

The three principal days of the series are July 23, 24, and 25, but where possible ascents will also be made on July 22, 26, and 27. All the observatories engaged in upper-air research will take part. In addition, the Prince of Monaco will make observations in a high northern latitude, and a German man-of-war will send up *ballons-sondes* between Iceland and Norway. Another German expedition, under Captain Hildebrandt, will go to the neighbourhood of the Hebrides, while a French man-of-war will be stationed near the Azores. Further south, M. Teisserenc de Bort and Mr. Rotch will send an expedition, in their yacht *Otaria*, to the region of the trade winds and doldrums. It is hoped, also, that the Italian Government will cooperate by sending a man-of-war to some point in the Mediterranean. With the addition of Blue Hill Observatory and other North American stations, there will thus be a net-work of observations over a large region of the northern hemisphere.

In this country Mr. W. H. Dines will send up *ballons-sondes* and pilot balloons at a station on the west coast of Scotland; *ballons-sondes* and pilot balloons will also be sent up at Manchester by Mr. Petavel, and at Ditcham Park, Petersfield. Conditions in this country at the end of July are not likely to be favourable for flying kites, but should there be sufficient wind kites will be flown at Glossop Moor, Pyrton Hill, Ditcham Park, and Brighton.

The Royal Meteorological Society is also making arrangements to cooperate in the investigations, and an allowance (in aid of the expenses) has been made to them from the Government grant for scientific investigations.

It may be possible to obtain the assistance of other observers to send up pilot balloons; by the use of two theodolites and a measured base, the velocity and direction of the wind and the heights of clouds may be determined. By using rubber balloons and filling them to a certain size corresponding to a known rate of ascent, useful observations may be made by a single observer using an ordinary theodolite.

The International Commission has also arranged for a series of observations on September 4, 5, and 6, and on November 6, 7, and 8.

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#### Radium and Geology.

THE temperature of 55° C. to which I referred in a former letter is the temperature of the *rock*. I find that Prof. C. Schmidt, of Basel, on his chart of isotherms, gives this temperature as attaining 56° C. This is in the dry part of the tunnel, towards the north end.

The difficulty attending the inflow of warm water mainly arose from the *rate* at which heat was thereby brought into the tunnel, necessitating large supplies of cold water to keep down the temperature. Prof. Schardt's paper, to which I have already referred, contains very strong evidence as to the *role* of the circulating water. The evidence is far too lengthy to quote here.

Mr. Fisher refers to the Hon. R. J. Strutt's estimates of radium in rocks as capable of accounting for a gradient of 1° F. in 42.4 feet. In point of fact, Mr. Strutt *assumes* this gradient (quoting from Prestwich) as a basis upon which to calculate the thickness of the radium-bearing crust. The gradient in question is, therefore, not derived from Mr. Strutt's observations (nor could it be), but is a gradient taken as a basis of calculation.

That special conditions affect the temperature gradients in mountain ranges appears from the results of observations on the Mont Cenis and the St. Gothard tunnels. Everett's estimate for the former, with correction for convexity of surface, is 1° F. in 79 feet. In the case of the latter there were remarkable variations observed, of which radium will very probably furnish the explanation. The central gradient is 1° F. in 85 feet. At the north end there is a gradient of 1° F. in 38 feet. This brings the general average for the whole tunnel up to 1° F. in 57.8 feet. Dr. Stapff, who conducted the temperature observations in the St. Gothard, subsequently predicted for the Simplon a maximum rock temperature of 47° C., as I have already pointed out.

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#### AËRIAL LOCOMOTION.

IN December of last year Dr. Alexander Graham Bell delivered an address, under the above title, before the Washington Academy of Sciences. This address recently appeared in the March number of the Proceedings of that academy (vol. viii., pp. 407-448), and the interesting nature of the contents is well worth the attention of the readers of this Journal who have not had the opportunity of perusing it.

In the opening paragraphs Dr. Bell refers to the earlier attempts made to travel in the air, and points out how the problem in the last decade or so has gradually been approached from a different point of view. The principle of the gas bag has taken second place, and the heavier-than-air type of machine is now in the forefront.

The researches of Lilienthal are next referred to, followed by those of Chanute, Herring, the Brothers Wright, and Hargrave. The magnificent work accomplished by Langley is here given its proper position. "To Prof. Langley," as Dr. Bell remarks, "is due the chief credit of placing this subject upon a proper basis, and of practically originating what he termed the art of 'Aerodromics.'"

Dr. Bell witnessed the experiments made by



FIG. 1.—Langley's Aërodrome No. 5 in Flight, May 6, 1896.

Langley on May 6, 1896, when a large model of an aerodrome, with a spread of wing of about 14 feet, was driven through the air by a steam engine under the action of its own propellers. With regard to the actual flight he saw, he wrote:—"No one who witnessed the extraordinary spectacle of a steam engine flying with wings in the air, like a great soaring bird, could doubt for one moment the practicability of mechanical flight." Dr. Bell was fortunate enough to secure a photograph of the apparatus while in the air, and this record, which is reproduced in his article, is here given (Fig. 1). In time it will undoubtedly be of exceptional historical interest.

The circumstances connected with the later experiments of Langley are next described, and Dr. Bell's knowledge and great faith in Langley's work allow him to state his unbiased opinion that the full-sized aerodrome, which the newspapers described as a failure, "would have flown had it been safely launched into the air."

It is with regret, however, that we find no mention made of either Hiram Maxim or Pilcher, for the

<sup>1</sup> See also *The National Geographic Magazine*, vol. xviii., No. 1, January.

former spent a great amount of money and time in valuable experiments, while the latter sacrificed his life in advancing the science of gliding.

Perhaps the most interesting portion of Dr. Bell's address is the account of his own initial experiments in the construction of an *aérodrome*. He has been at work on this subject for many years, and so far back as 1864 Langley visited him and witnessed some of his experiments.

The progress of his experiments is divided by him into three stages, namely, the kite stage, the motor-boat stage, and the free flying-machine rising from the water.

As the first of these is now complete, it is fully described in this address, and indicates that a distinct step in advance has been made. Dr. Bell's kite is quite different from any other form. It is built up of a great number of small structures or cells, all alike in form and size. Each cell has the form of a regular tetrahedron, and, as he says, "possesses in a remarkable degree the properties of strength and lightness." By connecting several of these figures by their corners a very rigid structure is built up, and the whole possesses the same properties of

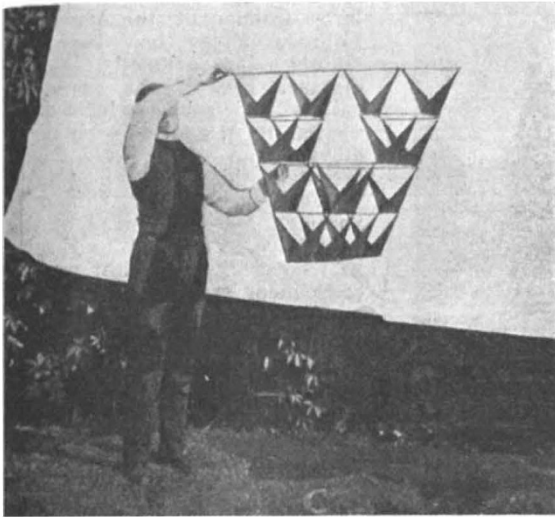


FIG. 2.—A sixteen-celled kite.

strength and lightness inherent in the individual cells themselves.

The *unit* tetrahedral cell is bounded by four equal triangular faces; if two adjoining faces be covered with some kite material, the result is a "winged cell" resembling a pair of birds' wings with their points raised upwards. By coupling four of these unit cells together at their corners, a four-celled structure is formed having itself the form of a tetrahedron, but with an empty space in the middle octahedral in shape. If now four four-celled structures be connected at their corners, a sixteen-cell structure of tetrahedral form is formed (Fig. 2). Experience has shown that when these structures are flown as kites they exhibit remarkable automatic stability in the air under varying conditions of wind.

Up to the present time, the most stable form of kite is that of the "box" or Hargrave type. Dr. Bell is, however, of the opinion that his compound tetrahedral structure is more stable even than this. To make a comparison, he flew both kinds simultaneously in squally weather. Although the tetrahedral appeared to "shiver" when struck by a sudden squall, the box kite "seemed to be liable to

a swaying or tipping motion that would be exceedingly dangerous in a structure of large size forming part of a flying machine."

The good behaviour of the former kite is due, as he suggests, to the porous nature of the structure, the squall passing right through between the covered triangles, and lifting the other side of the kite as well as the side first struck; the blow is thus counterbalanced before the kite has had time to upset.

Although the horizontal *aéroplane* has always an element of instability about it, it has, nevertheless, greater lifting power than similar surfaces arranged obliquely as in the tetrahedral construction. The structure of winged cells is, however, the reverse,

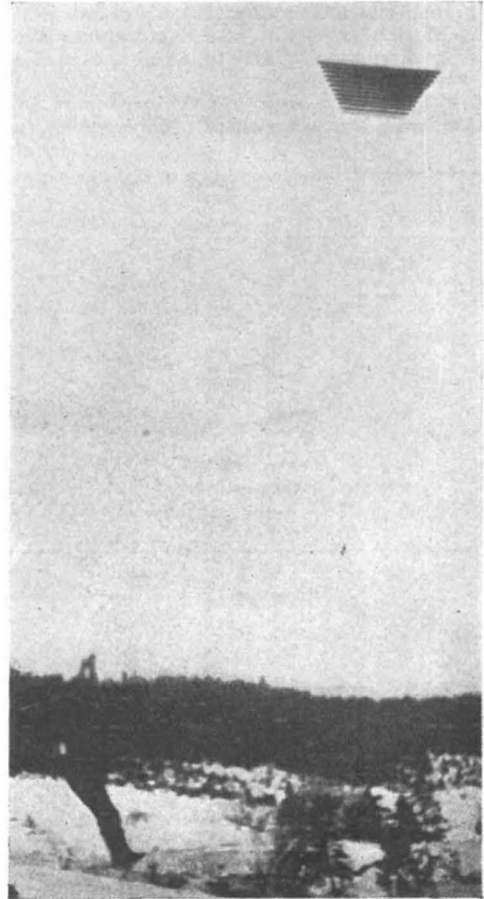


FIG. 3.—The *Frost King* in the air, flying in a ten-mile breeze, and supporting a man on the flying ropes.

being more stable when in the air, but deficient in lifting power. There seems, however, no difficulty in adding to the number of surfaces in the latter construction in order to secure the desired lifting power, while the condition of stability remains. Further experiments have shown that the blank spaces between the groups of winged cells can be filled up with more cells; in fact, the cells can be massed together "without marked injurious effects." Not only, therefore, is the structural strength improved by this increase of size, but the lifting power, which varies directly as the cube of the dimensions, is increased (Fig. 3).

The result of these kite experiments has been to show that it is possible to build a structure of moderate size, composed simply of these winged

cells, that will support a man and an engine in a moderate breeze.

It will be interesting to watch the progress made in the next two stages of Dr. Bell's programme, which literally means the conversion of a kite into a flying machine. These stages consist in mounting his structure on a light catamaran form of boat and propelling it on a water surface by means of aerial propellers until it can be steered upwards into the air. Whether this form of starting is as good or as practical as running it on wheels remains to be seen, but at any rate it seems the safest way to commence with (Fig. 4).

It may be mentioned in conclusion that not only is this printed address accompanied by numerous well-reproduced illustrations and a useful bibliography relating to aerial locomotion, but all details concerning one of the large winged-cell structures and the interesting discussion which followed the reading of the address are inserted.

Among those who took a prominent part in this discussion was Mr. Charles M. Manly, who, as he

caused the accidents that prevented any test of the aërodrome itself. These accidents were not due to defects in the design or fundamental construction of the launching apparatus, for the smaller apparatus of exactly the same design had been used more than thirty times for launching the smaller machines, and without a single failure. Certain minute defects in the releasing mechanism were the sole cause of the trouble."

#### MALTA FEVER.

##### A LESSON IN PREVENTIVE MEDICINE.

SITUATED in the midst of the Mediterranean, swept by all the winds of heaven, and enjoying brilliant sunshine for several months in the year, the island of Malta should be one of the healthiest of places. Its freedom from swamps or standing water of any kind protects the island from that scourge of warm climates—malaria. For many years past, however, Malta has suffered from the prevalence of a serious local fever, of a most persistent character, which has been the bane of the island, and particularly of the garrison; for a large fraction of the naval and military forces has been constantly incapacitated by this disease. Every year some 650 sailors and soldiers have fallen victims to it, and, as each patient stays on an average 120 days in hospital, this gives a total of about 80,000 days of illness per annum. Moreover, most of these men have to be sent to England to recover their health, and the consequent expense has involved a very considerable loss in money to the Government.

This fever appears to be widely distributed in the world, but is most familiar to us in its incidence around the coasts of the Mediterranean. On the island of Malta it has worked its worst ravages, and hence the name of Malta fever, by which it is best known.

Now, however, all this has been changed by a simple application of the discoveries of science, and widespread gratification will be given by the intelligence, furnished in recently published reports, that since June, 1906, when the new preventive measures were put into practice, Malta fever may be said to have practically disappeared from the garrison of the Island Fortress.

What are these preventive measures, and how has this result been achieved?

The serious ravages of Malta fever made it desirable that a searching investigation should be taken in hand. In 1904 the Royal Society, at the request of the Admiralty, the War Office, and the Colonial Office, undertook to investigate the causes of this fever, and sent out a small commission to Malta for that purpose. This commission, which consisted chiefly of Army and naval medical officers, has been at work for three years, under the supervision of a committee of the Royal Society, and has only lately completed its labours. It is unnecessary to describe the details of the three years' work; it is enough to say that every likely line of research was followed in order to discover how man becomes infected by

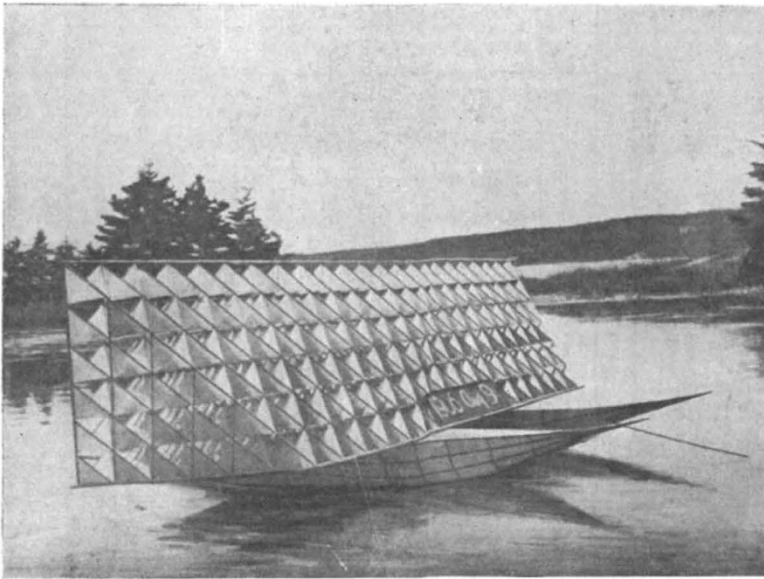


FIG. 4.—A floating kite, adapted to be towed out of the water.

stated, "had the pleasure and the honour of being associated for some seven years with the lamented Secretary Langley as his assistant in direct charge of the experiments which he conducted at the Smithsonian Institution." In his remarks it is good to read that the work initiated by Langley is not abandoned, but merely temporarily suspended. In fact, it seems quite probable that Langley's machine will again be seen flying through the air, for Mr. Manly proposes to re-equip and launch it again. To use his own words:—

"It is my purpose at the earliest moment that I can possibly spare the time for it, to re-equip the aërodrome with proper supporting surfaces, and, using the same launching apparatus, to give the aërodrome a fair trial, this time over land instead of over the water, when I feel very certain that it will fully demonstrate the correctness of its design and construction and crown Mr. Langley's researches with the success which they so richly deserve, and I trust that the day that this will be achieved is very near at hand. It was the launching apparatus, all will remember, which in both of the experiments