and may not be able to take this case up until his return, but if possible will prepare an amendment before he starts.

Very truly yours, (Signed) Mauro Cameron Lewis & Massie Per S. T. C.

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Beinn Bhreagh, near Baddeck, N.S., July 20, 1909.

The following claims, from the Joint Application in the names of all the members of the A.E.A. as inventors, have been allowed:—

2. In a flying machine, the combination of a plurality of concavo-convex supporting surfaces with their concave sides toward each other, means uniting said supporting surfaces, and a pair of normally horizontal rudders, one on each side of the medial fore and aft line of the structure.

15. In a flying machine, the combination of a plurality of suitably spaced supporting surfaces, a member projecting outside of the lateral marginal line of each of said surfaces, a rudder fulcrumed to each of said projecting members, and means for operating said rudders.

16. In a flying machine, the combination of a pair of superposed concavo-convex supporting surfaces, means uniting said supporting surfaces into a rigid non-flexing structure, with their concave sides towards each other, a pair of lateral balancing rudders one on each side of the medial fore and aft line of the structure, means connecting said rudders together whereby a movement of one imparts a reverse movement to the other, and operating means connected to both of said rudders.

18. In a flying machine, the combination of a supporting surface, a pair of lateral balancing rudders one on each side of the medial fore and aft line of the structure, an elevating and depressing device, a steering rudder, a shaft mounted to move longitudinally and operatively connected to 99 2 said elevating and depressing device, a member mounted on said shaft and connected to said steering rudder, and means for operating said balancing rudders.

20. In a flying machine, the combination of a chassis mounted on wheels one of which is a steering wheel, an aerodrome mounted on said chassis, a steering rudder, an elevating and depressing device, a longitudinally movable shaft, a steering element mounted on said shaft, and means operatively connecting said element to said steering rudder and steering wheel, and operative connections between said shaft and said elevating and depressing device.

21. In a flying machine, the combination of an aerodrome and two lateral balancing rudders one on each side of the longitudinal medial line of the machine and pivotally supported on the outside of the lateral marginal lines thereof, and means automatically operated by the body-movements of the aviator and operatively connected to said balancing rudders.

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1909, July 28, 666666 Wednesday At B.B. ARTIFICIAL VERSUS NATURAL FLYING MACHINES.

July 25: — It is a matter of common observation that heavier-than-air flying machines, which one would naturally suppose were admirably adapted, on account of their inertia , to withstand the disturbing effects of wind, are flown chiefly in calm weather:— Aviators are afraid of wind.

No gale is too heavy for the ocean birds; and the Albatross and other soaring birds, actually utilize the force of the wind to save their own motive power. The aviator on the other hand. They sail upon motionless out-spread wings and defy the storm. Apparently able to move hither and thither as they desire without the expenditure of muscular force. Under such circumstances they appear to be able to hither & thither at to support themselves in the air.

The human aviator, on the other hand , seems to look upon the wind as his an enemy, to be avoided, not conquered and harnessed to his use.

Are there any radical differences of structure and function between the aviator's wings etc. and those of the bird; and have these differences any bearing on the attitude of the two kinds of aviators concerning the wind — concerning the utilization or avoidance of the wind.

In comparing the artificial with the natural flying machine it is interesting to note that nature has omitted vertical surfaces from the make-up of the bird, whereas we look upon vertical surfaces as steadying devices in the air; and for this reason, even when we give them up we do so with regret.

101

2 The only vertical surface in the bird is the resolved vertical projection of his body; and the same is true of all the other flying creatures of the world. It is certainly remarkable that in birds all the surfaces, normally, approximate the horizontal; whereas our experiments show that horizontal surfaces are unstable in the air

It is also remarkable that recent progress in aviation reveals a tendency to discard vertical surfaces because they retard speed by their skin-resistance and weight without contributing anything to their own support in the air and because they promote side drifting under the action of a quartering wind. In the most successful machines of today the vertical surfaces have disappeared with the exception of the vertical rudder at the rear. and the vertical balancing surf In this particular the birds have advanced a stage beyond the human aviator aviators of to-day — they do not steer by means of a rudder with a normally vertical surface.

Horizontal surfaces are notoriously unstable in the air; and curved surface surfaces with the concavities underneath, which have gradually come to the be adopted by aviators, are still more unstable. Aeroplanes An aero-curve with the concavity above possesses much greater inherent stability than an aero-curve with the concavity below, and yet nature has adopted the more unstable device in the make-up of birds, their wings are concaved below.

A tetrahedral winged cell may be taken as a typical case; with the wings upwards as in most of my tetrahedral structures we have good stability and poor lifting power, but when flown upside down with the concavity 102 3 below they have good lifting power, and poor stability. In fact, in all cases, lift and stability seem to be in inverse ratios to one another. We gain lift at the expense of stability and we gain stability at the expense of lift. We are confronted by the problem efficiency versus stability. If we can't get them both which should we prefer.

Nature seems to have decided in favor of efficiency; and it is noteworthy that the most successful aerodromes, like the “Silver-Dart”, the Wright Brothers machine, and the monoplanes of Latham and Bleriot have sacrificed stability to efficiency. They seek to make the ratio of lift to drift as great as possible, discounting features that make for automatic stability where they conflict with efficiency. Both in the case of aviators and birds stability is gained by voluntary rather than by automatic action. They substitute skill for automatism.

We are then brought face to face with another phase of the same problem — automatic stability versus skill. Upon which shall we depend for safety in the air.

This is a the great question of to-day and its solution hinges largely upon the presence or absence of vertical surfaces The machine requiring skill to maintain its equilibrium The extreme type of the efficient machine requiring skill to preserve it equilibrium is a skimming dish with its concavity below. The extreme type of machine possessing stability and poor lifting power is an aeroplane with its surface vertical The intermediate type possessing moderate efficiency and 103 4 moderate stability is the skimming dish with its concavity above.

Why should vertical surfaces be omitted? What advantage and disadvantages do they possess in the air?

Advantages :— They resist tipping action, thus tending to preserve lateral stability. This I think is their sole advantage.

Disadvantages: — They retard advance by their skin-resistance. They constitute dead load to be carried by the machine and do not contribute to the element of lift. They place the machine at the mercy of side gusts and quartering winds presenting to such winds a large resisting surface so that these winds are able to cause the machine to drift sideways.

They engarer endanger lateral stabilty in They endanger lateral stability and longitudinal stability in the longitude direction by producing, if not exactly balanced about the center, a turning moevement movement. For example, if the vertical surface extends more to the rear than the front as it does where we use a vertical rudder without a balancng vertical surface at the front, a side wind tends to turn the machine around a vertical axis causing the machine to swerve from its course.

If the vertical surfaces extend more above the machine than below, or vice versa, the side wind tends to turn the machine around its longitudinal axis tipping it over to one side or the other. The longitudinal stability about a transverse axis is not affected by side winds so long as the surfaces remain vertical but should the machine tip to one 104 5 side then a vertical component of pressure appears tending to make the machine dive or climb unless the surfaces are semetrically arranged about the center of the machine. Even in this case the vertical component of pressure appears and the moment the machine tips to one side and the longitudinal equilibrium is only maintained when the diving effect produced by the action of the fore or aft surface is neutralized by the climbing effect produced on the other part.

Taking all these points into consideration I am inclined to think that vertical surfaces only act as steadiers in a calm or when the wind is head on or tail on; but under the action of side winds these vertical surfaces tend to disturb the equilibrium of the machine unless exactly balanced; and even when exactly balacned balanced they promote side drift under the action of a side wind; and create an artificial resistance to horizontal turning.

The whole question is a question of the advisability of retaining or abolishing vertical surfaces altogether.

We cannot abolish them altogether even , if desirable , for the body of the machine at least must possess a resolved vertical surface. Our machines are built in space of three dimensions. There must be an d element somewhere of vertical depth. Should the vertical surface of the body be balanced by a vertical fin above?

Is there no action of a vertical surface comparable to that of the keel of a boat. The keel retards side drifting when a boat is driven obliquely against the wind. But here we have the keel in a different medium, the water. Would the keel help to prevent side drift if the boat was driven across a stream of water. I am inclined to think that there would be 105 6 more side drift in such a case with a keeled boat than an almost flat bottomed boat of the skimming dish pattern. In the case of the aerodrome our keel is immersed in the fluid that moves at an angle to our course, and I am therefore inclined to think that vertical surfaces in the air do not act to retard side drift but to prmote it promote it. I submit the whole question of vertical surfaces for discussion, and would be glad to hear from McCurdy, Baldwin, Bedwin, or any of our staff. A.G.B.

Applying these thoughts to the machines we possess we should aim to abolish vertical surfaces as much as possible. A single surface machine, or monoplane, under this point of view would be preferable to a double surface machine like the “Silver-Dart”, or to a tripple or multiple surface machine on account of the struts which present ? considerable vertical surface. And they would be no special advantage in fish- stock shaped street material excepting that they reduce head resistance. This advantage is counter-balanced by an increase of the of the side resistance produced by the great extension of the the the struts in the fore and aft direction. We should abolish the vertical tail and substitute steering by lateral rudders. Vertical steering to be produced by a horizontal rudder in front with the propellers in the rear, or by a horizontal tail behind with a propeller in front. The propeller in front is the more convenient position. So far as the propelling power alone is concerned it matters not whether the propeller is in front or in the rear; but considerable doubt has been felt 106 7 as to whether, in the case of afront propeller, the wind of the propeller acting upon the main surfaces of the machine might not injuriously affect their supporting power. The success of the monoplanes of Bleriot and Latham have resolved that doubt in my mind; and I am inclined to think that the monoplane type of machine with the engine and propeller in front, represents an advance in the art of aviation

After the experiments of Bleriot and Latham we cannot doubt that a horizontal tail is fully as efficient as the front control of the “Silver-Dart”. I notice from photographs of Latham machine that the tetrahedral principle of construction seems to have been employed throughout in the framework of the machine.

If then there is any reason why we should abolish vertical surfaces this would point to the monoplane type of structure with the propeller in front, with both horizontal steering and side balancing effected by lateral rudders, and with vertical steering a by a horizontal tail, and the omission of the vertical tail altogether. A.G.B.

A perfect screw propeller, working theorectically like a solid screw in a nut, would produce advance of the machine without any disturbance of the air in the rear. The wind of the propeller represents the slip of the screw. Now when the propeller is placed at the rear we make no use of the wind of the propeller; but when placed in the front of slip wind blows on the under surfaces of our machine. 107 8 Does this not increase the lift or is it a case comparable to a man trying to lift himself by pulling on his boot-straps. With that veloci What velocity has this slip wind relatively to the surfaces against which it blows.

Suppose the “Silver-Dart” held on the ice with its propeller going. Now let a man stand in the rear of the machine and measure the velocity of the wind produced by the propeller. Now would not the wind experienced being be increased if the man was to run forward against the wind. Do not the surfaces of our machines run forward against the wind of the propeller when the propeller is in front? I put down a great many of these points in the form of questions merely without an answer, in order to provoke discussion. A.G.B.

2 In In fact, this private publication with aim to be, of its name implies “The Beinn Bhreagh Recorder”.

Alexander Graham Bell Editor

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BEINN BHREAGH ITEMS.

July 23:—John McDermid arrived with the Shetland Pony.

July 23:—The Princeton Students drove to visited South Gut St. Anne's in our the buckboard.

July 24:— Mrs. Bell, Mrs. Fairchild, Mr. Grosvenor, and the Princeton Students attended a party the McCurdy at Mrs. Frosts. & Men's McCurdy & Mrs. Frost.

July 25:— Dr. Richardson, son of my old friend, the late Supt. of St. Elizabeth's Asylum, Washington, D. C., visited Beinn Bhreagh July 25. He was accompanied by his wife, and left the same day for .

July 26:— The yacht J.A. McCosh, with the Princeton students on board left Beinn Bhreagh for Labrador Monday morning July 26.

July 26 The Laboratory, through the columns of the Recorder wishes to challenge any team on the estate to a game of Quoits; best two games in three to win. W.F.B.

July 26 Much interest was taken last winter in the old Scotch National Game of Curling. The following were the Beinn Bhreagh players:— Baldwin, McCurdy, Bedwin, MacFarlane, McLean, Ross, and Rudderham (skipper). The Cup donated by Mr. F.W. Baldwin for the greatest number of points in the season, was won by the Beinn Bhreagh Team against Baddeck. W.F.B.

July 26: Mr. & Mrs Albert Swalfer Dacselee, of 3735 Walnut St., Phil. visited Beinn Bhreagh. Copy Davidson's advertisement about sheep.

July 27:— Dr. Grenfell arrived at Beinn Bhreagh this forenoon. and became the great? Mr. & Mrs. BEll at Hall Dr. Grenfell assisted visited Beinn Bhreagh in the examination of the 6n, 7n, 8n, lambs born this year. He also visited the Aerodrome Factor y and the by Laboratory. He is staying at Beinn Bhreagh Hall.

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2 July 27:—Mr. and Mrs. Frost and Miss Georgina McCurdy visited BEINN Bhreagh this morning evening &

July 27 Dr. Grenfell was much interested in th ece-boat propelled by an aerial propeller which made last year a speed of between 50 and 60 miles an hour on the ice of Baddeck Bay. He suggests that an aerially propelled sledge would be of great assistance to him in his work in Labrador. He sometimes has to go of 60 or 70 miles to visit very often over ?? smooth & hard snow , and it on our takes him two or three days to make the journey with a dog team. These journeys are generally emergency cases to relieve sickness or accident and an aerially propelled sledge would probably reduce the time required to reach the patients very materially. We have under contemplation the construction of such a sledge for Dr. Grenfell's use to be driven by a gasolene motor and an aerial propeller and .

July 27 — Two automobiles appeared on Beinn Bhreagh.

13 no send,

14 It will

16 if of fish.—

22 rapid has often in a

23 the dish

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1909, July 28 Wednesday At B.B. WATER WATER EVERYWHERE AND NOT A DROP TO DRINK.

Every year fishermen on the Banks of Newfoundland become separated from their vessels in a fog; and before they are picked up, or make the shore in their dories, suffer terribly from thirst. One of our men at Beinn Bhreagh had two uncles whose dead bodies were picked up at sea in a dory. There was fish in their boat but no water.

It is certainly a reflection upon the intelligence of man that anyone should die of thirst upon the ocean; or that there should be “water, water , everywhere, nor any drop to drink”. Wherever there is water there is water to drink; and it is only our ignorance that prevents us from taking a draught. Certainly where fog exists there is plenty of fresh water at hand in the air, and no one need die of thirst under such circumstances.

Just consider what a fog means. It is fresh drinking water suspended in the atmosphere, half condensed in the form of a visible cloud. All that the fisherman has to do is to pump the fog into a bottle half submerged in the cold water of the ocean, and the fog will at once turn into drinking water.

Drinking Water Obtained from Fog.

Some years ago at Beinn Bhreagh I tried the experiment of causing a pair of bellows to pump fog continuously into a bottle submerged in Baddeck Bay; and after the lapse of a few hours I found the bottle half full of fresh water. The 111 2 The arrangement was as follows:—

A pair of bellows was fastened on the central wharf at Beinn Bhreagh with the handles projecting beyond the edge of the wharf. A coiled spring was placed between the handles to keep them apart; and a heavy log of wood was suspended from the upper handle, and floated on the surface of the Bay. The length of the connecting string was so adjusted that when a wave lifted the floating log, the string became slack, allowing the coiled spring to lift the upper handle of the bellows and thus k f ill the bellows with the air. Then when the wave passed, the weight of the log caused the string to become tense, thus compressing the bellows, and pumping air through a tube into the empty submerged bottle.

Two glass tubes passed through the stopper of the bottle, their upper ends being several feet above the surface of the Lake. The air was pumped down one tube and escaped up the other. The water-vapor contained in the air was condensed in the bottle and remained behind as fresh drinking water. The apparatus was started one evening in a light fog or mist, and the wavelets kept the bellows pumping all night. In the morning the bottle was half full of fresh water.

Drinking Water Obtained from the Breath.

Another experiment was tried this Spring, at Mr. David Fairchild's place near Washington, D. C. I tried the experiment of condensing water from my breath; for it is well known that water-vapor is one of the products of combustion 112 3 in the lungs; and it is a matter of common observation that if you breath upon a mirror or cold surface water is immediately condensed upon the surface in the form of a mist on fine dew. into a mist or dew upon the surface.

In this experiment I took a glass tumbler and, holding it in a bucket of cold water I simply breathed into the tumbler. The open mouth of the tumbler partly covered my mouth. I then breathed out through the mouth and in through the nose. I kept this up for an hour or so, and then found that several spoonfuls of fresh water had appeared at the bottom of the tumbler, showing the ease with which drinking water may be made with the simplest sort of apparatus, if we can only get water-vapor into a cool receiver.

Of course the quantity of water was not large, but a man suffering from thirst upon the ocean would have given all he possessed in the world for a drink of it. I Tasted the water condensed from my breath, and to my surprise found it quite fresh and without any disagreeable flavor whatever (The above is taken from a dictation notes made on the Steamer "Cedric" on the way over the Atlantic May 21, 1909.)

& drinking can be obtained from

Experiments relating to the measurement of the amount of water that can be condensed from the breath were made at Beinn Bhreagh July 3, July 11 (Recorder p.9) July 12, and July —. ¶ As a result I came to the conclusion that it would be possible, without any special cooling arrangement other than the water of the ocean, to condense about 25 cubic centimeters of water per hour. In 10 hours this would 113 4 amount to 250 cubic centimeters of water, weighing 25 2 0 250 grams, (practically half a pound of water .) This is equivalent to a full tumbler of water. Of course with special cooling arrangements the quantity would could be increased. The process

The process of breathing out through the mouth and in through the nose was not laborious, and could have been continued for hours without any fatigue. In fact during the experiments made at the House Boat I occupied myself in reading a book, and found the process as easy as smoking a pipe.

Whatever water may be gained from the breath is so much fresh water saved from loss. We are breathing out and in all the time, and loss of water-vapor is inevitable in the very act of breathing.

In figures the accompanying photographs, figs 1,2,3 & 4 I show some of the forms of apparatus employed in these experiments.

Fig.I shows an ordinary glass jam jar held in a bucket of cold water, and the mouth fitted loosely into the open mouth of the jar. This proved rather laborious in operation on account of the constrained position of the body required.

Fig.2 shows an empty bottle floating in a bucket of cold water with its neck resting on the edge of the bucket. The end of a long glass tube was inserted into the bottle and the other end of the tube held in the mouth. The operation of this apparatus was quite easy and I read a book for more than an hour while making the experiment ; and found that I could have gone on with the experiment for an indefinite period of time without any fatigue .

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5 Figs. 3 & 4 show a more complicated form of apparatus which however gave the largest amount of water condensed in a given time. In this apparatus a glass tube was employed about 4 ft. long and about three quarters of an inch internal diameter, which was plugged at the bottom with a rubber stopper. Into this tube another glass tube of smaller diameter was inserted with the projecting end bent almost at right angles to fit conveniently into the mouth and the end which was placed in the mouth was flattened. Upon blowing down through the inner tube. The breath blown down through the inner tube escaped up the outer tube, and condensation was immediately observed at the bottom of the outer tube, and in a short process of time several inches of water had collected there. The amount condensed was much increased by placing the outer glass tube in a large brass tube

closed at the bottom and filled with cold salt water from the Great Bras d'Or. The three tubes employed are shown separately in Fig.3; and the mode of operating the apparatus as a whole is illustrated by Fig.4.

I cam e to the conclusion that such an apparatus could be operated for hours at a time without any fatigue. A.G.B.

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July 27:— The following is an advertisement which Mr. Davidson is placing in the Baddeck and Sydney papers:—

Notice to Owners of Sheep.

At this season of the year when selling lambs why not get the highest price for them. Examine ans see if you have any having six or more nipples. I will buy all sheep having six or more nipples, and will pay, delivered at Beinn Bhreagh Nursery $10.00 for six, $15.00 for seven, and $20.00 for eight nippled. We have them now and you may also.

(Signed) John G. Davidson, Supt. Of Beinn Bhreagh Nursery, Beinn Bhreagh, near Baddeck, N.S.

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July 28, 1909. Dear Mr. Bedwin:

In addition to the list of photographs wanted sent you July 23 I would remind you of the following:—

1. Photo of man breathing into the open mouth of a jar floating on a bucket of water.

2. Photo of the new House-Boat (the “Old Ugly-Duckling”) I think you have a negative that will do.

3. Photo of the Crematory.

4. Photo of the Shetland Pony.

5. Photo of the Zulu Ram's head with four horns.

6. Photo of the Yawl “J.A. McCosh”.

These will be wanted for the “Recorder” Bulletin size, seven copies of each.

You better see that you have a good supply of Velox paper on hand full Bulletin size.

There will also be a blue print of drawing by Mr. Byrnes.

Yours sincerely, (Signed) Alexander Graham Bell.

1909, Aug 3 Tuesday At B.B.

738 cells. Surfaces 39.9 sq. m. , weight 27.240 kg or 60.0 lbs. weight of 4.852 kg or 10.7 lbs. weight of cord 1.053 kg or 2.3 lbs. weight of spring balance for measuring, kg or lbs.

MODEL OF CYGNET II, JULY 1909.

738 cells. Silk surface 39.9 sq. m. oblique.

Kite weighs 27.240 kg. or 60 lbs.

Surface 39.9 sq. m. oblique (say 40 sq. m).

100 , weights 4.852 kg or 10.7 lbs

100 m long, weight 1.053 kg or 2.3 lbs

Conditions Observations 2 2 Date Exp FL BL Wind Pull Altitude (2) (2) (4) (4) (4) (2) (2) (4) (4) (4) July 6 1 r100 r200 17.60 mph 32.0 lbs 8°.3 July 6 2 r100 14.25 mph 52.5 lbs 13°.8 July 12 1 r100 r200 17.10 mph 70.5 lbs 15°.8 July 12 2 r100 r200 15.60 mph 68.5

lbs 15°.2 July 12 3 r100 r200 15.16 mph 71.0 lbs 15°.3 July 12 4 r100 r200 17.00 mph 68.5 lbs 15°.5 July 12 5 r100 r200 16.25 mph 70.5 lbs 15°.7 July 12 6 r100 r200 17.50 mph 66.0 lbs 15°.0 July 12 7 r100 r200 16.40 mph 68.5 lbs 15°.0 July 12 8 r100 r200 17.60 mph 65.0 lbs 14°.5 July 12 9 r100 r200 18.00 mph 66.5 lbs 14°.4 July 12 10 r100 r200 16.25 mph 51.5 lbs 10°.9 July 26 1 r100 c200 19.60 mph 17.0 kg 21°.1 July 26 2 r100 c200 18.50 mph 13.2 kg 19°.6 July 26 3 r100 c200 19.20 mph 17.4 kg 21°.3 July 26 4 r100 c200 15.40 mph 15.6 kg 20°.1 July 26 5 r100 c200 16.60 mph 13.4 kg 19°.7 July 26 6 r100 c200 18.00 mph 12.4 kg 17°.8 July 26 7 r100 c200 20.00 mph 14.2 kg 20°.5 July 26 8 r100 c200 16.70 mph 14.8 kg 19°.7 July 26 9 r100 c200 17.40 mph 12.9 kg 17°.2 July 26 10 r100 c200 18.00 mph 11.7 kg 16°.1 July 26 11 r100 c200 17.40 mph 12.4 kg 16°.7 July 26 12 r100 c200 17.30 mph 15.8 kg 22°.4 July 26 13 r100 c200 17.00 mph 13.8 kg 19°.6 July 26 14 r100 c200 21.00 mph 15.0 kg 22°.5 July 26 15 r100 c200 20.60 mph 20.8 kg 26°.9 July 26 16 r100 c200 22.40 mph 22.2 kg 21°.9 July 26 17 r100 c200 22.60 mph 22.6 kg 22°.6 July 26 18 r100 c200 22.40 mph 21.1 kg 22°.2 July 26 19 r100 c200 21.50 mph 25.0 kg 25°.0 July 26 20 r100 c200 20.80 mph 26.2 kg 23°.5

Each observation of altitude and is the mean of ten reading.

Contributions: FL, flying live; BL, live; 20 rope; 5, cord; , miles per hour; lbs, pounds; kg, kilograms; of 2100, rope attached 100 centimeters in advances of the center of the kite.

C 200, cord attached 200 centimeters in advance of the center of the kite.

Sq. m., Square meters; Exp, Experiment.

UPSIDE-DOWN OIONOS JULY 1909.

For whole see p. 55: Horizontal surfaces 6.2500 sq m; oblique surfaces 8.0161. Estimated total surfaces 18.8493 sq m oblique, or 10.8750 sq m horizontal. weight 13.118 kg or 28.9 lbs. weight of rope 4.852 kg or 107. lbs. weight of cord 1.053 kg or 2.3 lbs. weight of spring balance for measuring fuels kg or lbs.

Kite weighs 13.118 kg. about 28.9 lbs.

Horizontal surfaces 6.2500 sq m (horizontal)

Oblique surfaces 8.0161 sq m (oblique)3

Total nainsook 14.2661 sq m.

Estimated surface horizontal plan 10.8750 sq m

Estimated surface on the oblique plan 18.8493 sq meters.

Conditions Observations Date Exp Fl Bl Wind Pull Altitude July 12 1 r 50 11.50 mph 27.5 lbs 18°.3 July 12 2 c 50 12.90 mph 37.5 lbs 34°.5 July 12 3 c 50 9.40 mph 37.0 lbs 35°.5 July 12 4 c 50 10.50 mph 35.0 lbs 36°.4 July 12 5 c 50 12.40 mph 34.5 lbs 35°.9 July 12 6 c 50 11.00 mph 35.5 lbs 32°.1 July 12 7 c 50 10.40 mph 34.6 lbs 34°.2 July 12 8 c 50 13.10 mph 38.4 lbs 29°.3 July 12 9 c 50 11.20 mph 34.4 lbs 33°.9 July 12 10 c 50 11.30 mph 36.5 lbs 34°.3 July 12 11 c 50 10.50 mph 35.3 lbs 32°.6 July 13 1 r 50 c150 13.95 mph 37.0 lbs 21°.4 July 13 2 r 50 c150 22.18 mph 39.0 lbs 21°.0 July 13 3 r 50 c150 21.85 mph 29.0 lbs 15°.6 July 13 4 r 50 c150 18.10 mph 23.5 lbs 13°.3 July 13 5 r 50 c150 18.60 mph 23.5 lbs 13°.7 July 13 6 r 50 c150 18.25 mph 22.0 lbs 13°.8 July 13 7 r 50 c150 19.20 mph 24.0 lbs 14°.7 July 13 8 r 50 c150 19.40 mph 22.5 lbs 14°.6 July 13 9 r 50 c150 19.00 mph 23.0 lbs 14°.2 July 13 10 r 50 c150 19.40 mph 23.0 lbs 13°.9 July 24 1 c 50 21.00 mph 11.6 kg 29°.5 July 24 2 c 50 20.80 mph 3.6 kg 28°.9 July 24 3 c 50 20.06 mph 12.5 kg 26°.1 July 24 4 c 50 21.18 mph 13.2 kg 26°.3 July 24 5 c 50 22.00 mph 14.2 kg 28°.3 July 24 6 c 50 21.50 mph 14.7 kg 25°.9 July 24 7 c 50 22.00 mph 15.0 kg 27°.7 July 24 8 c 50 24.40 mph 12.0 kg 27°.3 July 24 9 c 50 22.20 mph 13.0 kg 27°.6 July 24 10 c 50 20.20 mph 11.6 kg 29°.0

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1909, Nov. 13, Beinn Bhreagh Recorder

TABLE IV: SINGLE LAMBS: GRAPHICAL PERCENTAGES:

TABLE V: TWIN LAMBS: GRAPHICAL PERCENTAGES

1909, Nov. 23 Tuesday At B. B

DIFFERENTILA PERCENTAGES: LAMBS

1909, Nov. 24 Wednesday At B. B.

TABLE IX: DIFFERENTIAL PERCENTAGES: LAMBS