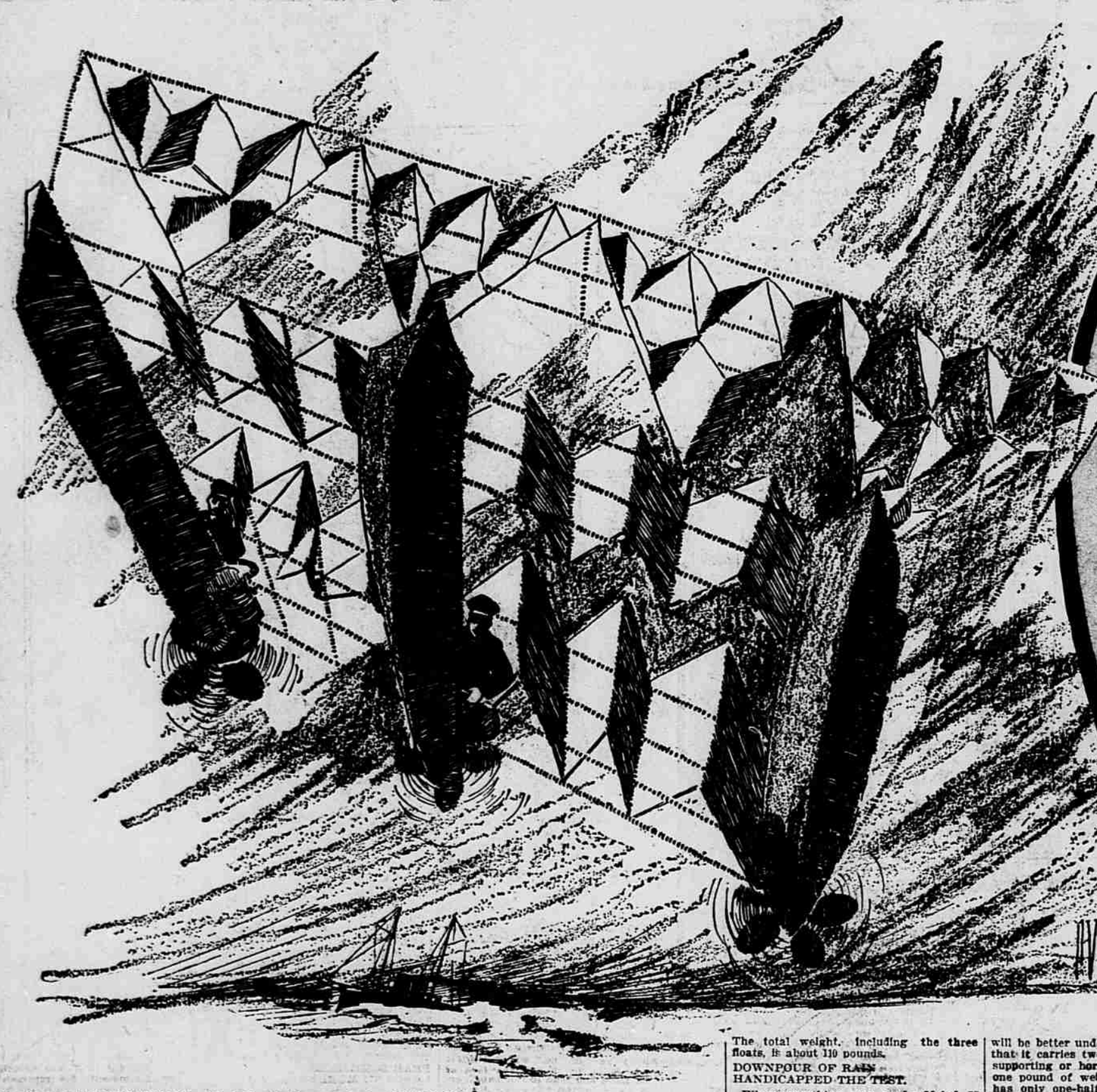
DR. ALEXANDER GRAHAM BELL PROMISES AN AIRSHIP THAT WILL FLY.

Tests Have Proven That the Famous Scientist's Invention Will Carry an Engine and Its Operator---How the Discovery Came to Be Made.

By GILBERT H. GROSVENOR, Editor of the National Geographic Magazine.



THE KITES ARE BUILT IN SECTIONS AND MAY BE PACKED AWAY.

16 CELLED TETRAHEDRAL KITE THE FIRST BUILT BY DR. BELL.

AN END VIEW OF ONE OF THE WINGS OF VICTOR I SHOWING THE CONSTRUCTION

WRITTEN FOR THE SUNDAY REPUBLIC.

Any one who has ever watched a heavy bird rise from the ground, has doubtless noticed that it runs on the ground for a few feet before it rises.

The bird must acquire some momentum before its wings can lift its heavy body into the air.

The natives in certain parts of the Andes understand this fact very well, and by means of it catch the great Andean vultures.

A small space is shut in with a high fence and left open at the top. Then a lamb or a piece of carion is placed on the ground inside.

Presently a vulture sees the bait and swoops down upon it; but when once he has lighted on the ground inside he cannot get out, for he has no running space in which to acquire the momentum that is necessary before his wings can lift him.

In the same way the first difficulty of all flying machines is to acquire the first momentum that will lift the machine into the air.

To overcome this difficulty the flying machine inventor usually shoots his machine from a high platform, which makes it unnecessary for the machine to rise immediately.

It may sail along on the same level as the platform, or even fall a few feet, until its propellers have generated enough speed to enable it to soar upward.

But if the flying machine cannot start in a natural way, the chances are its method of working is not right, and it is doomed to failure.

And even if a machine could fly perfectly after it had been started, how could it get up again if it came down for food or fuel at some point where there was no platform and starting apparatus?

In a word, the solution of the whole flying machine problem is to get a machine that will start of itself without being shot off as if from the mouth of a cannon.

MR. BELL WOULD CONSTRUCT MAN-LIFTING KITE.

During the last four months Doctor Alexander Graham Bell has been seeking to construct a giant man-lifting kite, or flying machine that could acquire by itself sufficient momentum to rise unaided from the ground or surface of a lake.

His belief is that his machine in rising would have to imitate the start of a large and heavy bird—that is, glide along the surface for some distance with constantly increasing speed until it rose of its own momentum.

It may be said that Doctor Bell has been successful and that he has developed a form of gigantic kite, or flying machine, which has this faculty of strating unaided.

The kite has power enough to lift a man—in fact, several men—but before describing it or how it has been evolved it will be necessary to go back a few months.

In an article published in the National Geographical Magazine last June, Doctor Bell announced his intention of the tetrahedral winged cell.

He described the wonderful combination of strength, lightness and steadiness which kites built of tetrahedral cells possessed.

Most important of all, he showed how it was possible by the use of the tetrahedral cell to build kites unlimited in size and in which, however gigantic the kite, the ratio of supporting surface to weight remained the same as in a small kite.

That is, by his invention of the tetrahedral cell, Doctor Bell demolished the old time belief that the size of a kite or flying machine was limited.

This old-time belief was based on the fact that in the Hargrave and in all other kites, except in the new Bell tetrahedral celled kite, as the size increased the weight increased as the cube, while the sustaining or wing surface increased as the square.

Expressed differently, take two Hargrave kites, the second of which is in all its dimensions just double the first; the second weighs eight times as much as the first, but it has only four times as much sustaining or wing surface—that is, the flying weight or the ratio of weight to wing surface, of the larger kite is just twice the flying weight of the smaller kite; hence, when a certain size is reached the wing surface is not sufficient to lift the weight.

Now, take two kites built of Bell tetrahedral cells, the second of which is twice as large in all its dimensions.

The second weighs four times as much as the first, but it has four times as much wing surface, so that the flying weight in the smaller kite is no less than the flying weight of the larger kite.

The flying weight of a kite ten times or one hundred times larger would be the same.

All this was so clearly demonstrated by Doctor Bell in the article referred to that it is unnecessary to enter into further explanation here.

Suffice it to repeat that by his invention of the tetrahedral cell Doctor Bell put an end to the old law which said that you can build kites up to a certain size, but no greater.

With the bell tetrahedral cell you can build kites as huge as you please and they will fly.

PREMISE ON WHICH EXPERIMENTS ARE MADE.

One other fact stated by Doctor Bell in the same article should also be repeated before I proceed further.

Doctor Bell's experiments are based on the premise that a kite in a ten-mile breeze will also support the man and engine when driven by a motor at the rate of ten miles an hour.

This proposition has not been actually proved, but there can be little doubt that it makes no difference whether the kite is supported by the motion of the air against it or by its own motion against the air.

In a calm a kite rises when it is pulled by a man or horse because of its motion through the air; there is no reason to believe that it would not also rise when urged through the air by propellers.

A kite then can be changed to a flying machine by hanging a motor and propellers to it and dropping the string which attaches the kite to the ground.

At his laboratory in beautiful Baddeck Doctor Bell has been building during the last summer hundreds and hundreds of tetrahedral cells, varying in size from twenty-five centimeters to one meter.

Some of them are covered with light-red silk weighing about forty grammes to the square meter and others with nainsook, a very fine cotton about as light as the silk.

Some of the earlier cells were covered with cheesecloth, but the cheese cloth weighed so much, more than 100 grammes to the square meter, that Doctor Bell has discarded it.

The framework of the cells is usually of black spruce, which is light and strong.

Any one can make a tetrahedral cell.

Take six sticks of equal length and place three of them on a table so as to make an equaliteral triangle.

Erect one of the three remaining sticks at each corner of the triangle and bring the tops together. It is the old-fashioned puzzle of making four triangles with six matches.

Then cover any two sides and you have your tetrachedral winged cell.

A number of cells outlined against the sky, look like a flock of birds.

The wings of a tetrahedral cell are also like a bird's wings in that they are not rigid like a board.

The silk covering yields to the pressure of the wind as the feathers of a bird's wing.

FRAMEWORK OF HOLLOW ALUMINUM TUBING.

Hundreds of cells are now being made in which the framework consists of hollow aluminum tubing.

The aluminum weighs very little more than the wood and gives much greater strength to the frame.

Using these cells just as a mason uses bricks to build houses of different designs, Mr. Bell has been constructing kites of every shape that a fertile brbain could devise.

Steadiness in the air and lifting power have been the main object in all.

Some of his combinations are gigantic, exceeding twenty-five feet in length and twelve and fifteen feet in height and width, but all are so light in spite of their strength that his trained assistants send the giant kites up into the air as easily as the little fellows.

The kite is teterahedral in form and built of teterahedral cells.

This was the first tetrahedral kite constructed by Mr. Bell.

It is a wonderful little flyer, darting up from the hand with a shrill whistle and climbing to extraordinary heights.

It is a pretty sight to see the operator bring the kite in after the experiment is over.

As the line is reeled in the kite flies steadily without a turn or quiver, and finally alights on his hand as gently as a bird.

ABILITY TO FLY DIRECTLY OVERHEAD.

One of the kites is two meters on a side.

The most remarkable feature of this kite, aside from its perfect equilibrium and steadiness in squalls, is its ability to fly almost directly overhead.

Even in the lightest breeze I have rarely seen it flying at an angle of less than 80 degrees.

The kite is admirably adapted for meteorological observations at great heights, as it can carry considerable weight with the greatest ease.

Mr. Bell's experiments have convinced him that the small cells are better.

When the wind varies, as in a squall, the shifting of pressure on a small cell is less than the shifting on a large shell, hence the resultant shifting of pressure in a kite built of small cells is considerably less than in a kite built of large cells.

The kite is not disturbed by the weight.

The average pull of the kite in light winds is eighty pounds; in a heavy it exceeds 150 pounds.

The strength of the kites made of tetrahedral cells is something remarkable.

I have seen one of these kites towed on a tetrahedral float for more than a mile on the bay at a speed of eleven or twelve knots without breaking, though one end was dragging one foot under water all the time.

As I saw the kite pulled along I expected to see it shattered to pieces, but beyond a few broken sticks it was as well and strong at the end of the journey as when it started.

The big teterahedral kites, twelve feet and more on a side, look like awkward things to travel with or to store away, but they may be packed as handily and in as small compass as blankets, or rugs.

Each kite is made in collapsible sections, which open and then fold up.

Half a dozen large kites can in this way be carried in a trunk from place to place and put together in a few minutes.

A little kite darts up from the hand if there is the least breath stirring.

PROBLEM TO RAISE THE MABEL.

To raise the giant kite, Mabel II, Doctor Bell found a serious problem.

It would be difficult for a man or horse to pull the great frame so steadily as to keep her from being dashed against the ground and smashed before she could rise.

The kite has power enough to lift several men, but how was Doctor Bell to get her up into the air?

If he could raise Mabel II naturally, like one of the smaller kites, he could be pretty sure that she would go up when a motor, with propellers, was suspended to her.

A pull or a push would be identical in its effect.

In a word, if Doctor Bell could get this great man-lifting kite into the air by towing, as he did the smaller kites, he had succeeded in obtaining a successful form for a flying machine.

There are two ways in which Mabel II might be towed—on wheels along a track or on flats on the surface of a lake. Doctor Bell preferred to try the second method first, as it is simpler and easier.

With tetrahedral frames he built three long boats and covered them with oilcloth to make them watertight.

The boats possess great strength, and yet, because of their tetrahedral structure, are so light as not to overweight the kite.

The three boats were ranged parallel to one another and the whole structure placed upon them and securely fastened to them.

Mabel II is eight meters long, nearly four meters high and four meters wide.

The total weight, including the three floats, is about 110 pounds.

DOWNPOUR OF RAIN HANDICAPPED THE TEST.

When everything was ready Mabel II was towed out to the center of the bay and her flying line cast aboard the steamer which Doctor Bell had engaged for the experiment.

The flying line was made fast to a cleat on deck and the steamer started ahead at full speed, twelve or thirteen knots an hour.

But Mabel II was working under two bad handicaps—first, a heavy downpour had begun some minutes before the start and had thoroughly drenched the kite, making her so heavy that every one but Doctor Bell urged that the experiment be postponed (when Mabel II was weighed after the experiment it was found that the rain water and lenkage in the boats had increased her weight by sixty-four pounds; second, the operator on the deck of the steamer had given Mabel II too short a line, so that she was blanketed by the big hull of the steamer and therefore received but a small fraction of the wind of motion.

In spite of these two serious disadvantages, however, as the steamer gathered headway the great kite first trembled for a few moments, and then rose gracefully from the water and flew steadily the full length of her line.

The rain was pouring down in such torrents at the time that my other pictures were not successful.

The experiment was thus a success, and showed conclusively that Doctor Bell has obtained a man-lifting kite, or flying machine, that will rise of itself.

If a pull will make the kite rise, there is no reason to doubt that an equally powerful push, such as propellers would give, would be equally successful in causing the kite to ascend.

Though the tests have proven that Mabel II can easily carry a man and engine, no actual ascents have been made this summer.

When ascensions are made the man will sit in the center of the open space between the two bridges.

One of the beauties of Doctor Bell's models is that in every one there is a large, roomy space in the center, where the operator and his passengers can sit.

This position is much safer and more comfortable than sitting in a chair suspended some yards below the machine.

As the ultimate machine will probably be of tougher material than wood and silk, in time of war the operator and the motor would be protected as well as bidden, instead of being a splendid target for every shot from below.

VICTOR I MOST WONDERFUL OF ALL.

Kites that are tetrahedral in form, like the Mabel II, have perfect equilibrium, but because of their small resultant arch or horizontal or sustaining surface, their lifting power, though considerable, is not as great as Doctor Bell is satisfied to obtain.

His latest combinations have, therefore, been made in the hope of obtaining greater horizontal surface and thus greater lifting power. Victor I is Doctor Bell's newest kite.

This great H-shaped kite rose from the hand, without running, in a breeze so light that a flag on a pole fifty yards away hung limp and motionless.

It glided up and up until it was flying 600 or 700 yards high, steady as a table top.

The breeze at that elevation was perhaps five or six miles, though on the ground the movement of the air was so light as to be imperceptible, even on the grass or trees.

In a breeze of fifteen miles it flew as steadily as before, but nearer the perpendicular and with a tremendous pull.

The cells or the two wings are reversed, the keels of the cells pointing up instead of down, and the tips pointing down instead of up, while above each tier of cells stretches a wide aeroplane.

This wide expanse of sustaining surface helps the winged cells tremendously, and at the same time does not interfere with their working.

Victor I is three meters long, three meters wide and one meter deep and weighs only twelve pounds.

Its flying weight is only 350 grams to the square meter of horizontal surface.

A smaller kite of similar model has been constructed whose flying weight is about 200 grams.

The wonderful lightness of this model will be better understood when we realize that it carries twenty-five square feet of supporting or horizontal wing surface to one pound of weight, while a wild duck has only one-half of one square foot of wing surface to one pound of weight.

The model almost rivals a mosquito in lightness; one pound of mosquitoes represents an area of wing surface of forty-nine square feet.

Doctor Bell is now making a wind boat on this model, and it would not be surprising if this new wind boat should eclipse even the redoubtable Mabel II.

FRAMEWORK STRONG ENOUGH TO SUPPORT A MAN.

The framework of this latest model is also strong enough to support a man, and yet its flying weight is, as I have said, only 30 grams to the square meter of supporting surface.

When we consider that the flying weight of other machines in which the greatest lightness has been striven for is nearly one hundred times as great as in this kite we realize the tremendous advance made by Doctor Bell in at least one direction—a marvelous combination of lightness and strength.

In not one of the successful kites of Doctor Bell has the flying weight exceeded 500 grams to the square meter of supporting surface, whereas in various other machines the ratio exceeds 10,000 grams to the square meter.

Doctor Bell has thus constructed one form of a succesful flying machine, Mabel II.

Another form, which will probably be even more successful, and of which Victor I is a model, is nearly completed.

To obtain the form of a flying machine has been the principal problem to solve; the matter of a motor is comparatively simple.

The next step is to place a motor on Mabel II, or an enlarged Victor I, with a propeller extending from each side of the kite like an aerial paddle wheel.

Strong and light motors are in the market and to be had easily.

Then, as the operator sits inside with spinning propellers he can drive the kite up and down the surface of the bay testing how to control and steer her.

Later, with the propeller going faster, he can send the kite skimming along a few yards above the surface and continue the experiments at this small height above the water without danger to life.

GREAT SPEED NOT THE INVENTOR'S OBJECT.

Finally, by still further increasing the speed of the propellers, he can shoot upward and leisurely proceed wherever he may desire.

Great speed is not Doctor Bell's object.

Ten or fifteen miles an hour is enough to start with.

Doctor Bell has now reached the point where the flying machine is no longer problematical.

It is simply a question of time necessary to put things together.

Whether the first flying machine carrying a man is built by him at his laboratory in Beinn Bhreagh is probably immaterial to him, but the chances are that if some one else does not build a successful machine within the next year or two he will have a flying machine of his own by that time.

Wild Cat Was Posed For World's Fair Statute.

Sculptor E. C. Porter Held Vicious Animal With Rope and Iron Bar.

WRITTEN FOR THE SUNDAY REPUBLIC.

Edward C. Potter, an animal sculptor, has a large country place in the fashionable suburbs of Greenwich, Conn., where he does his work surrounded by animal models, both wild and tame.

Artists and sculptors have one great difficulty in common—securing suitable models—but Mr. Potter has solved his difficulty by an animal farm. There are dogs, cats, horses, cows, sheep, chickens, ducks and pigeons.

All they do for a living is to pose in their master's studio whenever he requires their assistance.

As they run about the place they are a constant inspiration. The latest addition is a wildcat.

He is posing with a young cow for a group intended to decorate the Palace of Arts at the World's Fair.

It is a group representing the death of a long-horned steer. Wildcats have killed it by jumping at its throat and pulling it down.

The beast is on the ground, with its head resting on its fore legs, which are doubled up under it.

One cat stands triumphantly high up on the hips of the steer, lashing its stubby tail and looking fiercely in front, as if sighting an enemy.

The other is standing on the ground beside the dead animal's head, ready to spring anew.

If Mr. Potter's idea was to show that courage, not strength, was the ruling feature in animal life he has done so, for the wildcats are so small in comparison to the great bulk of the steer that the marvel of it is that the cats could kill it.

In order to secure his model, Mr. Potter made a tour of both New York zoos and that of Philadelphia, but all three places refused to part with their wildcats.

Finally, after a long chase, he discovered a cat in the possession of Mr. Bostock, and who agreed to send it up to Greenwich.

The sculptor had already made a preliminary sketch of his group, but when he compared his plaster cats to the cat in real life he found that he had overestimated the size.

For two months Zim posed. Usually, he could be used as he sat in his cage, especially when he posed for his head and shoulders, but it was sometimes necessary to have him out, in order to see how he looked in action.

The method used to persuade Zim to take the stand was unique.

Two ropes, an iron bar with a ring in the end and a short-handled whip were used. The two ropes were passed in a gentle slip knot around the cat's waist.

One was pulled through the ring on the end of the iron bar, and made fast.

The other was used chiefly as an emergency rope in case the animal broke away from the iron tar.

It was made fast to a ring on the floor near the model stand.

The cat was lifted out of his cage on the end of the iron bar and placed on the stand.

Mr. Dumont, one of Mr. Potter's assistants, held the iron bar, and the sculptor, walking around the cat for his point of view, went to work.

Zim fought and bit and scratched, but the iron bar held him at a distance and his wrath usually ended in nothing but subdued hisses.

For many years Mr. Potter was associated with Mr. Daniel C. French in sculpture. Mr. Potter naturally did the horses for equestrian statues and Mr. French the rider.

Mr. Potter's latest work, however, is an equestrian statue.

It represents De Soto, the explorer of the Mississippi Valley. Noget, the Arab horse, posed for the horse.

Both the animal and its rider are the work of Mr. Potter.

The equestrian statue of Grant, in Fairmount Park, Philadelphia, is an example of the work of Messrs. Potter and French.