Journal by Alexander Graham Bell, From September 2, 1901, to October 29, 1901

Dr. Alexander Graham Bell on verandah at Beinn Bhreagh. Aug. 30, 1901.

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HARGRAVE KITES

205

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Wootton's Patent, 1866, May 22: — Circular aeroplane driven edgeways slightly tipped up in front by propeller operated by steam power. Degree of tip controlled by shifting center of gravity — movable weight. Started by running down hill on wheels on inclined railway with propeller going. Track rises at end, thus starting machine on upward inclined part. Landing places consist of two tall poles with a rope stretched between them — machine to be driven between poles under rope — hook at top of machine catches in rope and thus stop machine which remains suspended from rope.

Sykes Patent, 1866, Sept. 11: — “Marine Balloon”: — Balloon-kite actuating a boat-like guide (sort of center-board without boat) with rudders at either end. A balloon kite combined with ordinary sail to propel a center board in sea. Balloon broad, flat and knife edged, made of tubular sections side by side (0000000) — the pointed or flattened ends making a sort of knife edge at either end.

A Balloon-Kite, combined with sail, to propel a center-board (without a boat) in the water. The balloon broad, flat, and composed of tubular sections side by side the pointed, or flattened ends of the cylinders coalescing into a flat knife edge at either end.

206

Elston's patent, 1867, August 13, “Aerial Machine”: — Boat-shaped car, partly supported by balloon, propelled by wings operated by man power — utilizing gravity also on a descending grade.

Stone's patent, 1868, May 12, “Improved Aerial Navigator”: — Oval or eliptical balloon, with flat under side and convex upper side — supporting boat-like car the end compartments being filled with gas. The whole designed to be slightly heavier specifically than the air, and propelled by paddles by man-power — ascent and descent to be aided by tipping front end up and down as desired — tipping action to be caused by shifting centre of gravity by means of movable weights. 62 67 15÷2 7 62 67 19÷2 9 62 41 21

The cause of the great difficulty in developing a an Art of Aerial Locomotive and some & the o means that may be employed to overcome it.

The great difficulty in developing an art of aerial locomotion, lies in the difficulty of developing apparatus experimentally — the difficulty of profiting by past experience. A dead man tells no tales, and the actual result of erroneous construction is often the death of the experimenter, HE advances no further, and his death acts as a deterrent upon others. Thus it happens that development has been along theoretical rather than practical lines. The hundreds — the thousands of references to publications upon the subject in my possession, demonstrate the wonderful activity of the inventor's mind upon this subject — and the woeful lack of experiments upon which safe generalizations can be made.

How can ideas be tested without actually going into the air and risking one's life on what perhaps may be an erroneous 207 judgment. Two methods suggest themselves to me: — (1), to use tethered kites and work the desired piece of apparatus attached to the kite by means of subsidiary strings. An error might lead to the death of the kite, but the operator would be safe. The conditions, however, are not similar to a body moving about freely in the air. Could we for example, judge properly of the effect of a rudder upon a ship at sea by anchoring the vessel in a stream and then shifting the rudder from side to side.

(2) The best way, it seems to me is to place your apparatus upon a boat, or float, where it may have a perfect liberty of motion and yet be supported by the water. A boat, for example might be propelled by aerial propellers wholly out of water, and steered by aerial rudders — have its bow elevated or depressed by a horizontal rudder or tail. All the propelling and steering devices that have been proposed for balloons or flying machines could be tested comparatively in this way upon a boat or float — better a float — so that the water should offer only a surface resistance, and not produce effects through the immersion of a keel or centre-board in the water.

(Sub-head) 15 Application to marine profulsion 62 32 30

THOUGHT : — Quite independently of any application to the art of aerial locomotion might we not hopefully seek to improve the propulsion of vessels - in the water along this line. On account of the enormous resistance of the water to a body moved rapidly through it, a limit is speedily set to the velocity of boats or vessels-in the water. Every increase of speed is only accomplished by a disproportionate increase in engine power, and all because the vessel is propelled THROUGH 208 the water, instead of over it.

Whatever resistence the water may offer to a body going through it at a certain velocity — THE AIR WOULD OFFER LESS RESISTANCE. If, therefore, with increase of speed the boat or vessel could be elevated more and more out of the water so that the chief part of the resistance should be the air, would not the engine power be more economically utilized under such circumstances. Would not, for example, torpedo boat destroyers be able to go at greater speed with the same engine power than they do now if they were so constructed above as to utilize the resistance of the air to lift them — at least partially — out of the water.

Sub-head Advantage of using Aerial Propellers

In order to avoid disaster, however, the conditions of aerial support and propulsion would have to be studied. An express train running at sixty miles an hour has sufficient momentum and velocity to be wholly supported in the air — but, under its present form of construction nothing but disaster need be anticipated should the wheels leave the rails. In this case propulsi on is gained through the rails, and the moment the wheels of the locomotive leave the rails the motive power ceases to propel the train.

So with a steamer on the water, the moment the propeller leaves the water the engine races and propulsion ceases. We could not safely subject a steamer going at a fast rate of speed to the chance of having her propeller lifted for a few seconds now and then out of the water: But, if the propellers should act continuously in the air and not in the water at all there could be no danger to the machinery, however much the vessel should be lifted out of water.

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1901, Sept. 2 Sat. At B.B.

Propel boats by aerial propellers, provide them with small rigid aeroplanes to utilize the air as a means of support, as their velocity increases. Provide them also with a horizontal rudder or tail by which the bow could be steered slightly upwards when going at a high speed, and you have conditions that might result in vessels going faster OVER the water than any vessels afloat. So that, quite apart from the applicabulity of your results to aerial locomotion out of the water, your experiments might lead to important improvements in the propulsion of vessels upon the water.

Sub-head Aerial rowing

One way in which experiments could easily be commenced without the necessity of expensive engines, &c. would be to test the efficiency of various forms of wings or paddles operated by man-power by propelling a boat by means of aerial oars. Scores of devices have appeared for propelling balloons and flying-machines in this way — hardly any of them have been tested, and most of them wouldn't work anyway. Why not rig some of them up on a small boat and start AERIAL ROWING, and see what it amounts to.

A.G.B 4

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1901, Sept. 2 Monday Recd. at B.B.

Helen Keller examining the details of a Kite.

Helen Keller My father

M? Het? Miss Safford Ms Fleguson A??

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1901, Sept. 2 Monday Recd

92

Helen Keller examining the operation of the wind gauge. AGB

94

The wind gauge showing a good freeze from the South. AGB

95

212

kite 97

White three called-kite in the air

99

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Elsie Daisy

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Ed. Bert

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1901, September 4 Wednesday At B.B.

MEMORANDUM.

Pages 210 to 219 (inclusive) contain photographs received from George McCurdy Monday, September 2.

221

On Monday September 2 I went to the Grand Narrows with Mr. and Mrs. A. Melville Bell, Mr. Hitz, Miss Sullivan and Helen Keller, to see them off. Prof. Langley arrived at the Grand Narrows same evening, Monday, Sept. 2, 1901,. All stayed Monday night at the Grand Narrows Hotel. Prof. Langley and I left for Baddeck yesterday, Tuesday morning, Sept. 3. The others were to leave Grand Narrows yesterday, Sept. 3 about noon for Truro.

My father and Mrs. Bell bound for Montreal, and Harrowsmith, Ontario; the others bound for parts unknown on their return to the States.

There was a meeting of the Young Ladies Club of Baddeck here at Beinn Bhreagh Hall on Saturday, August 31, to meet Prof. and Mrs. Grosvenor, and Helen Keller and Miss Sullivan. Mrs. Grosvenor made an address as President of the Ladies Club of Amherst, Mass., followed by an address from Prof. Grosvenor. Mr. George Kennan was present and gave an account of his expulsion from Russia. Miss Sullivan gave some account of Helen's education and I also spoke of Helen. Helen Keller made an address to the Club and afterwards recited Longfellow's Psalm of Life. In order that Helen Keller's address might be preserved she dictated it to Miss Safford while it was still fresh in her memory, and I read it to the club so that those who were unable to understand Helen Keller's articulation at the time she made the address might have the full benifit of it. I shall ask Miss Safford to make a copy of Helen's address for preservation here.

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REMARKS MADE BY HELEN KELLER AT BEINN BHREAGH HALL, TO THE YOUNG LADIES CLUB OF BADDECK. Dear Friends: —

I do not know just how to tell you what I feel tonight. I am so proud and glad to meet the Young Ladies Club of Baddeck my heart throbs in appreciation of your presence here; but “my tongue will not utter the thoughts that arise in me”. Here in this beautiful home love is supreme; we see it in every flower; we hear it in the music that sings itself inside and outside our hearts; it makes everything beautiful! Here our griefs, our deprivations, our failures, are made to “blossom like Aaron's rod” with flowers.

People often ask me if I am happy. It seems strange to them that one who cannot see or hear should be able to enter into the joys of life. That is because they do not understand the power of love. By its magic one perceives that everything has its wonders — even darkness and silence. The eye cannot follow the flight of song; the ear cannot hear the music in the heart that receives it; but the spirit knows no limitation — it may follow the song to the utmost boundary of the heavens and in the inner silence listen to the music of the spheres.

This thought is enough to make the saddest happy; it will make you happier if you will let it take root in your hearts. It was planted in mine by one who is all the world to me — my teacher — to whom all the best of me belongs; for there is not a talent, or aspiration, or joy in me that has not been awakened by her loving touch.

223

1901, Sept. 5 Thursday At B.B.

The following party left yesterday (Wednesday) for Cariboo Camp: Mrs. Edwin A. Grosvenor, Marian, Robbie Ker, Edwin P. Grosvenor, Douglass and Lucian McCurdy, and one of the men, either Malcomb or Archie.

Prof. Grosvenor remained behind at the Lodge with Bert and Elsie. He was in great pain and was awaiting the arrival of the Doctor, (to take the place of a dentist).

Mr. McInnis has been ill for two days with inflammatory rheumatism.

At dinner last night Mr. and Mrs. Gilbert H. Grosvenor, Miss Georgie McCurdy, Mrs. A. Graham Bell, Miss B. A. Safford, Prof. Grosvenor, Mr. Blanchard, of Windsor, N.S. (father of Percy Blanchard), Prof. S.P. Langley and A.G.B.

An epedemic of long distance swimming seems to have struck our young people. Some time ago Douglass swam across the bay from the McCurdy cottage to the Lodge. Then Susie McCurdy did the same thing last week in twenty-five minutes. This started Daisy up, and Monday Sept. 2 she swam from the Point rocks to the Warehouse, a distance of more than a mile, her mother following her in a canoe. Daisy kept close in shore so as to avoid any risk, and this seems to have been a preparation to see whether she could venture to swim across the bay. The distance is considerably more than from the McCurdy cottage to the 224 Lodge Wharf, so that this feat gave her the championship, for long distance swimming. Susie McCurdy, however, heard of it and followed it by swimming from Mrs. Kennan's wharf to the warehouse, certainly a much greater distance than from the Point to the Lodge.

Finished the sheep chart showing the ancestry of all the Beinn Bhreagh Flock at present living.

The following sheep have no collars because they are easily identified by the punch marks in their ears. This however has led John McKillop to record them by their punch marks and not be their correct names, thus leading to difficulty with the records. We shall put collars upon all of these sheep today. They are the lambs born 1900, and 1901.

This is a sheep.

226 227

1901, Sept. 6 Friday At. B.B.

The new three-celled triangular kite with four superposed aeroplanes was completed and photographed on Wednesday, see photographs on page 226.

Prof. Newcomb arrived yesterday evening, Thursday, September 5, 1901.

Yesterday, Thursday afternoon went up the mountain to see the sheep with George McCurdy. Bert drove his father and Prof. Langley up. John McKillop was not ready, but we were able to pick out a few of the more characteristic sheep before the arrival of our visitors.

Prof. Langley's thoughts have recurred to old ideas of his relating to the possibility of breeding intelligence in animals. In order to preserve them and get them down in black and white, he yesterday dictated a letter to me on the subject which I append to these notes.

Mrs. McLeod (Georgie) went over the bay in the gig with me yesterday when I went to Baddeck and we had some conversation about the plans for the proposed new boarding house for men. Mrs. McLeod thinks that an ice house would be necessary as she has great difficulty in keeping provisions. She thinks also that a coal or wood furnace would be advisable to heat the air of the whole house; and that there should be ten sleeping rooms, sitting room, dining room, kitchen, spare room, pantry and a bath room.

228

Prof. Langley gave us last night a very interesting account of the fire dance in Tahiti. He has written a note upon the subject which I understand appeared in "Nature" August 22, 1901.

A.G.B.

MEMORANDUM.

The letter from Prof. Langley relating to the breeding of intelligence in animals occupies pp. 229 to 234 inclusive.

A.G.B.

242

1901, Sept. 7 Saturday At B.B.

Prof. Grosvenor left yesterday for the Grand Narrows. He sailed with us over to Baddeck and caught the steamer. We then continued to Washaback where we spent the afternoon.

The party consisted of: — Mrs. A. Graham Bell, Mrs. Gilbert H. Grosvenor, Miss Safford, Prof. Langley, Prof. Newcomb, Gilbert H. Grosvenor, and A.G.B.

Dined in the evening at the Lodge. We were nearly run in to on the way to the Lodge in the dark by a team that was driven recklessly by Daniel Morrison and Malcomb Docherty. Think they were under influence of liquor — will investigate.

Since Bert and Elsie have lived at the Lodge they have discovered that people enter our place at three o'clock in the morning, driving along at a furious rate. I want, to find out who these people are. George McCurdy and Bert are rigging up an electric attachment to the gate by which a bell may be rung in the Lodge if the gate is opened at night. Warned in this way it will be an easy matter to discover who these people are. This is a great secret at the present time, for everything would be spoilt if it were known.

Just as we were going to the Lodge yesterday news came of the attempted assination of President McKinley at Buffalo. Mr. Arthur W. McCurdy has sent us two telegrams and the people in town at the telegraph office telephone out to us the news that passes on the wires. Glad to note that the latest telegram 243 nine A.M. this morning says: —

“President improving, good hopes for recovery”.

Have not been able to elaborate ideas for some time past. The following drawings, pp. 244, 245, illustrate ideas shown in my Home Notes, pp. 126 to 135, dated September 1 and September 3, 1901.

Last night's mail brought a newspaper cutting from Mrs. Kennan, taken from the New York Sun of September 1st, 1901, entitled “His Box-Kite Swivel Sails”, showing that a Mr. Pryor has realized that the propulsion of a boat by a kite will remedy many of the defects of the ordinary method of propelling boats by means of sails. (Who was prior?!!!!!!!!) — Mr. Pryor attaches his kites to the masts. I attach to this dictation the newspaper cutting referred to. It occupies pages 246 and 247.

A.G.B.

244

Aerial rotatory propellers &c.

Aerial oars or wings &c.

245

Aerial oars to perfect 'boat'

246

N. Y. Sun Sept 1st 1901

HIS BOX-KITE SWIVEL SAILS.

NEW BOAT RIG SPRUNG ON THE SOUND BY JAMES W. PRYOR.

Attempt by an Eminent Thinker of the City Club to Evolve the Perfect Sail System—Mr. Pryor Sails Out on the Trial Trip and Comes Home by Train.

Port Washington L. I ., Aug. 31.—James W. Pryor, Secretary of the City Club and one of the most eminent thinkers of that notable body, has failed to convince his friends that he has evolved the perfect boat rig. The failure of Mr. Pryor is not considered to be due to any unwillingness on his part to set aside all the ordinary principles of boat rigging. In fact, his plan was altogether original. Before it was tried the theory of it, as eloquently elucidated by Mr. Pryor, seemed eminently practical.

In his preliminary thoughts about boats Mr Pryor had been struck hard by an appreciation of the fact that the ordinary sails which have been used by the human race have a tendency to depress the boat. The thought that the sinking of the boat opposed a greater bulk of water to the hull and therefore retarded its progress depressed Mr. Pryor. The result was the evolution of what for want of a better name has been called the box-kite swivel-sail system.

Though Mr. Pryor's conception of his invention was as clear as could be, it is necessary for one who attempts to grasp the subject without the enthusiasm of the inventor and offhand to use diagrams. The pictures herewith presented were drawn by a friend of Mr. Pryor's from memory. He only requests critics to remember that what they lack in finish they gain in simplicity.

The inventor built a set of four sails for each mast. This called for a new nomenclature for sails. The severest and least

GOING BEFORE THE WIND.

imaginative system was decided upon and the sails were accordingly named upper port quarter, lower port quarter, and so on. Each quarter was made double, like a box kite. Mr. Pryor is all for buoyancy. Nothing seemed to him more proper, once it was established that the box-kite is more buoyant than an ordinary kite, than that the quarter sails should be made on the box-kite plan. Each one was mounted on an axle running through the middle. The details of the construction have not yet been made public. Inventors are reticent usually until their creations gain perfection, and Mr. Pryor seems to be no exception to the rule.

The axles of the four quarters were fastened to the mast on a swivel arrangement so that each pair of quarters might be swung around the mast at will to meet any angle of the wind. Thus each quarter will be seen to have both a horizontal and a vertical inclination. This seemed to Mr. Pryor a great advantage over the clumsy make-shifts with which sailor-folk have been content for so many generations. With all the arts and sciences advancing all manner of human effort by leaps and bounds, the sailor remains the slave of a system under which the only method of avoiding disaster in the face of an approaching squall is to lower sail.

By no means the least virtue of the City Club plan of sail is that there is no lowering or hoisting of sails. When the hurtling blast approached what was easier than to loosen all the swivels and let the quarters swing into positions of least resistance? Then, by tightening up the halliards a little here and a little there it would be possible so to temper the wind to the unshorn boat that there might always be just exactly the right and wise pressure on the sails. The sail plan of the most expensive yacht is at best an arbitrary thing. When it is necessary to shorten sail the sails are reefed down to arbitrary lines. Scientific arrangement demands a more certain and accurate graduation of the sail area.

But it was not for these things that the Pryor plan was devised. As one to whom Mr. Pryor has given his confidence has said: “The loveliest thing about it was the way in which it made the boat light on its feet.” She did not say whether the words were Mr. Pryor's or not.

As will be seen by the first illustration, the pressure of the wind against the backward tilted sails must be upward. The harder the wind blows against such an arrangement of the sails, the higher out

The Wind BEATING BACK.

See next page 247 of the water the boat rises and the faster she flies. One of the unhappiest sensations to those who are easily made sea-sick is that produced by the steady and violent slap-slap of the waves against the bow as the boat is driven head-on into heavy seas.

If it would not absolutely prevent sea-sickness, the City Club plan of sails at least promised to eliminate one of its most potent causes. Because when the wind blows its hardest the boat will be so far lifted out of the water that it will barely touch the water at all and in a hurricane of sufficient force it might even skip from wave to wave like a live thing.

The building and adjustment of this new sail plan has been the relaxation of Mr. Pryor all summer from his arduous duties at the club. Just at this time, on the eve of a municipal campaign the duties of every one connected with the organization are very heavy. If they seem to have borne less heavily on the shoulders of Mr. Pryor than on those of the Rev. Dr. Slicer or Chandos Fulton or any of the rest, it is undoubtedly due to the estful labor which he has spent upon his boat and sail plan.

The first set of the new sails was completed and in proper working order a week or two ago. There was quite a gathering of city folks and natives to see the start. It was noticed that there was no name visible on the bow of the boat; some of the sharper eyed among the spectators said however, that they thought that there had been a name there and that it had been painted out. They thought that the name was Flying Fish. Mr. Pryor and a friend whose name is not known were the only crew.

There was a strong breeze from the south giving the Flying Fish a fair wind to her destination at Mamaroneck. There were no heavy seas encountered but to the straining eyes of those on the shore there was every evidence that had there been heavy seas the invention would have fully justified the hopes of the inventor. The boat seemed to be moving with fair speed for a craft of her size, as she passed out of Manhasset Bay into the Sound.

Among those who saw the start were not a few men who have made their living by the building and sailing of catboats. As might have been expected from such prejudiced persons, they showed no great confidence in the rig of the Flying Fish. One of them went so far as to say that the boat would have sailed just as well before the wind if Mr. Pryor had opened a good stout umbrella of ample proportions and held it out to catch the breeze. But the rest determined to await the inventor's return and to welcome him as one deserved who had turned aside from his daily task to shed light in byways which had long been in darkness.

As the afternoon wore on the anxiety to have Mr. Pryor return increased Even some of the men folks returning from their offices in New York caught the fever of the excitement and joined the throng at the beach.

Night came, but no conquering hero came sailing home out of the sunset glow. Watch fires were lighted as beacons to guide the inventor home. He did not come. The watchers decided that the jealous folk of the north side of the Sound had detained him among them that the glory of his invention might shed a glamour over Mamaroneck and Larchmont rather than on the place to which the glory rightfully belonged, the birthplace of the box-kite, swivel-sail system.

Early risers next morning went down to the beach in the hope that by some chance they might see Mr. Pryor coming in with the dawn. They did, indeed, see Mr. Pryor, but he was not on the Flying Fish. He was on no boat at all. He said somewhat shortly when questioned that he had come back from Mamaroneck by train. He was waiting for the appearance of a launch which he had chartered to tow the Flying Fish back across the Sound.

It was quite apparent that he was deeply grieved by what had happened, whatever it was, but no further explanation could be obtained from him except that the new sails did not work nearly so well against the wind as they ought and that the return in the face of a head wind had been quite impossible. He thought that possibly he might study out some improvements that would obviate the difficulty. He was as positive as ever that the main principle was all right.

The Flying Fish has come back. It is apparent to the casual observer that there is something the matter with the sail system. The sails looked as though they had been overworked in the effort to meet the head wind with just the proper adjustment of buoyancy. The boat has made no voyage since, none at least by daylight. Perhaps she never will, now.

248

1901, September 9, Monday At B.B.

Proposed plan of experiments to level up to Aerial Locomotives.

Continuing the line of thought shown on pages 206–207, my idea is to approach the subject of areial locomotion experimentally along two lines: —

(1) Boats propelled by aerial propellers and steered by aerial rudders

(2) Kites provided with propellers and rudders.

Some ideas concerning the propulsion of boats by aerial propellers and aerial oars or wings, are shown on pp. 244, 245.

In relation to kites I propose to make a kite — (probably of the triangular form) that will float in water like a boat. My present idea is to construct a large kite on the same general plan as the three-celled triangular kite, with superposed aeroplanes shown in the lower left hand photograph on p. 129; or the kite shown on p. 226. This kite should be made of such dimensions as to be able to carry up a load of — say 250 lbs. — which would enable me to make an ascent, if I so desired. It would also enable the kite to carry up an engine and propeller, while still tethered to a boat on the surface of the water, and test the action of the propeller, &c. It would also enable experiments to be made with very powerful electric motors, taking their current from a dynamo on board of a boat — the current being led to the kite by means of two wires. I look upon a kite as a tethered flying-machine. If then, we utilize the wind to lift the machine with its load and propellers to a height above the water, then when the propellers are worked the kite becomes a flying machine, and the steamboat below can follow the motions of the 249 flying machine in the air so as to keep the lines slack, leaving the machine free to itself. Should any accident happen to the machinery, the lines can be allowed to become taut and the whole thing would be supported in the air as a kite; — Or, if there is no wind, the steamboat can go ahead full speed and by dragging the kite after it practically make its own wind.

A triangular kite, large enough to carry a man had best, I think, be made of metal. The frame-work could be made of large tubes of thin metal. These would be lighter than a wooden frame-work — more solid — and would float in water if hermetically sealed up. A series of V-shaped pipes would undoubtedly float in the water like a boat, especially if provided with a keel. These pipes form the frame-work on which the supporting kite-surfaces could be placed. These surfaces might be made of sheet-aluminum, or oil-cloth, or oil-silk. They had best be made of some material that will not absorb moisture, so that they will not load the kite down by being wet. I imagine that such a kite, with its tow-line attached to the keel, near the front part, would, when towed a tug-boat, be lifted out of the water and fly in the air as a kite. On account of the aeroplane surfaces above, such a kite, when pulled by the keel, tends to rise at the bow, thus 250 placing the aeroplanes in a position to catch the wind on the under surfaces

Inclined to think that kite whose cross section is an equilateral triangle of fifteen feet each way, and length 30 feet, would present sufficient surface to the wind to carry me up, or to carryup a load of 250 lbs. in addition to its frame-work — that is, if the frame work can be kept within 250 lbs.

A triangular frame-work of small dimensions needs no internal bracing, the form is self-braced.

251

If the triangle is very large each side will be weak in the middle, but can be simply braced by an internal triangle

This internal triangular bracing could be carried out indefinitely for triangles of indefinite size

A system of internal braces parallel to the three sides will give great strength and firmness with little weight.

A.G.B.

252

On Saturday, Sept. 7, I showed some kites to Prof. Langley and Prof. Newcomb. The triangular kite shown in lower left hand photograph, on p. 129, was flown by a cord attached to the center of the front cell and tethered to a tree.

The small two-celled triangular kite, shown in the upper photograph on p. 152, was flown by a cord attached to the bow and Prof. Langley let the cord out until the kite was practically out of sight; at least, it was difficult to find it after the eye had once been taken from it.

We also tried both forms of kite shown on p. 167, but without rudders; also another kite of the Hargrave form. The wind was very light, and the Hargrave kites were heavy — intended for a heavy breeze, so that they wobbled about considerably. The triangular kites, on the other hand were very steady, especially the one tethered to a tree. This kite, which impressed Prof. Langley very greatly as a suitable form for the attachment of propellers, &c as a body for a flying-machine, was of the form shown in the lower left-hand picture on p. 129, and the photograph on p. 154.I 154. I think these are different kites, and I am not sure at the present moment which one was used.

We also tried the kite shown in photograph on p. 226, but there was not enough wind to set it up properly.

Yesterday, Sunday, Prof. Langley and I walked to the house-boat and Mabel drove Prof. Newcomb there. Professors Newcomb and Langley returned in the phaeton and

Mabel and I walked home. Bert and Elsie took supper with us. A letter received from Mrs. Grosvenor states that all are well at Cariboo camp.

A.G.B.

253

1901, Sept. 10 Tuesday At B.B.

Mr. Ferguson is now making for me a foldable triangular kite, that will occupy but little space.

Kite will take to flies New sides each

The kite is made in three pieces, each side forms one flat piece, so that the three sides can be stowed away in flat condition, and tied together into the triangular form when they are wanted to be used as a kite. Or the pieces may be hinged like a Japanese screen, and folded one on the top of another, when not wanted to be used as a kite.

This would be very convenient for transportation on a boat. Quite large kites could be stowed away in flat condition and occupy very little room. The only trouble is that these kites are not specially adapted for floating on the water. If they were made of metal piping they would have to 254 be quite large.

THOUGHT: — Make wooden flotation chambers on the sides of these kites. For example: —

Kite Framework with flotation chambers.

Let, for example, two of the side sticks be 10 cm. apart and composed of pine having a cross section of 1 sq cm. Then fastened to them on either side two thin sheets of pine so as to convert them into a box.

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1901, Sept. 10 Tuesday AT B.B.

If the side sticks are 1 cm. square in cross section, and the thin boards 100 cm. long by 10 cm. wide by 1 millimeter thick Then the exterior surfaces of the floating chamber would be 100 cm. long, with cross section of 10 cm. by 1.2 cm. The area of the cross section would be 10 x 1.2 = 12 sq. cm. Length being 100 cm. we have 1200 cu. cm. of space occupied by the box; hence, the box if submerged would displace 1200 cu. cm. of distilled water, which would weigh 1200 grams.

256

1901, September 11 Tuesday Wed At B.B.

Went down to the Laboratory yesterday afternoon and found the framework for the triangular folding kite well under way. Made calculations as to weight of float for flotation chambers for a triangular kite like that shown on p. 154.

A flotation chamber going horizontally from end to end of the kite on either side, 175 cm. long by 10 cm. wide and 2 cm. thick would, if submerged in water, displace 3,500 c.cm. of water. The flotation power of the two floats would thus be 7,000 grams. I calculated that the floats when made of pine would weigh about 360 grams, so that they should be able to float an additional weight of 6,640 grams. In order to ascertain whether a kite, as constructed on p. 154 would carry up the load represented by the float, we tried the three-celled red triangular kite on p. 154, with a load consisting of a brass rod (weighing 840 grams — a load more than twice as great as the proposed flotation chamber). — The brass rod was attached to the keel of the kite. Although there was hardly any wind perceptible at the surface of the field, no difficulty was experienced in raising the kite with its load by running with the cord, and after the kite had gone up above the level of the trees it flew steadily and well.

257

Last night we had a display of the aurora bor i e alis. A diffused glow in the northern sky from which projected vertically shafts of light, having a slow and apparantly steady motion to the left Porf. Newcomb suggested that if such a shaft of light as that shown above could be observed simultaneously by two observers a few miles apart, the distance, height, &c. of the auroral streamers could mathematically be determined. I suggested that this could easily be accomplished here by telephone, for example,, I believe there is a telephone at Mrs. McLeod's at Middle River. Let me go there, and arrange the telephone so that I can sit upon the verandah at her door and have the telephone beside me. We can arrange our telephone here so that Prof. Newcomb can use the telephone on the verandah. Then, Prof. Newcomb here, and I in Middle River could watch the Aurora together, and talk through the telephone about what we saw.

Suppose, for example, we note a shaft of light like that above, proceeding slowly to the left, and we arrange by 158 telephone that I shall tell Prof. Newcomb the moment I see the shaft of light against the star — by telephone: — “It is almost there now — nearer — nearer — NOW — ” Prof. Newcomb, while listening to this through the telephone observes the position of the shaft of light relatively to the star, and when he hears the word “NOW” notes the angular distance and the time, &c.

We propose to make an experiment of this character. It might be worth while doing it tonight.

The auroral display began about ten o'clock last night, Halifax time. It disappeared before mid-night. I have often observed here auroral displays that were brilliant shortly after sun-down, but faded away later in the night.

THOUGHT: — Can these be local manifestations dependent on the heating of the land area during the day, and its cooling off at night.

Mr. Pietsch, an architect connected with Hornblower and Marshall, in Washington, was here last night with plans for the proposed Hubbard Memorial Building.

Prof. Langley leaves us this afternoon.

259

1901, September 12 Thursday At B.B.

Prof. Langley left us yesterday afternoon. George McCurdy and Miss Georgina McCurdy took lunch with us, and George took photographs of Prof. Langley and Prof. Newcomb on the verandah. The Blue Hill called at the Lodge Wharf for Prof. Langley. In farewell we sent up from the Laboratory the three-celled kite shown on p. 154, with an American flag flying at the stern

Wind Aurevoir to Langley

It flew up well, just as the steamer was leaving the wharf. Prof. Langley and other passengers waved their hats and handkerchiefs.

After the kite had been flying for about ten minutes the cord broke. The kite was then a very considerable elevation. The weight and resistence of the flag was the probable cause of the kite turning upside down. It turned topsey-turvey and began to come down with extreme slowness

wind

260 So slowly, in fact, that there was something remarkable about it. I am a little inclined to the belief that the resistence of the flag prevented the flag end of the kite from falling as rapidly as the other end, so that the flag end, being higher than the other end, the aeroplane surfaces would be inclined in above the horizontal in the direction in which the kite was going and thus retard descent. If inclined downwards, in the direction which the kite was going, the descent would surely have been rapid, aided by gravity. I cannot say,

however, that I observed the position of the aeroplanes. I simply noticed the kite floating away upside down, flag first, and falling with extreme slowness. It fell among the trees near the top of the mountain, and was not damaged at all.

Mr. Ferguson has been making apparatus for Prof. Newcomb to determine the amount of light received from the sky at night.

Mr. Ferguson has probably, completed today the folding Japanese screen kite, illustrated on p. 253. He will then proceed to make the kite shown on p. 256, with two horizontal flotation chambers 175 × 10 × 2 attached longitudinally to the middle of the kite on either side.

THOUGHT : — Why not make this an integral part of the kite instead of an attachment. Simply board in the side sticks of the kite, so as to make the flotation chamber. Unless the sticks forming the sides — that is the ribs of the kite — 261 were made heavier than in our present model, the flotation chambers would have only about half the floating capacity of the attached float, with the same weight. The ribs being made of 1 cm. sq. sticks, the thickness as of the proposed flotation chambers would only be 1 cm. plus the thickness of the boards The float would thus be 175 x 10 x 1.2 cm. (about). Each float would thus displace 2,100 cu. cm. of water. Total displacement 4,200 c. cm. In relation to wood-work, each board is supposed to be 175 cm. x 10 x 0.1 (only 1.millimeter thick) This, for 262 for the two boards would make 175 × 10 × 0.2 = 350 c. cm. of pine. The thickness of the boards may, in practice, be somewhat greater than this, thus increasing the volume of wood required. The horizontal sticks, to fill in between the ribs, we may call 175 × 1 × 1. This is an over-estimate, as a balance to the under estimate on the board. Each float would have two such sticks, equal to 350 c. cm.

Weight of four side boards equal 700 c. cm. of pine

Weight of four side sticks e qual 700 c. cm. of pine

Total additional material = 1400 c. cm. of pine

This would be the additional material required to make two floats, one on each side of the kite. I have not included the upright, or vertical sticks of the floats, because they already form portions of the ribs of the kite.

One c. cm. of pine weighs a little less than one-half a gram; hence, 1400 c. cm. of pine will weight less than 700 grams, which represents the additional load to be carried by the kite.

Weight of water displaced by 2 floats = 4200 grams

Weight of two floats = 700 grams

Floats will therefore support an additional 3500 grams

The kite, without flotation chambers, weighs 1180 grams, and it carried up, on Tuesday, a load of 840 grams, in a light wind, which represents a greater load than the proposed flotation chamber.

It is obvious, therefore, that the kite can carry the flotation chambers in the air, and that the flotation chambers can carry the kite in the water.

The wanderers returned last night: Mrs. Edwin A. Grosvenor/Miss Robbie Ker Miss Marian H. Bell Edwin Grosvenor 263 and Douglass and Lucian McCurdy, and Bert. Bert went out yesterday on horseback, to bring the party home — got lost in the woods, — heard voices — shouted — was heard — rescued — guided to camp — and returned with the party last night. George McCurdy went out on Saturday and returned on Tuesday morning.

Daisy and Ed and Douglass walked all the way from the camp to Baddeck.

Arrived by Steamer Blue Hill last night: — Robert and Sarah Marsh.

Mr. Pietch, the architect appeared this morning. As the plans for the Hubbard Memorial Building do not seem to have necessitated his return, there must be other attractions.

Ed swam across the bay this morning from the Lodge to the McCurdy wharf.

Examined the new arrangements for water supply last night. Left here about 9 P.M. didn't get back here until nearly mid-night. The ditch in the gully that supplies this house with water has been deepened and widened, and there is a good supply collected in the pool at the edge of the ditch — little or none of which reaches our reservoir I directed Mr. McInnis to have a syphon made of two-inch pipe. He informed me that this had been completed and put in 264 position yesterday, but would not syphon the water. This is a serious matter, because the reservoir is practically empty and the water so foul that we dare not use it for culinary purposes. For the first time in the history of Beinn Bhreagh we were obliged to haul the water the McNeal spring, that supplies the Laboratory. AND YET THERE IS WATER IN THE GULLY THAT SHOULD SUPPLY THIS HOUSE. A considerable quantity has collected in the pond at the end of the drain, but only a little surface trickle gets into the troughs that lead the water to the reservoir, and on account of the great distance — over a mile — the water disappears through leakage and evaporation before, reaching the reservoir. My idea was to put in a large syphon, which should act intermittantly When the water in the pond, or pool, should reach the top of the syphon, the whole pond was to be emptied out quickly into the trough.

With such a volume of water suddenly poured down the trough, the greater portion would reach the reservoir that supplies the house and very little would be lost by evaporation or leakage. I visited the pool last night, and found it full of water, and a mere trickle escaping into the troughs, none of which reached the reservoir. The following was the arrangement which was expected to syphon the water off:

Siphon! Trough

This was formed of 2 inch tin pipe. Of course, the water simply rose to the level of the lower part of the long horizontal pipe, and trickeled down that into the trough. There was no syphoning action at all.

In examining the syphon for the purpose of finding out why it did not work, Mr. McInnis found that it leaked in numerous places at the joints. He had attempted to remedy this by wrapping the pipe with rags at the leaky places. I got some pieces of rubber hose last night and put them into the pond, and the other end into the trough, as follows: —

The wooden trough, having been lowered by Mr. McInnis, had very little slope at this point, so that I was enabled by placing a stick across the trough, under the rubber hose, to get the nozzle of the rubber hose at the lower end, below the surface of the water in the trough, so that no air could get up the pipe from the lower end. Under these circumstances, by a little suction from the mouth, the syphon action was started. The moment a trickle of water appeared the nozzle was placed in the water of the trough, to prevent any air getting in at that end, and in a little while the 266 pipe cleared itself of air, and the syphon action was well established. I put three pieces of rubber hose into the pond and started all three syphons at work. Quite a good stream of water appeared in the trough. I walked along the trough all the way to the reservoir, accompanied by the pleasant music of trickling water in the trough at my side, a sound we have not heard for many a day. I followed the pipe down to the place where it crosses beneath the road, looked into the trough on the other side of the road, and found a good stream running there. I then started for home but turned back, that I might be sure that the water, which flowed well up to within a few feet of the reservoir, actually entered the reservoir. I therefore walked up to the reservoir, and not hearing any water fall as I expected sought the exit of the trough, and found ONLY A FEW MISERABLE DROPS falling into the reservoir. I found that the last section of the trough was defective — made out of a broken trough not half the diameter of the rest of the trough. It had become dammed up at the upper end of this section, and, the trough being so slight in diameter compared with the section immediately above, the water flowed out on either side over the dam, and escaped on to the grass, running down the embankment of the reservoir away from the reservoir, as follows: —

267

I removed the accummulated materials that dammed up the small trough, and immediately there was a good flow of water into the reservoir. The level of the water in the upper pool had lowered before I left, so it is probable that during the night the whole contets of that upper pool may have found their way into the reservoir below, and may prevent the lessening of pressure in the house, until we can get more water in.

A.G.B.

268

1901, Sept. 13 Friday Recd. at B.B.

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270

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271

1901, Sept. 14 Saturday At B.B. Lab.

The sad news was received this morning of the death of President Wm. McKinley. Our flags are at half mast, and draped with black.

A wet day — and a good stream of water running into the reservoir.

Party at Miss McCurdy's last night. Those who went over from the Point were: Mrs. A. Graham Bell, Miss Marian Hubbard Graham Bell, Miss Robbie Ker, Miss Sarah Marsh, Mr.

Edwin Grosvenor, Mr. Robert Marsh: — From the Lodge Mrs. Edwin A. Grosvenor, Mrs. Gilbert H. Grosvenor, Miss Maude Marsh, and Mr. Gilbert H. Grosvenor.

Mr. Sullivan, interviewed me last night on behalf of the Boston Transcript — gave him from recollection substantially the portion of the New York Herald interview that was not published in the N. Y. Herald.

Miss Safford read to Prof. Newcomb and myself some of the chapters in his new book "Astronomy for Everybody", that have been dictated here.

272

This morning the following left for the Grand Narrows by the Blue Hill, en route for home: —

Mrs. Edwin A. Grosvenor, Miss Robbie Ker, and Mr. Edwin P. Grosvenor.

Our triangular kites in which each cell represents an equilateral triangle, seemed to be indifferent as to their position in the air. We have flown them by strings attached to one corner — we have made one corner heavier than the other by having a double rod, or keel, so as to keep one corner down — but, upon thinking the matter over I fail to see the advantage gained by making these kites fly with one corner down, forming a keel, and the flat aeroplane surface above. I think one reason why it has seemed most proper to have the kites fly in this way, is the analogy of a ship with its deck above, and its keel below the water. The analogy, however, is probably false, and I am inclined to think that many advantages are to be gained from making our ship fly upside down — deck down, keel up.

When a triangular kite alights upon the ground, one corner generally strikes the ground, so that this one point has to bear the whole strain involved in stopping a kite of considerable weight. We very often have to repair damages on our larger kites, due to this cause. If the kites were made to fly flat side down, instead of edgeways, a larger surface would receive the shock of alighting and the strain 273 on any one part of the kite would be less than in the former case.

Then, again, in alighting in water, the flotation of the kite involves difficulties if it lights edge down. In order to secure flotation while retaining that position, a considerable portion of the kite would have to be submerged in order to secure stability in the water, for example, Mr. Ferguson is now making floats to be attached to a kite as follows: —

A l though the floats would nearly be in the middle of the kite, the base of support in the water would have very much smaller area than the upper part of the kite, and hence the it would be apt to be unstable in the water. If, however the kite were placed up-side down with the floats both below, as in the above diagram, the whole kite would be out of water, and the whole weight of the kite well within the base of support, and the kite would float in a stable manner in the water. Yesterday I made an experiment with the a two-celled triangular kite loaded with sticks at two edges 274 and flown by a bridle flat side down: —

There was no wind, and the flag at the Lodge hung idly down. Mr. Ferguson, however, ran with the string, and the kite rose very steadily and well, showing that it could fly in this way perfectly well in a breeze. The following are a few diagrams made in my note-book under date 1901, Sept. 12, Thursday: —

275 276

The folding triangular kite, shown on p. 253, was finished yesterday. Each side was 175 cm. long × 100 cm. wide. The aeroplane surfaces each 100 × 25.

Figure I shows the three sides of the kite lying flat upon the ground, piled one on top of the other:

See Fig 2 on next page.

In Figure 2 Mr. Ferguson is holding up one of the sides to show the mode in which the side sticks are attached to the longitudinal sticks

277

In Figure 3 Mr. Ferguson is holding the three sides open like a Japanese screen.

278

In Figure 4 Mr. Ferguson is preparing to tie the sides together into the form of a kite, and in Figure 5 the kite is completed ready for flying

279

We took the kite up to the field to see whether it would fly, yesterday, but there was no wind. Mr. Ferguson ran with the string, and the kite rose beautifully and flew steadily and well while he ran. The following is a picture of the kite in the air

The folding kite promises to be a great success and occupies very little room when folded up and stored away. The folding kite was weighed yesterday. It weighed 1340 gramS

A.G.B.

280

1901, Sept. 16 Monday At B.B.

MEMORANDUM

Pages 281 to 285 inclusive, contain photographs taken September 11.

281 282

Samuel Longley

g

283 284

Simon Newcomb

g

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1901, September 16 Monday Recd. at B.B.

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MEMORANDUM

Pages 287 to 293 (inclusive) were dictated by Prof. Simon Newcomb.

287

THE PRINCIPLES OF AERIAL MACHINE FLIGHT. 20 (A DICTATION BY PROF. SIMON NEWCOMB.)

Date?

(One following was dictated by the late Simon Newcomb while he was visiting Dr. Bell in the summer of 1901)

Sept 16, 1901: —

The weight of a flying-machine and of any person, or thing, it is to carry, must be supported by one or more plane surfaces, which I shall call wings, moving in the air.

The weight which a given wing will bear is proportional to its surface, and to the square of the velocity with which it moves. Hence, the first point to be arrived at is the highest possible speed; and the second is extend of wing surface.

If the machine is to rise from the state of rest, a sufficient velocity must be given to the wings while it is still at rest. This requires that the motion of the wings shall be circular. Wings with circular motion have an additional advantage that they can combine the functions of supporting and propelling surfaces. Any plane supported by the air may be made to move forward by simply giving it a slight inclination.

Confining ourselves to wings with circular motion, the possible speed is limited by two conditions: — The ability and the strength of the materials to resist the centrifugal force, and the viscosity of the air. The limit set by the first is absolute; that by the second relative — that is to say: — In the latter case we can define any special speed as a limit which cannot be exceeded.

The limit of linear velocity, fixed by the strength of the materials, will probably vary from 100 to 300 meters per

288

This is p. 289 3

The third column gives the Horse Power required for the horizontal motion under the given conditions.

The fourth column gives the weight which 1 Horse Power may thus carry.

Sustaining power and required Horse Power per square meter of surface, of a smooth surface, moving through the air with speeds of 60 and 90 meters per second, at different inclinations, from 1° or 2° to 5° = [???]

SPEED 60 M. PER SEC.

Weight supp. by [???] Weight Sup.. H. P. By 1 H. P. 2° 22 kilog. 0.62 36 kil. 3° 34 “ 1.40 24 “ 4° 45 “ 2.6 18 “ 5° 56 “ 4.0 14 “

SPEED 90 METER PER SECOND.

[???] Support H.P. Wt. [???] H.P. 1° 25 kil 0.35 70 2 50 " 1.4 35 3 75 " 3.2 23 4 100 " 5.8 18 289

This is p. 288 2 second. In machines of given model, it is independent of the size; that is to say, if we make two revolving machines on the same model, of which one has twice the linear dimensions of the other, the limiting linear velocity velocity of the circumference will be the same in both, consequently the angular velocity of the smaller may be double that of the larger.

We may suppose then that to a wheel, or revolving arms of some kind, are fixed wings, to which any inclination at Pleasure can be given. The problem is to so combine all the parts of the machine as to give the maximum lifting force with a given power. In solving this problem the following tables will be found convenient. They are based on the constants found by Langley's experiments published in his work on aerodynamics. To fix the ideas I have supposed the wing, or wings, to have 1 square meter of surface, and to move through the air with two given velocities: Firstly, 60 meters, and Secondly, 90 meters per second. The inclinations assigned to the wings range from 1° to 5°. There can be little doubt that the best results are to be sought for somewhere between these limits.

The first column of the table gives the inclination of the plane surface of the wings to the horizon, the motion being supposed horizontal.

The second column gives the number of kilograms per square meter which the wing will support without falling, assuming it to have a given inclination and velocity.

290

4

By comparing the two tables it will be seen that the ratio of weight to horse-power appears to be the same at all speeds, supposing the inclination to be the same. For example; at an inclination of 4° 1 H.P. may be made to sustain 18 kilograms. The sustaining rate increases as the weight decreases; but, practically, in a moving machine we shall probably never get an average inclination less than 3° or 4°.

One of the fundamental problems will be the most efficient form of driving engine; efficiency being to a large extent measured by the ratio of H.P. to W., when sufficiently high speed is attained.

The writer is not sufficiently acquainted with steam enginery to judge what the most efficient form of engine would be, but it would seem that the steam turbine would be at least the simplest, since by its use cylinders, valves and rapid alternating motion would be dispensed with , and thus a high higher speed of motion attainable that with the ordinary kind.

A steam turbine, also, seems best adapted to giving circular motion, by being attached to the same axis of revolution as the revolving wings.

The size of boiler and extent of heating surface necessary in the engine is to be considered. This again, is largely a question of practical engineering, but there are certain principles which govern the whole case.

Boilers of various sizes, but on the same model 291 5 thus having the same ratio of length, breadth and thickness of sides will bear the same steam pressure per square inch. To sustain a pressure of 120 lbs. per square inch with safety, the thickness should be nearly 1/30th the diameter.

A heating surface sufficient to give the required H.P. must be secured.

In order to judge whether it is best to begin with a small machine, or a large one, the various ratios that come into play must be considered. Let two machines (A) and (B) be built on the same model throughout, (A) having twice the linear dimensions of (B).

The amount of steam generated will be in the same proportion as the surface—which will be — to 1.

The steam pressure will be the same in both. If a turbine be used, the velocity, or exit of steam, will be the same in both.

The orifices of exit will be four times as great in (A) as in (B), the two will therefore exactly correspond in both production and consumption of steam.

The H.P. of (A) will therefore be four times that of (B)

The possible linear speed of the sails will be the same in both; (B) making twice as many revolutions per second as (A).

With a given inclination, the lifting power of the sails 292 6 per square meter of surface will be the same in both.

The ratio of H.P. already given will be the same as the resistence of the sails of the two. (A), therefore, working at the same steam pressure as (B) will have four times the lifting power, and eight times the weight.

So far, therefore, as ratio of lifting power to weight of the whole machine is concerned, the smaller will have an advantage, which will increase indefinitely with the diminution in size.

But, if it be required that in addition the machine shall raise a certain weight, it must have a sufficient size. In all machines of a given model, there will, therefore be a certain size a at which it will secure the maximum of weight which the machine can carry . a machine of such model can carry.

It is practically necessary that any machine shall have two sets of wings revolving in opposite directions. These may, however, be run independently on the same axis, especially if the spherical boiler is used. It will probably be desirable to have the sails of two different sizes, the upper ones being the smaller, and worked directly by the engine, while the lower ones are the larger, and worked by the reaction of the engine upon the boiler.

In designing a machine it must not be forgotten that the numbers given in the preceding tables are minimum numbers and take no account of the viscosity of the air.

In a first trial, the following constants might be aimed 293 7 at: —

& close up

Engine of 2 H.P.

Boiler of sufficient heating surface to secure this H.P.

Area of upper wings ½ a sq. meter;

Speed of upper wings 90 meters per second; of lower 60 M.

Distance of wings from axis to be arranged as experiments show to be the best, since the speed will be independent of the H.P., and also of this radius

Limit of lifting weight of the whole apparatus 20 kilog.

Making a machine weighing only 20 kilograms, which will have boilers and turbine engine of 2 H.P., and sails that can be driven as shown, it may be expected to raise its own weight from the ground. Once well in the air, a forward speed can be given to it.

In the construction allowance must be made for the fact that the supporting weight will come almost entirely on those sails which, at the time are revolving in the direction of the forward motion.

The details of weight, &c. for any required combination, may be obtained from the tables already given.

(The above was dictated by Prof. Simon Newcomb, Monday, September 16, 1901.; with corrections made same day.

B.A.S. Sept. 17, 1901.)

294

1901, Sept. 17 Tuesday At B.B. Lab

Prof. Newcomb made observations concerning the amount of light received from the sky at night, a few days ago, on the verandah of Beinn Bhreagh Hall. I think these observations were made on Saturday, Sept. 14, 1901.

Prof. Newcomb dictated to Miss Safford on Sunday, September 15, 1901, the results of his observations concerning the light received from the sky at night, which he had made during the summer.

Miss Safford went over to dinner at the McCurdy's on Sunday, Sept. 15, returning here Monday.

Sunday evening, Sept. 15, memorial services were held at the Presbyterian Church at Baddeck, for President McKinley, I am the late President, for Roosevelt is now President. Mr. McDougall prayed for Mrs. McKinley and HER FAMILY and made an address concerning McKinley and made a great point of his family life. He was followed by the Rev. Mr. Mix of Ohio, who spoke as an American. I was somewhat startled to be suddenly called upon to make an address, but upon such an occasion could hardly decline, so I occupied the pulpit for a few moments.

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1901, Sept. 17 Tuesday At B.B.Lab

Daisy drove Prof. Newcomb to Baddeck and back Monday.

Mr. McDougall telephoned Monday morning that he would bring Mr. Mix over to call on me between two and three o'clock in the afternoon, and he wanted to know whether it would be convenient for me to see them at that time. A reply was sent that it would not be convenient, as I would be engaged in my laboratory work in the afternoon, and an invitation was sent by telephone asking them to come to dinner and spend the evening with us. On driving home from the laboratory I passed Mr. McDougall and Mr. Mix, driving from the Point. I asked them to return to dinner with me, but Mr. McDougall wanted to drive round the bay before it became dark. So they went back to town. There was evidently some misunderstanding for Mabel had invited quite a little party for the evening. Present during the evening: — Mrs. A. Graham Bell, Miss Marian H. Graham Bell, Miss Sarah Marsh, Miss Safford — all staying at the Point, and in the course of the evening arrived, Mrs. Gilbert H. Grosvenor, Miss Susie McCurdy, Miss Maude Marsh. Gentlemen: Prof. Simon Newcomb, Prof. George McCurdy, Mr. Douglas McCurdy the Champion Swimmer of Cape Breton, and Mr. Lucian McCurdy who says he is not anything. Mr. Robert Marsh, the future Chief Justice of the United States, Editor Gilbert H. Grosvenor, and the flying-machine crank, A.G.B.

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Mr. George McCurdy looked rather solemn for such a festive occasion. This was probably due to the recent death of President McKinley, although it might also be explained by the absence of Miss Robbie Ker.

Prof. Newcomb, last night made observations of the amount of light received from the sky at night. We made him comfortable upon a sofa on the verandah, with overcoat and rugs. Miss Safford provided him with a scarf around my “sick” handkerchief his neck, and at his request I bandaged up one of his eyes with my sick handkerchief, as he wanted to look with only one eye through the apparatus he had prepared. He was assisted for a time by Mr. Robert Marsh, but Mr. Marsh was speedily wanted inside to join in part singing, and in other interesting and instructi ng ve occupations, such as acting charades. Miss Safford, and I, remained in attendance on Prof. Newcomb. Prof. Newcomb dictated his observations as they were made, and Miss Safford took them down in shorthand. Unfortunately Miss Safford could not write in the dark, and Prof. Newcomb could not see in the light. A candle lantern was provided, and a sort of tent was made of a rug by tying the ends of it around Miss Safford's neck, and she sat with the lantern on her lap, inside the rug tent.

297

EXPERIMENTS

Yesterday, Sept. 16, we tried the triangular kite with four superposed aeroplanes, shown in the lower picture on p. 226, flown by cord attached to keel at inner side of front cell. (See p. 226) (Lower picture without rudder). There was a good breeze and the kite went up well. The following photographs show the kite in the air: —

132

133

298

The kite was then turned up-side down — deck down, keep up, and flown by means of a bridle attached to the back of the first cell

The kite flew steadily and well. It reached a much higher angle than before, and the pull was so great that I feared the cord would break. The pull was certainly very much greater than when the kite was flown keel down. On another occasion we must measure the difference of pull. The following is a photograph of this kite flying in the air up-side down — deck down, keel up: —

134

299

The following is another photograph of this kite flown in the same way, taken subsequently to the last: —

135

We tried yesterday the folding kite shown in photographs on pp. 276 to 279. The kite went up well, but one of the sides broke in the air.

The floats, shown on p. 256 and p. 273, were completed yesterday, and attached to our best three celled triangular kite, shown on p. 154, in the manner shown in the diagram on p. 256. A photograph was taken to show the method of construction, but, it did not develop properly so cannot be given here. The kite was then flown by a cord attached to the keel at the back of the front cell. It flow 300 well and steadily carrying the floats with it. The following is a photograph of the kite as it was rising in the air: —

136

We then took the kite down to the Laboratory pond to see whether it would float properly. The following is a photograph of the kite floating upon the water: —

137

301

We then determined to fly the kite from the laboratory wharf, and allow it to drop into the water of the bay to see how it would float, and also to test the point whether it would rise from the water when the cord connected to its keel was pulled. Following is a photograph of the kite being flown from the Laboratory wharf: —

138

The following is a photograph showing the way in which the kite fell into the water: —

139

302

The kite settled on one side, and turned completely over, so that the deck was under water and the keel up in the air. The following photograph shows the effect of pulling the kite in towards the wharf by means of the cord attached to its keel: —

140

Upon examining the floats it was found that one of them contained a good deal of water, and the other was empty. It is probable, therefore that when the kite was first placed in the water, leakage took place in one of the floats, and when the kite was subsequently flown from the wharf the float containing the water — being heavier than the other caused the kite to come down on its side. We must try this experiment again with both floats empty 303 in order to determine how a kite, fitted with floats in the way shown would descend into the water under normal conditions:

Mr. Ferguson completed yesterday morning two aerial oars, or wings, substantially after the pattern shown on p. 245, and we tried to propel our twin boat, the Ed-Bert with them in the manner shown at the bottom of p. 245. The following is a photograph of Miss Maude Marsh, of Paterson, N. J., holding the aerial oars over her shoulders — a good specimen of

A JERSEY MOSQUITOE

As the photograph of the Ed-Bert provided with aerial oars is not yet ready, I will postpone description of this experiment until tomorrow. A.G.B.

304

1901, Sept. 18 Wed. At B.B. Lab

The following photograph, taken Monday, Sept. 16, shows the Edbert (our twin boat) fitted with aerial oars, or wings and Mr. Ferguson attempting to propel the boat by flapping the wings. Murdoch McDonald steering. The result was not very satisfactory. The bow of the boat lifted considerably at each stroke and a little headway was gained — so little however — that the experiment cannot be considered as a success.

142

The wing surface was forced upwards by the pressure of the air during each down stroke, so that the bamboo pole forming the front edge was much lower than the back edge of the wing. The depression of the wing, therefore, caused a propelling action, as well as a lift. The tendency to move forward was too strong for the bamboo poles, so that at each 305 flap the wings went forward instead of the boat. The following is another photograph taken Monday, Sept. 16

143

Yesterday, Tuesday, Sept. 17, we tried the effect of fe fettering the wing oar by tying a cord to the extremity of the wing, and attaching the other end of the cord to a point on the boathouse at the same level with the wing axis

145

306

Unfortunately, the white cord does not show very clearly in the photograph. Perhaps the following diagram may illustrate the point better: —

The cord effectually prevented the wing from moving forward, and with a cord attached to a suitable point on the rear of the boat at the same elevation as the axis of the wing, the propelling effect, instead of moving the wing forward, should move the boat. We will fix up the wings again in this way and try the experiment again. We cannot do so today, because one of the bamboo rods is broken and must be replaced by another.

The following photograph, taken yesterday, Sept. 17, shows two telephone sets with flexible wire attached to two easles. These are intended to aid in the proposed observations of the auroria borialis.

307

144

One set is to be placed on the northern porch at Beinn Bhreagh Hall, and be connected through the flexible wire with the telephone central office wire leading to Baddeck. The other set is to be taken to Nyanza, Middle River, or to some other suitable place, and be placed out in the open air where the aurora can be observed, and connected by its flexible wire with the telephone wire at that place leading to the central office in Baddeck. In this way Prof. Newcomb and I can be set in telephonic communication with one another — in two different places — during the progress of the aurora so as to make simultaneous observations concerning the apparant position of the auroral streamers against the stars.

A.G.B.

308

1901, Sept. 20 Friday At B.B.

MEMORANDUM.

Pages 309 and 310 contain story dictated by Prof. S.P. Langley, Secretary of the Smithsonian Institution, September 10, 1901, entitled: THE WAYS OF PROVIDENCE.

309

Story dictated by Prof. S.P. Langley, 1901,Sept. Sept. 10.

20 THE WAYS OF PROVIDENCE.

20 By Prof. S.P. Langley

Sept 10, 1901: —

Once, in Cairo, there was a Moolah, a very pious and holy, but simple minded man, who made his living by teaching a school. One day he was reading in the Koran the passage which is equivalent to our text — "He who giveth to the poor lendeth to the Lord" — and which, in the Koran, says — "What a man giveth to the poor he lendeth to the Lord, who shall return it to him an hundredfold".

The good Moolah had never noticed this text before, and it suddenly occurred to him that here was a way to make his fortune, for he had saved up 10 dinars, and, if he could invest them in charity and get them back an hundredfold, he would have a thousand. Being perfect in his faith, he took his 10 dinars, went out and distributed them to the poor, and sat down in his school waiting for the 1,000 dinars to come in.

But, nothing came all that day, nor the next, nor the next, and the scholars went away, while the hungry Moolah, who had nothing left to buy bread, sat with his head in his hands, waiting, waiting, for the money, til, in dispair, he ran out of his empty house into the desert, till tired, and miserable with his fasting and the loss of his 10 dinars, which was all he had in the world, he was ready to die, when he spied a tree in the distance, which offered a little bit of shade from the sun.

He went towards it, when he saw a man coming, whom he feared might be a robber, and he climbed up into a tree. The man, to his terror, came and sat down directly under him, 310 but without seeing him. Presently the man took out of his dress a little clay image of Moses, and a small hammer, and began to talk to the image.

“You”, he said, “are the cause of our having among us that cursed race, the Jews. They never would have been here but for you, you deserve death, and I am going to make an end of you”. And so saying he smashed Moses with his hammer.

Next he took out an image of the holy prophet Mahammed, and said to him: —

“You, Mahammed”, should have known better, for you had the advantage of living a thousand years later than Moses, and yet you brought a religion into the world which has caused more wars and fightings than all the Jews themselves, and obliges everybody to pray five times a day, and makes man's life a burden. I am going to put an end to you”. And he smashed Mahammed to bits with his hammer.

Then he sat a little while longer, and, to the Moolah's horror, took out a clay image of the Lord himself, and said: —

“Moses and Mohammed might have said that they knew no better, and, at any rate it was you who made them what they were, I cannot see that you have even as much excuse as they had, and I am going — — —”

Here he raised his hammer, when the Moolah cried out: —

“Stop! He owes me 1,000 dinars !” with such energy that he tumbled out of the tree on to the man's head and killed him.

When he examined the body he found that the man had a purse containing just 1,000 dinars in gold, which he took and went home, happy, admiring how the ways of God are justified to man. S.P. Langley per B.A.S. Sec.

311

1901, Sept. 21 Saturday At B.B.

I am anxious for the day when our kite experiments may be transferred from the land on to the water. We cannot ma make much progress until then. It is of the first consequence that our apparatus should be able to fall into water, and be recovered from the water without injury. I have aimed ultimately, to make all the apparatus of metal tubing, of sufficient diameter to float in the water, but I have been deterred from carrying this plan into execution because an apparatus of this sort would require to be of gigantic size, in order to support the tubing — to make an apparatus of such size would involve great expense — and such expense would not be justified unless careful plans could be made before hand, and we knew before hand just the sort of machine we want — whereas, we don't know, but wish to find out experimentally by making it.

The successful attempts of Mr. Ferguson to make very light water tight floats of wood, seem to indicate that he could also very readily make very light wooden pipes, and of this wooden piping large kites might be made at very little expense. Mr. Ferguson is now making specimen pipes of wood. The sample lengths are to be 1 meter long, and 5 cm. diam. in one case and 10 cm. diam. in the other. I am inclined to think that with 5 cm. pipes we can build large kites as readily as we can build small kites with wooden sticks. We have used fine sticks 1 cm. square, and 100 cm. long. Now, it is obvious that if we retain these proportions on larger kites the weight of the kite will increase more rapidly than the supporting surfaces; in fact, Prof. Newcomb's statement 312 should be as true of kites as of flying machines, vis: — That the sustaining surface increases as the square of the dimensions, whereas the weight increases as the cube; for example, Double the dimensions of a kite in every way; then, the aeroplane surfaces will be four times the area, and the weight will be eight times the weight. Consider simply one of the sticks of the kite as 1 cm. sq. and 100 cm. long; call this stick (A). Now double the dimensions in every part, and we have a stick 2 cm. square and 200 cm. long, cal this (B)

A B

Then (B) will weight eight times as much as (A). It would take eight sticks of the size of (A) to make one of the size of (B), see dotted lines above.

The same reasoning that Newcomb has applied to flying machines, would also apply to kites made of solid material, namely: — That the weight would increase as the cube of the dimensions, whereas the sustaining surfaces would only increase as the squares. Increase the dimensions of a kite five times and the larger kite will be 125 times as heavy as the smaller (5^3); whereas the supporting surfaces will only be 25 times as large (5^2). This line of reasoning would lead to the conclusion that g iant kites would be impracticable, and t h at the weights would increase so much more rapidly than the sustaining surfaces that a limit would soon be reached beyond which it 313 would not be practicable to make a kite that would fly. It would be borne down by its own weight in spite of the sustaining surfaces.

It is perfectly obvious to me that if the material of which a kite is constructed is solid throughout, that the weight increases as the cube of the dimensions; whereas the sustaining surfaces increase only as the square s . But, I do not think that this is true of a machine of tubular construction. The weights of tubes are surely not proportional to the cubes of their dimensions.

Take a tube double the dimensions of another tube — would it be eight times as heavy? — Yes, if the shell of the larger tube is twice as thick as the shell of the smaller. With tubes formed of the same thickness of material the weights will simply increase as the squares of the dimensions. Double your tube and you will four-fold your weight. Yes, it is obvious that where the thickness of the shells are is the same that the weights will vary as the surfaces

— and the surfaces as the squares. Takena Take a tube 1 cm. square and 100 cm. long. Now, make a tube o f double the dimensions, but of the same thinness of material, that is, ma? a tube 2 cm. square and 200 cm. long, the latter the larger tube, will weigh four times, not eight times the weight of the former.

Supposing that the supporting area in the first case amounted to 1 sq. meter, then, the supporting area in the second case, being of double the dimensions, i.e. twice the dimensions in every way (excepting that the thickness of the cloth should be the same) — then the surface, in the larger case, would be four times the surface in the former: — 314 That is: — In the kite of double the dimensions the supporting surface would be 4 sq. meters, instead of 1 sq meter: — B = 4A

From all this I conclude that in kites of tubular construction formed of tubes having the same thickness of shell, that the weights increase proportionally to the sustaining surfaces. Double your dimensions and the sustaining surfaces will be fourfold, and the weight also will be fourfold, so that you can reason, from the construction of a small kite to that of a large. If a tubular kite of given construction flies well, then a giant kite of similar construction should also fly well because each element of the sustaining surface will carry the same weight.

This is decidedly encouraging both for the construct or of kites and of flying machines. Newcomb's reasoning is undoubtedly sound where the dimensions of solid materials are concerned, and this reasoning applied to kites would mean that we could not safely generalize from a small kite to a large one. That is, we could not be sure that a large kite would behave in the same manner as a small model of it, because the sustaining surfaces in the large kite would be called upon to sustain a RELATIVELY larger weight. If our small kite should 315 fly well and we should give it to an engineer as a model to construct another on ten times the scale, we should find that in the large machine the sustaining surface would be 100 times as great as in the model, but the weight would be 1,000 times as great. So that, each element of the surface would be called upon to sustain ten times as much weight as a similar area of the model. In such a case could we be so sure that the kite would fly as to go to the expense of constructing it.

It is obvious that in such a case there is a limit to the size of a kite that would successfully fly, and that giant kites intended to carry up men would be practically impossible, but with tubular construction this does not follow.

I propose to have Mr. Ferguson construct wooden pipes of thin material, and of great length, from which we may calculate the weights, &c. of giant kites. We can construct such kites here very easily, of wood, and from our experiments with such kites we may be able to obtain data for the construction of similar kites on a large scale to be formed of metal tubing. The metallic kites will undoubtedly give us very much greater strength of material with similar dimensions when kites are constructed of tubes of large diameter. It is only with small models that wood has the advantage.

On last Wednesday evening Elsie and Bert and Miss Georgina McCurdy drove down from the Point, oitch dark night, in the phaeton, with our new horse McKinley. Malcomb McLeod went with them on the back seat, with a lanters. 316 Horse started off and was soon beyond control. When they reached the edge of the wood road, instead of turning to the left, Bert drove the horse up bill so as to stop him. Bert and Elsie then got out. Miss McCurdy remained in the phaeton, and had Malcomb McLeod drive her. The horse again got beyond control, and leaving the road upset the phaeton. Miss McCurdy was uninjured, but Malcomb McLeod landed on his head, fortunately the strain was distributed on his shoulder too, so that he was more shaken than injured, and now seems to be all right again.

On Thursday the funeral of President McKinley took place in Canton, Ohio.

On Friday morning Prof. Newcomb, Robert Marsh and Sarah Marsh left us. They were accompanied to the Grand Narrows by Susie McCurdy, Maude Marsh and Marian H. Graham-Bell, who did not return until late in the evening. They accompanied the others on the train as far as Orangedale, from there drove to Whycocomagh where they had lunch at the hotel, and from Whycocomagh they drove to Baddeck. They made great fun of the horse that brought them, which they nicknamed Admiral Sawbones. This explains the following telephone message received from the operator at Orangedale: —

317

"Will be home this evening by steamer Sawbones, Gee Whiz, M.H.G.B."

Stereoscopic pictures of distant objects.

On Thursday, Sept. 19 Mr. Ferguson measured the distance between the pupils of my eyes (6.5 cm.) and the distance at which I would read a book comfortably with my glasses on (47 cm.) The nearest point at which I could read comfortably was 34 cm., so that the limits of comfortable accommodation by the eyes varied from 34 to 47 cm. Mr. Ferguson's eyes were 6.5 cm. apart, limit of accomodation for reading 41 to 50 cm. (No glasses) Most comfortable distance 48 cm. George McCurdy's eyes were 6.5 cm. apart, limits of accommodation for comfortable reading (with glasses) 28 to 53 cm. The most comfortable distance 47 cm. His younger eyes had a much greater power of accommodation than our older eyes (Ferguson and myself), and the very slight accommodation in Mr. Ferguson's case seems to indicate that he has reached that period of life when he would be benefited by wearing glasses.

As the result of all three observations, I judge that with eyes 6.5 cm. apart the distance of comfortable reading is 47 cm. (about) From this we may judge the visual angle for binocular vision: —

318

Visual angle for comfortable binocular vision

The above determinations were made on Thursday, Sept. 19, 1901, and George McCurdy was directed, in consequence to try the following experiment: —

Take a photograph of the McCurdy house from the Laboratory side of the bay F f rom two points A and B, 365 feet apart. We guess that the McCurdy house is about half a mile away, that is 2640 feet, so that the angle (a) should be about the same as the ordinary visual angle for binocular 319 Vision

47: 6.5:: 2640 ft.: 365 ft.

Therefore, if we look at picture A with the left eye, and picture B with the right eye, combining them stereoscopically, we should see the McCurdy house and its surroundings as a giant would see it whose eyes were 365 feet apart.

QUERY : — What effect would be produced?

Would we see the McCurdy house &c. apparantly at the distance of 47 cm. from the eye, like a little model of the house.

THOUGHT: — If so — stereoscopic pictures of this kind might be of great importance in warfare. A picture of an enemies encampment in a valley could be taken from a mountain peak and another from another elevated point, a suitable distance away. The two pictures stereoscopically combined would give a much better idea of the arrangement of the encampant and the nature of the ground, than a flat map. Inclined to think that a model of the valley would appear stereoscopically in miniture.

Yesterday, Friday, Sept. 20, 1901, George McCurdy took the required photographs from the short, at points A and B 365 feet apart. He reports that picture A, the left hand picture, is a great success, but that B is a failure and must be taken again. We are not, therefore able to try the stereoscopic effect as yet.

320

Mr. Ferguson has painted our wind guage black, and marked the angles, &c. in white — a great improvement. See photograph below

Yesterday, Sept. 20, 1901, we tried the three-celled triangular kite with floats attached both on one side of the kite as shown in the following pho r t ograph

321

There was not much wind, but we succeeded in flying the kite from the laboratory wharf, and allowing it to drop into the water. The following photograph shows the kite in the air falling towards the water.

322

The following photograph shows the kite floating in the water, and being towed in by the flying string toward the wharf.

Yesterday, Friday, Sept. 20, 1901, we tried again propelling our kite boat “The Edbert” by means of aerial oars or wings. In this case the wings were prevented from movin forwards by strings attached to their tips and fastened to points on the boat pretty far back at the same level as the axis on which the wings turned: —

323

The following is a photograph of the twin boat “Edbert” with Mr. Ferguson holding the wings up ready for a flap.

RESULT : — The wings propelled the boat. Mr. Ferguson rode rowed the boat by means of its aerial oars a distance, I should judge, of about a hundred feet, then turned the boat by flapping one wing and not the other, and returned to the point of starting. The boat therefore, can be propelled in this way, but the bamboo framework is too supple. Mr. Ferguson has therefore been given instructions to make another pair of aerial oars with the frame work of stout pine, something like an ordinary oar, with a bamboo termination, to give flexibility to the tip of the wing.

324

Yesterday we failed to get a picture of Mr. Ferguson flapping his bamboo wings, while making his boat tour of 100 feet and back, as Geo McCurdy had to go up to the dark room to change his films. When he returned he took the following picture of Mr. Ferguson propelling the boat, but it is not successful in this respect, the boat was going so very slowly, or hardly moving at all, that the propulsion was not to be compared with that in the experiment above noted. The blurring of the wings in the following photograph is due to the fact that they were in motion at the time the photograph was taken.

A.G.B

325

1901 Sept. 23. Mon. At B.B.

The following photograph s give s a picture of the McCurdy house an d suroundings taken from the Laboratory side of the bay, from the point A, see page 318 and 319. The coresponding picture B did not come out properly.

The following photographs show the construction of the Aerial car or wings, shown bottom of page 323. In t wo of the three photographs one of the bamboo wings lies on the laboratory veranda for comparison

326

Water appeared in the troughs last night at 7.47 P. M., and was still running at one A. M. this morning. I walked up to the gully to examine the syphon. The level of the pond had only fallen about one inch, and the syphon was in full operation. Nearly as much water came into the pond as went out. At the present rate it will take the syphon two days to empty the pond, running a two inch stream of water all the time.

327

John McKillop returned on Saturday evening, having purchased 16 sheep. These are all he could find with f our functional nipples out of 694 sheep which he had examined. Of the

16 (4-nippled sheep) 11 were white, and 5 were black. Out of the 694 sheep 543 were white, 89 black; an in 62 cases the color was not noted. These 694 sheep constituted 31 one flocks. He paid $ 61.00 for these 16 sheep which is at the rate of $ 3.81 a piece.

THOUGHT: — Would cloth kite alone fly?

No solid frame work to the kite part at all.

The kite attachment simply a sail that can be lowered o r raised from the float deck.

Santos-Dumonts frame-work resembles somewhat the frame-work of my THOUGHT: — triangular kites, — is an improvement in fact, — for the bringing together of the horizontal sticks to a point at either end enables him to dispense with side braces;

Why not adopt this construction for kites?

A.G.B. per M.G.B. sec

328

1901 Sept. 25. Wed. At B.B.

Monday 23d inst. was George McCurdy's birthday. Marian and Miss Safford went over to Miss McCurdy's and took supper at the boys' log cabin in honor of the occasion. Afterwards they staid at the Telegraph House all night, and left yesterday, (Tuesday,) morning for Halifax, leaving Mabel and myself alone here.

Monday Sept. 23 tried the new wing cars shown in photographs on p.p. 325 and 236. 325 & 326 The following is a photograph of the aerial oars attached to the Edbert. Mr Ferguson is holding them up, and George McCurdy is standing behind. We took his photograph on the Edbert to celebrate his eighteenthe birthday as he was seventeen years old on Monday

The Edbert with wings attached was put into the laboratory pond. Considerable headway could be made with these cars. A great improvement on the bamboo oars.

See over.

329

Stiff our p. 326. Water riffled flow that boat mad headway.

The following are photographs of the boat taken on Monday (Sept 23) while being tried in the pond

330 331 334

1901 Sept 26 — Thursday — at BB.

THE HALIFAX HERALD, THURSDAY, SEPTEMBER 26, 1901 OF PERSONAL INTEREST

Miss Graham Bell, daughter of Professor Alexander Graham Bell, and Miss Safford, private secretary to Professor Bell, were at the Halifax hotel yesterday.

335

1901. Sept. 28. Sat. At B.B.

In thinking over the permanent water supply for this house, I have come to the conclusion that open wooden troughs will be the simplist, less expensive and best method of bringing the water here.

It would be a very expensive matter to put down a pipe over one mile long below frost level, and after all a pipe would be inaccessible except at specified points. The wooden trough is open to examination at every part, and the water can be taken off at any part for irrigation purposes, or for supplying pressure to points below, — the warehouse settlemen for example. The water troughs should not be too high so as to facilitate examination by a person walking along, and could be combined with a fence so as to prevent cattle or sheep from passing through. Small pastures could be made both above and below, and each pasture could be supplied with a water trough for cattle or sheep, which can automatically be kept full or flowing from the main trough. This will be a great advantage. A main difficulty of having small pastures has been the difficulty of supplying the animals with water.

I think the trough should be rectangular in cross-section rather than the V shaped, as they will hold more water, and be more easily fastened in position. They can be nailed right through the bottom on to the tops of posts which form supports for a wire fence. The posts should be carefully made, and go well into the ground, and then braced by side pieces of any sort. These could either be staked at an angle. Or wires fastened to tent pins driven into the ground could be used.

The slope need be very slight.

I would commence at the reservoir and build the trough up to the gully keeping it almost level. It will then strike the gully so much lower down than the present trough that it is probable that water can be collected from a great many points on the mountain side that are below the present trough. I would propose also to tap the springs found by Mr McInnis on the south side at considerable elevations and carry the water around the brow of the bill connecting with the proposed trough. This trough would supply the sheep pasture with water.

The following would be a simple way of supplying automatically a watering trough for cattle.

347

1901 Sept. 30. Mon. At B.B.

Mamma, Grace and Charlie, Gypsy Helen and Gracie, Gardiner and Bobbie have arrived in Washington from Europe. A telegram came from Mamma this morning saying "Arrived here last night. All well" this would probably mean that they arrived in Washington Saturday night.

Daisy and Bessie still absent either in Truro or on the way here. Am having the rugs put down for their benifit.

Yesterday, Sunday was a lovely day, warm and bright. Alec and I took our lunch with us and started off on a tramp through our own woods. It is the first time that I have been through them this year.

We went up first to the reservoir. No water coming in, but very full, and water very muddy. Alec came to the conclusion that it would be well to have three reservoirs. One a little higher than the present one, and one lower down. The highest one to serve for pressure for our house in case of fire. At present we cannot quite throw a straem of water from the hose over the house when we stand on the ground, although it is possible to project the water over the roof when standing on a height. So Alec thinks that by building the new reservoir just a few feet higher than the present one we can get all the pressure that we require. As this new reservoir will be simply for pressure as a reserve in case of fire, it must never be emptied, and only the overflow will go into the second, the present reservoir. It will however be connected directly with the fire hose, which will give us the benifit of the few feet additional pressure. The third and lowest reservoir will be for the garden use.

We decided upon what we thought would be the best site for the fire reservoir, and I blazed the trees. After this we walked up the road until we came to the train blazed by Mr McInnis this summer to the permanent springs on the South Side. This we followed, and examined the springs. We found quite a number all about the same level very high up, and with a great deal of very cold water oozing up out of the ground. There was so much water, and so high up in fact that Alec decided that before doing anything more about the troughs on the other side and deepening the trench in the gully, it would be well to trench the springs. He was of opinion that it would be possible to carry the water from these new springs around the brow of the bill and empty into the other trough near the gully at no more expenditure of troughing than would be necessary to lead the water into the reservoir as the springs were so high. This would give us additional water for irrigation or cattle.

Written by MGB AGB

355

1901, Oct. 2 Wednesday At B.B.

356 357 358

string?

359 360

1901, Oct. 4 Fri. At B.B.

Miss Graham Bell and Miss Safford returned Tuesday evening (Oct. 1). Mr. and Mrs. Gilbert H. Grosvenor left Thursday evening (Oct. 3) for the Grand Narrows. Marian accompanied them and will go on a short distance on the way. They are to visit the Embree Bros. at Port Hawksbury with the object of getting them to build us a sailing boat with cabin accommodations for camping out purposes.

Dr. Gillett died in Jacksonville, Ill. Wednesday, Oct. 2. Received telegram yesterday, Thurs., Oct. 3 inviting me to the funeral, which is to be today. Unfortunately distance too great. Couldn't reach there for two or three days after the funeral.

A.G.B.

360

Boston Transcript, Oct 5, 1901 HELEN KELLER'S SUMMER ENJOYMENT IN THE LAND OF EVANGELINE

“Under the Shadow of His Majesty's Ships” at Halifax—The Famous Blind, Deaf and Dumb Girl Gave Alexander Bell Points About Flying Kites

Members of the royal family could have no more flattering reception than did Helen Keller on her visit to Halifax this summer. It was the first time she had ever been out of the United States, and the freshness of it all made keen impressions on a mind that is filled with imagination. She was quick to detect the change of atmosphere in a far land and spoke of its coolness—so refreshing and bracing! The journey was taken shortly after Radcliffe College closed and Miss Keller hurried away without finding out whether she had passed her examinations or not. It was the end of her first year in college, and many a girl would have wondered and worried about her fate all summer. Not so Helen, however, for she is a philosopher, and never worries about anything. Nevertheless, she was delighted upon her return home to receive the long belated letter telling that she had passed in everything.

It has been a summer of activity, and books have been left unopened. The effect of the outdoor life is easily apparent in Miss Keller's appearance, for she has returned strong and brown and enthusiastic. A greater part of the days were spent upon the water, and in her own words: “It was delightful to sail in the shadow of his majesty's ships.” It was the realization of long-cherished hopes to go to Evangeline land, and Grand-Pré was one of the first places visited. In recalling the memorable scenes she impulsively used the words of Longfellow, for while she can neither see nor hear she has been taught to articulate, repeating, as she made an outward gesture, “Vast meadows stretched to the eastward, Giving the village its name, and pastures to flock without number,” and then she spoke of the ancient dykes, and added in the words of the poem, “Dykes that the hands of the farmers had raised with labor incessant, shut out the turbulent tide.” Once, at a reception, someone heard her speak of the poem—“Evangeline”—and asked her who wrote it.

Instantly she answered, straight to the point, “Why, a man who is as well known as your own King Edward himself.” Who could have made a keener thrust?

The official people of the land vied with each other in showing Miss Keller attention. She was the honored guest at the commencement exercises of the Halifax Institute for the Deaf and Dumb, and made the occasion memorable with a little speech that was as bright as it was sweet. In reviewing this part of her visit she said.

“The institutions in Halifax are fine, and that shows that the people of Halifax are generous and public spirited.” The public gardens especially pleased her, for she is a true lover of nature, and she smiled as she clasped her hands and remembered. “They were beautiful for they had natural brooks, splendid beds of carnations and roses, and grand trees.” No girl in the land is more patriotic than this one who never truly saw the flag, and when the Fourth of July came she, as she expresses it, “simply made her Halifax friends buy some American flags and fling them to the breeze.” A brilliant bit of description was her recital of a storm, the worst she was ever out in on the ocean. She began with, “I spent much time on the water, rowing and sailing, and drinking in the fresh, salt, air, and it was a joy to bound over the great waves” and with the words, “Great waves” her shapely white hands swept a graceful curve with forceful abandon. Then sitting alertly erect and freely gesturing she told how one Saturday she sailed down the Halifax harbor to witness a regatta. “The harbor was jammed full of yachts and small crafts in the beginning,” she said, “and we had great difficulty in getting around. When the storm broke all the little boats except ours scudded home. The waves were so high that we slid straight down into the trough, the boat lay way over on one side”—Miss Keller suited the action to the word—“and the water lifted itself over the gunwale and came into the boat.” At this point the pitch of her voice was raised, and there was great excitement pictured on her face. “I was sorry to see them take down the sail and go home under the jib, for I exulted in the storm. A Viking could not have been happier.”

Miss Sullivan, her companion, said that Miss Keller was tense with excitement that day, and that when the waves tossed the boat the highest she laughed with all her heart and gave herself to the wild spirit of the hour. “Ours was the only little boat on the water,” Miss Keller said exultantly, and it is no wonder that all the big craft, and even the gunboat. Destroyer, saluted the fearless girl, as she tossed on the waves and laughed. She was not unmindful of the danger of what was going on, for she knew by the mighty vibrations of the waves and the booming guns that she was living no common experience. A picture for a painter, the girl must have been, dressed all in white, with a dash of red on her hat, sitting as proudly erect and watching the battle of the elements as triumphantly as ever Undine could have done.

This poetical maiden found much to interest her on every side this summer, and she loves to tell about what charmed her in Halifax. “The chief glory of the city,” she said, “is its harbor, but it has many other attractions—there is a beautiful wooded park, long drives and walks through the trees where I enjoyed the soft green light that came streaming through the branches, and the splendid view of the harbor and the rock islands.” One unacquainted with the girl would ask, “How could she see the soft, green light and the harbor view?” When she walks in the woods she stretches out her hands and feels the warmth of the sunshine, and to her the light of the woods is always soft and green, and the harbor view is real to her, for she lived her life into it. When asked what she did at a picnic that she attended at York, where there is one of the strongest fortifications on the continent, she quickly 360 answered, “We did the usual things—ate, drank and were merry.” The new guns fascinated her, so mysteriously did they appear and disappear, and she speaks of them as “shining, for they are smooth.” “I was surprised,” she said “to find how much I enjoyed the military atmosphere. I was never tired of watching the Tommies in their red coats and white helmets as they came out of chapel. I could feel the tramp of their feet and the roll of the drums.”

When the Indiana visited Halifax Miss Keller was invited to go on board, and Lieutenant James J. Raby did the honors of the day. In a letter which speaks of that visit, he writes. “It was an honor to show Miss Keller over the Indiana, and the very happiest incident of the cruise for me. Her delight at being aboard was a great pleasure to me, and more than once my eyes filled with tears, when I looked at her beautiful face that could not return my gaze. She is a wonderful woman and I was astonished at her knowledge of ships and their appliances. When we showed her the turret she wanted to know where the ‘sighting-hood’ was. I had never before known a woman that knew what a sighting-hood is, so that you can well imagine my surprise.” When the Spanish war was in full blast, Miss Keller first heard from the newspapers of the “sighting-hood,” and it was ever after her ambition to know for herself what it was. Worthy of Kipling was her description of a grand concert which was given to the governor general, Lord Minto, and in summing it up she said, “The grounds were brilliantly decorated with electric lights, flags and Tommies!” The red and white of Tommie's uniform always appealed to her. “They played ‘God Save the King’ every five minutes, and the ‘Star Spangled Banner’ only once, but be sure my heart thrilled that once.”

Two weeks of the summer were spent with Mr. and Mrs. Alexander Bell, who have a beautiful home on the mountain, Beinn Bhreagh, which is the Gaelic term for beautiful mountain, overlooking the Bras d'Or. “There,” said Miss Keller, “in the words of Milton, “one sees only nature and her fair work—woods, brooks, mountain cascades and the wonderful changing sea.” She was much interested in Dr. Bell's experiments in his laboratory and his flying kites. “Just think,” she said, “I helped him fly some kites, and was nearly carried up by one.” It was her delight to run with the kites, and often she was successful in getting them up. She was able to tell by the feeling of the string whether it would hold or not. “One day,” she relates, “I said to Dr. Bell, ‘Won't this string break?’ ‘Oh, no,’ he said, confidently; but in a few moments my fears were realized, and lo! the string snapped and off went the kite, and poor Dr. Bell stood forlornly looking after it.” After that the doctor always asked Helen if the strings were all right. During her stay there, Dr. Bell gave the annual harvest fete. It was held earlier than usual in the season on her account, and she was the queen of the festival. She was old the name of each contestant and his characteristics noted. When she came re award the prizes, to the delight of all she remembered each name and said something appropriate as she gave the prize into the hand of the winner. One of the experiences she most delights in was when she slept in a houseboat which was a mile and a half from any human being, right in the woods of the great Bras d'Or. In her own words, “It was a beautiful moonlight night, a glorious night, and I got up early in the morning and took a fine constitutional on deck.” In conclusion, she said: “Upon our return from Halifax we took one last ramble, one last sail and one last picnic. Then, with a heroic effort, we tore ourselves away from the delights of the summer and turned our faces homeward and our thoughts collegeward.”

When the return ship reached Boston harbor, Helen was out on the deck, although it was early in the morning, and so vividly did she feel all the passing glory, that this is an excerpt from a letter which she wrote describing it: “How beautiful it was. The whole world seemed steeped in beauty; the sea an ever-changing miracle of loveliness, waited calmly for the sun to come out of the East.

“‘The wind with wonder whist, Smoothly the waters kissed, Whispering new joys to the wild ocean, Who now hath quite forgot to rave.’

“You remember how the colors warmed and deepened as we watched the beautiful, gold-tinted clouds peacefully take possession of the sky. Then came the sun, gathering the mist into silvery bands with which he wreathed the islands that lifted their heads out of the purple sea as it passed. A mighty tide of life and joy followed in its track. The ocean awoke, ships and boats of every description sprang from the waves as if by magic; and as we sighted Minot's Ledge Light, a great six-masted schooner with snowy sails passed us like a beautiful winged spirit, bound for some unknown haven beyond the bar. How delightful it was to see Minot's Ledge in the morning light. There one expects to see the ocean lashed into fury by the splendid resistance of the rocks; but as we passed the ‘light’ seemed to rise out of the tranquil water, like Venus from her morning bath. It seemed so near, I thought I could touch it; but I am rather glad I did not; for perhaps the lovely illusion would have been destroyed had I examined it more closely."

It will be seen by this letter, and also from every conversation that Miss Keller's mind is saturated with poetry and joy. She never expresses herself in prosaic manner. She has never attempted to write poetry, but all her prose is poetical. This past year since entering Radcliffe she has made great progress in mental development, and the beauty of her womanhood is shown in the tribute which her companion pays to her. Miss Sullivan has been with her from those earliest days of chaos when she could not express herself in any way. Now, when she is a college girl versed in higher mathematics, Greek, French, German and all the rest, Miss Sullivan says, "Her lovely disposition is more than her bright mind or her intellectual achievements."

Ivah M. Dunklee

361

1901, Oct. 5 Saturday At B.B.

Last dictation made to Miss Safford before she went to Halfax occurred on Saturday, Sept. 21, 1901, see p. 324. A great many thoughts, &c. have occurred since then that have not appeared in dictated notes. Will look over Home Notes in search of points that may have escaped dictation since then.

In kites of tubular construction a slight leake would cause water to gain admission to the interior of the kite and thus increase enormously the load to be carried. Why not make the V-shaped tubes (in the triangular construction) be open at the bottom, and closed at the top, like Sir William Thompson's deep sea sounding apparatus. The weight of the kite will compress air in pipes, allowing water to ascend inside to a certain height. The lower ends of the pipes being water-logged, so to speak will act as ballast to keep the kite on an even keel.

And, when the kite attempts to rise from the sea the water will run out of the V-shaped pipe, having a free exit below. (See Home notes, Sat., Sept. 21, 1901.pp. 165–6).

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The wind-guage has been changed since photograph taken on Sept. 20 (See p. 320. It has been changed to form shown in Home Notes for September 21, (Home Notes p. 165), as follows: —

Other points in Home Notes for Sept. 21. Why not make basket work frame — Why not wire frame work sticks — skeletons — basket-work wire work — open-work sticks. (pp.166–7)

Home Notes , Sept. 22 Would cloth kite alone fly? — Already noted in these notes p. 327.

Home Notes , Sept. 22: — Santos-Dumont's frame-work, already referred to in dictated notes p. 327.

Home Notes , Sept. 22, 1901, p. 171 — A drawing showing interior triangular bracing, does not seem to have been referred to in dictated notes: —

Also numerous drawings on pp. 172, 173 and 174 of Home Notes, dated 1901, Sept. 23 have not been referred to 363 or described. Cannot stop to do so now. Will ask Miss Safford to try to make tracings of these drawings, to be appended to this dictation. Also tracings of drawings on pp. 175, 176, and 177 of Home Notes, dated 1901, Sept. 28.

In pursuance of the line of thought contained in dictated Notes, dated Monday, Sept. 30, (see this Vol. pp. 342–346) numerous drawings appear in Home Notes pp. 187 and 188, under date Sept. 30, 1901. These drawings are in pencil, as they were only “Bath-tub Notes”. They do not seem to have been referred to in later dictations. In fact they could not be, because there has been no later dictation, with the exception of the Memorandum on p. 360 I will ask Miss Safford to append to this dictation a copy of drawings and notes in Home. Notes for Sept. 30, 1901, pp. 187 and 188.

The kite made on the basis of the Santos-Dumont frame-work, was completed and tried on Tuesday, Oct. 1. For photograph of this kite, see this Vol. p. 355. Although there was very little wind, we were able to get it up in the air by running with the string until the kite rose high enough to catch a breeze sufficient to support it. The string was attached to the rear of the front cell, as shown in the photograph on p. 355.

The first photograph on p. 356 is believed to be a snapshot at this kite in the air at a considerable elevation. (Oct. 1)

364

The second photograph on p. 356 shows the Santos Dumont Kite in the air, from a nearer point of view, so that the outline if the frame-work shows against the sky.

The first picture on p. 357 is believed to be a photograph of the same kite in the air, although it is difficult to identify it as the characteristic framework is — to my eye at least — invisible.

The second photograph on p. 357 is another photograph of the Santos Dumont kite in the air, and in this case the frame-work can be distinctly seen, but it is rather unfortunate that the flying cord remains invisible.

The first photograph on p. 358 is a very clear photograph of the Santos-Dumont in the air, apparantly taken from underneath, and I fancy I can see traces of the flying cord in the picture.

N.B. Why not attach to a kite a piece of good thick red picture cord, say 10 or 12 ft. long — or a length of green flexible wire, so that the point of attachment of the flying cord, and the direction in which it pulls, may clearly come out in a photograph. A length of ten or twelve feet would be enough to show on the plate. All the photographs referred to above were taken on Tuesday, October 1, 1901. There was very little wind upon that day, so that satisfactory experiments would not be made. But, the experiments noted in the Laboratory Notes, (pp. 85–86, Oct. 1) demonstrated the fact that the kite was structurally weak without side-bracing, so that the advantage of the Santos-Dumont form is not apparant. I had hoped to find that, by bringing the sticks together at a point at either end, the necessity for side-bracing would not arise, but, on flying the kite by a bridle 365 connecting the rear of the first cell to the front of the second cell, a marked distortion of the kite resulted in fact, it almost broke its back going up. When the flying string had attained a considerable altitude, the kite straightened itself by its own elasticity, and seemed to fly well and horizontally. The necessity for side-bracing having been demonstrated, the kite was braced as follows: —

The lower photograph, on p. 358, which was taken Oct. 1. shows the side bracing on the kite.

Experiments with the Santos-Dumont braced were made in a good breeze on Wed., Oct. 2. Results noted at the time in Laboratory Notes, p. 88. The kite did not bend when flown by a bridle as shown above, showing the advantage of the side bracing. Even with the bridle connecting first and second cells as shown above, the pull of the kite was only about 8 lbs. (maximum 12 lbs.) although quite a strong breeze was 366 blowing

The Santos-Dumont rose even when the string was attached to the bow, but in this case the string made only a small angle with the horizon, and the pull was hardly perceptible.

When attached to the inner part of the front cell the kite flew well, with string at a considerable angle to the horizon. pull only about 4 lbs. with a maximum of 7 lbs in gusts. Attached with the bridle between the first and second cells, the flying cord made a still greater angle with the horizon, Pull 8 lbs., maximum 12 lbs.

With the bridle the kite flew off the wind to the left, and came gently down among the trees near the place where my old white horse Champ was fastened. The kite was uninjured, but Champ acted like a young colt, plunging and rearing, and snorting with terror. He is accostomed to our kites, but could not stand the large object indistinctly seen through the trees coming flown like a huge bird in his neighborhood.

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The above experiments were made Wednesday, October 2.

On Tuesday, October 1 we tried our three-celled triangular kite with two superposed aeroplanes, with wooden floats attached to one side of the kite, as shown in photographs on pp. 321 and 322. The kite being flown by a bridle, as shown in the upper photograph on p. 321.

The first photograph on p. 359 was taken on Oct. 1, just before the experiment was made, but it has not come out well, as the light was poor.

The object of the experiment was to determine how the kite thus arranged would light upon the water. George McCurdy held the flying line in the stern of a boat, and Mr. Ferguson rowed rode out towards the middle of Baddeck Bay, the kite flying from the stern of the boat. The kite was then allowed to drop into the water. It lighted on both floats very gently and then settled on one side, and finally turned completely over, kite underneath, floats above. The whole kite disappeared beneath the waves and nothing could be seen but the two floats. On recovering the kite and turning it carefully in the water, it floated in the desired position, with a marked tendency to upset — extremely top-heavy of course — because of the soaked condition of the cells. It remained floating however when towed from the boat by a short line, but showed a tendency to overturn when the tension of the cord was relaxed. George Mr. Curdy succeeded in getting a photograph of the kite floating on the water from the stern of the boat, and this is shown in the second photograph on p. 359. This photograph shows me that I made a mistake in supposing that the 368 floats were attached to the kite as shown in the photographs on pp. 321 and 322, which were taken on Sept. 20. There is an important difference. These photographs show the floats attached directly to the kite, so that (p. 322) the cloth of the kite is level with the water. In the actual experiments made Oct. 1 the floats were attached 10 cm. below the cloth of the cell, on a separate frame-work so that the kite was supported wholly out of water. See lower picture p. 359.

Heading Diagonal Kite, compounded of triangular kites, successfully tried; demonstrating- the principle that a cellular constructive overcomes Newcomb's difficulty.

A most important experiment were made yesterday, Friday, October 4, 1901, when in pursuance of the line of thought contained in dictated notes, Monday, Sept. 30 (pp. 342 — 346) we tried the effect of flying a compound kite formed by tying a number of smaller kites together. Mr. Ferguson had been instructed to make three triangular kites of the following model

Length 100 cm.; cell-sticks 50 cm.; width of cloth 25 cm. The triangular frames are 25 cm. apart. One side brace on each side of the kite. One of these kites weighed 180 280x grams, another 193 293 gms. and the other 182 282 gms. He also constructed a third kite, on the same scale, having the three Mr. Ferguson mistook a 200 gm weight for a 100 gm weight 369 sides separate, as in our folding kite

The three sides could be tied together to form a triangular kite, as shown in the second diagram above. The three sides weighed 320 gms.

The three kites referred to above, and the three sides were then tied together to make a compound kite of hexagonal cross-section

Cannot draw it but close McCurdy, took photographs which we will offered to this dictations.

This form of compound kite, 100 cm. long and 100 cm. diam. weight 875 1175 gms. plus the string required to tie the parts together

Flying weight 392 gm for sq m. of surface.

We tied a string round the kite as shown above near the front edge of the front cell, where we attached the flying line. The kite was completed and ready for trial yesterday afternoon at 4.15 P.M. just when Mabel arrived with Miss 370 Georgina McCurdy to take me to Baddeck to attend a meeting of the Trustees of the Baddeck Public Library. We thus had quite a number of witnesses to the experiment. Present: — Mrs. A. Graham Bell, Miss Georgina McCurdy, A. Graham Bell, George McCurdy, Angus Ferguson, Archie MacDonald (the driver) and the two boatmen, Malcolm McLeod, and Merdoch MacDonald.

There had been a good breeze all day, but at this time 4.15 P.M. the wind had died down and it appeared almost calm. The wind guage on the hill hung limply down, so that when I proposed to try the kite Miss McCurdy exclaimed “There is no wind”. I told her that George would run with the string and thus create an artificial wind. I had no expectation that the kite could possibly fly without being pulled along. George ran with the string — the kite mounted into the air and KEPT UP. It flew perfectly steadily and perfectly well in so gentle a breeze that it was not perceptible at all on the surface, and the pull of the kite was so great as to occasion surprise on the part of all of us , ? considering the slightness of the breeze.

I cannot help thinking that an important stage has been reached, and that yesterday's experiment will be historical. The result is more important than appears upon its face, for it illustrated A PRINCIPLE of the greatest importance in aerodromics, namely, that by adopting a cellular structure we can make a large kite of solid construction with no greater weight per area of surface than a small kite. Stop quotation here.

In the the present case the compound kite weighed exactly as much as the summation of its component kites, but it is obvious that as solid a kite may be made by substituting 371 one stick where two or three come together, thus saving weight on the larger kite.

The photographs have just arrived.

The following is a photograph of the compound kite built up into a hexagonal form, as it was immediately before trying

The following photograph illustrates how three triangular kites can be tied together to form a larger kite of triangular form. — a triangular kite made of triangular kites — In the back ground Mr. Ferguson is seen holding the three sides in his hands, which are required to complete the hexanonal kite shown in the preceding photograph.

See own

372

As this dictation is already sufficiently long, I will defer description of arrangement now being constructed by Mr. Ferguson for weighing sheep, and George McCurdy's idea of a rudder in the front cell of a kite.

A.G.B.

373

N.B. The following drawings (pp. 374 to 381) have been copied by me from Mr. Bell's drawings in his scribbling book “Home Notes” as requested by him today in his dictation pp. 362 and 363.

For the originals of drawings on —

pp. 374, 375, 376, see Home Hotes 1901, Sept 23, pp. 172–3–4;

pp. 377, 378, 379, see " " " Sept. 28, pp. 175–6–7;

pp. 380, 381 see " " " Sept 30, pp. 187–88.

B. A. Safford Private Secretary.

374

(From Home Notes dated 1901, Sept. 23, p. 172. B.A.S.)

375

(From Home Notes dated 1901, Sept. 23, p. 173, B.A.S.)

376

(From Home Notes dated 1901, Sept 23, p. 174, B.A.S.)

377

(From Home Notes, dated 1901, Sept. 28, p. 175, B.A.S.)

Central upright part for weight machinary &c.

378

(From Home Notes dated 1901, Sept. 28, p. 176, B.A.S.)

379

(From Home Notes dated 1901, Sept. 28, p. 177, B.A.S.)

379 380

(From Home Notes, dated 1901, Sept. 30, p. 187, B.A.S.)

Bath-tub Notes Compound Kites

Could be combined into almost any desired form.

This is really Hargrave's multicellular form but with self-braced triangular cells flow about longitudinal bracing? The horizontal sticks may be brought together at each level in groups à la Santos Dumont framework — and these converted ad

this would weight no more throw summation or separate cell Kites

381

(From Home Notes, dated 1901, Sept. 30, p. 188, B.A.S.)

Thought : Cover Kite with netting — as a balloon is covered — to distribute the strain of the load

382

1901, Oct. 7 Monday At B.B.

Friday Mabel and I attended meeting of the Trustees of the Baddeck Public Library. Present: — Vice-President MacKay, Treas. Taylor, Sec. Blanchard, Miss Georgina McCurdy, Mr. James G. Dunlop, Mr. John E. Campbell, Mr. and Mrs. A. G. Bell. After the meeting Mabel and I called at the Telegraph House on Mrs. Hoppin, sister-in-law of Mr. Hoppin of Baddeck, daughter of Donald Mitchell “Ike Marvel”, author of “The Reveries of A Bachelor” &c. Mrs. Hoppin had been with Mabel and Daisy in Europe. Mrs. Hoppin arrived Friday evening by steamer Blue Hill accompanied by her uncle (I believe), Mr. Perkins.

Saturday, Oct. 5, Daisy returned in the evening. She went as far as Truto with Elsie and Bert. Mrs. Hoppin came over with her and stayed here Saturday night.

Sunday, Oct. 6, Mrs. Hoppin returned to Baddeck. I understand that the presence of his relatives is proving rather exciting to Mr. Hoppin of Baddeck, and they therefore propose to cut their visit short.

Mr. Ferguson is now making a new arrangement for weighing sheep. Hitherto the sheep have been placed in a box on a Fairbank's Scale, and weighed by means of a sliding weight 383 This has involved a great deal of labor on the part of the shepherd and some uncertainty as to the actual weight. The sheep rebelled against going into the box, and had to be lifted and shoved — hind legs had to be lifted in in order to shut the gate at the back — the whole box moved from side to side like a ship at sea at every motion of the sheep — under these circumstances it is a little difficult to get the exact weight.

The Beinn Bhreagh sheep had been pretty well accustomed to the box so that they give much less trouble than new sheep. The new sheep purchased recently have had an AWFUL time of it. They are all pretty heavy sheep, and it is no joke to tackel a 135 lb. sheep and force him into the narrow weighing box. John McKillop was quite exhausted after weighing the twenty-one new sheep, and I was disappointed with the arrangement made for weighing, and feel less confidence in the accuracy of the weights assigned.

Some time ago John McKillop suggested that a spring balance would be more easily handled for weighing sheep, and informed me that he had seen spring balances that would weigh up to 200 lbs. They are used by butchers 384 A joint of meat is suspended by a hook, and the indicator hand flies round and stops at the correct weight. This seemed to me a good idea, and I told John McKilop to order two spring balances weighing up to 200 lbs. This has been done, but the balances have not yet arrived from Boston. In the meantime Mr. Ferguson is making an arrangement to facilitate the weighing of the sheep by means of a spring balance.

The spring balance should indicate the weight of the sheep as it is to be recorded in our recordbook, and not the weight of the sheep plus any box or other receptical in which it may be placed. Our records are sufficiently numerous and it would be a terrible job to have to subtract each time the weight of the box in order to ascertain the weight of the sheep.

The box, therefore, will be separately balanced by itself 385 and then the spring balance will indicate the weight of the sheep alone. See three diagrams above, p. 384. As the weighing box will rest upon the floor when the sheep is inside until the moment when it is lifted by means of the spring balance, there will be no swaying motion of the box, and the sheep will probably be quiet.

To accustom the sheep to the box and to keep them quiet I propose to have a feeding trough inside the box, with oats in it. Before the sheep goes in the box will be balanced by a counter weight — in fact a little over balanced — and the fine adjustment will be made by pouring oats into the feeding box. Then the sheep shall be invited to come in and partake, and while he is quietly eating his oats the box may be carefully lifted for a moment and the spring balance will show the weight of the sheep

After the weight has been recorded the sheep will be let out through a side door, as shown above, and the balance will then again be adjusted by pouring in oats into the feeding 386 box to make up for the oats eaten by the last occupant. Miss Safford remarks that the sheep will weigh more when he goes out of the box than when he goes in because of the oats that he has eaten. This is very true, but the spring balance will record the weight of the sheep WITHOUT THE OATS HE HAS EATEN!

Sheep do not like to be alone, and want company. Perhaps it would facilitate matters to place mirrors on the two sides of the box, so that when a sheep enters a box he may imagine he has a companion on either side of him. If, in addition to this two mirrors should be arranged at right angles to one another at the feeding box Mr. Sheep might imagine himself in a regular crowd. He would see NO END of sheep feeding at the same time with himself.

I think that with arrangements of this sort that would encourage the sheep to go into the weighing box undriven, and reward him when he gets there by a quiet feed of something he likes — that the sheep would soon become accustomed to the box and go in quietly, and remain quietly while being weighed. They would go in of themselves and have to be driven out.

In our experiments with rudders on kites, we have hitherto had the rudder in the stern. George McCurdy suggests putting it in the bow.

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In the Laboratory Note Book under date 1901, Oct. 4, he notes: —

“I find with the rudder in the stern of the kite two objections were manifest. The strings working the rudder passed through two or three screw eyes and came out at the front. Now the strings broke here owing to friction. Next, second, the rudder always struck the ground first, generally breaking it. Why not put the rudder in the front cell like shaded part of above drawing. Then the rudder would be in the cell and not easilt broken, and the strings easier manipulated

W.G.McC.”

Another note by George McCurdy occurred under date Saturday, Oct. 5, 1901: —

“Why not use celluloid on kites instead of cloth or alluminum for lifting power.

W.G.McC.”

388

1901, Oct. 12 Saturday At BLB.

The importance of making a note — however short — every day is obvious, for if we allow one day to pass another passes more easily, and a great gap, or even total cessation of notes may result. We have had no dictation since Monday, Oct. 7, and it will be difficult now to recover the thread of events and of thoughts.

Memorandum concerning the payment of the ransom demanded by brigands for the release of Miss Stone.

Tuesday night, October 8th, we received the following telegram from Washington: —

“Washington, D.C., Oct. 8 1901 A. Graham Bell,

Baddeck.

Christian Herald. T. DeWitt Talmage wires you your prompt help urgently needed. Miss Stone dies tomorrow unless ransom $60,000 received, $50,000 more needed — life or death — please wire help”.

Miss Stone, an American missionary was captured by brigands near the frontier line of Bulgaria and Turkey, and they demand a ransom of $110,000 for her release, and threaten her with death if the money is not forthcoming. It appears to me that if such a sum of money should be paid to the brigands no Americans would be safe when traveling in the wilder parts of Europe. Whatever subsequent action might be taken by the government to recover the money paid from the rather uncertain government under whose jurisdiction the brigands may be (no one knows whether is Bulgaria or Turkey, and certainly each will repudiate jurisdiction when the U.S. Government asks for the return of the money paid) — the very payment 389 of the ransom will encourage brigandage everywhere. What a prize Mabel would be should she return to Sicily, &c., &c.

While I would willingly contribute to a fund to be used in ferreting out the brigands, and bringing them to punishment — and money can do this where our government could not — I am not willing to reward the brigands by paying the ransom demanded — even though they should go to the extreme extent of their threat — because it would imperil the lives and persons of Americans generally, and the good of the individual must give way to the good of the whole. I therefore sent the following telegram to Talmage: —

“Baddeck, N. S., Oct. 8, 1901 Rev. DeWitt Talmage,

Washington, D.C., U.S.A.

Telegram received. The best help we can give Miss Stone is to let it be known that should one hair of her head be touched the fund collected will be used to track down the brigands and secure their punishment. To pay the ransom demanded would be most unwise, as it would imperil the lives and persons of other Americans abroad by rewarding and encouraging brigandage. It is the duty of the United States Government to protect its citizens, and it is our duty to insist that the government shall do this.

Graham Bell”.

Miss Marian H. Graham Bell, to whose insistence was due the sending of the above telegram urged that it would be rather inconsistent for me to telegraph Talmage that “it is our duty to insist that the government shall do this” unless I followed my own advise. It was MY duty also to insist that the government should protect its citizens abroad and so nothing would serve Daisy but a telegram from me to President Roosevelt upon the subject. The following telegram was then sent: —

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“Baddeck, N. S., Oct. 8, 1901 President Roosevelt,

White House, Washington, D.C.

Dr. Talmage is soliciting private subscriptions by telegraph to pay the sum of $110,000 demanded as ransom by the abductors of Miss Stone. I fear that sympathy for Miss Stone may lead to action that will injure American Interests abroad, and therefore respectfully direct your attention to my reply to Talmage, which is as follows: —

Telegram received The best help we can give Miss Stone is to let it be known that should one hair of her head be touched the fund collected will be used to track down the brigands and secure their punishment. To pay the ransom demanded would be most unwise, as it would imperil the lives and persons of other Americans abroad by rewarding and encouraging brigandage. It is the duty of the United States government to protect its citizens, and it is our duty to insist that the government shall do this.

Graham Bell".

The thought occurs, what would I do if Mabel should be captured and held for ransom. Well, there, then comes a conflict between my duty as an individual and my duty as a citizen of the United States. I would then find out whether I am more of a citizen than a man — or more a man than a citizen. Whatever my individual action might be I would still hold that the GENERAL good demanded that the ransom should not be paid — whether I should pay it myself, is quite another thing.

$110,000 is quite a large sum, Surely the GENERAL GOOD would be more advanced to use it to effect the capture and punishment of the brigands than to reward them. As I am not a relative of Miss Stone, or personally interested in her, the CITIZEN outweighs the man in her case.

391

Lina McCurdy was here on Tuesday, October 8th, for I remember when I took down the above telegrams to show to Mabel I found Mabel at work in her office down stairs — at work, I think, upon the plans of a proposed house for the men employed on this place — and I found Lina coiled up on the floor, like a kitten — at her feet — fast asleep before the open fire. Lina returned home Wednesday October 9th in the afternoon.

Wednesday, October 9 Could hardly get a look at Mabel or Daisy — both busy drawing plans for the men's house.

Douglas McCurdy dined with us Wed., Oct. 9, and and Mabel talked business with him about Gertrude Hall.

Monday, October 7 Susie, George and Douglas McCurdy and Mr. Allan Duffus, of Halifax spent the evening here. Miss Safford, Daisy and I worked upon sheep books until 2.30 A.M.

Wednesday night the people did not get to bed until after one o'clock in the morning, although all had to be up at half past five on Thursday morning. I hardly slept all night. Mabel left by steamer Blue Hill from Baddeck at seven o'clock. Daisy, Miss Safford and I accompanied her to the Grand Narrows — also Arthur Clarkson. Just before the steamer left Baddeck a canoe was seen approaching rapidly, and George and Douglas McCurdy appeared upon the scenes to say 392 good bye to Mabel, so we took them along too. Charles Thompson was to meet Mabel at the Grand Narrows. He had been absent in Sidney since Monday, October 7, looking after a piece of property he purchased three years ago. Miss Safford reports that it is a corner lot 90 ft. front and 50 ft. deep and that it is now worth three times what he gave for it. On the way to the Grand Narrows I became so sleepy that I lay down for a nap, and was surprised by the stillness when I awake awoke. I noticed that the engine had stopped and so supposed that we were approaching the wharf at the Grand Narrows. But, on looking out of the window I found we were approaching THE LABORATORY WHARF and that I had the steamer all to myself. Mabel, Daisy, Miss Safford, the McCurdy boys, everybody, had disappeared. I can't imagine even now how it all happened. I only have a confused dream-like remembrance of anything at all happening after I lay down. Perhaps Miss Safford can put down here what did happen.

(Mr. Bell slept nearly all the way to the Grand Narrows on a sofa in the saloon, and Mrs. Bell wrote some letters sitting beside him. When we were nearly there, Mrs. Bell woke Mr. Bell, but when he got up he found that he had a bad headache and that the light hurt his eyes. He waited however until just before Mrs. Bell went ashore, and gave her a very affectionate farewell. Then she saw he was comfortable again, lying down, and went away, leaving him to finish his nap. Mr. Bell does not remember anything about this, but he came home with a bad headache, which wore off after a while. B.A.S.)

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Charles joined Mabel at the Grand Narrows and went on with her from there. Arthur returned here and left same night Thursday, October 10 for Baddeck intending to take the Blue Hill for the Grand Narrows on Friday, so as to catch the train for Halifax where he would catch the steamer for Boston.

Daisy, Miss Safford, and George and Douglas McCurdy went on to Sydney by train from the Grand Narrows Thursday afternoon, October 10. They telephoned here from the Sydney Hotel Thursday night. They left Sydney by train Friday morning returning here the same day.

Friday, October 11 (yesterday) Daisy and Miss Safford returned and Miss Bessie MacRae took dinner with us and spent the night here. She is now teaching a class in the Baddeck Academy. She will stay over Sunday with us here.

9

This brings the events up to date, I think.

I am afraid I will have more difficulty with thoughts and experiments, and shall not therefore attempt to go into details. Will simply give photographs handed in by George McCurdy and then describe the general effect of experiments, &c. upon my mind — the general impression made by them

The following photograph, taken Wednesday, October 9, shows the wind-guage. It shows a breeze sufficient to hold the aluminum cone out at an angle of 45 degrees. It also 394 indicates — if the points of the compass are correctly given — that the direction of the wind at the place where the wind-guage was — was from the SSE. This guage is so arranged that a photograph of it taken upon the same plate with a flying kite indicates the direction and force of the wind at the surface This indicates what we call a 45 degree wind.

The following photograph shows a triangular kite 100 cm. long with equilateral triangular cells, each side 50 cm. The cotton strips 8 cm. wide tacked to sticks along their front edges, but not fastened on their rear edges. 4 cells. Photograph taken Wednesday, Oct. 9. And the next photograph shows it flying in the air by a short line from the end of the bamboo pole

395

The three photographs on the next page show a kite 100 cm long, 50 cm. wide, having wooden framework, and alluminum cells. To strips of alluminum 10 cm. wide in place of cloth. The first photograph shows the kite in detail, and the other two show it flying from the bamboo pole

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The three photographs following show (1), Three celled triangular kite with aluminum cells 50 cm. x 10 cm. each side. Length of kite 100 cm.; (2) Four-celled triangular kite with cotton cells, each cell 50 cm. x 8 cm. and attached to wooden support by front edges alone. Length of kite 100 cm.; (3) A tape kite of triangular form containing a multitude of cells formed by winding a strip of black tape spirally around the whole kite. Width of tape about 1 cm. Space between adjoining strips about 2cm.

397

New celled Aluminum Kite

Cloth Kite — front edges twisted rear edges free.

398

Tape Kite

This dictation is already sufficiently long, and we must postpone further notes until Monday.

A.G.B.

399

1901, October 16, Wednesday At B.B.

A whole lot of thoughts and experiments have not been noted. Will try to save what I can.

Aeroplanes of tape and string

It is well known that the center of pressure of an aeroplane is in front of the center of form, so that if we divide an aeroplane in imagination into two halves — a front half and a rear half — the pressure on the front half exceeds that on the rear half. From which it follows that the total pressure should be greater if the aeroplane were to be cut in half longitudinally, and the two halves separated so as each to be acted on by fresh air

Fig. 1

Fig 2.

For example, the pressure on (?) Figure I, is less than on (a) Figure I, but if separated as in Figure 2, there is no reason why (b) should not experience the same pressure as (a). Hence the total pressure experienced by (a) and (b) separated, as in Figure 2, should be greater than that experienced by them when united as in Figure I.

This principle is well known, but I do not know that it has been carried out to its logical conclusion, Viz: — 400 that the aeroplanes should be as narrow as possible.

Given an aeroplane of a certain length, say 1 meter, and a certain width, say 1 meter, we have a total surface of 1 sq. meter exposed to the wind. Now we know that the total pressure received by this surface will be greater if it is divided into two aeroplanes, each of 50 cm in width, separated by a space. We may also anticipate that a still greater pressure would be experienced by dividing it into four aeroplanes 25 cm. each in width. Still greater by dividing it into 10 aeroplanes of 10 cm. each in width, &c., &c.

How narrow could the aeroplanes be made successfully? If the surface were divided into a multitude of aeroplanes only 1 cm. wide, would we have a still greater increase in pressure. In such a case the aeroplanes would have the width of ordinary tape.

We tried the experiment of making a kite with tape aeroplanes. This kite is shown in the photograph on p. 398 which seems to have been taken on October 11. The kite frame-work is 100 cm. long. The equilateral triangular cells of 50 cm. each side. The aeroplane surfaces are formed by a long piece of black tape about 1 cm. wide, wound spirally around the whole framework, so that the spaces between adjoining aeroplanes are greater than the width of the aeroplanes themselves. My recollection is that the aeroplanes are 1 cm. wide, and the spaces between 2 cm. This kite was tried on Wednesday, October 9, before it was completed. The amount of tape on hand was only sufficient to cover about 401 two-thirds of the length of the kite. We attached the kite, however, to the bamboo pole on Wednesday afternoon (October 9), to let Mabel see the effect. There was only a slight breeze blowing at the time, but the pull exerted by the kite was something greater than we had ever before experienced with a kite of these dimensions, even in a stiff breeze

I find this experiment was noted at the time in the Laboratory Note Book, p. 102, under date 1901, Oct. 9, Wed. The tape kite was completed Thursday, October 10, and the photograph shown on p. 398, was taken October 11.

We have not yet attempted to fly this kite excepting from the bamboo rod. It does not seem to fly well, its chief peculiarity being the tremendous pull that it exerts. The tape aeroplanes are too long in proportion to their width. They are 50 times as long as they are wide: Result, the surfaces of the different aeroplanes do not remain parallel with one another under the action of the wind. The tape twists in 402 different directions at different places, so that, when the keel of the kite is horizontal, the aeroplanes do not keep their edges to the wind, but turn in different directions so as to catch the wind. This accounts for the tremendous pull.

PULL however, can be translated into SUPPORTING POWER. The kite that pulls the most , if held at a great angle to the wind, will support the most , if horizontal to the wind. The pull represents a resistance to motion through the air, and if this resistance is so arranged as to retard descent, it represents that important element supporting power.

The twisting of the tape aeroplanes caused them to expose a different surface to the wind at different rent times. If presented edgeways to the wind, the resistance of each tape would be small, but a little angular deviation would make the resistance large.

This suggested the thought that strings or threads might be used in place of tape with advantage, even though the length of each string should be enormous in comparison with its width . The strings being cylindrical in shape would not offer a varying surface to the wind. Mr. Ferguson has almost completed a kite would round with twine instead of tape:— The space between each layer of twine being greater than the diameter of the twine.

Experiments in the Laboratory have been delayed for some days past because Mr. Ferguson has been at work on the top of the mountain helping John McKillop get his sheep weighing apparatus in order, and he has been absent on Monday and Tuesday 403 on account of sickness. He only returned this morning and is now completing the string kite.

We may foresee one difficulty with the string kite, as with the tape kite, resulting from the great length of each string in comparison with its width: — The string surfaces will not remain parallel with one another under the action of the wind. They will act like the strings of a musical instrument, and will vibrate at different rates according to their tension.

<u>Thought</u> : — Damp their vibrations by strings woven in at right angles.

Thought : — Use a stretched net.

Thought : — A piece of muslin, or woven material, with pores larger than the diameter of the threads composing the material, should preserve its surface under the action of the wind.

Thought : — If the aeroplane principle described above is correct, one logical consequence would be that porous cloth, like muslin, mosquitoe netting, &c., should do better than air tight cloth — this is opposed to all our ideas of kite surfaces. Every attempt has been made to secure cloth that the air will not pass through . If the narrow aeroplane idea is correct porosity will prove an advantage.

ERGO : — Try muslin and mosquitoe netting in a kite. And this reminds me, that we have never tried a kite completely covered with cloth, excepting the experiment that was made some years ago — successfully by the by — to use a long 404 pipe of triangular cross-section as a kite. We have photographs of what we called “Washington's monument” in the air. I remember it would not fly with the ends closed, but with the ends open, and the air passing freely through the pipe it flew well.

Mr. Ferguson has covered one of our kite frameworks 100 × 50 cm. with cloth, so that we may try the experiment.

Here is an interesting thought: — If the narrow aeroplane idea is correct, then we want a multitude of narrow surfaces with spaces between — porous material, muslin, mosquitoe netting, &c.: — But, if it is not correct, then we want a kite framework completely covered with cloth, and not with separated cells at all.

Porosity, or non-porosity — that is a question which can easily be settled by experiment.

Aeroplanes with rear edges free

When our kites break loose they generally settle down gently with an oscilating motion. They fall for a short distance with the bow depressed, moving forwards, then they go backwards a short distance stern down, until by successive oscilations of this sort they reach the ground. This would hardly be a safe method of descent in a flying machine, or in a kite carrying a man. The thought occurred that if the aeroplanes consisted of narrow strips of cloth having their front edges tacked on to wooden sticks, with their back edges free, that the sagging of the cloth at the rear would caused the kite always to move forward horizontally 405 when descending

Given headway, and you can steer. A man in a kite could control the alighting of the kite could control the alighting of the kite if he had headway, so as to steer up at a considerable angle when close to the ground. We converted one of our small kites into a kite with narrow aeroplanes, as shown above, retaining the rear cell untouched as a rudder.

On Wednesday, October 9, we flew this kite in the light breeze then blowing, and cut the string. The kite in descending acquired considerable headway, and made straight tracks for me, like an arrow from a bow. I succeeded in dodging it and it whizzed by right over my head, within six inches, I should say. Mabel was present upon the occasion.

406

The rear cell was then cut away, so as to make four narrow cells, as shown in photograph on p. 395, (First photograph), which was taken on October 9. The second photograph on that page shows the kite flying from the bamboo pole. Another picture of this kite is shown in the second photograph on p. 397, taken October 11.

On October 9 we fitted on to a kite framework two cells of aluminum 10 cm. wide each. Picture of this kite shown on p. 396, taken October 9. The second and third photographs on that same page (p. 396) show the aluminum kite flying from the bamboo pole.

In the first photograph on p. 395 the aluminum kite can also be seen in the background trying to fly from the bamboo pole. This kite has since been fitted with three aluminum cells, see first photograph on p. 397, taken October 11. This has not yet been tried.

If we construct kites of a large size of thin wood or steel wires — compound kites — it becomes a serious problem how to land them successfully without injury to the kite. One way that has occurred to me is to use a ne? sustained by poles, and land the kite in the net. Some ideas are shown the Laboratory Note Book, p. 93, under date Friday, October 4, 1901. We have purchased a fishing net to be used in landing the next large kite made.

407

Advantage of Kites over balloons in warfare

The most important point reached yet has been the success of the compound Hexagonal kite shown on p. 371, photograph taken October 4. Successful experiments were made with it same day (October 4), see pp. 369–370. The important point has been proved that a large kite compounded of several smaller t triangular kites can be made to fly as well as the component kites, and with no greater ratio of weight to surface. The whole compound structure, too, being solid and well braced in every part.

I have been considering for some time past the best form to give to a large kite, for I propose to make at least one giant before returning to the States. Various ideas have been copied from my home note book, by Miss Safford, on pp. 374 to 381 from sketches dated by me September 30. Other ideas appear in a new volume of Home Notes, on pp. 31, 32, 33, 34, dated Sunday, October 6, 1901, and in the same volume pp. 59 and 60, dated October 15, 1901. Other thoughts are noted in the Laboratory note book pp. 92 and 93, dated Friday October 4, 1901, also Laboratory Notes pp. 95, 96, and 97, dated October 4.

I am most struck with the idea shown in the Laboratory Note Book, p. 97, dated October 4, upper diagram. In which a good substantial core appears, of triangular form, surrounded by the lighter kite framework. The substantial w c enter part, well braced, and perhaps brought to a point at either end, a la Santos Dumont's framework, woul d afford a substantial support for men or machinery, and the center of gravity would 408 be very nearly in the center of the kite. I am an satisfied that the load carried by a kite should be very little below the center of form. When we attach a metal rod road to the keel of a triangular kite the kite has a tendency to oscilate like a pendulum. The weight should be nearly in the center of the triangular cell, but a little below it

Central core surrounded by a cellular kite structure composed of triangular cells (not shown)

Such a structure, if made of wood or metal wires would not be adapted to float on the water, and therefore would have to be used on land, and means provided for safely landing it in a net.

If a cellular kite should be developed into a flying machine, with engines, &c. on board, the landing of such a machine would not be present great difficulties. The machine 409 could simply be anchored, and would then fly as a kite if there is any breese. Without a breese, or with an unsufficient breese the tethered machine could be kept up by the action of its own propellers. Special landing places could be provided consisting of nets stretched between poles. These should be portable, and could be easily used in warfare upon the field

net Bringing down a giant kite.

The triangular form, is flown keel downwards, has special advantages for use in warfare because it would be difficult for an enemy to injure the kite by firing at it. Bullets would pass easily through the supporting surfaces without injuring them materially for flying purposes. The resistance they would oppose — as the surfaces would in nearly every case be at a considerable angle to the line of impact — wou l d tend to deflect the bullets, so that it 410 would be very difficult for the bullet to reach the central core containing the man, if it had to pass through first several thicknesses of resisting material presented obliquely with air spaces between. Quite independently of this the man in the central core could be almost completely protected by a V-shaped metallic shield with impaired force on account of gravitation, and be deflected instead of penetrating

A man firing a rifle at the man in the kite protected by the V shaped metallic screen. Pictures shows the deflection of the bullets. AGB

411

Quite independently of any flying machine carrying a motor, a mere kite, of the above construction, carrying a man, would have a great advantage in warfare over a captive balloon. The captive balloon must be kept at a great distance away from the enemy, because, if a single bullet penetrates, the gas comes out and the balloon falls.

But, the balloon is so conspicuous an object, that the moment it appears it becomes a target for the enemy, and the bullets that do not hit the balloon, fall in the ranks of the army, whose position is located to the enemy by the position of the balloon. Great mortality is found from this cause in the military escort of the balloon. The enemy can always locate them, however concealed by trees, &c., and they get the benefit of the bullets aimed at the balloon.

A kite, however, may be made to fly by two or more wires directly over the enemy, and if the man is protected by a metallic V-shaped shield below him, it need not be at any very great elevation. The man can telephone information through the conducting wires, besides being able to do damage from above. The kite may be shot through in a hundred places without bringing it down or materially injuring its flying properties, and if the man in the kite — though they may reach the altitude of the kite with diminished velocity — return with full force upon the enemy themselves.

While, therefore, a balloon raised at the rear of an attacking force would very properly be a target for the enemy, they would be chary at firing at a kite directly overhead 412 where their bullets would return on their own heads. If it was a balloon overhead they might take the risk because one shot suitably placed would bring the balloon down. But they would surely think twice before firing at a kite that could not be brought down by a whole volley even though shot through in numerous places.

The light kite framework would be an advantage in this, that it might be injured in one place and not in others. It would also be of advantage in this respect, that the light kite structure would cause the kite to descend slowly, if any accident happened, and upon reaching the ground the light structure below the central core would be crushed in like an egg-shel l thus reducing the shock to the man in the central core.

Such a kite should be flown by two or more wires. Should the enemy succeed in breaking one of these wires, it would still be held by the other, and go off to one side. Should the supporting surfaces be fixed to the solid framework in their front part, and be loose at the rear, the kite would gather headway in descending, and the man in the kite would then have the power to steer the kite to a suitable landing place, and reduce the shock of descent by steering upwards at the critical moment of landing.

Of course, should the kite carry up an engine and propeller, as well as a man, it would in reality be a flying machine, and be independent of any wires connecting it with headquarters. In this case, of course, we should lose the advantage of telephonic communication. Either in the case of the 413 kite or flying machine, the apparatus on returning to its proper quarters could be landed safely without injury upon a net stretched between poles. (End quotation) AGB

While the triangular form seems specially adapted for use in warfare, the hexagonal form, see this volume p. 371, has the advantage, I think, in point of solidity of construction. The cloth forming the outer surface of a hexagonal compound cellular kite ties the whole structure together, so that it is practically rigid. A hexagonal kite of giant construction could easily be built with a hexagonal core — or even a triangular — I am uncertain at the present time which form to adopt in the giant kite I am now planning. Intn

In the meantime we have taken to pieces the hexagonal kite shown on p. 371, for the purpose of using the component kites in experiments to settle the best form of covering. The form we decide upon — tape — narrow strips of cloth — wide strips of cloth — aluminum, &c., &c. — will be utilized in the large kite.

We will make our large kite of wood, because Mr. Ferguson is a carpenter and can handle a kite of this description much more readily than one of metal; but I would propose in a practical kite for war purposes, that the interior core should be made of metal tubing, and the right kite structure surrounding it of metallic wires, forming a sort of basket work. I have satisfied myself by measuring and weighing wires of steel and brass, that a structure of this kind can be made 414 as strong, or stronger, than if made of wood, without weighing any more — probably weighing less.

I have not yet satisfied myself that the supporting surfaces could also be made of metal, but I am inclined to think that thin brass or copper foil could be used, or even tin, for the wing surfaces, in which case the metallic surfaces could be soldered to a the metallic framework and add immensely to the solidity of the whole structure.

We could certainly use aluminum, but there are difficulties in the way of attaching it to the framework, as we cannot solder it. After all, it may be an advantage to use for the wing surfaces fragile material easily penetrated by bullets.

I have not yet weighed strips of leather, but I am inclined to think that leather surfaces underneath that part of the core where the man and his shield are located, would prove to be a material defence to the man. It would surely be extremely difficult for a bullet traveling even at a very high velocity, to penetrate several layers of leather, with air spaces between, if the leather surfaces are presented obliquely to the line of advance of the bullet. In such a case few bullets could possibly reach the V-shaped steel shield, and those that did would be so reduced in velocity and so turned from their original path, that they would surely, in almost every case, glance off without penetrating.

Mr. Ferguson is now making a series of wooden frames like the following 415 after the manner of the folding kite, see pp. 276, 277, 278, 279. A large number of frames will be made, which can be tied together to form a compound kite of triangular hexagonal, or any other desired shape, and thus guide us to the best form for the proposed GIANT. In the meantime I am going on with my calculations relating to a giant structure.

On Saturday, October 12 rowed up from the warehouse to the point with Daisy, Bessie MacRae, and Miss Safford. Saturday evening telegram received from Mabel announcing her safe arrival in Washington, and asking me what I thought of Santos Dumont's latest achievements. This part of the telegram was unintelligible until last night when we received the New York papers of Friday, Saturday and Sunday, containing accounts of another attempt by Santos Dumont to win the Deutsch prize. His experiments with the new dirigible balloon seem to have been wonderfully successful, but unfortunately he failed to win the prize owing to another breakdown. All the world hopes he will get it. He certainly, if any man, deserves success.

416

1901, October 16 Wednesday At B.B.

Sunday, October 13, Daisy, Miss Safford and Bessie MacRae walked down to the House Boat in the afternoon and took lunch there. Bessie MacRae returned to Baddeck Monday morning, October 14.

Monday, October 14, George McCurdy and I went up the mountain to see the new sheep weighing machine, which works well. We did not put any looking glasses inside the weighing box, but put in a good supply of oats. The sheep on entering he the box immediately discovered this fact and remained perfectly quiet while being weighed. The spring balance is so great an improvement and reduces so materially the labor involved that I have decided to weigh the sheep daily for at least a month, whatever use we make of the weights the records will surely be of value some day, and out of the multitude of records we will get reliable facts. Susie McCurdy came to dinner Monday, October 14, and went home this morning. She is going to Halifax Friday the 18th with Miss Lina McCurdy to try and see the Duke and Dutchess of York. Received note from Mabel, Monday, October 14 written on the train in Maine near Waterville.

Yesterday, Tuesday October 15 — a blank — HEADACHE. In the evening Mr. McInnis called to see me and made a confidential communication which I wrote about to Mabel last night. Today, Wednesday October 16 have devoted the whole day to this dictation.

A.G.B.

423

1901 Oct 20 Sunday At B.B.

N.B. Pages 422 and 423 contain drawings by George McCurdy. They are referred to in Mr. Bell's Home Notes under date October 20, 1901, pp. 111–12–13–14–16–17–18.

Jean.

424

1901, October 22 Tuesday At B.B.

Flying-weight

My time has been largely occupied for some days past in calculating. I have weighed our best flying kites and measured the amount of wing surface, from all of which I conclude that a kite, in order to be light, and fly in a gentle breeze, should not weigh more than about 400 gms. per square meter of wing surface. Our best flyers weigh from 350 gms. to 400 gms. per square meter of cloth.

The red cotton cloth used for wing surfaces weighs from 144gms. to 160 gms. per square meter, which leaves for the framework from 200 gms. to 250 gms. per square meter of wing surface.

We need a term akin to specific gravity, and must coin a word. A kite may be absolutely very heavy, weighing kilograms upon kilograms, and yet be specifically light — but the word specific is not the term in this case — the kite may be made perhaps, of metal, and so may be specifically, as well as absolutely heavy, and yet be a light kite — come down gently in the air, and be capable of carrying quite a load in a light wind. I do not know of any term to employ, and shall so adopt provisionally the name " flying weight ". The flying weight of a kite is its weight relatively to its supporting surface.

THE FLYING WEIGHT OF A LIGHT KITE IS 400 gms. PER SQUARE METER OF SURFACE. The cloth, or material required, for the wing surface weighs about 150 gms. per square meter; Therefore:

We can only allow about 250 gms. per square meter of 425 wing surface for the framework.

FLYING WEIGHT OF LIGHT KITE

(Weight per square meter of wing surface).

Cloth 150 grams

Framework 250 grams

Total 400 grams

(End quotation here AGB)

FLYING WEIGHTS OF KITES.

A study of the flying weights of several of our best forms of kite will be found in Home Notes under date of Oct. 18, 1901, pp. 92–93

50 cm. celled kite of the two-celled type; 347, 373, 389, 391 gms. per sq. M. of w.s. (With three seperable sides, 427 gms).

1 m. celled kite, three-cells, with superposed aeroplanes 416 gms. per sq.M. of w.s. (with double keel 449 gms.)

Compound hexagonal kite composed of three two-celled kites and three seperable sides; 392 gms per sq. M. of w.s.

The Santos-Dumont kite, which is too heavy for a light breeze; 840 gms. per sq. M. of w.s.

Of course the absolute weights are very different

426

The above kites — with the exception of the Santos-Dumont,—will fly in an extremely light breeze, hardly perceptible at the ground, if raised by running with a long string, so as to get them up to some elevation in the air, say 100 m. when they sustain themselves.

LOAD.

I tried the load carrying capacity of the 50 cm. celled kite in a calm — or rather with only a breath of wind, so slight that the kite could not be sustained in the air

George McCurdy created an artificial wind by running with the kite, and I noted the time he took to run the distance between two posts (A) and (B). I estimated his velocity at 4-½ M. per second, but something should be added to this because there was a slight trace of wind — a mere breath — and he faced it, so the real velocity was 4-½ M plus the velocity of “the breath of air”.

427

Under these circumstances the kite flew well while George ran, and carried up with it a brass rod weighing 411 gms. The weight of the kite was about 292 gms., so that the total weight sustained was about 703 gms. The surface of the cloth forming the wing surface was 7,500 sq. cm., so that the brass pipe represented a load of about 548 gms. per sq. m. of w.s. From which I conclude that light kites, like those referred to above should be able to carry a load of 500 gms. per sq. m. of w.s. in a gentle wind of 4-½ m. per second.

Or, let us take a definite figure of 5 m. per second, which corresponds of to a wind velocity of about 11 miles an hour. Our kites should, with such a wind, support EASILY a load of 600 gms. per sq. m. of w.s., making, with their own weight a total of 1 kilo. per sq. m. They will carry more than this, but I mean, that with this wind velocity, they should fly well and easily: —

In Davis's Meteorology, p. 94, a Table of Wind Velocities is given, with pressure on square foot, and square meter of surface opposed normally to it: —

From this it appears that with wind velocity of 5 m. per sec. a square meter of surface receives a pressure of 3,150 gms., Our kites can sustain easily a weight of one third of this. They are capable of supporting much more, but would then be heavy flyers. The following is Davis's Table: —

428 AVERAGE VELOCITIES AVERAGE PRESSURES SCALE TERMS MILES PER HOUR METERS PER SECOND LBS. PER SQ. FT. KILOS. Per SQ. M. 0 Calm 0 0 0 0 1 Very light brz. 2 1 0.03 0.15 2 Gentle breeze 7 or less 3 or less 0.23(-) 1.13 (-) 3 Fresh breeze 11 5 0.64 3.15 4 Strong wind 18 or more 8 or more 1.62(+) 7.97 (+) 5 High wind 27 12 3.64 17.9 6 Gale 36 16 6.48 31.9 7 Strong gale 45 20 10.12 49.8 8 Violent gale 58 26 17.12 84.2 9 Hurricane 76 34 29.26 143.9 10 Most violent Hurricane 95 42 45.12 222.0

(From Davis's Elementary Meteorology, paragraph 18,p.194.)

I am constantly needing to translate miles per hour into feet per sec. or meters per sec. Have been making a calculation to get some easy way of remembering the relation. 1 mile per hour is equivalent to 1.4666 ft. per sec. approximately 1–½ feet per second. This gives the rule: — ADD ON HALF THE NUMBER OF MILES AND CALL THE ANSWER FEET.

For example: — 10 miles per hour, how many feet per sec.?

10 + 5 = 15. (15 ft. per sec. approximately)

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Again: — 1 mile per hour is equivalent to 50 cm. per second (approximately), or (½ a meter). This gives the rule HALVE THE NUMBER OF MILES AND CALL THEM METERS PER SEC.

For example: — 10 miles an hour, how many meters per sec?

10 ÷ 2 = 5. (5 meters per sec.)

These rules can easily be remembered, and will enable me to calculate the number of feet or meters per sec. when given the velocity in miles, or vice versa. The results are not exactly correct, but are so nearly so that they will do for approximations to the truth. The following table will show how near the rule comes for feet per second: —

Miles per hour	Feet per second (By calculation)	Feet per second (By rule).
1	1.46	1.5
2	2.93	3.0
3	4.49	4.5
4	5.86 (Repeating decimals)	6.0
5	7.33	7.5
6	8.99	9.0
7	10.26	10.5
8	11.73	12.0
9	13.49	13.5
10	14.66	15.0
20	29.33	30.0
30	44.99	45.0
40	58.66	60.0

A.G.B.

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1901, Oct. 25 Friday At B.B.

COPY OF LETTER TO MRS. BELL October 25, 1901. Dear Mabel: —

Since you left, the kite, or rather the flying machine, has occupied pretty nearly all of my thoughts. I have realized that Prof. Newcomb has done a great service by pointing out the undoubted fact that you cannot increase indefinitely the dimensions of a flying machine upon any given model, because the weight will increase as the cube of the dimensions; whereas the sustaining surfaces increase only as the square of the dimensions. So that the FLYING WEIGHT — that is the ratio of weight to surface — continually increases with the size of your model and large machines, capable of carrying men and engines, &c. would be impracticable because their weights would be too great to be sustained by their surfaces.

I find this is as true of kites as of flying machines

A

B

For example, if you construct two kites (A) and (B) upon the same model — one of double the dimensions of the other in every way, — (B) will weigh 8 times as muchaas (A), but have only four times the supporting surface, so that the flying weight of (B) — that is the ratio of weight to surface — is twice as 431 #2 great in (B) as in (A).

If you make (B) three times the dimensions of (A) in every respect, then (B) will weigh 27 times as much as (A), and expose only 9 times as much supporting surface, so that its flying weight — or ratio of weight to surface — will be three times as great.

Thus, it is obvious that as you increase the dimensions of your kite, you increase the flying weight (or ratio of weight to surface), so that a limit of size would soon be reached beyond which your kite would not fly. This is undoubtedly the reason why the giant kites I constructed some years ago, on the model of my smaller kites, were unsuccessful, because the flying weight proved to be too great, and it would have taken a hurricane to raise them.

The first realization of the truth of Newcomb's Law, came as a shock, as it seemed to throw doubt upon the practicability of constructing flying machines upon the Heavier than air principle, of a sufficiently large size to carry up men and engines, &c. unless a new principle of support — momentum — was introduced.

In kites — which are stationary on account of being attached to the ground by a string — the question of momentum does not enter as a factor. They have no velocity proper of their own and hence have no momentum. So, Newcomb's law applies in full force to kites, and at first sight it seemed as though it would be impracticable to construct a large kite that would carry up 432 #3 a man. This was a great blow to me, but further consideration of the problem assured me that Newcomb's conclusions were only half true; and the experiments I have made here have demonstrated the fact that although his process of reasoning is right his general conclusion is WRONG; and I now see that he has erred because in his general conclusion he has gone outside of the premises with which he started.

His promise is as follows: —

“Let us make two flying machines exactly alike, only make one on double the scale of the other in all its dimensions”.

From this he draws a first conclusion which is undoubtedly correct: —

“We all know that the volume, and therefore the weight of two similar bodies are proportioned to the cubes of their dimensions. The cube of 2 is 8. Hence the large machine will have 8 times the weight of the other. But surfaces are as the squares of the dimensions. The square of 2 is 4. The heavier machine will therefore expose only four times the wing surface to the air, and so will have a distinct disadvantage in the ratio of efficiency to weight.”

His general conclusion is: —

“That the construction of an aerial vehicle, which could carry even a single man from place to place, at pleasure, requires the discovery of some new metal or some new force.”

He thus draws a general conclusion from a restricted premise. His premise is that the large and the small machine shall be “exactly alike”, only differing in the scale of their dimensions. His conclusion is that a large machine — whether exactly like the smaller one or not — cannot be made to carry 433 #4 up a man, &c. A sweeping conclusion not justified by his premises, and a conclusion which, I venture to believe, the experiments made here since you left have demonstrated to be FALSE.

The experiments here show that his first conclusion is correct, for, if you make two kites “exactly alike, only making one on double the scale of the other in all its dimensions,” the larger kite weigh s 8 times as much as the former, but has only 4 times the supporting surface.”

But the experiments also show that this is not a general conclusion, but only a special conclusion in a special case, for three of my triangular kites tied together fly as well as when separate, and weigh only three times as much as one kite

The compound kite thus formed has the same length as the original but twice the width. It contains 9 longitudinal sticks on which the cloth is stretched, but in the compound form 3 of those sticks can be omitted, as in the second diagram below so that you ha? here a compound kite having 3 times the surface 434 #5 but less than three times the weight of the original kite — less by the three sticks omitted. The flying weight of the larger kite — that is the relation of weight to surface — is LESS — not greater — than in the case of the smaller kite, so it will sustain a larger, not a smaller, proportionate load. The triple kite will sustain more than 3 times the load sustained by the smaller kite. This result you will observe, is entirely opposed to Newcomb's conclusion.

In the above case we have only doubled the width of the kite and not its length. If we double the dimensions of the KITE we find that the larger kite can be built up by tying together 6 of the smaller kites so that the larger kite exposes 6 times the surface of the smaller kite and weighs just six times as much. A result entirely opposed to Newcomb's general conclusion.

But, as shown above in the case of the three kites, some of the longitudinal sticks can, with advantage be omitted, in constructing the larger form, so that the compound kite weighs LESS than six times the original kite.

In the above case we have doubled the dimensions of the KITE in all its parts without doubling the dimensions of the material of which the kite is made. The construction of the large kite is equally stong with that of the small kite, and yet 435 #6 Newcomb's law does not apply. The weight of the larger kite is NOT 8 times that of the smaller, nor its surface 4 times. On The surface is 6 times that of the smaller, and the weight less than 6 times.

The importance of the cellular construction becomes apparant upon reflection. As we increase the number of component cells the flying weight becomes less and less by the omission of multidunious longitudinal sticks, without weakening the construction. That is:— the weight of the kite proportionally to its surface becomes less as we increase the dimensions of the compound form.

Keeping the length of the kite constant, and building up a compound form by placing triangular cells, side by side as shown, and calling the side of one cell (1), the surface of one of the elemental kites (1), and its weight (1), we find that a comp oun d kite having a side twice that of the other has a surface three times that of the first, and a weight three times 436 that of the first minus three longitudinal sticks, &c. We will make a table of the results as shown in the diagrams above: —

RELATION OF WEIGHT TO SURFACE.

LENGTH OF SIDE SURFACE WEIGHT OF KITE 1 1 1 2 3 3 — (3 sticks) 3 6 6 — (8 sticks) 4 10 10 — (15 sticks) 5 15 15 — (24 sticks) 6 21 21 — (35 sticks) 7 28 28 — (48 sticks) 8 36 36 — (63 sticks)

The weight of the kite compared to the supporting surface constantly diminishes with increase of size, from which it follows that the additional load that can be carried increases in the same proportion.

I have no time to elaborate further before this mail goes, and so will close now. You can show this letter to Prof. Langley if you like. I think he will appreciate the importance of the cellular construction.

Your loving husband (Signed) Alex W. M. Graham Bell 1331 Conn. Ave. Washington D.C.

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1901, October 26 Saturday At B.B.

It is my experience that my periods of activity leave few records behind them, and certainly the last two weeks have constituted a period of great activity for me, with very little to show for it in the way of dictated notes. I can only now recall general impressions of what I have been about, reasons, &c.

The clear realization of the point that a kite of cellular construction can be indefinitely increased in size, without increasing its flying weight, has been the key to everything done during the past two or three weeks. I want to make a giant kite that will take up a considerable weight — a man for instance — I am convinced that a structure consisting of cells, constituting equilateral triangles, can be built of any desired size or form. One chief question in my mind has been what is the best material. Pine, which we have been using is not suitable. The wood, although the lightest we can obtain here, is extremely fragil, and a moment's consideration shows that a giant kite, made of pine sticks, though it might be very strong as a whole, would be so weak that no stick could support the weight of the entire kite, so that something could support the weight of the entire kite, so that something would be sure to smash everytime it comes down.

A good deal of my time has been occupied in weighing material of different sorts, and in measuring their strength, and also in looking at materials suitable for wing surfaces. Some of the results are noted in Home-Notes, under date Oct. 18 1901, pp. 89 to 93. Am very much struck with the light weight 438 of the celluloid films used in a Kodak. The cotton cloth we now use weighs about 150 gms. per sq. M. We calculate that the celluloid film weighs only 76 gms. per sq. M. We have been unable, however, to try this for wing surfaces, as the celluloid we have in the laboratory is too heavy, weighing 350 gms. per sq. M. I will here note a few of the substances examined with reference to wing surfaces: —

SURFACE MATERIALS.

Weight per Square Meter

Celluloid (Kodak Film) 76 gms.

White Cotton (used for our kite surfaces) 152 gms.

Red Cotton (used for our kite surfaces) 144 gms.

“ “ “ “ “ 160 gms.

Celluloid film (heavy) 350 gms.

Oil cloth (table cover material) 543 gms.

Aluminum (sheet) 1,051 gms.

Brass foil 1,307 gms.

Sheet copper 1,729 gms.

Tin plate 2,517 gms.

“ “ 2,862 gms.

Various materials suitable to be used in place of pine sticks in making framework were weighed, and calculations made to reduce the weight to that of a uniform length of 1 Meter.

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The following table shows a few of the materials tested: —

FRAME MATERIALS.

Weight per meter length

Steel (Fine piano wire used for high notes) 1 grm.

(About 0.05 cm. diameter)

Aluminum wire (about 0.15 cm. diam.) 2 gms.

Brass wire (about 0.1 cm. diam. springy) 3 gms.

Iron wire (about 0.05 cm. diam. used for fastning the corks of bottles) 3 gms.

Iron wire (stove-pipe wire) (About 0.15 cm. diam.) 5 gms.

Brass wire (about 0.1 cm. diam. medium hard) 5 gms.

Steel (piano wire) (about 0.15 cm. diam. stout and strong 8 gms.

Pine stick (about 0.5 cm. diam. sq. cross section; a 50 cm. length broke with weight of 1815 gms. suspended from center) 10 gms.

Spruce stick (about 0.5 cm. diam. — square cross section. Broke with weight of 2,315 gms. suspended from center of a stick 50 cm. long) 12 gms.

Pine stick used in kites 100 × 0.5 × 0.5 cm. 11 gms.

Pine sticks used in kites (calculation made from 39 sticks, each 50 × 0.5 × 0.5 cm. and weighing altogether 224 gms.) 11 gms.

Iron wire (About 0.25 cm. diam.) 19 gms.

Pine stick (100 × 1 × 1) 40 gms.

Spruce stick (100 × 1 × 1 mm.) 44 gms.

Brass rod (About 0.25 cm. diam.) 64 gms.

Steel rod (100 × 0.5 × 0.5 sq. cross section) 187 gms.

Pine wood (100 × 3 × 3 sq. cross section) 427 gms.

Brass Pipe (100 long, about 2.5 cm. diam.) 466 gms.

Aluminum pipe (100 long, about 1.5 cm. diam.) 145 gms.

(The following weights are calculated from a Table of Specific Gravity, given in Ganot's Physics p. 107).

Yellow pine (100 × 0.5 × 0.5) 16 gms.

Oak (100 × 0.5 × 0.5) 21 gms.

Elm (100 × 0.5 × 0.5) 20 gms.

Beech (100 × 0.5 × 0.5) 22 gms.

Bronze (100 × 0.1 × 0.1) 9 gms.

German Silver (100 × 0.1 × 0.1) 8 gms.

Aluminum (100 × 0.1 × 0.1) 3 gms.

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Of all the material investigated, the most promising seems to be steel. Calculation shows that steel wires, like the stout piano wire, weighing only 8 gms. per meter length, could be used for framework of large kite.

The lightness, and yet great strength, of the fine piano wire, weighing only 1 gram per meter, suggests utilizing its tensile strength in the construction of light frameworks. This at once struck me on weighing the wire, Friday October 18, 1901, and I talked over various plans with George McCurdy for utilizing the tensile strength of such wire. This led him, on Sunday, October 20, 1901, to the idea shown on p. 422, and p. 423. A few days ago I think Monday, October 21, George McCurdy proceeded to test his idea by constructing an iron ring, I should think about 40 cm. diam., of wire, about 0.25 cm. diam., which by itself appeared to be too slim, and wobbly, to be of any use, but when he had braced it by numerous strings forming diameters of the circle, it became quite stiff in the direction of its plane.; but evidently wanted side bracing as in the center ring shown on p. 423.

On Thursday, October 24, he made a model of a kite frame formed of two rings of iron, about 40 perhaps 50 cm. diam. and about 0.25 cm. thick (that is thickness of wire) with a brass rod in the center. The whole braced by strings, as 441 shown above. The resulting structure was wonderfully strong and light. Mr. MacInnis was present here when George made this, and he showed it to Miss Safford and Marian, when they returned from the

Young Ladies Club, Thursday night, Oct. 24, 1901. I have asked him to preserve it as a model.

This form of kite frame, since George McCurdy suggested it last Sunday, Oct. 20, see p. 422 has led to quite a number of ideas, which are noted in Home Notes under date October 20, pp. 110, 111, 112, 113, 114, 115, 116, 117, 118, and Notes dated Tuesday, Oct. 22, pp. 124, 125, 126, 127, 128, 129, 130, 131, 132, 133. Also in Notes dated Wednesday October 23, on pp. 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151. These pages contain written conversations between George McCurdy and myself upon the subject, and the discussion gradually developed the conception of the globular celled kite, shown on p. 141, of Home Notes, under date Wednesday, October 23, a model of which I made of paper the same evening. Have not time to develop this further, but shall simply make in conclusion a drawing of the globular cell.

A.G.B.

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1901, Oct. 27 Sunday At B.B. BOSTON EVENING TRANSCRIPT, WEDNESDAY, OCTOBER 23, 1901

AERIAL LOCOMOTION

In spite of the fact that some scientific men are disposed to sneer at the achievement, the recent performance of M. Santos-Dumont with his aerial vessel must be considered as most remarkable, being an advance in important respects over anything preceding it, and as likely to give a great impetus to the progress of aeronautics. To be sure, the construction of a flying machine capable of going several miles through the air and of being steered against adverse currents of wind is not entirely new. The balloon “La France” accomplished this feat some ten years ago, using a storage battery as the means of power. But later attempts failed, and it has remained for this indomitable Brazilian to construct a machine capable of carrying him through the air against strong winds and at a rate of speed which was altogether unexpected.

The balloon which M. Santos-Dumont uses is, however, far from perfection. It has the merit of being reduced to one-fifth the size of the first dirigible balloon, that of 1851, but is not constructed so as to offer the least amount of resistance and it lacks rigidity, while the close neighboring of a huge envelop full of hydrogen and of an engine run by explosions of naphtha is a source of danger which may deter any but the bravest from taking the risks involved to life. That these defects will be remedied by subsequent experimenters there is little reason to doubt, and indeed inventors are already, as the result of his feats, at work upon machines which present improved types of Santos-Dumont's machine. The consensus of the best opinion among aeronauts leads one to the conclusion that unsupported aeroplanes are not so promising as power machines supported by some means of levitation. The buoyancy, however, need not be the amount requisite to support the entire weight, but in the interest of safety must be such that in case the machine becomes disabled it will settle rather than dash to the earth.

What some experts say is needed is some means of control of the levitation, so that one may rise or sink in the air in much the same manner that fishes rise and sink in water by means of their air-bladders. Professor Bell , however, told a Transcript correspondent last month that not the fish but the bird is the model to work after, as he is at present doing. Professor Bell paid a very hearty tribute to Santos-Dumont's achievement, saying: “I approach the subject with the absolute conviction that a practical flying machine is perfectly possible. It is purely a matter of speed of propulsion. Once we get a machine that will go through the air sixty feet a second, we can pick up anything on earth and fly away with it. Now the machine in which M. Santos-Dumont has been propelling about the top of the Eiffel Tower has a speed of thirty-five feet a second. And in 1881 the highest speed obtained was nine feet a second. Let science do as well the coming twenty years as in the past twenty and the literal ‘Air Line Express’ will be a reality”. But Professor Bell wants to go still further on Santos-Dumont's line in diminishing the size of the balloon. Nothing that flies in the air has any air-bladder as a fish has. Therefore he declares that air navigation is the wrong thing to aim for; it should be air locomotion; and he believes we will see it before another generation passes.

One element of the problem appears to be a close connection of the balloon and the power by which it is propelled, so that there shall not be any such "buckling" strain as exists in most of the types of flying machines. This precludes the use together of hydrogen gas and an explosive engine. It has been suggested by one of the leading minds in this country concerned with this problem that ammonia gas, which weighs only half as much as air, might be used, and it could be carried in liquid form for filling the envelope as required, its expansion being very great and it being free from the objections which would accompany the use of an explosive gas. A close connection and a rigidity which is wanting in the Santos-Dumont machine might thus be acquired.

So far as the Santos-Dumont experiment is concerned, however, the demonstration afforded shows that we are nearing the solution of the problem of aerial navigation. Others will take up the work when M. Santos-Dumont leaves it, and there is no question that the air will be navigated. The carrying of any considerable burdens through a rare medium like the atmosphere is unlikely, but with perfected machines navigation of the air is likely to become an accomplished fact within a generation. Naturally Paris has been excited over this remarkable demonstration. Before taking up with the old-fashioned British prejudice and jealously and patronizingly echoing theState talk on the volatility of the French people and their love of sensation, however, it might be well to remember what their excitement and delight over Franklin's kite-flying has led to and how their thirst for scientific novelty has given hospitality to new developments in all directions. If there were not a lively popular interest in the trip of a flying machine from Boston Common around Bunker Hill Monument and back to its starting point, against winds blowing twenty miles an hour for part of the distance, we should say that Bostonians were pretty stupid. It is unbecoming in an inventive nation like ours to attempt to belittle an achievement which is the most notable in a century of aeronautics and promising of such great results in future.

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1901, Oct. 28 Monday Recd. at B.B.

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SUPERFINE LINEN RECORD

446 447 448 449 450

1901, Oct. 29 Tuesday At B.B.

Thursday, Oct. 24, Daisy and I went over to dine at Mrs. Kennan's. Mr. Kennan had a petition in French, drawn up by the Finnish people, which he asked her to translate, and consequently Daisy brought it home with her. This petition had been circulated throughout Finland, and in eight days had been signed by 500,000 reading and writing persons. After dinner Mrs. Kennan and Daisy and I went to the Club. When we reached Beinn Bhreagh we found that Mr. Bell and George had been working upon kite frameworks, and George had made the one referred to on pp. 440–441.

Friday, Oct. 25, Lucian McCurdy came over to spend Sunday with us. Miss Lina McCurdy was here working on her paper for the club on the architecture of Sicily. Mr. Bell was tired and went to bed, but got up when the mail came, and found in it a letter from Mrs. Bell. He was working nearly all night.

Saturday, Oct. 26. Mr. Bell went down to the Laboratory as soon as he got up, and was down there nearly all day.George McCurdy took a number of photographs,which precede these notes. (the ones bearing the date of Oct. 26th). Daisy went over to dine with Mrs. Kennan, and I went home with Miss Lina McCurdy and took supper with her. Afterwards I went down to call upon Mr. Robert Elmsley. He is almost the oldest inhabitant in Baddeck, having been there since 1859. Mr. Bell has asked me to get together a record of what he remembers of the town history. I find that he has kept a diary since 1859, and is quite 451 willing to give information. He has written a good many pages and is going on with the work. He wants me to come over and make some extracts from his books, in regard to church yard records, &c., which I propose to do sometime this week.

Saturday, Oct. 26 was an important date in the development of the new form of kite. Mr. Bell has come to the conclusion that HE WILL BUILD A GIANT, and so informed Daisy and I me when we returned to Beinn Bhreagh on Saturday night. He feels that the time has come for this, and will get in a number of workmen, and build a kite large enough to carry up a man. He was working all Saturday night, and Sunday in making calculations for the dimensions of this GIANT.

Monday, Oct. 28th. Daisy sent over the finished translation to Mr. Kennan and he seems very much pleased with it. It is certainly beautifully done.

Mr. Bell went down to the Laboratory and gave Mr. Ferguson directions. He is having Mr. Ferguson make a kite frame of ash, and the sticks are rounded. He finds that rounded sticks greatly decrease the weight of the kite frame, and do not decrease the strength. The ash framework, however, is so elastic that it may not be practicable. If rigidity is a necessary element, pine would be the best wood, but if elasticity is wanted ash is the best.

Last night Mr. Bell continued his calculations, but went to bed rather early.

Tuesday, Oct. 29. This morning Mr. Bell was up about half past seven. The big kite is gradually being developed in his mind, and upon paper, so that he will soon know what 452 the exact form of the giant will be.

Daisy and I are to go to Washington one week from next Thursday, Nov. 7th Miss Grossman is to make her debut on the 9th of November, and Mrs. Bell telegraphed yesterday for Daisy to come down. I will probably accompany her.

This morning we made arrangements for Mr. Bell to deliver a lecture upon Aerial Navigation in Baddeck on Friday, Nov. 8, for the benefit of the Victorian Order of Nurses. George McCurdy is to make the lantern slides.

Jean Safford

Private Secretary.